



Small mammals in Nowy Dwór Mazowiecki and adjacent area (central Poland) revealed by analyses of the tawny owl's *Strix aluco* pellets

Grzegorz LESIŃSKI¹ & Krzysztof JANUS²

¹*Institute of Animal Science, Warsaw University of Life Sciences – SGGW, Ciszewskiego 8, 02–786 Warsaw, Poland, ORCID 0000-0003-3471-4821, e-mail: grzegorz_lesinski@sggw.edu.pl (corresponding author)*

²*Nature Research Office, Krańcowa 59/82, 02–493 Warsaw, Poland, e-mail: biuro@ornitolog.com.pl*

Abstract: In the years 2007–2024, the diet of *Strix aluco* was analysed in three sites in Nowy Dwór Mazowiecki (central Poland) and in areas directly adjacent to the town. Analysis of pellets revealed the presence of 438 small mammals. The group comprised 17 species belonging to Soricomorpha 3, Chiroptera 4 and Rodentia 10 species. Species most often caught were: *Apodemus flavicollis* and *Microtus arvalis*. Soricomorpha were caught rarely and constituted less than 5% of mammals. *Nyctalus noctula* and *Eptesicus serotinus* dominated among bats whose total share was 3.2–4.7% of mammalian prey. Species composition of prey indicates that the hunting grounds of owls encompassed a variety of habitats: the neighbourhood of built-up areas, river valley and forested area.

Key words: Mammalia, owls' diet, opportunistic predation, local fauna, central Poland

INTRODUCTION

Small mammals in Warsaw and its vicinity are quite well recognized. Many extensive studies (largely based on the analyses of owls' diet) have been made on both bats and on terrestrial species (Kowalski & Lesiński 1986, Lesiński 1986, Goszczyński et al. 1993, Kowalski & Lesiński 1995, Lesiński et al. 2001, 2006, 2013, Gryz et al. 2017, Romanowski et al. 2020). Probably most of species present there are known, although some species, especially bats, are still being found (Fuszara & Cygan 1994, Popczyk et al. 2008, Lesiński & Janus 2023). Due to a high degree of habitat fragmentation, some species like e.g. *Arvicola amphibius*, *Microtus agrestis*, *Muscardinus avellanarius* or *Sicista betulina* are present there in isolated populations (Lesiński et al. 1998, 2013, 2016, 2017). Therefore, it is necessary to undertake studies in new locations, where small and isolated populations are still preserved. Specifically, valleys of large rivers may play an important role as ecological corridors for mammals that enable dispersion of these animals (Romanowski et al. 2023).

Analyses of owls' diet provide information about small mammals occurring in their hunting territories. Especially *Strix aluco* is a useful species for studying this group of animals. This owl is sedentary, has a diverse diet, and its foraging areas are located in many various habitats (Galeotti 2001).

The aim of presented study was to recognise species composition and general structure of community of small mammals in mosaic landscape composed of urban ecosystems, forested areas and valleys of large rivers.

MATERIAL AND METHODS

Pellets of *S. aluco* were collected in the years 2007–2024 in three sites in Nowy Dwór Mazowiecki (about 15 km NW of Warsaw) and in areas adjacent to this town. The first is a forest of an area of about 1 km² neighbouring town from the south. Tree stand of this forest is dominated by deciduous trees, especially by old oaks. The area is partly protected as Natura 2000 object –

Ostoja Nowodworska PLH140043 (coordinates of the site where pellets were collected: 52.42°N, 20.75°E). Two other sites are situated in northern part of Nowy Dwór Mazowiecki, in Modlin, one by the southern boundary of the citadel Modlin Fortress (52.44°N, 20.69°E) and the other – between the two large rivers just at the outlet of the Narew River to the Vistula River in a base of the Fire University (52.43°N, 20.69°E). Areas in Modlin are characterised by a big share of deciduous trees among scattered housing and fortress objects.

Pellets in forest were collected in its northern part in the years 2007–2021 under trees on area about 2 ha. Twenty two controls of the area were performed in various seasons. In the citadel, pellets were collected once under old trees in the year 2016. In the base of the Fire University, pellets were collected under buildings known as resting and breeding sites of owls during three surveys in the years 2022–2024.

Pellets were analysed after soaking in water. Then, the elements of mammal's skeleton (mainly skulls, less often humeral bones) were prepared. Species were determined based on keys (Pucek 1984, Ruprecht 1987) and on comparative collection of skulls. Total material contained 438 individuals of small mammals as well as 53 birds and 39 amphibians.

RESULTS

In the forest site (Natura 2000), 16 species of small mammals were found in the diet of *S. aluco* (Table 1). *Apodemus flavicollis* was the most often caught species followed by: *Microtus arvalis*, *Apodemus agrarius* and *Clethrionomys glareolus*. Soricomorpha were represented by three species, most frequent of which was *Sorex araneus*. Bat fauna included four species with *Nyctalus noctula* and *Eptesicus serotinus* being most frequent. Three species of rodents of the genus *Apodemus* were found. In this group, *A. sylvaticus* was rarely caught.

Table 1. Small mammals in food of the tawny owl *Strix aluco* in forest site neighbouring Nowy Dwór Mazowiecki from the south (Natura 2000 area PLH140043).
Dates of pellet collection: 1 – 24 Apr 2007, 2 – 11 May 2010, 3 – 1 Apr 2011–12 Jul 2011, 4 – 3 Mar 2012–8 May 2012, 5 – 17 Apr 2013–10 Oct 2013, 6 – 30 Sep 2016–20 Nov 2016, 7 – 31 Mar 2017, 8 – 12 Apr 2018–4 Oct 2018, 9 – 17 Mar 2019–29 Dec 2019, 10 – 28 Apr 2020, 11 – 17 May 2021;

No.	Species	Dates of pellet collection											Total	%
		1	2	3	4	5	6	7	8	9	10	11		
1.	<i>Talpa europaea</i> Linnaeus, 1758	0	1	0	0	1	0	0	0	0	0	0	2	0.6
2.	<i>Sorex araneus</i> Linnaeus, 1758	1	1	1	0	4	0	0	0	0	0	0	7	2.3
3.	<i>S. minutus</i> Linnaeus, 1766	2	0	2	0	1	0	0	0	0	0	0	5	1.6
4.	<i>Myotis nattereri</i> (Kuhl, 1818)	0	0	1	0	0	0	0	0	0	0	0	1	0.3
5.	<i>Eptesicus serotinus</i> (Schreber, 1774)	0	0	3	0	0	1	0	0	0	0	0	4	1.3
6.	<i>Nyctalus noctula</i> (Schreber, 1774)	0	0	3	0	0	0	0	1	0	0	0	4	1.3
7.	<i>Pipistrellus nathusii</i> (Keyserling et Blasius, 1839)	0	0	0	0	0	0	0	0	1	0	0	1	0.3
8.	<i>Clethrionomys glareolus</i> (Schreber, 1780)	0	7	12	1	1	1	0	2	0	0	0	24	7.8
9.	<i>Microtus arvalis</i> (Pallas, 1779)	1	6	25	1	2	1	0	7	6	0	0	49	15.9
10.	<i>M. oeconomus</i> (Pallas, 1766)	0	0	0	0	1	0	0	0	1	0	0	2	0.6
11.	<i>Mus musculus</i> Linnaeus, 1758	0	0	3	0	0	2	0	1	2	0	0	8	2.6
12.	<i>Rattus norvegicus</i> (Berkenhout, 1769)	0	0	0	0	0	0	0	1	0	0	0	1	0.3
–.	<i>Rattus</i> spp.	0	1	0	0	0	0	0	0	0	0	1	2	0.6
13.	<i>Apodemus agrarius</i> (Pallas, 1771)	1	5	9	5	2	3	0	1	5	0	0	31	10.0
14.	<i>A. sylvaticus</i> (Linnaeus, 1758)	0	0	3	0	0	0	0	0	0	0	0	3	1.0
15.	<i>A. flavicollis</i> (Melchior, 1834)	1	0	26	3	13	8	6	15	13	2	1	88	28.5
–.	<i>Apodemus</i> spp.	0	12	21	2	11	7	1	2	9	0	0	65	21.0
16.	<i>Micromys minutus</i> (Pallas, 1771)	0	0	6	0	4	0	0	1	1	0	0	12	3.9
	Total	6	33	115	12	40	23	7	31	38	2	2	309	100.0

Data in Table 2 on the diet of *S. aluco* in Modlin indicate slightly poorer (13) but similar species composition of mammalian prey. The only species not found in the forest was *Microtus subterraneus* otherwise recorded in Modlin. Dominating species were similar to those noted in the forest. Noteworthy is a smaller share of species of the genus *Sorex* and a bigger share of *Microtus oeconomus*.

Table 2. Small mammals in food of the tawny owl *Strix aluco* in two sites in Modlin.

No.	Species	Modlin Citadel	Modlin Base SGSP			Modlin	%
		12 Jun 2016	24 Feb 2022	3 Feb 2023	4 Jan 2024	Total	
1.	<i>Talpa europaea</i>	2	1	1	0	4	3.1
2.	<i>Sorex araneus</i>	0	1	0	0	1	0.8
3.	<i>Myotis nattereri</i>	0	1	0	0	1	0.8
4.	<i>Eptesicus serotinus</i>	2	0	0	0	2	1.6
5.	<i>Nyctalus noctula</i>	1	1	0	1	3	2.3
6.	<i>Clethrionomys glareolus</i>	0	7	4	1	12	9.3
7.	<i>Microtus subterraneus</i> (de Selys-Longchamps, 1836)	0	0	1	0	1	0.8
8.	<i>M. arvalis</i>	1	4	23	5	33	25.6
9.	<i>M. oeconomus</i>	0	0	8	0	8	6.2
10.	<i>Rattus norvegicus</i>	0	1	0	0	1	0.8
11.	<i>Apodemus agrarius</i>	0	5	2	0	7	5.4
12.	<i>A. flavicollis</i>	0	21	17	5	43	33.3
–.	<i>Apodemus</i> spp.	0	4	7	1	12	9.3
13.	<i>Micromys minutus</i>	0	1	0	0	1	0.8
Total		6	47	63	13	129	100.0

DISCUSSION

S. aluco is the most eurytopic species among country owls. It is mainly connected with forested areas but inhabits wide spectrum of ecosystems from the centers of large cities through peripheries and suburban areas to the interior of large forest complexes (Goszczyński et al. 1993). Therefore, in a mosaic landscape such as our study area in Nowy Dwór Mazowiecki and its surroundings, this owl may reveal species of small mammals typical of different habitats.

Species of small terrestrial mammals in the study area are typical for this part of the country. Most of them are common and numerous (Pucek & Raczyński 1983, Pucek 1984). Hunting grounds of *S. aluco* included a mosaic landscape composed of various ecosystems typical for some species such as: *M. arvalis* (open areas), *M. oeconomus* (wet riparian areas), *Mus musculus* and *Rattus norvegicus* (outskirts of urban areas), or *A. flavicollis* and *C. glareolus* (thickets and forests). Some species present in nearby Kampinos Forest (Lesiński et al. 2013) were not found in the study area including: *Neomys fodiens* (Pennant, 1771), *Arvicola amphibius* (Linnaeus, 1758), *Microtus agrestis* (Linnaeus, 1761), and *Muscardinus avellanarius* (Linnaeus, 1758). Species listed above require extended forests with large wetlands – the habitats absent in the study area.

Relatively few bat species were found in the study area from among potentially present there. One may expect 17–18 bat species in this part of Poland (Fuszara & Cygan 1994, Sachanowicz et al. 2006, Popczyk et al. 2008). Four species noted belong to common and numerous species throughout the country (Pucek & Raczyński 1983), including central Masovia (Kowalski & Lesiński 1995, Lesiński et al. 2006). Noteworthy is a big share of bats in the diet of *S. aluco* in studied sites (more than 3% of caught mammals – table 1 and 2). This confirms earlier findings that in man-made habitats, especially in towns and in outskirts, bats are caught significantly more often than in habitats close to natural (Lesiński et al. 2009). In a small sample of food from citadel in Modlin, bats constituted as many as half of prey (Table 2). This may evidence

the richness of chiroptero fauna in area neighbouring the river, densely forested with buildings and basements being potential shelters for bats.

Community of small mammals in Nowy Dwór Mazowiecki and in adjacent areas determined based on the analysis of the diet of *S. aluco* does not single out the presence of particularly valuable species. Documenting its species composition may be important in future when these areas will undergo increased man-made transformations.

ACKNOWLEDGEMENTS

Authors wish to thank Hubert Waśniewski for help in collecting study material in Modlin.

REFERENCES

- FUSZARA M. & CYGAN J. P. 1994. Nowe stanowisko nocka Bechsteina, *Myotis bechsteini* (Kuhl, 1818) w centralnej Polsce. *Przegląd Zoologiczny* 38: 335–337.
- GALEOTTI P. 2001. *Strix aluco* Tawny Owl. BWP Update 3, 1: 43–77.
- GOSZCZYŃSKI J., JABŁOŃSKI P., LESIŃSKI G. & ROMANOWSKI J. 1993. Variation in diet of Tawny Owl *Strix aluco* L. along an urbanization gradient. *Acta Ornithologica* 27: 113–123.
- GRYZ J., LESIŃSKI G., KRAUZE-GRYZ D. & STOLARZ P. 2017. Woodland reserves within an urban agglomeration as important refuges for small mammals. *Folia Forestalia Polonica* 59, 1: 3–13.
- KOWALSKI M. & LESIŃSKI G. 1986. Fauna drobnych ssaków w Janowie (woj. stołeczne) w oparciu o analizę zrzutek płomykówki (*Tyto alba* Scop.). *Przegląd Zoologiczny* 30: 327–331.
- KOWALSKI M. & LESIŃSKI G. 1995. Skład gatunkowy i wybiórczość kryjówek nietoperzy w Puszczy Kampinoskiej. *Przegląd Przyrodniczy* 6, 2: 99–108.
- LESIŃSKI G., Blicharski M. & SIELECKI M. 1998. Stanowisko smużki *Sicista betulina* koło Warszawy. *Kulon* 3: 101–103.
- LESIŃSKI G., FUSZARA E. & KOWALSKI M. 2001. Charakterystyka miejskiego zgrupowania nietoperzy Warszawy. *Nietoperze* 2: 3–17.
- LESIŃSKI G., GRYZ J. & KOWALSKI M. 2009. Bat predation by tawny owls *Strix aluco* in differently human-transformed habitats. *Italian Journal of Zoology* 76: 415–421.
- Lesiński G., Gulatowska J., Kowalski M., Fuszara E., Fuszara M. & Wojtowicz B. 2006. Nietoperze Wysoczyzny Płońskiej. *Nietoperze* 7: 39–55.
- LESIŃSKI G. & JANUS K. 2023. The second record of *Pipistrellus kuhlii lepidus* Blyth, 1845 (Chiroptera: Vespertilionidae) in Warsaw (central Poland). *Fragmenta Faunistica* 66: 59–61.
- LESIŃSKI G., KOWALSKI M., STOLARZ P., GRYZ J., KRAUZE-GRYZ D. & ROMANOWSKI J. 2017. Distribution of the European water vole *Arvicola amphibius* (Linnaeus, 1758) in Mazowsze and southern Podlasie. *Fragmenta Faunistica* 60: 129–140.
- LESIŃSKI G., ROMANOWSKI J., GRYZ J., OLSZEWSKI A., KOWALSKI M., KRAUZE-GRYZ D., OLECH B., PEPEŁOWSKA-MARCZAK D. & TARŁOWSKI A. 2013. Small mammals of Kampinos National Park and its protection zone, as revealed by analyses of the diet of tawny owls *Strix aluco*. *Fragmenta Faunistica* 56: 65–81.
- LESIŃSKI G., STOLARZ P., DĄBROWSKI R., GRYZ J., KRAUZE-GRYZ D., SKRZYPIEC-NOWAK P. & ŚWIC J. 2016. Small mammals in the diet of owls in the Masovian Landscape Park and its adjacent areas. *Fragmenta Faunistica* 59: 73–86.
- POPCZYK B., LESIŃSKI G., BAUMANN A. & WOJTOWICZ B. 2008. Kuhl's pipistrelle, *Pipistrellus kuhlii* (Kuhl, 1817) or *Pipistrellus lepidus* Blyth, 1845, in Central Poland – accidental record or a result of expansion? *Nyctalus* (N.F.) 13: 279–281.
- PUCEK Z. (ed.) 1984. *Klucz do oznaczania ssaków Polski*. PWN, Warsaw, 384 pp.
- ROMANOWSKI J., DUDEK-GODEAU D. & LESIŃSKI G. 2023. Diversity of small mammals along a large river valley revealed from pellets of Tawny Owl *Strix aluco*. *Biology* 12, 1118. <https://doi.org/10.3390/biology12081118>
- ROMANOWSKI J., LESIŃSKI G. & BARDZIŃSKA M. 2020. Small mammals of the suburban areas of Warsaw in the diet of the tawny owl *Strix aluco*. *Studia Ecologiae et Bioethicae* 18: 349–354.
- RUPRECHT A. L. 1987. *Klucz do oznaczania żuchw nietoperzy fauny Polski*. *Przegląd Zoologiczny* 31: 89–105.
- SACHANOWICZ K., CIECHANOWSKI M. & PIKSA K. 2006. Distribution patterns, species richness and status of bats in Poland. *Vespertilio* 9–10: 151–173.

STRESZCZENIE

[Małe ssaki w Nowym Dworze Mazowieckim i na terenie przyległym (środkowa Polska) wykazane w wyniku analiz wypluwek puszczyka *Strix aluco*]

Badania prowadzono na trzech stanowiskach w Nowym Dworze Mazowieckim (środkowa Polska) i na terenach bezpośrednio przylegających do miasta. Jedno z nich znajdowało się w lesie (częściowo objęty ochroną w postaci obszaru Natura 2000), a dwa wśród luźnej zabudowy z dużym udziałem zadrzewień, w dzielnicy Modlin. Wypluwki puszczyka *Strix aluco* zbierano w latach 2007–2024. Ich analiza wykazała obecność 438 drobnych ssaków – 309 w lesie, a 129 w Modlinie (Tab. 1 i 2). Stwierdzono łącznie 17 gatunków drobnych ssaków: 3 Soricomorpha, 4 Chiroptera i 10 Rodentia. Najczęściej łowionymi gatunkami były: *Apodemus flavicollis* i *Microtus arvalis*. Wśród Soricomorpha najczęstsze były: *Sorex araneus* i *Talpa europaea*, ale ich udział w diecie sów był stosunkowo niewielki (mniej niż 5% ssaków). Spośród nietoperzy stwierdzono: *Myotis nattereri*, *Eptesicus serotinus* *Nyctalus noctula* i *Pipistrellus nathusii*, gatunki pospolite i dość liczne w tej części Polski. Udział tej grupy ssaków w diecie *S. aluco* w porównaniu do innych terenów badań był znaczny (3,2–4,7%). Skład gatunkowy ssaków jako ofiar sów stwierdzony w analizowanym pokarmie wskazuje, że areale łowieckie drapieżników obejmowały różne środowiska: sąsiedztwo zabudowy, dolinę rzeki i tereny zadrzewione.

Accepted: 10 October 2024