



Small mammals in the diet of the tawny owl *Strix aluco* in selected sites of the Biebrza Basin and Knyszyn Forest in north-eastern Poland

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Abstract: The analysis of pellets of the tawny owl *Strix aluco* collected in the years 2009–2023 in 22 sites (ten in the Biebrza Basin and twelve in Knyszyn Forest) allowed for finding four species of Soricomorpha, nine species of Chiroptera and fifteen species of Rodentia (4, 5 and 12 in the Biebrza Basin and 4, 7 and 13 in Knyszyn Forest, respectively). Most common and most frequently caught by owls were: the bank vole *Clethrionomys glareolus*, the yellow-necked mouse *Apodemus flavicollis* and the common shrew *Sorex araneus*. Valuable species of bats included the pond bat *Myotis dasycneme* and the western barbastelle *Barbastella barbastellus* noted in Knyszyn Forest. Rare rodents found in both study areas were: the northern birch mouse *Sicista betulina* and the common dormouse *Muscardinus avellanarius* while the forest dormouse *Dryomys nitedula* was noted only in Knyszyn Forest. The European water vole *Arvicola amphibius* commonly noted in the Biebrza Basin was not found in Knyszyn Forest. On the contrary, the common pine vole *Microtus subterraneus* was recorded only in Knyszyn Forest.

Key words: mammal fauna, Chiroptera, Rodentia, owl pellets, NE Poland

INTRODUCTION

Studies on small mammals belonging to Soricomorpha, Rodentia and Chiroptera have already been carried out in the Biebrza Basin and Knyszyn Forest. The earliest found sites of these species were set up in the atlas of mammal distribution in Poland (Pucek & Raczyński 1983). Later, more information has been published on the Biebrza Basin, where soricomorphs and rodents have been studied (Raczyński et al. 1983, 1984, Hebda 1998, Gryz & Krauze 2008) as well as bats (Lesiński 1989, Kowalski & Lesiński 1994, Lesiński & Lesiński 2005, Lesiński et al. 2006, 2008). Moreover, data from the owl pellets were analysed (Lesiński & Gryz 2008, Lesiński 2009, Lesiński et al. 2009a, Gryz et al. 2011, Lesiński et al. 2016). Data from Knyszyn Forest are less abundant (Białas et al. 1982, Kupryjanowicz & Ruprecht 2006, Lesiński & Gryz 2008, Lesiński 2009, Lesiński et al. 2009a, Czarnomska et al. 2008-2010, Błachowski 2011, 2017). Cited studies showed the presence of four species of soricomorphs, thirteen species of bats and sixteen species of rodents. Collected data allowed for finding relatively few sites of some species.

This elaboration was undertaken to supplement data on species composition and distribution of small mammals and to determine the specificity of their communities and also to distinguish valuable and rare species.

MATERIAL AND METHODS

Collection and analyses of the tawny owl's *Strix aluco* pellets were made in the years 2009–2023 in 22 sites in the Biebrza Basin and in Knyszyn Forest or in their outskirts. Samples collected in the Biebrza Basin contained 946 individuals of vertebrates out of which 837 were small mammals (771 determined to species). Samples from Knyszyn Forest contained 3,205 individuals of vertebrates; 2,308 in that number were mammals (1,931 determined to species).

The list presented below gives the place and date of the collection of pellets, geographic coordinates of the site and numbers of squares of Polish Atlas of Mammals (Okarma et al. 2023). Numbers in brackets show the number of mammals caught by owls and determined to species.

Biebrza Basin:

1. Białobrzесьkie, 53.2°N, 22.7°E, 18Fb – in an abandoned building 29 Apr 2023 (15).
2. Giełczyn, 53.2°N, 22.5°E, 17Ff – in not used barn and under old trees 16 Jul 2011, 11 Sep 2013 and 23 Jun 2015 (176).
3. Grzędy, 53.6°N, 22.8°E, 18Eb – under old trees near the forest ranger lodge (about 200–300 m to the south) 23 May 2019 (16).
4. Kapicki Las, 53.5°N, 22.7°E, 18Ee – under spruce and old trees near Kapicki Canal 11 Aug 2012, 10 May 2022 (77).
5. Kołodziejce, 53.3°N, 22.5°E, 17Ff – in the old unused building 16 Jul 2011 (100).
6. Łojki, 53.6°N, 22.5°E, 17Ef – under spruce trees near residential buildings 12 Dec 2014 (9).
7. Mścichy, 53.4°N, 22.4°E, 17Ei – in unused buildings 29 Apr 2023 (123).
8. Olszowa Droga, 53.4°N, 22.6°E, 18Eg – in unused building 4 Apr 2009, 13 Jul 2009, 29 Jul 2009, 27 Mar 2010, 15 Apr 2011, 24 Apr 2011 (127).
9. Osowiec-Twierdza, 53.5°N, 22.7°E, 18Eg – in the Central Fort of the Osowiec Fortress, under spruce trees 6 Feb 2011, 4 Nov 2012, 12 Feb 2016 (105).
10. Trzyrzeczki, 53.7°N, 23.2°E, 19Dk – in unused barn 27 Apr 2009, 17 Jul 2009 (23).

Knyszyn Forest:

11. Gajówka Jesienicha, 53.4°N, 23.2°E, 19Ek – in midforest barn 30 May 2009, 17 Jul 2009, 3 May 2014, 20 May 2014, 9 Aug 2014, 16 Aug 2015, 14 May 2016, 11 Jul 2019, 21 May 2020, 22 Aug 2021, 24 Feb 2022, 28 Mar 2022, 18 Aug 2022 (658).
12. Gnidzin, 53.4°N, 23.3°E, 19Ek – in the farm barn 6 Aug 2016, 10 Jul 2020, 22 Aug 2021 (50).
13. Górka near Krynki, 53.2°N, 23.8°E, 20Fe – in a barn 24 Apr 2023 (44).
14. Karczmisko, 53.3°N, 23.2°E, 19Fb – in the barn of an old forest lodge 13 Mar 2020, 12 Jun 2020, 6 Jul 2020, 23 Aug 2021, 10 Jan 2022, 20 Jun 2022, 31 Jul 2022, 28 Mar 2023 (676).
15. Krasne Leśn., 53.2°N, 23.5°E, 19Fe – under trees 30 Mar 2022, 10 Jun 2022 (35).
16. Łapicze, 53.2°N, 23.8°E, 20Fe – under tree with a tree hole 12 Apr 2022, 7 Feb 2023 (14).
17. Nad Płoską, 53.1°N, 23.4°E, 19Fi – under tree 19 Apr 2023 (8).
18. Pólko, 53.2°N, 23.3°E, 19Fe – in unused barn 30 Apr 2023 (40).
19. Stary Szor, 53.4°N, 23.3°E, 19Ek – in abandoned building 30 May 2009, 17 Jul 2009, 1 Aug 2018 (315).
20. Suchodolina, 53.6°N, 23.3°E, 19Eb – in a barn 5 Mar 2020, 25 Feb 2022 (16).
21. Turo, 53.2°N, 23.4°E, 19Ff – in unused barn 30 Apr 2023 (21).
22. Wyrębki, 53.3°N, 23.3°E, 19Fb – under tree with a tree hole 29 Mar 2023, 20 May 2023 (54).

Pellets were analysed with the use of the standard method. After soaking in water, recognizable bone elements (mainly skulls, less often other bones) were prepared. Species were established based on the key for mammals determination (Pucek 1984) and on comparative collection. In the case of the European mole *Talpa europaea*, the characteristic humeral bones were considered apart from skulls. Traits described by Ruprecht (1979) were considered when determining species of the genus *Apodemus*, especially representatives of the subgenus *Sylvaemus*, which are otherwise hard to determine.

RESULTS

Overall, 28 species of small mammals were found in the study areas, 21 species in the Biebrza Basin and 24 species in Knyszyn Forest (Tables 1–6).

From among four species of soricomorphs caught by the tawny owls, the common shrew *Sorex araneus* being most numerous (12.2% of mammals in the Biebrza Basin and 16.1% in Knyszyn Forest) was found in 15 sites in total (Tables 1–6). Seven sites of the European water shrew *Neomys fodiens* were found in: Gajówka Jesienicha, Górka near Krynki, Kapicki Las, Karczmisko, Olszowa Droga, Pólko and Stary Szor (Tables 1, 2–6). The presence of the European mole was noted in most sites in Knyszyn Forest while the species was found in only two sites of the Biebrza Basin (Tables 1–6).

Bats were relatively seldom caught by tawny owls in the study areas. Nine species of bats in total were noted – seven in Knyszyn Forest and five in the Biebrza Basin. Their share in all caught mammals determined to species was 0.6% in Knyszyn Forest and 0.9% in the Biebrza Basin. The most often caught bats were: the serotine bat *Eptesicus serotinus* (6 individuals) and the common long-eared bat *Plecotus auritus* (4 individuals) (Tables 2–6). Noteworthy is the presence of as many as five species in site Stary Szor where the pond bat *Myotis dasycneme* and the particoloured bat *Vespertilio murinus* were noted (Table 6). The presence of two individuals of the western barbastelle *Barbastella barbastellus* was recorded in site Gajówka Jesienicha (Table 3).

Rodents represented by 15 species were the basis of the tawny owl's diet in both study areas (Tables 1–6). Slightly more rodent species (13) were found in Knyszyn Forest including the European pine vole *Microtus subterraneus*, the brown rat *Rattus norvegicus* and the forest dormouse *Dryomys nitedula* present only there. Twelve rodent species were noted in the Biebrza Basin including the European water vole *Arvicola amphibius* and the wood mouse *Apodemus sylvaticus* present only in the basin. When comparing the shares of the field vole *Microtus agrestis* and the root vole *Microtus oeconomus*, we found that the first was more frequent in Knyszyn Forest while the second was more numerous in the Biebrza Basin. The northern birch mouse *Sicista betulina* was a bit more often caught by owls in the Biebrza Basin. From among rodents of the family Gliridae, the hazel dormouse *Muscardinus avellanarius* was distinctly more frequent and numerous than the forest dormouse. In Knyszyn Forest, where both species coexisted, the first was about three times more numerous (Tables 3–6). The forest dormouse was found in three sites: Gajówka Jesienicha, Karczmisko and Turo (Tables 3–5). From among rodents, two species dominated in the number of prey caught by the tawny owl namely the bank vole *Clethrionomys glareolus* and the yellow-necked mouse *Apodemus flavicollis* (Tables 1–6).

Table 1. The number of individuals of small mammals caught by tawny owls in sites in the heart of forest complexes in the Biebrza Basin.

No.	Species	Grzędy			Kapicki Las				Olszowa Droga				Total (%)
		23 May 2019	11 Aug 2012	10 May 2022	Total	4 Apr 2009	13 Jul 2009	29 Jul 2009	27 Mar 2010	15 Apr 2011	24 Apr 2011		
1.	<i>Talpa europaea</i>				16				2				2 (1.6)
2.	<i>Sorex araneus</i>		5	11	16		3	2	1	43	2		51 (40.2)
3.	<i>Sorex minutus</i>	1	1	1	2					6	2		8 (6.3)
4.	<i>Neomys fodiens</i>		2		2	1				24	1		26 (20.5)
5.	<i>Clethrionomys glareolus</i>	12	1	28	29	3	1	4			1		9 (7.1)
6.	<i>Arvicola amphibius</i>		3		3		2	1		2			5 (3.9)
7.	<i>Microtus arvalis</i>			2	2				1				1 (0.8)
8.	<i>Microtus agrestis</i>	1	2	1	3	2	1	1	4				8 (6.3)
9.	<i>Microtus oeconomus</i>		11	1	12	4		2	3	1			10 (7.8)
10.	<i>Apodemus agrarius</i>			3	3								
11.	<i>Apodemus flavicollis</i>	2	1		1								
12.	<i>Micromys minutus</i>		1	1	2				3				3 (2.4)
13.	<i>Sicista betulina</i>		1	1	2		4						4 (3.1)
	Total	16	28	49	77	10	11	6	16	78	6		127 (100.0)

Table 2. The number of individuals of small mammals caught by tawny owls in sites at the edge of forest or outside forest in the Biebrza Basin.

No.	Species	Biało-brzeskie		Gielczyn		Kołodzieje 16 Jul 2011 (%)	Łojki 12 Dec 2014	Mścichy 29 Apr 2023 (%)	Osowiec Twierdza			Trzyrzeczki				
		29 Apr 2023	16 Jul 2011	11 Sep 2013	23 Jun 2015				Total (%)	6 Feb 2011	4 Nov 2012	12 Feb 2016	Total (%)	27 Apr 2009	17 July 2009	Total
1.	<i>Talpa europaea</i>							1 (0.8)								
2.	<i>Sorex araneus</i>	2		5		5 (2.8)		13		19 (15.4)			1 (1.0)			
3.	<i>Sorex minutus</i>					2		6 (4.9)	1	2			3 (2.9)	1	1	
4.	<i>Myotis nattereri</i>							1 (0.8)								
5.	<i>Eptesicus serotinus</i>				1	1 (0.6)		1 (0.8)					1		1	
6.	<i>Nyctalus noctula</i>			1		1 (0.6)										
7.	<i>Pipistrellus nathusii</i>							1 (0.8)								
8.	<i>Plecotus auritus</i>						1									
9.	<i>Clethrionomys glareolus</i>	7		10	18	28 (15.9)	12	5	15 (12.2)	18	6		24 (22.9)	8	8	
10.	<i>Arvicola amphibius</i>			20		20 (11.4)	21		5 (4.1)	3	6		9 (8.6)			
11.	<i>Microtus arvalis</i>	5		10	1	11 (6.3)	3	1	24 (19.5)							
12.	<i>Microtus agrestis</i>			13	15	28 (15.9)	3	1	2 (1.6)	2		1	3 (2.9)			
13.	<i>Microtus oeconomus</i>			16	7	23 (13.1)	5		18 (14.6)	9	3		12 (11.4)			
14.	<i>Mus musculus</i>				1	1 (0.6)	3	1	3 (2.4)					1	1	
15.	<i>Apodemus agrarius</i>			4	4	8 (4.5)	2		2 (1.6)							
16.	<i>Apodemus sylvaticus</i>								2 (1.6)							
17.	<i>Apodemus flavicollis</i>			15	13	28 (15.9)	8		2 (1.6)	36	5		41 (39.0)	6	1	
18.	<i>Micromys minutus</i>	1		4	13	17 (9.7)	19	1	6 (4.9)	7	3		10 (9.5)	4	1	
19.	<i>Sicista betulina</i>		1		1	2 (1.1)	1		15 (12.2)						5	
20.	<i>Muscardinus avellanarius</i>				3	3 (1.7)	7			1	1		2 (1.9)			
	Total	15	1	99	76	176 (100.0)	100	9	123 (100.0)	78	26	1	105 (100.0)	20	3	23

Table 3. The number of individuals of small mammals caught by tawny owls in site Gajówka Jesienicha (inside forest) in Knyszyn Forest

No,	Species	30 May 2009	17 Jul 2009	3 May 2014	20 May 2014	9 Aug 2014	16 Aug 2015	14 May 2016	11 Jul 2019	21 May 2020	22 Aug 2021	24 Feb 2022	28 Mar 2022	18 Aug 2022	Total (%)
1.	<i>Talpa europaea</i>	4	5	1	1	3	2	2		1	2			2	23 (3.5)
2.	<i>Sorex araneus</i>	36	27		1	4	4		5	3	21	2	3	1	107 (16.3)
3.	<i>Sorex minutus</i>	4									1				5 (0.8)
4.	<i>Neomys fodiens</i>										1				1 (0.2)
5.	<i>Plecotus auritus</i>		1*												1 (0.2)
6.	<i>Barbastella barbastellus</i>		1*								1				2 (0.3)
7.	<i>Clethrionomys glareolus</i>	4	47	15	10	21	5	6	24	21	19	2	3	2	179 (27.2)
8.	<i>Microtus subterraneus</i>		7	2	2	4	1	2	3	2	12		7	1	43 (6.5)
9.	<i>Microtus arvalis</i>	1	3			1					4	1	1		11 (1.7)
10.	<i>Microtus agrestis</i>	4	5		1	6	2	2	3	1	2		1		27 (4.1)
11.	<i>Microtus oeconomus</i>		4		1	1		3	4		1				14 (2.1)
12.	<i>Mus musculus</i>		5			3					3				11 (1.7)
13.	<i>Apodemus agrarius</i>	2							1						3 (0.5)
14.	<i>Apodemus flavicollis</i>		71	10	10	21	6	6	21	24	7	1	2		179 (27.2)
15.	<i>Micromys minutus</i>		1			1									2 (0.3)
16.	<i>Sicista betulina</i>	10	2						1	1	2				16 (2.4)
17.	<i>Muscardinus avellanarius</i>	10	10	6		3		2							31 (4.7)
18.	<i>Dryomys nitedula</i>	2	1												3 (0.5)
	Total	77	190	34	26	68	20	23	62	53	76	6	17	6	658 (100.0)

* published in Lesiński (2009)

Table 4. The number of individuals of small mammals caught by tawny owls in sites in the heart of forest complexes of Knyszyn Forest.

No.	Species	Krasne Leśn.			Nad Płoską	Pólko	Turo	Wyrobki		
		30 Mar 2022	10 Jun 2022	Total	19 Apr 2023	30 Apr 2023	30 Apr 2023	29 Mar 2023	20 May 2023	Total
1.	<i>Talpa europaea</i>		1	1		2			1	1
2.	<i>Sorex araneus</i>	5	5	10	1	10			30	30
3.	<i>Sorex minutus</i>	1	1	2		1				
4.	<i>Neomys fodiens</i>					1				
5.	<i>Plecotus auritus</i>						1			
6.	<i>Clethrionomys glareolus</i>	2	5	7	5	18	8	5	2	7
7.	<i>Microtus subterraneus</i>								1	1
8.	<i>Microtus arvalis</i>						1	1		1
9.	<i>Microtus agrestis</i>				1	1	1		1	1
10.	<i>Microtus oeconomus</i>				1					
11.	<i>Apodemus agrarius</i>		1	1		1				
12.	<i>Apodemus flavicollis</i>	6	4	10		1	8	9	3	12
13.	<i>Micromys minutus</i>		1	1		2				
14.	<i>Sicista betulina</i>					1			1	1
15.	<i>Muscardinus avellanarius</i>	2	1	3		2	1			
16.	<i>Dryomys nitedula</i>						1			
Total		16	19	35	8	40	21	15	39	54

Table 5. The number of individuals of small mammals caught by tawny owls in site Karczmisko (forest edge) in Knyszyn Forest.

No.	Species	13 Mar 2020	12 Jun 2020	6 Jul 2020	23 Aug 2021	10 Jan 2022	20 Jun 2022	31 Jul 2022	28 Mar 2023	Total (%)
1.	<i>Talpa europaea</i>	2		4	1		1	1	2	11 (1.6)
2.	<i>Sorex araneus</i>	30	29	16	7	2	17	7	2	110 (16.3)
3.	<i>Sorex minutus</i>	1	3			1	1	2	1	9 (1.3)
4.	<i>Neomys fodiens</i>	3		1			1			5 (0.7)
5.	<i>Eptesicus serotinus</i>			1						1 (0.1)
6.	<i>Clethrionomys glareolus</i>	81	23	27	8	13	35	6	30	223 (33.0)
7.	<i>Microtus subterraneus</i>		1							1 (0.1)
8.	<i>Microtus arvalis</i>	8	4	5	1			3		21 (3.1)
9.	<i>Microtus agrestis</i>	26	7	12	4		5	1	3	58 (8.6)
10.	<i>Microtus oeconomus</i>	10	3	4		1	2	3	4	27 (4.0)
11.	<i>Rattus norvegicus</i>	2		1			1		2	6 (0.9)
12.	<i>Mus musculus</i>	15		2						17 (2.5)
13.	<i>Apodemus agrarius</i>	7	2	1		1			1	12 (1.8)
14.	<i>Apodemus flavicollis</i>	45	10	13	2	11	9		19	109 (16.1)
15.	<i>Micromys minutus</i>	2	1	1		1	1		2	8 (1.2)
16.	<i>Sicista betulina</i>	3	2	1	1	1	2	1	1	12 (1.8)
17.	<i>Muscardinus avellanarius</i>	7	4	2		5	8	1	2	29 (4.3)
18.	<i>Dryomys nitedula</i>		2	3		5	5	2		17 (2.5)
Total		242	91	94	24	41	88	27	69	676 (100.0)

Table 6. The number of individuals of small mammals caught by tawny owls in sites at the edge or outside the forest in Knyszyn Forest.

No,	Species	Gnidzin				Górka k. Krynek		Łapicze		Stary Szor				Suchodolina		
		6 Aug 2016	10 Jul 2020	22 Jul 2021	Total	24 Apr 2023	12 Apr 2022	7 Feb 2023	Total	30 May 2009	17 Jul 2009	1 Aug 2018	Total (%)	5 Mar 2020	25 Feb 2022	Total
1.	<i>Talpa europaea</i>	2	1	2	5	1				6	1		7 (2.2)			
2.	<i>Sorex araneus</i>					15				13	8	6	27 (8.6)			
3.	<i>Sorex minutus</i>					3	1		1			1	1 (0.3)		1	1
4.	<i>Neomys fodiens</i>					1				2		1	3 (1.0)			
5.	<i>Myotis daubentonii</i>									1*			1 (0.3)			
6.	<i>Myotis dasycneme</i>									1*			1 (0.3)			
7.	<i>Vespertilio murinus</i>									1*			1 (0.3)			
8.	<i>Eptesicus serotinus</i>									2*			2 (0.6)			
9.	<i>Nyctalus noctula</i>									1*			1 (0.3)			
10.	<i>Plecotus auritus</i>					1										
11.	<i>Clethrionomys glareolus</i>	6	6		12	12	2	3	5	82	24	4	110 (34.9)	5	1	6
12.	<i>Microtus subterraneus</i>	2			2					6	2		8 (2.5)			
13.	<i>Microtus arvalis</i>		2	1	3	3				32	12		44 (14.0)			
14.	<i>Microtus agrestis</i>	1			1		1	1	2	12	3	4	19 (6.0)			
15.	<i>Microtus oeconomus</i>	3	1		4	1				4	3		7 (2.2)			
16.	<i>Rattus norvegicus</i>									1	1		2 (0.6)			
17.	<i>Mus musculus</i>	2	7		9					18	6	1	25 (7.9)	2		2
18.	<i>Apodemus agrarius</i>	4	1		5			1	1	5	1		6 (1.9)	1	1	2
19.	<i>Apodemus flavicollis</i>	3	5	1	9	2	2	1	3	34	6		40 (12.7)	4		4
20.	<i>Micromys minutus</i>						2		2					1		1
21.	<i>Sicista betulina</i>					3				2	1	1	4 (1.3)			
22.	<i>Muscardinus avellanarius</i>					2				2	2	2	6 (1.9)			
	Total	23	23	4	50	44	8	6	14	225	70	20	315 (100.0)	13	3	16

* published in Lesiński (2009)

DISCUSSION

Results presented in this paper do not enrich the list of the species of soricomorphs, bats and rodents noted so far in the study areas. They deliver, however, information about several new sites of these mammals and present approximate proportions between species present in the Biebrza Basin and in Knyszyn Forest. Our results enable also to compare the community structure of small mammals in the two study areas and in other grounds in this part of the country. The tawny owl belongs to opportunistic predators which catch their prey in proportions similar to those available in the hunting grounds (Wendland 1980, Lesiński et al. 2009c).

No rare and/or valuable species were noted among soricomorphs. All of them are common and quite numerous in the whole country (Pucek & Raczyński 1983). As in many other areas, the dominating species in this group of mammals was the common shrew.

In the case of bats, noteworthy is the site of the pond bat – the species noted rarely, usually in north-eastern Poland (Ciechanowski et al. 2007). The site was found in Knyszyn Forest devoid of larger water bodies, which are the main feeding places for the pond bat. During hibernation, the pond bat was found far from any open waters (Lesiński et al. 2008), which indicates remarkable dispersion abilities of this species. In the Biebrza Basin, the species was recorded in several sites (Lesiński 1989, 2001, Lesiński et al. 2008). Moreover, important is the finding of two individuals of the western barbastelle (out of twelve bats noted in this forest complex), which may indicate the presence of its large population there. In the central and north-eastern part of the country, the share of the western barbastelle in the diet of tawny owls is much smaller (0.8% on average – Lesiński et al. 2009b). Similar assessment of its relatively numerous presence can be found in published data on the bat fauna of Knyszyn Forest (Kupryjanowicz & Ruprecht 2006). The species is listed in Appendix II to the Habitat Directive of the European Union.

Valuable species of the order Rodentia having many sites in the study area include: the northern birch mouse, the hazel dormouse and the forest dormouse. The first species is most probably common in both study areas. The hazel dormouse is most numerous in the lower part of the Biebrza Basin, which was indicated by sites found in this study and mentioned in the literature (Raczyński et al. 1983, Lesiński, Gryz 2008, Gryz et al. 2011). The presence of the forest dormouse in Knyszyn Forest is the consequence of the great share of its favourite habitats – dry-ground forests (Sidorowicz 1959, Nowakowski & Boratyński 1997, Batsaikhan et al. 2016), which are seldom represented in the Biebrza Basin and its surrounding (Bartoszek 2005). The share of the forest dormouse in tawny owl's prey from Białowieża Forest (inhabited by its numerous population – Gryz et al. 2012) was 0.3%, hence less than that in Knyszyn Forest. Therefore, one may assume that the forest dormouse is also represented by relatively large population in the latter forest.

Comparison of the two study areas with respect to species richness of small mammals shows that Knyszyn Forest is more valuable than the Biebrza Basin. The European water vole in the diet of tawny owls was noted exclusively in the Biebrza Basin because of the presence of many wetlands – typical habitats of this species (Bonesi et al. 2002). However, the common pine vole does not find suitable habitats by the Biebrza River and that is why it was not found in analysed material from this area. Surprisingly, the brown rat was not found in the diet of tawny owls from the Biebrza Basin although it is not rare there and in some sites its share in mammalian prey of tawny owls was quite high (e.g. in Goniądz the share equalled 11% – Gryz et al. 2011).

The shares of particular species in the diet of tawny owls compared between the study areas and Białowieża Forest or Augustów Forest (Table 7) show some remarkable differences. Bats were most often caught in the Biebrza Basin while the common shrew, the yellow-necked mouse, the hazel dormouse and the forest dormouse – in Knyszyn Forest. Synanthropic rodents (the

house mouse *Mus musculus* and the brown rat) were not frequent prey items of tawny owls and their share was highest (5.8%) in Augustów Forest. The root vole associated with wetlands was most often (above 10% of prey) caught in the Biebrza Basin.

Table 7. Comparison of percentage shares of selected species or groups of species among mammals caught by tawny owls in the study areas, Białowieża Forest and Augustów Forest. Individuals determined to species were only considered. The highest shares of particular species are given in bold

No.	Taxon	Biebrza Basin (this paper) N = 771	Knyszyn Forest (this paper) N = 1,931	Biebrza Basin (Gryz et al. 2011) N = 809	Białowieża Forest (Gryz et al. 2012) N = 616	Augustów Forest (Zawadzka & Zawadzki 2007) N = 341
1.	<i>Sorex araneus</i>	12.2	16.1	12.9	14.6	11.1
2.	<i>Sorex minutus</i>	3.0	1.2	7.5	4.2	3.2
3.	Chiroptera	0.9	0.6	0.5	0.3	0
4.	<i>Clethrionomys glareolus</i>	19.3	30.7	40.0	14.0	26.4
5.	<i>Microtus agrestis</i>	6.4	5.7	3.3	7.0	5.0
6.	<i>Microtus oeconomus</i>	10.4	2.8	15.3	9.9	6.7
7.	<i>Mus musculus</i> + <i>Rattus norvegicus</i>	1.2	3.7	2.5	3.6	5.8
8.	<i>Apodemus flavicollis</i>	11.5	19.5	1.6	18.7	6.2
9.	<i>Sicista betulina</i>	3.1	1.9	3.7	3.1	0
10.	<i>Muscardinus avellanarius</i>	1.6	3.8	0.9	0	0
11.	<i>Dryomys nitedula</i>	0	1.1	0	0.3	0

No mammal species new to north-eastern Poland were found in this study but information was given on their new sites. These data enable comparative assessment of the numbers of selected species of small mammals both between study areas and within each.

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STRESZCZENIE

[Drobne ssaki w diecie puszczyka *Strix aluco* na wybranych stanowiskach w Kotlinie Biebrzańskiej i Puszczy Knyszyńskiej w północno-wschodniej Polsce]

Analiza wypluwek puszczyka *Strix aluco* zebranych w latach 2009–2023 na 22 stanowiskach w Kotlinie Biebrzańskiej (10) i Puszczy Knyszyńskiej (12) pozwoliła na wykrycie czterech gatunków ryjówkokształtnych Soricomorpha, dziewięciu gatunków nietoperzy Chiroptera i 15 gatunków gryzoni Rodentia, odpowiednio: czterech, pięciu i 12 w Kotlinie Biebrzańskiej oraz czterech, siedmiu i 13 w Puszczy Knyszyńskiej. Gatunkami najliczniej łowionymi przez sowy i najpospolitszymi były: nornica ruda *Clethrionomys glareolus*, myszarka leśna *Apodemus flavicollis* i ryjówka aksamitna *Sorex araneus*. Do gatunków przyrodniczo cennych należy zaliczyć nocka łydkowłosego *Myotis dasycneme* i mopka zachodniego *Barbastella barbastellus*, stwierdzonych w Puszczy Knyszyńskiej. Spośród gryzoni do rzadkich należą też: smużka leśna *Sicista betulina* i orzesznica leszczynowa *Muscardinus avellanarius*, odnalezione na obu terenach, a także koszatka leśna *Dryomys nitedula*, stwierdzona wyłącznie w Puszczy Knyszyńskiej. Karczownik ziemnowodny *Arvicola amphibius*, pospolicie notowany w Kotlinie Biebrzańskiej, nie był odnaleziony w Puszczy Knyszyńskiej. Z kolei, nornik darniowy *Microtus subterraneus* był wykazany tylko w Puszczy Knyszyńskiej.

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