



## Vertebrates in the diet of the tawny owl *Strix aluco* in northern Podlasie (NE Poland) – comparison of forest and rural habitats

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**Abstract:** Tawny owls' pellets were collected in north-eastern Poland at eight sites situated in forests or at forest edges and four sites in agricultural landscapes. In total, 2046 vertebrate prey items were found, including 1459 at the forest sites and 587 at the rural sites. The types of prey most commonly captured by forest owls were amphibians (25.7%) and *Myodes glareolus* (14.6%), while rural owls preferred amphibians (17.7%), birds (17.4%) and *Mus musculus* (16.2%). Comparisons of proportions of selected prey taken by tawny owls made between forest and rural habitats revealed that the capture frequencies of insectivores, *M. musculus*, *Apodemus agrarius* and birds are the best indicators of anthropogenic changes in tawny owls' habitats.

**Key words:** tawny owls, diet plasticity, forest, agricultural landscape, central Europe

### INTRODUCTION

The tawny owl ranks among the most eurytopic owl species in Europe. It occupies habitats ranging from the interiors of large forests to only slightly wooded areas in an agricultural landscape, as well as areas of various levels of urbanisation, including villages and centres of large cities (Wendland 1980, Mikkola 1983, Goszczyński et al. 1993). With such variety of habitats, this species of owl must display considerable plasticity in diet composition. The tawny owl is strongly dependent on the local food base. As an opportunistic predator, it is able to alter its diet markedly in relation to the abundance of different species of small vertebrates, which are its main prey. Several studies have compared the diet of the tawny owl in different habitats. Compared to non-urban ones, urban individuals take more birds with a relatively lower number of amphibians and mammals (Southern 1954, Schnurre 1961, Beven 1964, Bogucki 1967, Goszczyński et al. 1993, Zalewski 1994). Data are also available regarding the diet of forest and rural tawny owls but a limited number of studies have been conducted in the same regions with comparisons made in a relatively small area. In an agricultural landscape, species connected with open habitats, for instance *Microtus arvalis* in western Poland, constitute a higher proportion of a tawny owl's diet (Goszczyński 1981).

Several papers have presented the composition of the diet of this species of owl from north-eastern Poland (Kowalski 1961, Ruprecht & Szwagrzak 1987, Kowalski & Lesiński 1988, Jędrzejewski et al. 1994, Żmihorski & Osojca 2006, Zawadzka & Zawadzki 2007) but all of them were based on samples collected in or close to forests. The aim of this study was to present a wider spectrum of diet, including samples from typical agricultural landscape, as well as to determine the characteristics of the diet of forest vs. rural individuals.

## MATERIAL AND METHODS

The study area, entirely lowland in character with maximum altitudes of ca. 240 m above sea level, extended over a part of northern Podlasie (NE Poland) between the Biebrza and Narew rivers and the border of Belarus (Fig. 1). Pellets were collected in the years 1987–2008 (mostly from 2002) at 12 sites divided into two groups: forest (8 sites situated in or close to a forest of an area over 1 km<sup>2</sup>, mostly close to forest edges) and rural (4 sites situated in an agricultural landscape at a distance of more than 0.5 km from the forest). Short descriptions of each site are presented below, including geographical coordinates and dates of pellet collection.

## Forest sites:

1. Bobrowa (53°06'N, 23°21'E, one sample – 07.08.2007). Pellets were collected in a small wooden barn situated near the border between a large clearing where the village was and the Knyszyn Forest.

2. Dobarz (53°21'N, 22°36'E, one sample – 19.04.1987). Pellets were found under a group of firs (resting sites of owls) in the forest interior, ca.1 km SE from the village (Biebrza National Park). The locality was situated between a pine stand and a wet alder stand.

3. Kolonia Polomin (53°32'N, 23°17'E, 2 samples – 12.10.2008, 13.12.2008). The roosting site of owls was situated in a large barn near the western edge of the forest.

4. Olszowa Droga (53°25'N, 22°35'E, 15 samples – 01.05.2005, 20.07.2005, 24.06.2006, 08.06.2007, 14.07.2007, 26.08.2007, 01.11.2007, 26.12.2007, 09.02.2008, 24.03.2008, 22.04.2008, 20.05.2008, 24.07.2008, 09.11.2008, 07.02.2009). The site is situated on a clearing in a pine forest near the border of the Biebrza National Park. Owls visited a partly ruined barn close to an abandoned building.

5. Osowiec-Twierdza (53°29'N, 22°39'E, one sample – 28.07.2007). A few pellets lay under an old tree on the border of a mixed forest and the Biebrza river valley. This site is part of the Biebrza National Park.

6. Stary Szor (53°21'N, 23°19'E, one sample – 28.09.2008). Pellets were collected in the attic of an old wooden house situated at the eastern edge of the Knyszyn Forest. The house has been abandoned for about 30 years.

7. Trzyrzeczki edge (53°41'N, 23°12'E, 6 samples – 29.12.1998, 21.05.1999, 11.11.1999, 07.12.2002, 08.05.2003, 13.12.2003). The roosting site of owls was situated in a barn at the edge of the forest of an area ca. 7 km<sup>2</sup>, close to the border of the Biebrza National Park. Forest stands were mostly composed of deciduous trees.

8. Trzyrzeczki interior (53°42'N, 23°13'E, one sample – 07.12.2002). Pellets were found inside the forest described above (national park) in an old concrete military shelter (near the entrance).

## Rural sites:

9. Kalinówka Kościelna (53°23'N, 22°56'E, 14 samples – 06.02.2004, 10.03.2004, 20.03.2004, 02.06.2004, 19.06.2004, 29.06.2004, 28.08.2004, 13.04.2005, 15.06.2005, 30.06.2006, 05.05.2007, 07.06.2007, 23.04.2008, 22.06.2008). The village was surrounded by extensive agricultural areas. Owls were observed and pellets were collected under old trees close to the church.

10. Szpakowo Kolonia (53°26'N, 22°51'E, 3 samples – 26.07.2007, 05.08.2007, 02.11.2007). The site of pellet collection was situated in a barn in an abandoned farm.

11. Szymaki (53°26'N, 23°41'E, 2 samples – 08.12.2007, 30.11.2008). Pellets were collected mostly in an old barn, and a small number were collected under trees. The surrounding landscape was strongly deforested for a distance up to 1 km.

12. Waški (53°24'N, 22°52'E, 3 samples – 24.07.2007, 22.03.2008, 23.04.2008). Several pellets were found in the attic of an abandoned building situated far from the village. The main shelter of owls was a chimney.

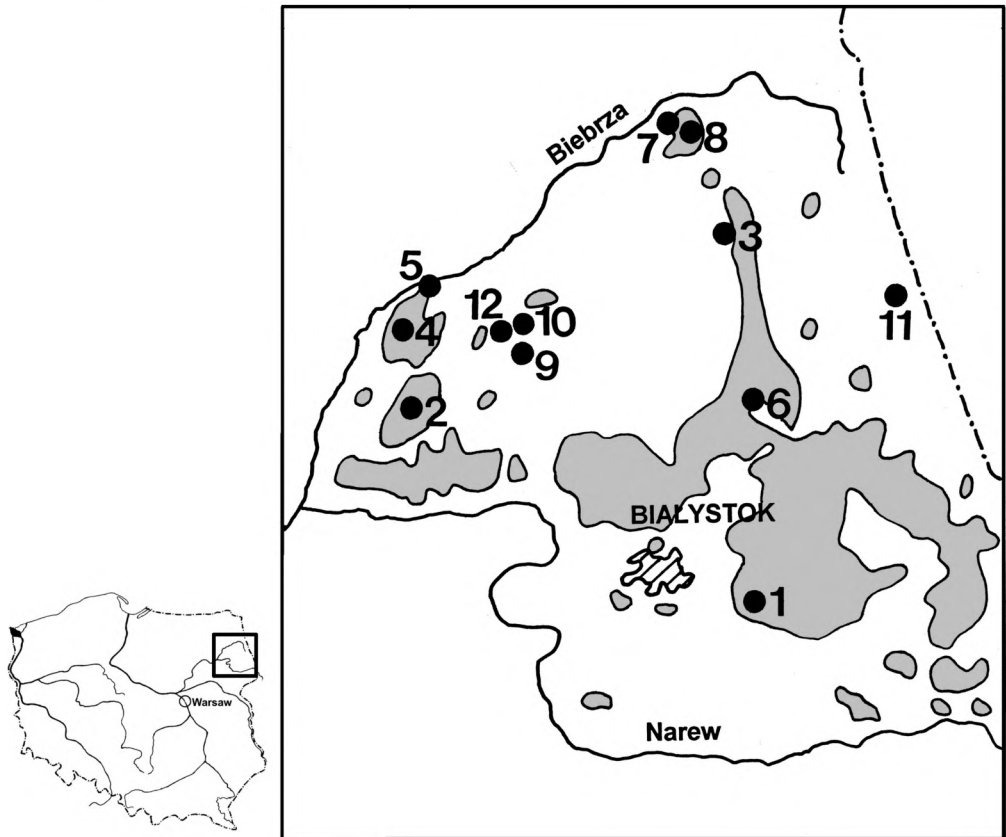


Fig. 1. Distribution of sites where the pellets of the tawny owl were collected in north-eastern Poland; grey spots – forest; the numbers as in the section “Material and methods” and in Table 1: 1 – Bobrowa, 2 – Dobarz, 3 – Kolonia Polomin, 4 – Olszowa Droga, 5 – Osowiec Twierdza, 6 – Stary Szor, 7 – Trzerzeczki edge, 8 – Trzyrzeczki interior, 9 – Kalinówka Kościelna, 10 – Szpakowo Kolonia, 11 – Szymaki, 12 – Waški.

The analysis was based on bone remains and yielded a total of 2046 vertebrates (F: 1459, R: 587). The numbers of mammals and birds were mostly established on the basis of the presence of skulls, rarely other bones. In the case of amphibians, pelvic bones were used. The number of prey items was established on the basis of the maximal number of one of the elements identified (skulls, right or left mandibles, other bones). The keys of Pucek (1984) and März (1987) were used to determine the species in mammalian prey.

The ratio of the number of individuals of selected prey to other prey items was compared between habitats (forest and rural) in the western part of the study area (localities: 4 vs. 9 and 10) and in the eastern part (localities: 11 vs. 6, 7 and 8) as well as for the entire area. The  $\chi^2$  test (2 x 2 tables, with Yates' correction if at least one number was less than 10) was used with d.f. = 1 and significance level of  $p = 0.05$ .

## RESULTS

The most frequent prey items in the diet of tawny owls inhabiting forests or their edges were amphibians (25.7% of prey items). Other frequent prey included *Myodes glareolus* (14.6%), *Apodemus flavicollis* (12.4%), and *Sorex araneus* (9.1%). In an agricultural landscape, the owls preyed mostly on amphibians (17.7%), birds (17.4%), *Mus musculus* (16.2%), and *Apodemus agrarius* (8.5%). Strictly forest species (*Sicista betulina*, *Muscardinus avellanarius*) occurred in the food of forest tawny owls only in three localities. Bats were recorded in most samples, being absent only in one sample of those containing more than 100 prey items (Table 1).

The ratio of the number of individuals of selected prey to other prey items was compared between two habitat types. The following species or higher-level taxa were taken into consideration: Insectivora, separately *S. araneus*, Chiroptera, *M. glareolus*, *Microtus* spp., separately *Microtus arvalis*, *Rattus* spp. (cf. *norvegicus*), *M. musculus*, *Apodemus* spp., separately *A. agrarius* and *A. flavicollis*, Aves and Anura (Table 2). In the entire sample, most species or their groups showed differences, excluding *Apodemus* mice if considered together (though individual species showed differences). In the western part of the study area (comparisons: Olszowa Droga vs. Szpakowo or Kalinówka Kościelna), significant differences in two comparisons were obtained for: Insectivora and separately *S. araneus* (more frequent in forest sites), *M. arvalis* and *Apodemus* spp. (more frequent in rural sites), while in the eastern part (comparisons: Stary Szor or Trzrzeczki vs. Szymaki) differences were significant in three comparisons: *M. glareolus* (more frequent in forest sites), *M. musculus*, *A. agrarius* and Aves (more frequent in rural sites). For both parts of the study area, at least 4 (of 5) comparisons showed significant differences for: Insectivora, *M. musculus* and Aves. In the case of *M. glareolus*, three instances of differences between forest and rural sites were positive and one was negative.

## DISCUSSION

The analysis showed differences in the diet composition of forest and rural tawny owls. Different timing of pellet collection could be one source of error. The diet of this species is subject to seasonal changes (Skuratowicz 1950, Galeotti et al. 1991, Goszczyński et al. 1993). However, we expected that large samples (over 100 prey items) would represent year-round diet of owls, and only small samples could contain material from shorter periods. Nevertheless, in randomly collected pellets the percentage of seasonally available prey, eg. insectivores, bats or amphibians, could differ slightly. Statistically important differences obtained in many comparisons between various localities indicated that they were actual differences.

As the data presented in this paper mostly came from relatively small forests or even deforested areas, it would be interesting to compare them to the species composition of the diet of tawny owls living in large forests. There are three published papers regarding materials collected in such habitats in the vicinity of the area of the present study: the Białowieża Forest (Jędrzejewski et al. 1994), the Augustów Forest (Zawadzka & Zawadzki 2007) and the Romincka Forest (Żmihorski & Osojca 2006). The capture frequencies of prey groups distinguished (apart from bats, which were absent in the three forests) for the forests from the study area fell within the range of values recorded in those larger forests. The proportions of captured mammals and, separately, insectivores and rodents in the study area were relatively low, especially as compared to the data from the Białowieża and Augustów Forests. Amphibians occurred frequently, but their proportion in the diet was higher only in the Romincka Forest (Fig. 2).

Table 1. Diet composition of tawny owls on single localities in northern Podlasie.

Prey item	Forest habitat										Rural habitat						Total	
	1. Bobrowa	2. Dobarz	3. Kolonia Polomin	4. Olszowa Droga	5. Osowiec-Twierdza	6 Stary Szor	7 Trzyrzeczki edge	8. Trzyrzeczki interior	Total		9. Kalinówka Kościełna	10. Szpakowo Kolonia	11. Szymaki	12. Waszki	Total			
	N	N	N	N	N	N	N	N	%	N	N	N	N	N	%	N		
<i>Talpa europaea</i>	0	0	0	2	0	1	12	1	16	1.1	2	0	0	0	2	0.3	18	0.9
<i>Sorex araneus</i>	0	24	1	70	3	1	20	13	132	9.1	2	0	2	2	6	1.0	138	6.7
<i>S. minutus</i>	0	13	0	23	0	0	1	1	38	2.6	0	1	0	0	1	0.2	39	1.9
<i>Neomys fodiens</i>	0	1	0	3	1	0	0	0	5	0.3	0	4	0	0	4	0.7	9	0.4
Chiroptera	0	0	2	1	1	2	2	0	8	0.5	2	1	10	1	14	2.4	22	1.1
<i>Sciurus vulgaris</i>	0	0	0	0	0	0	1	0	1	0.1	0	0	0	0	0	0	1	0.0
<i>Arvicola terrestris</i>	0	0	0	5	0	0	0	0	5	0.3	0	0	0	0	0	0	5	0.2
<i>Myodes glareolus</i>	1	9	5	19	0	22	116	41	213	14.6	18	10	6	4	38	6.5	251	12.3
<i>Microtus arvalis</i>	0	1	0	2	1	9	26	4	43	2.9	7	7	21	1	36	6.1	79	3.9
<i>M. oeconomus</i>	0	1	0	16	2	0	9	2	30	2.1	2	1	6	0	9	1.5	39	1.9
<i>M. agrestis</i>	0	1	1	20	0	4	13	4	43	2.9	1	2	10	1	14	2.4	57	2.8
<i>Microtus</i>	0	1	0	2	0	3	4	0	10	0.7	5	1	3	0	9	1.5	19	0.9
<i>Rattus norvegicus</i>	0	0	0	0	0	0	0	0	0	0	5	0	3	0	8	1.4	8	0.4
<i>Rattus</i>	0	0	0	0	0	0	1	0	1	0.1	1	0	1	1	3	0.5	4	0.2
<i>Mus musculus</i>	0	0	1	6	0	0	36	1	44	3.0	8	57	27	3	95	16.2	139	6.8
<i>Apodemus agrarius</i>	0	0	0	2	0	0	1	0	3	0.2	3	4	43	0	50	8.5	53	2.6
<i>A. sylvaticus</i>	0	0	0	1	0	0	7	0	8	0.5	2	1	2	0	5	0.9	13	0.6
<i>A. flavicollis</i>	0	0	29	1	0	34	109	8	181	12.4	9	2	10	2	23	3.9	204	10.0
<i>Apodemus</i>	1	1	14	6	0	12	95	32	161	11.0	11	5	44	1	61	10.4	222	10.9
<i>Micromys minutus</i>	0	2	0	6	0	0	14	1	23	1.6	0	0	3	0	3	0.5	26	1.3
<i>Sicista betulina</i>	4	0	0	34	0	0	0	0	38	2.6	0	0	0	0	0	0	38	1.9
<i>Muscardinus avellanarius</i>	0	1	0	6	0	0	0	0	7	0.5	0	0	0	0	0	0	7	0.3
Aves	1	2	1	25	2	3	34	4	72	4.9	45	11	40	6	102	17.4	174	8.5
Reptilia	0	0	0	1	0	0	0	0	1	0.1	0	0	0	0	0	0	1	0.0
Anura	8	4	24	6	1	41	265	26	375	25.7	40	9	47	8	104	17.7	479	23.4
Not determined	0	0	0	0	0	0	1	0	1	-	0	0	0	0	0	-	1	-
Total	15	61	78	257	11	132	767	138	1459	100.0	163	116	278	30	587	100.0	2046	100.0

Table 2. Comparisons of the proportions of selected food items to remaining food items between forest (F) and rural (R) tawny owls; statistically important differences are bolded.

Prey items	Total area		Olszowa Droga (F) vs. Szpakowo Kolonia (R)		Olszowa Droga (F) vs. Kalinówka Kościelna (R)		Stary Szor (F) vs. Szymaki (R)		Trzyrzeczki edge (F) vs. Szymaki (R)		Trzyrzeczki interior (F) vs. Szymaki (R)	
	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p	$\chi^2$	p
Insectivora	<b>55.2</b>	<b>&lt;0.001</b>	<b>51.4</b>	<b>&lt;0.001</b>	<b>76.7</b>	<b>&lt;0.001</b>	0.1	0.82	<b>7.0</b>	<b>0.01</b>	<b>21.7</b>	<b>&lt;0.001</b>
<i>S. araneus</i>	<b>41.6</b>	<b>&lt;0.001</b>	<b>41.8</b>	<b>&lt;0.001</b>	<b>51.6</b>	<b>&lt;0.001</b>	0.3	0.56	2.7	0.10	<b>17.7</b>	<b>&lt;0.001</b>
Chiroptera	<b>11.6</b>	<b>&lt;0.001</b>	0.1	0.78	0.1	0.79	0.7	0.39	<b>17.2</b>	<b>&lt;0.001</b>	3.7	0.06
<i>M. glareolus</i>	<b>25.7</b>	<b>&lt;0.001</b>	1.8	0.19	<b>5.0</b>	<b>0.03</b>	<b>27.4</b>	<b>&lt;0.001</b>	<b>32.0</b>	<b>&lt;0.001</b>	<b>67.1</b>	<b>&lt;0.001</b>
<i>Microtus</i> spp.	<b>4.2</b>	<b>0.04</b>	0.0	0.89	0.0	0.95	0.4	0.53	<b>14.7</b>	<b>&lt;0.001</b>	<b>4.5</b>	<b>0.03</b>
<i>M. arvalis</i>	<b>11.4</b>	<b>&lt;0.001</b>	<b>8.0</b>	<b>0.01</b>	<b>5.1</b>	<b>0.02</b>	0.0	0.95	<b>8.2</b>	<b>0.004</b>	2.8	0.10
<i>Rattus</i> spp.	<b>20.4</b>	<b>&lt;0.001</b>	-	-	3.8	0.05	0.7	0.40	<b>4.9</b>	<b>0.03</b>	0.8	0.38
<i>M. musculus</i>	<b>114.6</b>	<b>&lt;0.001</b>	<b>105.3</b>	<b>&lt;0.001</b>	0.8	0.39	<b>12.2</b>	<b>&lt;0.001</b>	<b>9.1</b>	<b>0.003</b>	<b>10.5</b>	<b>0.001</b>
<i>Apodemus</i> spp.	0.1	0.81	<b>5.1</b>	<b>0.02</b>	<b>4.3</b>	<b>0.04</b>	0.0	0.88	<b>6.2</b>	<b>0.01</b>	1.8	0.18
<i>A. agrarius</i>	<b>111.4</b>	<b>&lt;0.001</b>	2.9	0.09	0.7	0.41	<b>21.2</b>	<b>&lt;0.001</b>	<b>115.2</b>	<b>&lt;0.001</b>	<b>22.2</b>	<b>&lt;0.001</b>
<i>A. flavicollis</i>	<b>33.6</b>	<b>&lt;0.001</b>	0.3	0.57	<b>7.7</b>	<b>0.01</b>	<b>45.9</b>	<b>&lt;0.001</b>	<b>22.8</b>	<b>&lt;0.001</b>	0.6	0.43
Aves	<b>83.4</b>	<b>&lt;0.001</b>	0.3	0.61	<b>16.9</b>	<b>&lt;0.001</b>	<b>12.7</b>	<b>&lt;0.001</b>	<b>30.7</b>	<b>&lt;0.001</b>	<b>11.7</b>	<b>&lt;0.001</b>
Anura	<b>14.9</b>	<b>&lt;0.001</b>	3.5	0.06	<b>40.1</b>	<b>&lt;0.001</b>	<b>10.6</b>	<b>0.001</b>	<b>30.3</b>	<b>&lt;0.001</b>	0.2	0.63

The higher proportion of birds in the diet of rural tawny owls (17.4%) compared to forest ones (4.9%) makes the former more similar to those inhabiting highly transformed areas – cities, where there is a particularly marked predominance of birds, eg., in Berlin – 82.0% (Schnurre 1961), Warsaw – 88.7% (Goszczyński et al. 1993), Poznań – 90.1% (Bogucki 1967) or London – 91.0% (Beven 1964). In suburban zones this parameter assumes average values: 18.0–42.3% in Warsaw suburbs (Goszczyński et al. 1993), and 54.6% in Kraków suburbs (Bocheński jun. 1990). Also in a landscape with a high proportion of rural and suburban habitats near Helsinki (southern Finland), birds were captured relatively frequently (Solonen & Karhunen 2002). Goszczyński (1981) noted that in an agricultural landscape of western Poland tawny owls captured birds at a similar frequency as in an agricultural landscape of northern Podlasie. Tawny owls inhabiting large forests consume birds relatively rarely, both in north-eastern Poland (4.5–8.8% – Jędrzejewski et al. 1994, Żmihorski & Osojca 2006, Zawadzka & Zawadzki 2007) and western Poland (7.2% – Ruprecht et al. 1998) or northern Belarus (7.8% – Sidorovich et al. 2003). But in some smaller forest complexes, the percentage of birds showed greater variability, from 3.8% in forests in south-western Poland (Gramsz 1991), to 13.2% in floodplain forests in Slovakia (Obuch 2003), to 20.5% in a forest in Belgium (Delmée et al. 1982), and 23.8% in the Niepołomice Forest in southern Poland (Wasilewski 1990). Nevertheless, the frequency at which that prey is captured seems to be a good indicator of increasing anthropogenic transformations of tawny owls' habitats.

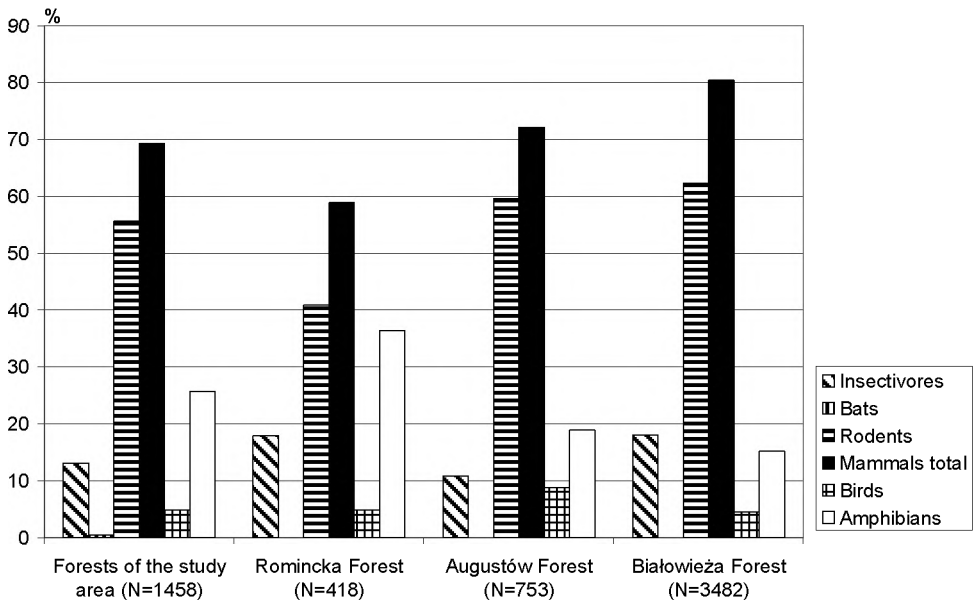


Fig. 2. Comparison of the percentage of prey groups in the diet of tawny owls from forests of the study area and large forests in north-eastern Poland; N – number of vertebrate prey items. Source of data: Romincka Forest (Żmihorski & Osojca 2006), Augustów Forest (Zawadzka & Zawadzki 2007), Białowieża Forest (Jędrzejewski et al. 1994)

A reverse relationship has been found for insectivores, frequently captured by forest tawny owls, and very rarely by urban individuals (Schnurre 1961, Bogucki 1967, Goszczyński et al. 1993, Zalewski 1994, Gryz et al. 2008). Data obtained in the study in northern Podlasie support this statement.

Amphibians are relatively rare prey in highly transformed areas, i.e. cities (Beven 1964, Bogucki 1967, Goszczyński et al. 1993, Zalewski 1994, Ranazzi et al. 2001). In samples collected in forest habitats their proportion varies: in the Białowieża Forest amphibians were taken by owls with a lower frequency (15.2%) than in smaller forests of the study area (Fig. 2), and at a similar level as in the agricultural landscape. Predation on bats tends to increase with the level of transformation of tawny owl habitats from forest interiors to cities (Lesiński et al. in print). The results obtained in northern Podlasie confirm this relationship.

In conclusion, the diet composition of tawny owls living in different landscapes (forested and agricultural) shows important differences. Predation of these birds on small vertebrates is strongly dependent on the local food base and shows an opportunistic nature. Mammals of the order Insectivora, *M. musculus* and birds as prey items seem to be the best indicators of anthropogenic changes in tawny owls' hunting territories.

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## STRESZCZENIE

**[Kręgowce w diecie puszczyka *Strix aluco* na północnym Podlasiu (północno-wschodnia Polska) – porównanie środowisk leśnych i rolniczych]**

Zrzutki puszczyka zebrano na północnym Podlasiu (Ryc. 1), na ośmiu stanowiskach reprezentujących rewiry leśne (miejsce zbioru w lesie lub na skraju lasu o powierzchni przynajmniej 1 km<sup>2</sup>) oraz czterech reprezentujących rewiry krajobrazu rolniczego (miejsce zbioru ponad 0,5 km od lasu). Analiza materiału kostnego wykazała obecność łącznie 2046 kręgowców, w tym 1459 w rewirach leśnych i 587 w rewirach krajobrazu rolniczego. Najczęstszymi ofiarami puszczyków leśnych były płazy (25,7%), *Myodes glareolus* (14,6%) i *Apodemus flavicollis* (12,4%), natomiast puszczyków krajobrazu rolniczego – płazy (17,7%), ptaki (17,4%) i *Mus musculus* (16,2%) (Tab. 1). Gatunki typowo leśne (*Sicista betulina* i *Muscardinus avellanarius*) były obecne tylko w diecie leśnych puszczyków. Porównano proporcje poszczególnych gatunków lub grup gatunków w stosunku do pozostałych ofiar dla puszczyków w krajobrazie leśnym i rolniczym. W przypadku materiału pochodzącego z całego terenu badań uzyskano istotne różnice dla prawie wszystkich analizowanych taksonów, oprócz myszy z rodzaju *Apodemus*, gdy wzięto pod uwagę trzy gatunki łącznie (Tab. 2). Przy porównaniu poszczególnych stanowisk, znajdujących się w stosunkowo niewielkim oddaleniu od siebie, statystycznie istotne różnice w czterech na pięć porównań uzyskano dla: Insectivora (częstsze w lasach lub na ich obrzeżach), jak również *M. musculus*, *Apodemus agrarius* i ptaków (częstsze w krajobrazie rolniczym) (Tab. 2). Gatunki te są najlepszym wskaźnikiem antropogenicznych przekształceń arealów puszczyka, na co dodatkowo wskazuje porównanie z danymi dla dużych kompleksów leśnych północno-wschodniej Polski (Fig. 2) i danymi dla miast. Wyniki badań prowadzonych na północnym Podlasiu potwierdzają, że puszczyk charakteryzuje się dużą plastycznością w składzie diety, w dużym stopniu uzależniając ją od struktury zgrupowań drobnych kręgowców w areale łowieckim.

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