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Feeding ecology of long-eared owl A*sio otus* (L.) during non-breeding period in south-east Poland

Ekologia pokarmowa uszatki *Asio otus* (L.) w okresie pozalęgowym w Polsce południowo-wschodniej

SUMMARY

Studies on feeding ecology of long-eared owl A*sio otus* (L.) of south-east Poland were carried out in agricultural landscape of two types: one with predominating small individual farms and the other with predominating big farms. In both agricultural landscape types individuals of common voles *Microtus arvalis* Pall. were predominating. They constituted on average 71.0 % of prey biomass in the landscape of individual farms and 65.1% in the areas with predominating large monocultures. But these differencies were not statistically significant. Also for many other prey categories there were differences, but they were not statistically significant. Despite many distinct differences between the two landscape types used by long-eared owls in the non-breeding period, our studies did not show clear differentiation of their food composition, which cannot be changed by factors of the landscape.

STRESZCZENIE

Badania nad ekologią pokarmową uszatki *Asio otus* (L.) w Polsce południowo-wschodniej przeprowadzone zostały w dwóch typach krajobrazu rolniczego: z dominacją drobnych gospodarstw indywidualnych oraz na terenach gdzie przeważały gospodarstwa wielkoobszarowe. W obu typach krajobrazu w pokarmie dominowały osobniki nornika zwyczajnego *Microtus arvalis* Pall. Stanowił on średnio 71,0% biomasy zdobyczy w krajobrazie drobnych gospodarstw i 65,1% na obszarach gdzie dominowały monokultury. Różnice jednak nie były statystyczne istotne. Również dla wielu innych kategorii zdobyczy wykazane różnice nie były statystycznie istotne. Pomimo wielu wyraźnych różnic pomiędzy dwoma typami krajobrazu, w którym polowały uszatki w okresie

pozalęgowym, nasze badania nie wykazały wyraźnych różnic w składzie pokarmowym, który nie może być zmieniony przez czynniki natury krajobrazowej.

Key words: feeding ecology, long-eared owl, *Asio otus*, pellets, south-east Poland.

INTRODUCTION

The non-breeding period, particularly the winter season is exceptionally difficult for owl *Strigiformes* living in areas of the Nothern Hemisphere. Reduced food resources and low temperatures lead then to a high mortality among these raptors (13, 14). In response to such harsh conditions owls have developed many adaptation features. One of them is communal roosts formation (5, 14, 15). Long-eared owl *Asio otus* (L) belongs to these species forming communal roosts. Roosting in one place during the day of a large number of birds allows us to collect considerable amounts of pellets dropped there. Their analysis can be a source of valuable data about feeding ecology of this species. The results of examination of pellets collected in the agricultural areas of south-east Poland are presented in this paper.

MATERIAL AND METHODS

This paper presents the analysis results of 1,564 long-eared owl pellets collected in the years 2000–2003 at 16 localities of south-east Poland in Zamość region, where 4–46 long-eared owls were found (12). Communal roosts occurred on thujas *Thuja* sp. or in spruce *Picea abies*.

Studies were carried out in the agricultural landscape of two types: one with predominating small individual farms (3,936 prey from collections (n = 17) from 11 localities), and the other with predominating big farms (2,320 pellets collections (n = 12) from 5 localities). Pellets were collected in very early spring. The former is characterized by small fields of a chess-board pattern with predominating unusual richness of small landscape elements such: single old trees, bushes, coppices, small woods. The settlement system in the discussed area has been characterised by "chains".

The structure of the landscape was analyzed within radius r = 3 km for 11 localities predominated by small individual farms and 5 localities predominated by big farms area. Forests covering on average 3.3 ±1.7% pointed the areas for big farm landscape and 7.7 ±5.3% for small farm landscape (Mann-Whitney U test: $U = 5$, $n_1 = 5$, $n_2 = 11$, $p < 0.05$). The rate of the area covered by buildings in big farm landscape was 3.7 ±1.4% and for small individual ones 5.2 ±2.2% (Mann-Whitney U test: $U = 8$, $n_1 = 5$, $n_2 = 11$, $p < 0.05$). The rate of the open area (without any forest or buildings) in total surface within radius r = 3 km was 92.8 ±2.6% for large farms landscape and 87.2 ±6.9% for small farms landscape (Mann-Whitney U test: $U = 6$, $n_1 = 5$, $n_2 = 11$, $p < 0.05$).

The latter is characterised by large fields of a chess-board pattern with predominating monocultures without small landscape elements and settlement system has the character of "islands" infrastructure and settlements of living blocks amidst wide fields (1, 9). In the areas with predominating small farms communal roosts of long-eared owls were found in adjacent garden farms and cemeteries. In the areas with predominating big farms, communal roosts were found in trees and shrubs growing with the infrastructure. Pellets were determined by standards methods (18). The disintegration rate of pellets material did not always allow determination of all prey. Therefore such species as long-tailed field mouse *Apodemus sylvaticus* L. and yelow-necked field mouse *Apodemus flavicollis* Melchior were presented due to considerable diffculties in (10, 20) as subgenus *Sylvaemus* Ognev et Vorobiev.

The mentioned disintegration resulted, on the one hand, from partial digestion of bones by owls, and on the other, from destruction of bones by low temperatures and pellets lying on the ground particularly after thaw. The biomass of the studied vertebrates was assumed after (8, 17). The width of the food niche was calculated by the formula $B = 1/\Sigma p_i^2$, where p_i is the amount of the biomass of the *i*-th prey in the food of the long-eared owl (11). Because of using nonparametric statistical tests the data in the paper have been given as mean ±SE (21).

RESULTS

In all 6,256 prey were distinguished which belonged to 16 mammalian prey and 10 species of birds. Amphibians were represented by one genus. Long-eared owls caught prey of meadium size geometrical mass 20.86 g, range: 3.5–200.0 g.

In both discussed agricultural landscape types of south-east Poland individuals of common voles *Microtus arvalis* Pall. predominated (Tab. 1, 2). They constituted on average 71.0 ±4.8% of prey biomass in the landscape of individual farms and 65.1 ±7.2% in the landscape of with predominating large monocultures. The differences were insignificant (Mann-Whitney U test: $Z = -0.62$, $n_1 = 17$, $n_2 = 12$, n.s.). The percentage of the common vole in the total mass of prey caught in the years 2001–2003 was analysed, excluding one collection from 2000. Vole constituted 74.5 ±6.5%, 61.3 ±7.0%, 75.1 ±5.0% respectively, of the total biomass of the prey caught. The differences of the total biomass percentage of the caught common voles were insignificant between the particular years (Kruskall-Wallis ANOVA: $H = 5.15$, $df = 2$, n.s.). Besides the mentioned prey species, long-eared owls caught other vole species such: root vole *Microtus oeconomus* (Pall.), field vole *Microtus agrestis* (L.). In all both species mentioned above constituted 8.4 ±2.3% and 5.1 ±1.2% respectively, of the total biomass caught in the landscape with predominating individual farms and large monocultures. However, even in this case the differences were statistically insignificant (Mann-Whitney U test: $Z = -0.77$, $n_1 = 9$, $n_2 = 15$, n.s.). In pellet collections, 44 individuals of the house mouse *Mus musculus* L. were found. They constituted, however only 1.2 ±0.47% of prey biomass in the areas with predominating small individual farms (Tab. 1). In the collections from areas with predominating big farms they also constituted a low percentage: 1.3 ±0.10% of the prey biomass, neither the statistical differences were significant (Mann-Whitney U test: $U = 21$, $n_1 = 8$, $n_2 = 9$, n.s.).

Besides the above mouse species, another synanthropic mammal species was detected in pellets: brown rat *Rattus norvegicus* (Berken.) (Tab. 1, 2). In all the analysed synanthropic mammals: *Mus musculus* (L.) and *Rattus norvegicus* (Berken.) constituted 1.94 ±0.74% of the biomass of prey caught in highly differentiated landscape. In the landscape with predominating large farms both mentioned species constituted in all 3.44 ±2.2% of biomass of the caught prey. However, also here the estimated differences were statistically insignificant ($U = 25$,

Table 1. Food composition (% biomass) of long-eared owl (*Asio otus*)

	Prey biomass [g]	Dłużniów 2001	Dłużniów 2002	Horodyszcze 2001	Horodyszcze 2002	Krytów 2002	Liwcze 2001
		n = 848	n = 342	n = 98	n = 90	n = 312	n = 704
Sorex araneus L.	8	0.05	—	—	0.46	0.13	—
Sorex minutus L.	3.5	0.06	—	—	—	—	—
Crocidura leucodon (Herm.)	7.5	—	—	—	—	— 0.06	
Mustela nivalis L.	66	—	0.97	—	—	—	—
Mus musculus L.	15.5	—	0.91	—	0.89	0.26	0.12
Rattus norvegicus (Berk.)	166	—	—	—	—	—	—
Micromys minutus (Pall.)	8	0.99	0.59	0.42	0.46	0.80	1.08
Apodemus agrarius (Pall.)	17	0.63	2.50	0.90	0.97	1.42	1.40
Sylvaemus sp.	25.5	5.83	17.66	6.73	4.38	7.66	5.53
Muridae sp.	21	—	—	1.11	—	—	—
Clethrionomys glareolus (Schreb.)	17	0.84	0.50	2.69	—	1.14	0.64
Microtus subterraneus (Sélys-Long.)	17	1.47	6.01	5.39	2.92	1.70	1.40
Microtus agrestis (L.)	23	0.28	0.68	—	—	—	—
Microtus oeconomus (Pall.)	26	2.09	2.30	5.49	10.43	3.47	1.17
Microtus arvalis (Pall.)	19	86.91	66.62	77.26	79.48	83.42	87.98
Passer domesticus (L.)	32	0.20	0.47	—	—	—	0.24
Passer montanus (L.)	23	0.14	0.34	—	—	—	0.17
Parus major L.	28	—	—	—	—	—	—
Emberiza calandra (L.)	50	0.31	—	—	—	—	—
Emberiza citrinella L.	30	0.19	0.44	—	—	—	0.22
Phoenicurus ochruros (Gmel.)	17	—	—	—	—	—	—
Turdus pilaris L.	100	—	—	—	—	—	—
Streptopelia decaocto (Friv.)	200	—	—	—	—	—	—
B		1.32	2.08	1.64	1.55	1.42	1.29

n — number of prey, B — Levis' index.

$n_1 = 8$, $n_2 = 9$, n.s.). In contrast to *Mus musculus* (L.) significant differences of the percentage of striped field mouse *Apodemus agrarius* (Pall.) in the total biomass of prey caught by long-eared owls: 1.77 ±0.36% *vs* 7.6 ±2.4%, (Mann-Whitney U test: $Z = -2.99$, $n_1 = 15$, $n_2 = 10$, $P < 0.001$) were shown for both types of studied landscape. However, in the cases of mammal species of subgenus *Sylvaemus* (Ogn. et Vorob.) no statistically significant differences (Mann-Whitney U test: $Z = -0.67$, $n_1 = 17$, $n_2 = 11$, n.s.) were shown for both considered types of the agricultural landscape (10.6 ±3.1% *vs* 12.6 ±3.4%).

Besides the above indicated species, rarely caught by long-eared owls: common dormouse *Muscardinus avellanarius* (L.) one specimen from Wólka

in the area dominated by individual small farms of south-east Poland

Liwcze 2002	Rzeplin 2002	Rzeplin 2003	Żerniki 2000	Żerniki 2001	Żerniki 2003	Udrycze-Wola 2002	Chorążanka 2003	Skierbieszów 2002	Gorajec 2002	Łaziska 2002
n = 234	n = 108	n = 71	n = 197	n = 157	n = 186	n = 184	n = 92	n = 137	n = 70	n = 106
—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—
—	0.64	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—
—	3.29	—	—	—	—	0.81	—	0.53	—	3.07
—	—	—	—	—	—	—	—	5.64	—	—
0.18	1.70	0.57	1.05	0.24	0.84	0.84	0.44	—	—	—
1.50	5.78	3.62	0.89	2.07	0.89	—	0.94	0.58	—	2.53
2.25	51.99	14.50	4.03	2.33	29.44	6.68	11.30	7.80	1.42	1.26
—	—	—	0.55	—	—	2.75	3.49	—	7.01	2.08
—	—	2.42	1.34	1.56	3.12	0.45	—	0.58	—	0.84
1.87	2.89	—	1.79	0.52	0.45	1.78	1.88	0.58	0.95	0.84
—	—	—	—	—	—	18.69	—	—	—	—
6.88	13.25	3.70	4.79	0.79	1.36	—	—	16.79	33.29	—
86.67	17.75	72.92	83.02	79.40	60.82	62.75	78.90	66.50	30.67	86.64
—	2.72	2.27	2.53	1.95	1.68	—	1.77	—	14.25	1.59
—	—	—	—	—	0.60	—	1.27	—	1.28	1.14
—	—	—	—	0.55	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—
0.66	—	—	—	0.92	0.79	—	—	1.02	—	—
—	—	—	—	0.52	—	—	—	—	—	—
—	—	—	—	3.05	—	—	—	—	—	—
—	—	—	—	6.10	—	5.24	—	—	11.13	—
1.32	3.07	1.80	1.44	1.57	2.18	2.29	1.57	2.08	4.12	1.33

Wierzbicka (district Tomaszow Lubelski) (Tab. 2) and two specimens of least weasel *Mustela nivalis* (L.) (Tab. 1, 2) from Dłużniów and Oszczów (Hrubieszów district) were recorded in the pellet collections. Apart from mammals also birds were found in the collections of long-eared owls pellets from the area of south-east Poland. Among them sparrows *Passer* sp. predominated which constituted in all 2.3% (m = 3039 g) of the total prey biomass. In areas of a more mosaic landscape (small individual farms) sparrows constituted 1.2 ±1.3% prey biomass, while in uniformed areas the rate of sparrow in total prey biomass was 4.0 ±1.2% (Tab. 1, 2). The shown differences appeared, however, significant (Mann-Whitney U test: $Z = -1.28$, $n_1 = 11$, $n_2 = 11$, n.s.). Among avian prey: yellowhammers *Emberiza citrinella* L. (most numerous after sparrows *Passer* sp.) and corn

Table 2. Food composition (% biomass) of long-eared owl (*Asio otus*) in the area dominated by large farms of south-east Poland

	Prey biomass [g]	Krzewica 2002	Krzewica 2001	Oszczów 2001	Oszczów 2002	Wólka Wierzbicka 2001	Wólka Wierzbicka 2002	Wólka Wierzbicka 2003	Ulhówek 2002	Ulhówek 2003	Poturzyn 2001	Poturzyn 2002 Poturzyn 2003	
		n = 489	n = 206	n = 168	n = 109	n = 94	n = 275	n = 127	n = 206	n = 214	n = 239	n = 136	n = 57
Sorex araneus L.	8	—	—	—	—	—	—	—	—	0.38	—	—	—
Sorex minutus L.	3.5	—	—	—	—	—	—	—	—	0.08	0.08	—	—
Neomys fodiens (Penn.)	14	—	—	0.60	—	—	—	—	—	—	—	—	—
Crocidura leucodon (Herm.)	7.5	—	—	2.38	0.23	—	—	—	—	0.18	—	0.54	—
Mustela nivalis L.	66	—	—	—	2.01	—	—	—	—	—	—	—	—
Muscardinus avellanarius (L.)	16	—	—	—	—	0.83	—	—	—	—	—	—	—
Mus musculus L.	15.5	0.99	1.15	1.79	0.94	—	0.58	—	1.16	1.11	—	1.11	1.38
Rattus norvegicus (Berk.)	166	—	—	0.60	20.20	—	—	—	—	3.95	—	—	—
Micromys minutus (Pall.)	8	0.43	—	1.79	0.49	—	1.34	—	0.80	1.90	1.62	2.01	0.71
Apodemus agrarius (Pall.)	17	5.06	2.95	27.98	5.17	—	2.84	0.70	2.96	8.90	7.27	12.21	—
Sylvaemus sp.	25.5	1.36	—	20.83	30.26	14.54	7.57	2.09	8.89	12.13	0.57	32.97	6.83
Muridae sp.	21	0.45	0.52	—	—	—	—	—	4.18	2.00	0.95	—	1.88
Clethrionomys glareolus (Schreb.)	17	0.18	—	1.79	—	1.76	0.63	—	—	1.21	1.15	0.61	—
Microtus subterraneus (Sélys-Long.)	17	0.72	—	0.60	3.10	1.76	1.26	0.70	0.85	0.40	1.91	3.66	—
Microtus agrestis (L.)	23	0.24	—	0.60	—	2.39	2.56	0.94	—	—	0.52	—	—
Microtus oeconomus (Pall)	26	6.36	10.31	1.79	—	2.70	8.68	1.06	3.88	—	2.34	1.87	—
Microtus arvalis (Pall.)	19	82.45	82.91	32.74	12.72	67.00	71.57	93.29	75.69	63.28	82.14	35.49	81.43
Passer domesticus (L.)	32	1.02	1.59	4.17	11.68	6.64	1.78	—	1.59	3.81	1.44	6.90	5.71
Passer montanus (L.)	23	0.73	0.57	1.19	2.10	2.39	0.85	—	—	—	—	0.83	2.05
Carduelis chloris (L.)	28	—	—	—	—	—	—	—	—	0.67	—	—	—
Parus major L.	18	—	—	—	—	—	0.33	—	—	—	—	—	—
Emberiza calandra (L.)	50	—	—	—	—	—	—	—	—	—	—	1.80	—
Emberiza citrinella L.	30	—	—	0.60	0.91	—	—	1.23	—	—	—	—	—
Turdus pilaris L.	100	—	—	—	9.13	—	—	—	—	—	—	—	—
Coccothraustes coccothraustes (L.)	55	—	—	0.60	—	—	—	—	—	—	—	—	—
Rana sp.	11.5	—	—	—	1.05	—	—	—	—	—	—	—	—
B		1.46	1.43	4.30	5.70	2.10	1.89	1.15	1.71	2.34	1.47	3.89	1.49

n — number of prey, B — Levis' index.

buntings *Emberiza calandra* L. Single individuals hawfinchs *Coccothraustes coccothraustes* L. were also detected. Besides passerines of small size the presence of prey in the form of bigger birds such as thrushes *Turdus* sp., collared dove *Streptopelia decaocto* (Friv.) were consumed as carrion by long-eared owls. In the landscape dominated by small fields of individual farms birds (as the category *Aves*) constitituted only 4.7 ±1.9% of the biomass of prey caught there, while in the area of large farms the prey constituted 6.02 ±1.8% of the total hunted biomass there. The differences were insignificant (Mann-Whitney U test: $Z = -0.93$, $n_1 = 14$, $n_2 = 12$, n.s.). Analysing all pellet collections independently of landscape, the percentage of the house sparrow *Passer domesticus* (L.) 1.89 ±0.16% and tree sparrow *Passer montanus* (L.) 0.44 ±0.18% in total prey biomass was compared. The differences were insignificant like in many cases analyzed above ($Z = -1.39$, Mann-Whitney U test: $Z = -1.39$, $n_1 = 22$, $n_2 = 15$, n.s).

The content of the house sparrow of the total mass of the prey hunted sparrow in the years 2001–2003 (excluding the collection from 2000). House sparrow individuals constituted 2.3 ±0.9%, 3.0 ±8.0%, 4.7 ±1.7%, respectively of total mass of caught prey. The differences between the particular years were insignificant (Kruskall-Wallis ANOVA: $H = 1.51$, $df = 2$, n.s.).

The pellet collections in the disscussed landscape types differed in the values of index B (11) amounting for that with small farms B = 1.89 ±0.74, range: 1.28–4.11, while for highly uniformized landscape 2.41 ±1.43, range: 1.14–5.7. However, the differences of the values were insignificant (Mann-Whitney U test: $Z = 0.88$, $n_1 = 17$, $n_2 = 12$, n.s.). The Levins' B index was strongly modified by some prey categories. Thus, catching such prey as striped field mouse *Apodemus agrarius* (Pall.), synanthropic mammals *Mus musculus* (Pall.) and *Rattus norvegicus* (Berken.), *Sylvaemus* (Ogn. et Vorob.) and birds *Aves* particularly house sparrow *Passer domesticus* (L.) contributed to extention of the food niche width, and thereby to increased values of Levins' B index. However, caught species of the genus *Microtus* sp., particularly common voles *Microtus arvalis* (Pall.), narrowed considerably the food niche (Tab. 3).

DISCUSSION

The studies showed the occurrence of communal roosts of long-eared owls in south-east Poland in the autumn-winter season. Besides the study of Biaduń (3), earlier papers (16, 18) did not report about the presence of such roosts of long-eared owls. On the contrary, they suggested that such phenomenon could not entirely take place in that region. Despite many distinct differences between the two landscape types used by long-eared owls in the non-breeding period,

Table 3. Spearman rank correlation coefficient between Levins' B index and biomass rate of prey categories of long-eared owl (*Asio otus*) in south-east Poland

Prey category	Levins' B index
Synanthropic mammals	0.52*, n = 17
Mus musculus	0.23, n = 17
Micromys minutus	0.33, n = 23
Apodemus agrarius	0.51**, n = 25
Sylvaemus sp.	0.68**, n = 23
Clethrionomys glareolus	0.11, n = 19
Microtus subterraneus	0.05, n = 26
Microtus oeconomus	0.18, n = 23
Microtus arvalis	–0.99**, n = 29
Microtus (total)	–0.89**, n = 29
Passer domesticus	0.75**, n = 22
Passer montanus	0.56**, n = 15
Passer sp.	0.65**, n = 15
Aves sp.	0.69**, n = 26

* $p < 0.05$, ** $p < 0.01$.

our studies did not show any clear differentiation of their food composition, which cannot be changed by any other landscape factors. This results from a high specialisation of the studied owl species in cathing small mammals of the genus *Microtus* sp. — in our case *Microtus arvalis* (Pall.) — as was recorded in the area of Europe (22, 23). This high specialisation in our studies was reflected as the lack of differences in the rate of common voles and alternative for them prey (sparrows) in total prey biomass between the two analysed landscapes.

Similar comparative studies carried out earlier on the food of barn owl *Tyto alba* (Scop.) with regard to both landscape types in the same area of south--east Poland, showed very distinct significant differences in its composition: more differentiated landscape (dominated by small farms), the food of barn owls was highly different, which showed a variety of species as prey. In highly uniformised landscape the food of barn owls consisted largely of common voles and the range of species as their prey was narrowed (9). The indicated strong dependence of long-eared owls on the supply of common voles *Microtus arvalis* (Pall.), with simultaneous poor utilisation of other prey (e.g. insectivore *Insectivora*, passerine birds *Passeriformes*, synanthropic mammals), seems to be the main cause of migration of these owls in the autumn-winter period and formation of communal roosts of numerous individuals (5).

Table 4. Spearman rank correlation coefficient between percent biomass of different prey categories

Prey	Synanthropic mammals	*Micromys minutus*	*Apodemus agrarius*	*Sylvaemus* sp.	*Clethrionoms glareolus*	*Microtus subterraneus*	*Microtus oeconomus*	*Microtus arvalis*	*Microtus* total	*Passer domesticus*	*Passer montanus*	*Passer* sp.	*Aves* sp.
Mus musculus	0.87**	0.23	0.68*	0.30	0.21	–0.08	0.10	–0.23	–0.416*	0.30	0.50	0.38	0.33
	n = 17	n = 14	n = 15	n = 16	n = 11	n = 17	n = 12	n = 17	n = 17	n = 13	n = 10	n = 13	n = 15
Synanthropic mammals	—	0.13	0.41	0.45*	0.11	–0.28	0.43	–0.50*	–0.54*	0.61*	0.79**	0.68**	0.31
		n = 14	n = 15	n = 16	n = 11	n = 15	n = 12	n = 17	n = 17	n = 13	n = 10	n = 13	n = 15
Micromys minutus		—	0.45*	0.38*	0.11	–0.16	–0.19	–0.31	–0.33	0.24	–0.20	0.19	0.08
			n = 21	n = 23	n = 16	n = 21	n = 18	n = 23	n = 23	n = 18	n = 11	n = 18	n = 20
Apodemus agrarius			—	0.15	–0.06	0.10	0.02	–0.49**	–0.52**	0.54*	0.51*	0.48*	0.47*
				n = 24	n = 17	n = 23	n = 21	n = 25	n = 25	n = 18	n = 12	n = 19	n = 22
Sylvaemus sp.				—	0.21	0.19	–0.11	–0.70**	–0.77**	0.41*	0.15	0.32	0.30*
					n = 19	n = 26	n = 22	n = 28	n = 28	n = 21	n = 14	n = 21	n = 25
Clethrionomys glareolus					—	0.20	–0.27	–0.09	–0.34	0.44	0.33	0.32	0.35
						n = 18	n = 16	n = 19	n = 19	n = 15	n = 10	n = 15	n = 17
Microtus subterraneus						—	0.25	–0.08	–0.06	0.05	0.06	0.02	–0.09
							n = 21	n = 26	n = 26	n = 19	n = 13	n = 19	n = 23
Microtus oeconomus							—	–0.24	–0.07	0.23	0.37	0.34	–0.02
								n = 23	n = 23	n = 17	n = 11	n = 17	n = 20
Microtus arvalis								—	0.90**	–0.70**	–0.53**	–0.61**	–0.64**
									n = 29	n = 22	n = 15	n = 22	n = 26
Microtus sp.									—	–0.68**	–0.52**	–0.60**	–0.66**
										n = 22	n = 15	n = 22	n = 26
Passer domesticus										—	0.83**	0.91**	0.87**
											n = 15	n = 22	n = 22
Passer montanus											—	0.92**	0.82**
												n = 22	n = 15
Passer sp.												—	0.87**
													n = 22

* $p < 0.05$, ** $p < 0.01$.

On the other hand, our studies showed that availability to the common vole resources for long-eared owls was usually on the same level (lack of significant differences in the percentage of common vole in food from the years 2001–2003) and the percentage of alternative prey (house sparrow) was on the similar level (Tab. 4). The results of studies confirm the preference of long-eared owls for open foraging areas observed by other authors (4, 7, 19, 22), evidence of which in their cases was a high percentage of prey biomasses such: voles *Microtus* (Pall.), *Apodemus agrarius* (Pall.) typical of open areas. In our studies the latter species was the only one of those analysed for which statistically significant differences were found between the landscape types in question.

Our collected material may suggest that long-eared owls in extreme cases hunt around human buildings and inside them as barn owl do (2, 6, 9). This possibility is suggested by two premises: the presence in pellets of synanthropic mammals such as: *Mus musculus* (L.) and *Rattus norvegicus* (Berken.), though the latter can occur in open fields in the autumn-winter period (Sałata-Piłacińska 1995), but when it does not occur in fields it is not shown in the material from the mentioned period (10, 19). However, the former of above mammals does not surely occur in fields. The other premise concerns the presence in pellets of a considerable percentage of *Passer domesticus* (L.) of communal roosts which can occur in buildings (2) or very often in bushes near buildings (e.g. hedges). This is of great importance in a uniformized landscape, where very small forests, groups of bushes and afforestations amidst fields disappeared when monoculture systems were formed. "Islands" of farm infrastructure with associated vegetation are the only places in it, where these birds can shelter for the night.

An analysis of Levins B index indicates that it assumed small values for studied pellet collections (despite the analysis of 27 prey/prey category). Our considerations are in contrast with the results given by Tome (22) from Slovenia, where Levins B index reached the highest values in autumn and winter, although only 17 prey/prey categories were shown in the studies.

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