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DIET OF THE EURASIAN TAWNY OWL IN FARMLAND OF EAST POLAND

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Abstract. Food habits of the Eurasian Tawny Owl in farmland have been analyzed for seven astronomical seasons in the Lublin region (E Poland) from 1999–2001. Mammalian prey was found to dominate in the overall biomass, contributing 92.7 % of the total number of prey (n = 3813) and 92.3 % of the mass of consumed prey, respectively. Among mammals, the most numerous in the diet was the Common Vole 46.9 % in number and 50.5 % in biomass, respectively. Avian prey contributed only 3.3 % of the number and 5.3 % of the total biomass in the overall prey consumed by Tawny Owls. Avian prey was dominated by the House Sparrow. Tawny Owls captured prey ranging in biomass from 0.5–460 g. The mean weight of prey was 46.3 ± 15.0 g with a geometric average: 22.2 g. European Hamster (460 g) were the largest individual prey items caught by Tawny Owls.

Key words: Eurasian Tawny Owl, *Strix aluco*, east Poland, ecology, feeding, prey, pellet.

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Питание серой неясыти в агроландшафте Восточной Польши. - И. Китовский, Г. Питуха. - Беркут. 16 (2). 2007. - Питание серой неясыти на сельхозугодьях в Люблинском регионе на востоке Польши анализировалось на протяжении 7 сезонов от лета 1999 до весны 2001 гг. Всего в погадках определено 3737 особей позвоночных животных. В рационе преобладали млекопитающие. Они составляли 92.7 % по количеству и 92.3 % – по биомассе. Наиболее многочисленной была серая полевка (46.9 % и 50.5 % соответственно). Птицы в питании играли незначительную роль – 3.3 % и 5.3 %. Среди них преобладал домовый воробей. Масса добычи колебалась от 0,5 до 460 г. Средний вес – 46,3 ± 15,0 г (± SD). Самой крупной добычей серой неясыти был хомяк (460 г).

Introduction

The Eurasian Tawny Owl (*Strix aluco*) is a good example of a nocturnal raptor whose population size is increasing in many European countries (Galeotti, 2001). The owl is known as a medium-size nocturnal predator which preys on small mammals in woodland habitats (Goszczynski et al., 1993; Jedrzejewska, Jedrzejewski 1998; Galeotti, 2001; Zawadzka, Zawadzki, 2007). In urban habitats, Tawny Owls clearly shift their diet to the birds (Galeotti et al., 1991; Goszczynski et al., 1993; Zalewski, 1994). The Tawny Owl also occurs in farmland (Goszczynski, 1981; Plesnik, Dusik, 1994, Galeotti 2001). Despite the fact that the rural landscapes in Europe and Poland are subordinated to wide economical and ecological transformations, we still lack new data on the food habits of Tawny Owls in farmland. Moreover, in southeastern Poland there are evident signs of an increase in number of the species in the agricultural landscape and incidents of Tawny Owls displacing Little Owls (*Athene noctua*) and Barn Owls (*Tyto alba*) from the localities they have occupied for many years (Dobrowolski, 2007; I. Kitowski, unpubl. data). The mechanisms of this expanse are not yet entirely explained. The aims of the study was to determine the food composition of the Tawny Owl in agricultural habitats of southeastern Poland, and the examination of relations between particular components of its diet.

Study Area and Methods

Studies were carried out in 1999–2001 in farmland of the southeastern part of the Lublin region (E Poland). Agricultural lands in this region used to be owned by state and collective farms from the time of the Second World War until the early 1990's. This are was characterised by high usage of chemicals and pesticides. Now, most of the state farms belong to workers' associations or private farmers. The infrastructure of the farms and their dwelling

houses formed "islands" surrounded by large monoculture fields.

Corn hops, barns, cow sheds, granaries, blins, fertiliser store houses, grainers and other buildings in: 1) Plebanka (Tomaszow Lubelski district), Husynne (Chelm District) were searched for pellet stations to collect pellets of Tawny Owls for study. In 2) Rzeplin and 3) Jarczow (Tomaszow Lubelski district), pellets of Tawny Owls were found in belfries and garrets of churches.

The food composition of Tawny Owls was studied in seven consecutive astronomical yearly seasons, from summer 1999 to spring 2001. Prior to searching pellets from summer 1999, all the pellet stations in the sites mentioned above have been cleaned of the old pellets. The last collection of pellets was performed on the day of the end of the astronomical winter of 2001 (Table). The pellets (n = 671) were analyzed according to the method proposed by Ruprecht (1979a) and Ruprecht et al. (1998). The vertebrate prey species were determined on the basis of teeth, mandibules, skulls and other significant remains following the keys suggested by: Bohme (1977), Pucek (1984), Cuisin (1989), Ruprecht (1979b). To estimate the vertebrate prey biomass, the data from the papers by Pucek (1984), Jedrzejewska, Jedrzejewski (1998) were used. A biomass 0.5 g of all invertebrates was assumed follow Romanowski (1988).

Occasionally, a high degree of bone fragmentation did not allow for the identification of vertebrate prey. Therefore, some prey were grouped as: *Sylvaemus*, *Apodemus*, *Aves, Sicista* sp. indet. etc.

The breadth of food niches of Eurasian Tawny Owls was computed with the formula of Levin's B index = $1/S\ p_i^2$, where p_i is proportion of prey category *i* in the total biomass of the owl's diet. Using species richness (S) to measure how similar the abundance of different prey categories were, Shannon-Wiener (H) index, we computed evenness E index = H / log(S) to measure how similar the abundance of different prey categories were. In the formula mentioned, H is the sum $[P_i \log (P_i)]$, S is the number of prey categories, P_i is the prey category proportion *i* in the total number of the owl's diet (Krebs, 1997). The means are given ± SD (Fowler, Cohen, 1992).

Results

The remains of n = 3813 prey items with biomass m = 68294 g. were found in the pellets (Table). In total, the remains of 3737 individuals which were identifiable belonged to vertebrate species. One species of amphibian was represented in the sample. Amphibian prey played a small role in the overall composition of prey in the study area, contributing to 2.4 % of the overall prey biomass. The prey type concerned peaked in spring 2000 (5.0 % of the prey biomass) (Table). In the case of avian prey, only six species from two orders: Passeriformes, Columbiformes were found, which contributed merely 3.3 % of the number and 5.3 % of the total biomass of the overall prey consumed by the Tawny Owls (Table). Avian prey was dominated by the House Sparrow (*Passer domesticus*) (57 % of the total biomass of caught birds). During winter of 1999 all sparrow prey (all *Passer* sp.), composed nearly 10 % of total biomass eaten by Tawny Owls. When all birds contributed 15.1 % of total biomass. Mammalian prey was represented by 20 species from two orders: Insectivora and Rodentia. Mammalian prey found to dominate in the overall biomass contributed 92.7 % (n = 3531) of the total number of prey and 92.3% (62865 g.) of the mass of consumed prey, respectively.

In the case of insectivore (Insectivora), five species of prey were dissected from pellets, which contributed 13.8 % (n = 531) of the number and 5.8 % (m = 3920 g.) of the total biomass in the overall prey caught by Tawny Owls in the study area. Among insectivore, Tawny Owls more frequently preyed on the Eurasian Shrew (*Sorex araneus*): 66.1 % of the number of prey caught of this category, and 71.6 % of the biomass of the prey, respectively (Table). Rodents (Rodentia) accounted for the majority of mammalian prey both as regards the num-

Seasonal changes of food composition of Tawny Owl in farmland of southeast Poland
Сезонные изменения состава пищи серой неясыти в агроландшафте Юго-Восточной Польши

Prey category	m, g.	summer 1999		autumn 1999		winter 1999		spring 2000		summer 2000		autumn 2000		winter 2001		Total	
		%n	%m	%n	%m	%n	%m	%n	%m	%n	%m	%n	%m	%n	%m	%n	%m
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Pelobates fuscus	19	3.5	4.0	2.1	2.4			5.5	5.0	0.6	0.6	1.7	2.3			2.0	2.4
Phoenicurus ochruros	17	0.2	0.2			0.2	0.2									0.1	+
Passer domesticus	29	4.0	6.6	0.6	1.0	4.3	6.6	3.0	4.2	0.4	0.6	1	2.1	1.1	2.0	1.9	3.1
P. montanus	22	0.8	1.0	0.6	0.7	2.2	2.5	0.9	1.0			0.2	0.3	0.6	0.8	0.7	0.8
Passer sp.	26	0.8	1.2			0.5	0.7	0.5	0.7	0.1	0.2					0.3	0.4
Turdus pilaris	100					0.2	1.3							0.6	3.5	0.1	0.3
Bombycilla garrulus	50					0.5	1.3									0.1	0.1
Streptopelia decaocto	200					0.2	2.5	0.1	1.3							0.1	0.6
Talpa europaea	60	0.2	0.7													+	0.1
Crocidura leucodon	8			2.8	1.3	2.2	1	3.5	1.4	0.4	0.2	1.7	1.0	4.0	1.9	1.9	0.9
Sorex araneus	8	2.9	1.3	3.1	1.5	6.2	2.6	6.3	2.4	7.3	3.0	26.6	15.0	19.0	9.1	9.2	4.1
S. minutus	4	2.4	0.6	1.0	0.2	0.7	0.2	0.9	0.2	2.2	0.4	9.6	2.7			2.6	0.6
Neomys fodiens	14			0.3	0.2							0.3	0.3			0.1	0.1
Arvicolidae indet.	20	5.5	6.5	7.0	8.2	3.4	3.6	3.1	3.0	1.7	2.0	3.0	4.3			3.8	4.2
Arvicola amphibius	83	0.4	2.0					0.7	2.7							0.2	0.9
Cricetus cricetus	460							0.5	12.0	0.4	10.3					0.2	4.7
Myodes glareolus.	17			2.4	2.4	6.0	5.4	2.6	2.1	0.6	0.5	1.3	1.6	1.7	1.8	2.0	1.9
Microtus subterraneus	17	0.6	0.6	1.4	1.4	3.6	3.2	1.9	1.5					4.0	4.1	1.3	1.2
M. agrestis	23	1.2	1.6	0.4	0.6											0.2	0.3
M. economus	26			1.3	1.9							0.5	0.9			0.3	0.5
M. arvalis	19	28.4	31.5	23.5	25.9	40.0	40.3	55.2	51.0	73.2	72.1	32.7	43.8	41.4	47.4	43.4	46.1
Muridae indet.	19	3.1	3.4	7.7	8.5	5.3	5.3	2.7	2.5	1.2	1.1	5.2	7.0	5.2	5.9	4.2	4.4
Mus musculus	17	5.3	5.3	8.4	8.4	0.7	0.6	2.3	1.9	4.3	3.8	4.1	4.8	2.3	2.4	4.3	4.1

End of the Table

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Rattus norvegicus	100			0.3	1.7							0.3	2.4			0.1	0.6
Micromys minutus	8	2.4	1.1	6.7	3.1	2.4	1.0	1.2	0.5	2.0	0.8	5.1	2.9	1.7	0.8	3.3	1.5
Apodemus agrarius	17	30.8	30.6	26.6	26.3	9.4	8.4	3.1	2.5	2.6	2.3			14.4	14.7	11.6	11.0
A. flavicollis	31	0.6	1.1	1.4	2.6	3.4	5.5	1.2	1.8	0.6	0.9	1.3	2.9			1.3	2.2
A. silvaticus	20	0.4	0.5	0.9	1.0	2.9	3.0	1.2	1.2	0.9	0.9	1.0	1.4			1.1	1.2
Sylvaemus sp.	23			0.3	0.4	3.8	4.7	0.5	0.6	0.3	0.3	1.2	1.9	4.0	5.6	1.0	1.3
Sicista sp.	8							0.4	0.2			0.5	0.3			0.2	+
Muscardinus avellanarius	16			0.3	0.3			0.3	0.2			2.0	2.1			0.4	0.4
Insects *Insecta*	0.5	6.5	0.2	0.9	+	1.9	0.1	2.4	0.1	1.2	+	0.7	+			2.0	+
Total		490	8378	699	12009	417	7872	745	15320	695	13414	593	8414	174	2887	3813	68294
Levins' B index			4.80		6.19		5.25		3.52		1.87		4.37		3.76		4.21
Shannon -Wienner index		3.046		3.320		3.307		2.816		1.747		3.021		2.651		3.194	
Evenness		0.705		0.734		0. 742		0.614		0.419		0.688		0.716		0.645	

ber: 85.0 % (n = 3000), and biomass 93.8 % (58945 g.).

Among the mammalian prey, the Common Vole (*Microtus arvalis*), was the largest fraction (46.9 % in numbers, and 50.5 % in biomass, respectively (Table). Similarly among rodents, Common Vole contributed 55.2 % in the number of all rodents and up to 53.4 % of all the rodents' biomass. Common Mice (*Mus musculus*), contributed 4.1 % of the food in farmland of SE Poland, while Brown Rats (*Rattus norvegicus*), contributed 0.6 % to the total biomass. In the winter, rats were not exploited as a source of food, while the contribution of Common Mice reached its highest value in the winter of 2001: 2.4 % of the total biomass of caught prey (Table).

Results showed that Levin's *B* index changed during the time of the study with the average of 5.40 ± 4.06 (range: 1.87–14.29). An increased contribution of Common Voles to the prey biomass resulted in narrowing of the food niche, as expressed by Levin's B index (Pearson $r = –0.78$, $n = 7$, $P < 0.05$). Increased contribution of the Harvest Mouse (*Micromys minutus*) (Pearson $r = 0.76$, $n = 7$, $P < 0.05$), as well as the increased contribution of synanthropic mammals: the Common Mouse (*Mus musculus*) and Brown Rat to the prey biomass, resulted in the extending of the food niche (Pearson $r = 0.79$, $n = 7$, $P < 0.05$). Also, an increase in the consumption of *Apodemus* sp. caused a decrease in the consumption in mass of *Microtus arvalis* (–0.83, $n = 7$, $P < 0.05$).

The diet of the Tawny Owls was most varied in the autumn of 1999 (Shannon-Wiener H index = 3.32), indicating 23 prey categories at the time, while the diet was characterized by a similar percentage of contribution of Common Voles and Field Mice (*Apodemus agrarius*) (Table). On the other hand, in the summer of 2000, food was the most uniformed (Shannon-

Wiener H index = 1.75), when only 18 prey categories were indicated, and the food was dominated by a high percentage of contribution of Common Voles among the total number of caught prey. In this period evenness E index had the smallest value (Table).

Tawny Owls nesting in the south eastern part of the Lublin region captured prey ranging in biomass from 0.5–460g. (Table). That gave a mean weight of 46.3 ± 15.0 g. with a geometric average of 22.2 g. The greatest fraction in the food biomass consumed by Tawny owls was found for prey weighing between 17–29 g: 79.8 % of total biomass, which amounted to 76.3 % of the number of prey caught (Table). In the study area, European Hamsters (*Cricetus cricetus*) (460 g.), were the biggest individual prey items, and they were caught by Tawny Owls.

Discussion

As in case of many other owls, Eurasian Tawny Owl's food composition in Europe exhibited some changes along geographical gradients. In northern part of continental Europe and British Islands basic prey are voles, but their share is declines along W–E gradient, while the role of mice grows (Galleotti, 2001).

In area of Poland the percentage of birds and amphibians seemed to arise along W–E gradient (Zawadzka, Zawadzki, 2007). It can be illustrated by study from four large forest complexes in northern Poland. In Notecka Primeval Forest (NW Poland) food is consisted mainly small mammals (mainly rodents 68 % and insectivores 21 %) but also included bats, birds and frogs (Ruprecht et al., 1998). In the primeval deciduous forests of Bialowieza Primeval Forest (BPF) in NE Poland small mammals dominated in died (65 % of prey) when birds, amphibians and insects composed 7 %, 19 % and 10 % of total number of prey respectively. There take place the increased exploitation of birds took place as a result of an increase in their availability when birds were breeding. That is why birds of such habitats were caught in the period of May – June (16.2 % of total consumed biomass) (Jedrzejewska, Jedrzejewski, 1998). In Romnicka Primeval Forest (NE Poland) the diet consisted of 38 % of rodents, 34 % of amphibians and 17 % of insectivores. The most often found prey bank voles (*Myodes glareolus*) and frogs: 15.1 % and 10.7 % respectively (Żmihorski, Osojca, 2006). In forests of Wigry National Park (NE Poland), small mammals composed 66.5 % of prey items and 78. 9 % prey biomass of Tawny Owls, birds – 8.1 % and 13.9 % and frogs –17.4 % and 6.8 % of prey number and biomass, respectively. There the diet was dominated by Bank and Common Voles which together composed 37.0 % of prey items and 37.2 % of the biomass consumed (Zawadzka, Zawadzki, 2007). These authors observed that amphibians were most caught during May and June (spring: 28.9 % of total number of prey). Studied in southeast Poland Tawny Owls also caught amphibian prey but only during spring, but they contribution in total number of prey was not so high (Table). There were no frogs *Rana* sp. in studied pellets.

In central and eastern part of Europe food composition strongly varies in different habitats. Tawny Owls from the northern part Czech Republic, even though Voles accounted for as much as 47.8 % of the biomass of all caught prey, the contribution of birds in that area was the greatest (28.6 % of total biomass) among the available sources analyzing the content of food from farmland (Plesnik, Dusnik, 1994). This can indicate, similar to our study, a very strong reduction in the diversity of potential prey in intensively agricultural landscape of other sources of food, such as insectivore, bats (Chiroptera), Reptiles (Reptilia), and Amphibians (Amphibia), resulting from the effects of intensive agricultural work (extensive usage of chemical agents, uniformization of the landscape). In area of Moravia and Slovakia most frequent prey were rodents, mainly: Common Vole, Harvest Mouse, Yellow-necked Mouse (*Apodemus silvaticus*), Bank Vole (*Myodes glareolus*) and Field Mouse (Obuch, 2003).

The observations carried out also showed that in SE Poland only 5.3 % of the total bio-

mass of prey consumed by the Tawny Owls were birds. The researched owls consumed avian prey more extensively only during the winter of 1999, when the contribution of avian prey to the biomass reached as much as 15.1 % at the time, as a result of a lack of access to the Vole, *Microtus* sp. prey, with the fall of snow. This confirms the observations of other researchers that a greater utilization of birds by Tawny Owls may increase as a result of a decrease in the density of small mammals in farmland (Goszczynski, 1981). Other studies from forest of Central Europe shows more important role of birds and amphibians. In areas of Poland, Lithuania and former Czechoslovakia (Obuch, 2003; Balciauskiene et al., 2005; Zawadzka, Zawadzki 2007). Studies of other authors indicate also that the rate of biomass of birds may also increase along an urbanization gradient (Goszczynski et al., 1993), as indicated by a very large (> 60%) contribution of birds in the total biomass of prey of Tawny Owls holding territories in the centres of such European cities as London (Beven, 1982), Pavia (Galeotti et al., 1990), and Polish cities such as Torun (Zalewski, 1994) and Warsaw (Goszczynski et al., 1993).

Zawadzka and Zawadzki (2007) found that birds most were preyed during May – June period (12.1 % of all prey) in Wigry National Park. In our study during winter, birds (especially sparrows) can play some role in diet of Tawny Owls. However, probably Collared Dove (*Streptopelia decaocto*), was eat as carrion. The discovery of Black Redstart (*Phoenicurus ochruros*) specimens, in pellets from east Poland in winter seemed somewhat surprising. But this fact indicates the process of an increasing frequency of instances of wintering Black Redstarts observed in Poland (Tomialojc, Stawarczyk, 2003).

Research in southeastern Poland indicated that the increase in the proportion of biomass of Common Vole was associated with a substantial decrease in proportion of *Apodemus* sp., when the whole period of study was examined. However, in the researched localities in E Poland, such a process did not take place in the winter, while the proportion of Common Vole and *Apodemus* sp. was stable during the winters when the research was carried out (Table). A similar process took place in Bialowieza Primeval Forest – an increase in the biomass of *Apodemus* sp. caught by Tawny Owls occurred there during the period of autumn – winter, with a very strong dominance of Yellow-necked mouse (Jedrzejewska, Jedrzejewski, 1998).

In the food in farmland of Lublin region, Common Mice contributed 4.1 % and Brown Rats 0.6 % of the total biomass. During the period of winter, rats were not at all utilized as food, while the contribution of Common Mice did increase by four times between the winters of research, yet did not exceed 2.4 % of the biomass. Tawny Owls inhabiting forests of BPF, during the period of autumn – winter caught Common Mice in the Polish and the Belorussian parts of Bialowieza Primeval Forest as 0.1 % and 7.7 % of the total biomass of the prey, respectively. On the other hand, Brown Rats were caught during this period in the Polish and the Belorussian parts of Bialowieza Primeval Forest as 2.8 % and 3.5 % of the total biomass of prey, respectively (Jedrzejewska, Jedrzejewski,1998). On the other hand, the contribution of Common Mice and Brown Rats during the period proceeded of study considered, however for Tawny Owls inhabiting one of the villages of BFP, it amounted to 14.4 % and 1.8 % of the total biomass (Ruprecht, Szwagrzak, 1987). Furthermore, Goszczynski et al. (1993), during an analysis of pellets found in Warsaw and forests from a radius of approximately 40 km from the city's central district, realized that with the approach to the city's center (along an urbanization gradient), the contribution of synanthropic mammal species increased, with the maximal proportion of 10.2 % and 2.6 % in the center of Warsaw for Common Mice and Brown Rats, respectively. The insects formed an extremely small fraction in the number of prey of Tawny Owl on the studied area, and their respective biomass contribution to the consumed prey as in other studies (Jedrzejewska, Jedrzejewski,

1998; Zawadzka, Zawadzki, 2007) in other habitats was very minor (Table).

In summary, the studies revealed that Tawny Owls, despite the fact that they inhabit various environments, make use of four groups of sources of food: amphibians, birds, shrews, and rodents, and their proportions in number and biomass in food is a result of utilizing these groups according to their availability.

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2nd Pan-European Duck Symposium to be held in Arles, Camargue (Southern France), 23–26 March 2009, sponsored by The French National Game and Wildlife Agency (Office National de la Chasse et de la Faune Sauvage). All aspects of dabbling-, diving- or seaduck ecology will be considered. Scientists from non-European countries are welcome. Interested people are welcome to join the mailing list to be kept informed regularly. To join the mailing list or for any further information contact:

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