10.2478/v10067-010-0016-7

ANNALES
UNIVERSITATIS MARIAE CURIE-SKŁODOWSKA
LUBLIN – POLONIA

VOL. LXIV, 2 SECTIO C 2009

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The diet composition of the Tawny Owl *Strix aluco* in the Kozłówka Forest (eastern Poland)

Skład pokarmu puszczyka *Strix aluco* w Lasach Kozłowieckich we wschodniej Polsce

SUMMARY

The diet composition of the Tawny Owl *Strix aluco* breeding in the Kozłówka Forest in eastern Poland was analysed. Materials were collected from seven nest-boxes in 2007. The material contained the food remains of 24 species: twelve rodent, two insectivore, one bat, three bird, two fish, as well as three insects and frogs. Among 286 identified prey items, small mammals were represented as dominant group in a food (78.7%). Frogs to made 13.6% all of prey, birds (2.8%), fishes (1.7%), insects (3.2%). The main components of food were forest species of rodents (*Apodemus* and *Clethrionomys)*. Frogs and fishes in the food were only presence in the wet territories with fish ponds and meadows in the small river valleys. Food from the Kozłówka forest contained 8.5% fishes by biomass. To our knowledge, it is the highest level of this food component recorded in European literature.

STRESZCZENIE

Analizowano skład pokarmu puszczyków gnieżdżących się w Lasach Kozłowieckich, położonych w okolicach Lublina we wschodniej Polsce. Materiał do analizy zebrano w 2007 roku z siedmiu budek lęgowych. Materiał zawierał szczątki 24 gatunków: 12 gatunków gryzoni, 2 gatunków owadożernych, 1 gat. nietoperza, 3 gat. ptaków, 2 gat. ryb, 3 gat. owadów oraz szczątki żab. Wśród 286 zidentyfikowanych ofiar dominującą grupą w pokarmie były drobne ssaki (78,7%). Żaby stanowiły 13,6% składu pokarmu, ptaki 2,8%, ryby 1,7%, a owady 3,2%. Głównym składnikiem pokarmu były leśne gatunki gryzoni z rodzaju *Apodemus* oraz *Clethrionomys*. Żaby i ryby były obecne w pokarmie jedynie na terytoriach z udziałem stawów rybnych, wilgotnych łąk oraz małych

dolin rzecznych. Ryby w pokarmie puszczyków z Lasów Kozłowieckich stanowiły 8,5% upolowanej biomasy. Według naszej wiedzy jest to największy udział tej kategorii zdobyczy w pokarmie puszczyków zanotowany w europejskiej literaturze ornitologicznej.

K e y w o r d s: Tawny Owl, *Strix aluco*, food, pine forest, eastern Poland

INTRODUCTION

Tawny Owl *Strix aluco* is the most common species of owl in Poland (Tomiałojć & Stawarczyk 2003, Grzywaczewski & Szczepaniak 2007). This species in Poland, similarly as in Europe, breeds in old forest, urban parks and gardens but also starts to nest in the cities (Galeotti 1990, Jabłoński 1991, Luniak 1996). But typical Tawny Owl habitat are broadleaved woodlands and forests (Southern 1970, Mikkola 1983). Results of diet analysis of Tawny Owl in western countries of Europe based mainly on pellet examination (Glutz & Bauer 1980, Cramp & Simmons 1980). Food remains and pellets lefts in the nest-boxes were analysed in the breeding and non-breeding periods by many authors. Most of data came from England (Southern 1954, 1969), Germany (Wendland 1980), Finland and Sweden (Mikkola 1983) and recently from Lithuania (Balciauskiene 2005, Balciauskiene et al. 2005, Balciauskiene et al. 2006). Many studies were done in other European countries (Glutz & Bauer 1980). In Poland diet of the Tawny Owl was studied in different habitats (Jędrzejewski et al. 1994, Jędrzejewski et al. 1996, Żmihorski & Osojca 2006). Many authors underline strong correlation between diet composition of the Tawny Owl and common species of vertebrates living in breeding habitat of this owl (Cramp & Simmons 1980, Mikkola 1983). This opportunistic strategy of the Tawny Owl observed in hunting areas, is subject to seasonal and geographical variation in the diet (Galeotti 2001). The food analyses of materials from nest-boxes performed in the study area confirmed published data.

The aims of this work were:

1) to present all-year composition of the Tawny Owl food in the Kozłówka Forest;

2) to compare the species composition of the food from different habitats in the study area (wet and dry).

METHODS

Our study was performed in the Kozłówka Forest (51˚30'N, 22˚35'E), one of the biggest forest complexes, situated 20 km to the north of Lublin in eastern Poland (Fig. 1). The study area was 46.2 km^2. The structure of the stand is characteristic of the majority of the State Forests in Poland. Predominating were: coniferous forest (70%) with pine *Pinus sylvestris* as dominant, oak-hornbeam forest (20%), marshes, meadows and alder swamp forest – 10% (see Wiącek 1993). Study area stands consisted of six dominant species: pine *Pinus sylvestris* (77.9%), oaks *Quercus robur* and *Quercus petraea* (12.8%), birch *Betula pendula* and *Betula pubescens* (4.9%), alder *Alnus glutinosa* (3.3%). The pine similarly as oaks was on average 73 years old, birch – 63 and alder 52. The food remains and pellets of the – Tawny Owl were collected from seven nest-boxes, where owls were breeding in 2002–2006. We analysed all-+year diet of Tawny Owl from different periods of breeding cycle and non-breeding stage.

Materials were collected in the end of March and April 2007 from actually not settled nest--boxes. Monitored nest-boxes were not regularly settled by Tawny Owl in different breeding seasons since 2002. The remains of 286 prey items were identified by skulls, jaws, dentaries, feathers of birds, wing covers of insects. Prey of the Tawny Owl was analysed in laboratory using stereomicroscope and identification key (Pucek 1981). A collection of skulls of local species of mammals were used in

species identification. Identifiable fragments of preys were counted and completed for the number of individuals estimated. Biomass of mammal preys was estimated with the use of keys (Pucek 1981, Sokołowski 1965) for birds and Mattison (1982) for frogs. Biomass of fishes was estimated by the method described by Libois et al. (1987). The breadth of the food niche was calculated by Levins (1968).

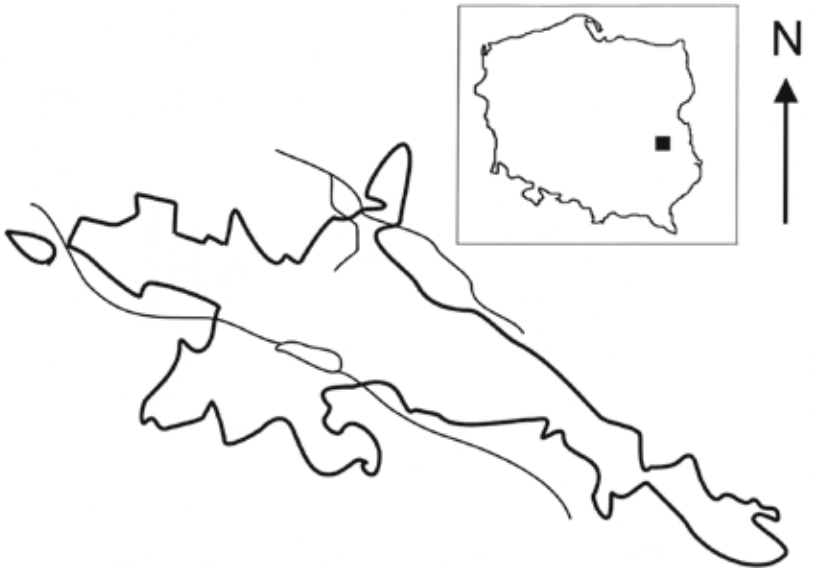

Fig. 1. The map of the study area

RESULTS

Food analyses from pellets and materials from next-boxes of the Tawny Owl in the Kozłówka Forest show that the main food component were small mammals (78.7%). Frogs made up 13.6% of all prey, while birds 2.8%, fishes 1.7% and insects 3.2%. Structure of food by biomass consumed by the Tawny Owl was similar: mammals (79.6%), frogs (10.%), birds (1.8%). But biomass of the fishes (two heavy individuals of *Cyprinidae*) was higher (8.5%) in comparison with the number of prey in the diet (1.7%). Biomass of insects in the food was low (0.1%). Food of the Tawny Owls breeding in nest-boxes in the Kozłówka Forest contained fragments of preys from 24 species of animals. Most of them (21) belong to vertebrates, only three species belong to insects. In detail, the diet of the Tawny Owl was presented in Table 1.

The basic components of food were forest species of *Apodemus* and *Clethrionomys glareolus* (each above 5% of food). The important element of diet in wet habitats were frogs and fishes. Fragments of frogs and fishes were collected from three nest-boxes situated near fish ponds or a small river near forest border. Ma-

Table 1. Food of the Tawny Owl *Strix aluco* by number of prey and consumed biomass in the Kozłówka Forest

Species	N	%	Biomass consumed (g)	% by biomass
European mole *Talpa europea*	3	1.0	285	3.3
Common shrew *Sorex araneus*	8	2.8	90	1.0
Common dormouse *Muscardinus avellanarius*	6	2.1	96	1.1
Bank vole *Clethrionomys glareolus*	**50**	17.5	**1215**	14.2
Root vole *Microtus oeconomus*	4	1.4	188	2.2
Short-tailed vole *Microtus agrestis*	**14**	4.9	**469**	5.5
Common vole *Microtus arvalis*	6	2.1	165	1.9
European pine vole *Microtus subterraneus*	1	0.4	17.3	0.2
Microtus spp.	2	0.7	62.6	0.7
Arvicolidae	10	3.5	300	3.5
Harvest mouse *Micromys minutus*	2	0.7	15	0.2
Striped field mouse *Apodemus agrarius*	9	3.1	211.5	2.5
Yellow-necked mouse *Apodemus flavicollis*	**24**	8.4	**720**	8.5
Wood mouse *Apodemus sylvaticus*	7	2.5	140	1.6
Apodemus sylvaemus	**63**	22.0	**1575**	18.3
House mouse *Mus musculus*	2	0.7	31	0.4
Muridae	5	1.8	101.3	1.2
Brown rat *Rattus norvegicus*	3	1.0	**946.5**	11.0
Rodentia	5	1.8	126	1.5
Noctule bat *Nyctalus noctula*	1	0.4	30.5	0.4
Garden warbler *Sylvia borin*	1	0.4	18	0.2
Robin *Erithacus rubecula*	1	0.4	17	0.2
Chaffinch *Fringilla coelebs*	3	1.0	64.5	0.8
Fringillidae	3	1.0	72	0.8
Rana spp.	**39**	13.6	**885.3**	10.3
Cyprinidae	2	0.7	**700**	8.2
Roach *Rutilus rutilus*	3	1.0	35.1	0.4
European Hornet *Vespa crabro*	1	0.4	< 9	0.1
European Cockchafer *Melolontha melolontha*	4	1.4		
Geotrupes spp.	4	1.4		
TOTAL	**286**	**100.0**	**8585.5**	**100.0**

terials from the fourth strictly forest area contained only fragments of mammals, birds and insects. On the basis of the full diet, the niche breadth of the Tawny Owl was estimated at B=9.4.

DISCUSSION

Many authors describing the diet of the Tawny Owl in Europe and Poland stress opportunism in the feeding strategy of this species (Jędrzejewska & Jędrzejewski 2001, Galeotti 2001).

The Tawny Owl breeding in all Europe has a wide spectrum of food. The range of food niche described in this study, similarly as that given by other authors from different European countries confirm these observations (Mikkola 1983, Gramsz 1991, Jędrzejewski et al.1996, Galeotti 2001). This common species of owl, widespread in Poland is a typical forest species, but it also breeds in towns (Tomiałojć & Stawarczyk 2003). Forest species of rodents (*Apodemus* and *Clethrionomys*) are most important food components of this owl in Poland (Jędrzejewska & Jędrzejewski 2001, Żmihorski & Osojca 2006). On the other hand, city populations of the Tawny Owl prefer birds in the diet (Goszczyński et al. 1993, Galeotti 2001). Similarly as in the Białowieża National Park the dominant group in Tawny Owl food in the Kozłówka Forest were forest species of mice – *Apodemus* and *Clethrionomys glareolus* (Jędrzejewska & Jędrzejewski 2001). Less important food components were shrews and birds. Similar situation was described in pine forests of central Poland (Kowalski & Lesiński 1990) and in oak and hornbeam forests near Oława in Western Poland (Gramsz 1991). In the European literature similar components of food from oak and mixed wood were described in France (Henry & Perthuis 1986). The Tawny Owl from Kozłówka fed with success on frogs, very common in the time of spring in wet parts of forest, near ponds or on the meadows near the study area. Similar data was described by Petty (1999) from the Kielder Forest in England. A lot of frogs in the diet were connected with localization of nest-boxes, situated in the study area by workers of the State Forest. Sometimes nest-boxes were situated in sub-optimal habitats, different from that preferred by owls with natural holes. The natural holes were always occupied in dry habitats as pine forest or hornbeam (Wiącek 1993, Wiącek et al. 2007). Therefore pairs of birds from wet territories, utilized food resources as widespread frogs. Fishes in the diet of the Tawny Owl were always very rarely recorded in literature (Galeotti 2001). Food from the Kozłówka Forest contained 8.5% fishes by biomass. To our knowledge, it is the highest level of this food component recorded in the European literature. Only Bouvier and Bayle (1989) described fishes in food of the Tawny Owl (2.7%) in the forest of south-east France. These data suggest that Tawny Owls exploit easily

available food resources in the territory. Data presented by Kowalski and Lesiński (1990) from central Poland confirm this opportunity strategy. In their researches, the cave with bats was present in the study area. Therefore, bats were represented in the food (18.8%), but other data did not confirm high attractiveness of this kind of food despite occurrence of bats in the study area (this study, Sara & Massa 1985, Jędrzejewski et al. 1996, Bouvier & Bayle 1989, Galeotti 2001).

Summarizing, diet composition of the Tawny Owl from the Kozłówka Forest is representative for pine forest in Poland, where majority of forest areas are managed by the State Forest. The diet of this owl is characteristic of "typical generalist" with a wide food niche. The dominant group of mammals in the diet of the Tawny Owl in Kozłówka were forest species of rodents, but in different seasons owls completed their diet by frogs in the time of spring, birds (adults and fledglings) in the summer and carcass fishes in the winter time.

ACKNOWLEDGEMENTS

We are grateful to Mr. Lech Gajuś (Forest Officer from State Forest in Lubartów) for professional assistance in the field study and to the students from Maria Curie-Skłodowska University: Żaneta Jakubowska, Marlena Giza, Marta Kolanecka for their help in the field work.

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