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The food of the tawny owl (*Strix aluco* L.) from near a bat cave in Poland

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Abstract. Tawny owls living near the Szachownica cave in central Poland caught bats more frequently compared to other studies of tawny owl diet. There were significant differences in the frequency of different bat species taken by the owls compared with the bats present in the cave. *Myotis myotis* was the most abundant and largest bat in the cave. It was not preferentially taken by the tawny owls, although it comprised around half the number of prey consumed by the owls.

Key words. Aves, Strigiformes, *Strix aluco*, Mammalia, Chiroptera, food choice, Poland.

Introduction

The food of the tawny owl comprises mostly small mammals, birds and amphibians (Mikkola 1983, Cramp 1985). The species composition of prey is related to what is available within the territories of the owls (Mikkola 1982). Bats are recorded infrequently in the diet of tawny owls (Mikkola 1983, Cramp 1985). Data from Poland have shown that bats form up to 2.9 % of the owl prey (Ruprecht 1979), although it is usually much lower. For instance 0.4 % in the Białowieża Primeval Forest (Ruprecht & Szwagrzak 1987), 0.2 % in the Masurian Lake District (Kowalski & Lesiński 1988) or less than 0.1 % around Warsaw (J. Goszczyński, P. Jabłoński, G. Lesiński & J. Romanowski, unpubl. data). Ruprecht (1979) suggested that among Polish owls it is probably the tawny owl that catches bats most frequently. It is unclear whether low frequencies of bats in the owl diet are due to their scarcity or because they are difficult to catch.

The aim of this work is to investigate whether tawny owls exploit bats for food when they are living near a cave where large numbers of bats hibernate.

Study Area, Material and Methods

Szachownica cave is located at the northern edge of the Kraków-Wieluń Upland (Częstochowa voivodship, 51 °04'N; 18 °50'E) in a limestone hill covered with a pine forest (*Pinus silvestris*) including a few birches (*Betula* sp.), beeches (*Fagus silvatica*), oaks (*Quercus* sp.) and larches (*Larix* sp.). The cave lies about 0.5 km off the edge of the forest and 1 km from the nearest buildings. Bats staying in the cave were counted two or three times a year from 1980 to 1988. In the autumn and winter months (October—April) bats occurred numerously (max. 1477 individuals — 8 III 1987 — unpubl. data of authors). In the summer months they were rarely encountered.

Tawny owl pellets were collected in chambers located near the entrance of the Szachownica cave and under nearby trees on Jan. 29 and Mar. 7, 1987 and Jan. 29, 1988. This latter sample of pellets comprised 22 complete ones and remains of numerous older pellets. In the lower bone layer we found a bat-ring from a *Myotis nattereri* ringed in January 1982. We assume that the oldest bone remains come from that period of time.

The prey items were largely identified from skull remains but occasionally other skeletal remains were used, for instance the humerus of *Talpa europaea* and the os ilium of amphibians.

Lesiński (1983 a) has previously described the food of the tawny owl in the same locality

from a smaller number of pellets collected on Aug. 3, 1982. That material is included in this paper.

The distribution of bat occurrence in the food of the owl and in the cave was compared using a chi-square test.

Results

The most frequent species identified from the owl pellets are small mammals associated with forest habitats (Tab. 1). For instance *Clethrionomys glareolus* and *Apodemus flavicollis* comprise over 25 % of the prey items, while small mammals of open habitats such as *Microtus arvalis*, *Mus musculus* and *Apodemus agrarius* comprise only about 7 %. Bird and amphibian remains are present in the pellets in small numbers, whereas bats constitute over 20 %. The seven species of bats recorded in the pellets also inhabit the cave during hibernation (Lesiński 1983 b), but the frequency of occurrence of the various species in the pellets and in the cave show highly significant differences (Tab. 2). This is largely due to the owls which took propor-

Table 1: The food of the tawny owl from Szachownica cave.

Species	N	%
Insectivora		
Talpa europaea L., 1758	4	0.9
Sorex araneus L., 1758	64	14.9
S. minutus L., 1766	24	5.6
Chiroptera		
Myotis myotis (Bork., 1797)	44	10.3
M. nattereri (Kuhl, 1818)	13	3.0
M. mystacinus (Kuhl, 1819)	1	0.2
M. brandti (Eversmann, 1845)	2	0.5
M. dasycneme (Boie, 1825)	1	0.2
M. daubentoni (Kuhl, 1819)	26	6.0
Plecotus auritus (L., 1758)	6	1.4
Rodentia		
Clethrionomys glareolus (Schreb., 1780)	83	19.3
Microtus agrestis (L., 1761)	2	0.5
M. arvalis (Pall., 1779)	8	1.9
Microtus indet.	7	1.6
Mus musculus L., 1758	10	2.3
Apodemus agrarius (Pall., 1771)	12	2.8
A. sylvaticus (L., 1758)	13	3.0
A. flavicollis (Melchior, 1834)	27	6.3
Apodemus indet.	40	9.3
Muridae indet.	2	0.5
Aves indet.	19	4.4
Amphibia		
Pelobates fuscus (Laur., 1768)	2	0.5
Hyla arborea (L., 1758)	1	0.2
Rana indet.	14	3.3
Coleoptera indet.	5	1.2
Total	430	100.0

tionally more *Myotis daubentoni* and proportionally less *M. nattereri* in relation to the percentage of the bats inhabiting the cave. Nearly half of the bats taken by the tawny owls are of one species — *M. myotis*.

Discussion

There are few reported cases of bats taken by the tawny owl (Jaskowski 1956, König 1961). Gauckler & Kraus (1963) indicate that some individual owls may specialize to catching bats near sites where bats hibernate. Other predators are also reported to exploit concentrations of bats. In the undergrounds of the Nietoperek reserve in Poland the stone marten (*Martes foina* Erxl.) preyed on bats almost exclusively (over 80 % of the food biomass: Urbańczyk 1981, Lesiński & Romanowski 1988). Therefore, it is of interest that the diet of tawny owls in the vicinity of the Szachownica cave included many bats as well as small mammals from open and woodland habitats.

The presence of large numbers of bats did not change the food of owls to a degree observed in the case of the stone marten in Nietoperek, presumably because the marten removed bats from the walls of underground corridors, whereas tawny owls catch their prey in flight, which is far more difficult.

M. daubentoni is the most numerous species in the cave in summer (over 60 % of bats), but in winter its percentage decreases to about 3 %. High percentage of *M. daubentoni* in the owl pellets (28 %) in relation to the percentage of the species in the cave (4.8 % — Tab. 2) generally points that the majority of bats were caught in the spring, summer and autumn months (April—November). Presumably during this time, when the bats were most active, the tawny owls could easily catch them when they flew to and from the cave. Bat species occurring in the cave only in winter (e. g. *M. nattereri*) appeared less numerously in the owl pellets than in the cave (Tab. 2).

Table 2: The percentage of the bat species observed in the food of tawny owls and in the cave (means of all counts in the years 1980—1988). The difference between A and B is highly significant, $\chi^2_7 = 35.2$ ($p < 0.001$), and similar between A and C, $\chi^2_7 = 53.5$ ($p < 0.001$).

Species	In the food of *S. aluco* (A)	In the cave generally (B)	In the cave in the period of Apr.-Oct. (C)
M. myotis	47.3	48.2	66.8
M. bechsteini	0	0.3	0.3
M. nattereri	14.0	36.3	15.1
M. mystacinus/M. brandti	3.2	3.5	5.5
M. dasycneme	1.1	0.2	0.2
M. daubentoni	28.0	4.8	9.7
P. auritus	6.5	5.6	2.3
B. barbastellus	0	1.1	0.2
Number of specimens	93	7753	650
Number of cave controls	—	20	6

The results do not suggest that the tawny owls selected the largest bats. *M. myotis* is considerably larger than other species present in the cave and was taken by the owls in proportions similar to its occurrence in the cave. Numerically *M. myotis* comprised around half of the bats taken by the owls (Tab. 2).

Taking into account the fact that the bats were eaten during a couple of years at least, we conclude that the owls influenced the numbers of bats to a low degree.

Zusammenfassung

In dieser Arbeit wurde eine Analyse der Nahrung eines Waldkauzes, der die Gegend der Höhle Szachownica besiedelt, vorgestellt. In dieser Höhle halten alljährlich über 1000 Fledermäuse ihren Winterschlaf. Die Gewölle wurden zwischen 1984 und 1988 gesammelt. Daraus sind 430 Opfer präpariert worden (Tabelle 1), darunter 21,5 % Fledermäuse. Tabelle 2 präsentiert einen Vergleich der Artenzusammensetzung von Fledermäusen, die in den Gewöllen der Eulen und in der Höhle gefunden worden sind. Alle Arten, die von dem Waldkauz gejagt werden, bewohnten die Höhle. Die Autoren deuten an, daß die Fledermäuse in der Zeit ihrer größten Aktivität, d. h. der Ankunft in der Höhle und während des Verlassens, gefangen wurden (April—November). Darauf weist der große Anteil von *M. daubentoni* hin (28,0 %). Im Sommer macht diese Art über 60 % der Fledermäuse in der Höhle aus, im Winter sind es dagegen nur 3 %. Was *M. nattereri* betrifft, der erst im Spätherbst auftaucht (November), ist sein Anteil geringer im Gewölle (14,0 %) als in der Höhle. Es wurden keine Präferenzen des Waldkauzes bemerkt, was die großen Fledermausarten angeht.

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