Folia Zool. – 58(1): 98–103 (2009)

Bat predation by the barn owl *Tyto alba* in a hibernation site of bats

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Received 28 May 2007; Accepted 23 January 2009

A b s t r a c t . Bats appear regularly among the mammalian prey species of the barn owl. However, from numerous studies of owl pellets, bats are rarely represented in the prey of the barn owl and usually make up less than 1% of the prey individuals. Prey remains of the barn owl from the fortress Dömitz, south-east of Mecklenburg-Western Pomerania (Germany) were collected and analysed. A total of 2931 identifiable fragments from at least 1100 vertebrate individuals were discovered and identified. The analysis of the pellets over a four year period shows that, aside from the typical spectrum of mammalian prey (voles 34.9%, shrews 24.6 % and mice 13.8%), a relatively large proportion of prey individuals (26.6 %) were bats. From the pellet sample from 2002, Natterer's bat *Myotis nattereri* were clearly the dominant prey with 79 individuals (30.2 %) followed by the common vole *Microtus arvalis* with 74 individuals (28.2 %). This high frequency of bats from the 2002 sample led to a total percentage of bats of almost 39 % and bats were clearly dominant over other potential prey groups. The frequency of bats in all samples is much higher than in all other known studies of barn owl pellet samples in a comparable volume. Our results show that *Tyto alba* is an opportunistic but no selective hunter of bats.

Key words: feeding ecology, food preference, pellet analysis, *Myotis*, Chiroptera

Introduction

The food preferences of the barn owl (*Tyto alba*) in the Palaearctic are well known: the main prey are voles, followed by other small mammal taxa such as shrews and murids. It is also known that in some cases a remarkable number of birds, reptiles and amphibians are consumed (K ö n i g 1961, G ö r n e r 1978, L a n g e 2003, S o m m e r et al. 2005). However, the larger the pellet samples, the more clearly visible it is that small mammals, mainly voles, are the dominant prey species. Bats appear regularly among the mammalian prey species of the barn owl, as recorded in Europe (B a u e r 1956, M ä r z 1956, R u p r e c h t 1979, N o w s a d & S a ł a t a - P i ł a c i ń s k a 1987, L e s i ń s k i 1989, O b u c h 1998, K a s p r z y k et al. 2004, P e t r ž e l k o v á et al. 2004, S o m m e r et al. 2005), southern Asia (A g o r a m o o r t y & H s u 2001) as well as South America (V a r g a s et al. 2002, E s c a r l a t e - T a v a r e s & P e s s ô l a 2005). Bats were caught partially directly during flight (B a u e r 1956, A g o r a m o o r t h y & H s u 2001). The predation of bats in their summer colonies has negative effects on the reproductive behaviour (B e r n d et al. 2000) and the presence of owls near the roosts of bats can influence the degree of clustering (P e t r ž e l k o v á & Z u k a l 2003). A study by P e t r ž e l k o v á et al. (2004) shows, at least in the case of the great mouse-eared bats, that *Tyto alba* most probably prefers to prey on flying inexperienced yearlings which are easier to catch. In this study we describe a case of extensive annual bat predation by barn owls in a hibernation site of bats.

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Material and Methods

The owl pellets analyzed came from the fortress Dömitz, south-east of Mecklenburg-Western Pomerania, Germany (Fig. 1). Pellets were collected in the years 2002–2004 and 2006 in the undergrounds of the fortress in the second half of January respectively first half of February during the annual inspection and counting of hibernating bats. The shape and colour of the pellets and feathers which were found are characteristic of the barn owl. Additionally, from time to time during the survey barn owls were observed directly. All identifiable fragments, primarily skulls, were sorted out from the pellets. Tweezers were used for cleaning to prevent loss of teeth from the skulls of bats. From the maximum number of identifiable prey fragments of each prey species, the minimum number of individuals was calculated on the basis of mandibles or upper jaws (Table 1). The determination of the mammalian bones was carried out using T u r n i (1999) and S c h o b e r & G r i m m b e r g e r (1998). The results of the counting of hibernating bats in the fortress of Dömitz from 1996–2006 is listed in Table 2 for comparison.

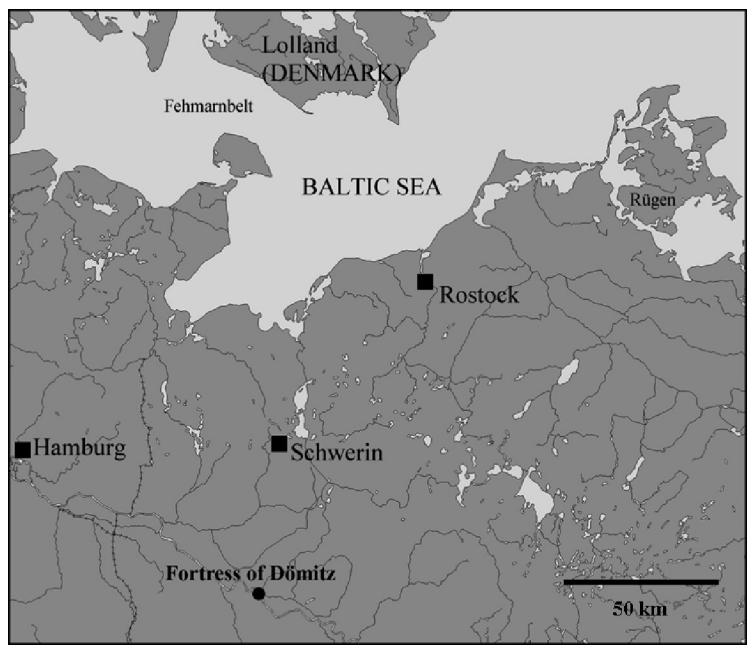

Fig. 1. Geographic position of the fortress of Dömitz in northeastern Germany.

Results and Discussion

In total, 2931 identifiable fragments of at least 1100 vertebrate individuals were discovered and identified among the prey remains of the barn owl. The analysis of the pellets shows that, aside from the typical spectrum of mammalian prey species (voles 34.9%, shrews 24.6 % and mice 13.8%), a relatively large proportion of prey individuals (26.6 %) consists of bats. Within the pellet sample from the year 2002, Natterer's bat *Myotis nattereri* were already clearly the dominant prey (30.2 %) followed by the common vole *Microtus arvalis* (28.2 %). This high frequency of bats from the 2002 sample (including *Myotis myotis* and *Myotis daubentonii*) led to a total percentage of bats of nearly 39% and bats clearly dominate all

Table 1. Results of the prey analysis of *Tyto alba* from the fortress of Dömitz (northeastern Germany).

	Minimum number of individuals				minimum number of individuals	percentage of the prey	biomass of the prey
Prey species	2002	2003	2004	2006	n	(%)	(g)
Microtus arvalis	74	88	51	112	325	29.5	7215
Microtus agrestis	8	15	10	8	41	3.7	1131
Microtus sp.	1	-	2	-	3	0.3	75
Clethrionomys glareolus	6	4	1	-	11	1	220
Arvicola terrestris	-	3	1	-	4	0.4	320
Apodemus sylv. / flav.	21	20	6	8	55	5	1361
Apodemus agrarius	11	23	8	9	51	4.6	1020
Apodemus sp.	3	1	21	13	38	3.5	566
Micromys minutus	1	5	-	2	8	0.7	56
Sorex araneus	25	127	51	22	225	20.5	2070
Sorex minutus	4	20	11	2	37	3.4	143
Crocidura leucodon	4	1	-	-	5	0.5	575
Neomys fodiens	-	-	2	-	2	0.2	274
Talpa europaea	-	-	-	1	1	0.1	70
Myotis myotis	2	-	-	-	2	0.2	58
Myotis nattereri	79	83	49	23	234	21.3	1638
Myotis daubentonii	18	15	10	6	49	4.5	588
Myotis sp. *(daub./natt.)*	3	-	3	-	6	0.5	47
Plecotus auritus	-	1	-	-	1	0.1	75
Passer domesticus	-	-	-	1	1	0.1	285
Lacerta sp.	-	-	1	-	1	0.1	
Rana temporaria	1	-	-	-	1	0.1	36
Pelobates fuscus	1	-	-	-	1	0.1	50
total number	262	406	227	207	1100		

other potential prey groups (Fig. 2). Nearly 30 % of the biomass in this sample consists of bats (Table 1). This seems to have been a unique phenomenon, because in the following years a decrease of the bats as prey of the barn owl is clearly visible (Fig. 2). However, despite of this decrease, the frequency of bats in all samples is much higher than in all other known samples of barn owl pellet samples in a comparable volume. If the numbers of prey specimen in the whole analysis is compared, bats are the second main prey group of the barn owl (26.6 %), followed by shrews (24.7 %). After M i k k o l a (1983) bats are rarely represented as prey of the barn owl and usually consist of less that 1% of the prey individuals. This is demonstrated by the last large-scale pellet analysis of barn owls in this geographical region of Mecklenburg-Western Pomerania, where among 7443 prey individuals (Z o l l e r et al. 2004) no bats were found. The results of the following authors, who studied the appearance of bats in the diet of the barn owl using large-scale samples (more than 1000 prey individuals) show that this prey group generally has a low importance for *Tyto alba*: M ä r z (1956): among 3346 vertebrate individuals 1 bat (0.03%), K a s p r z y k et al. (2004): 0.19%), R u p r e c h t

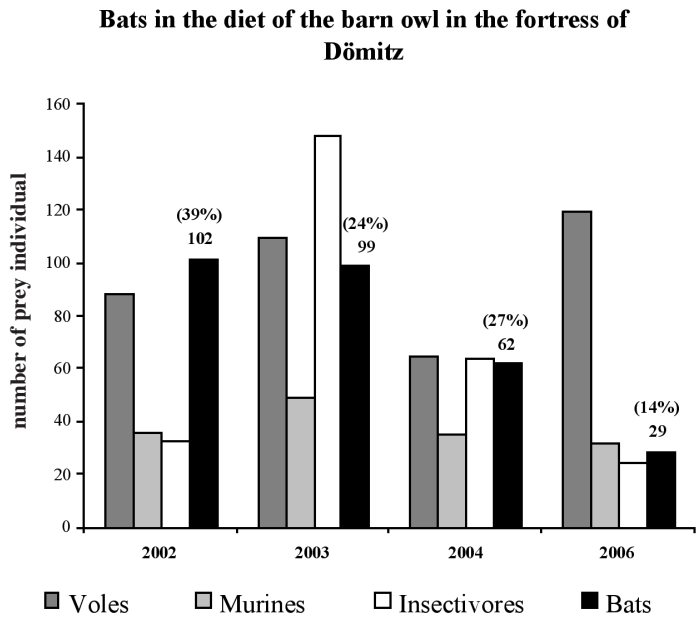

Fig. 2. Frequency of bats in the diet of the barn owl during 2002–2006.

(1979): 0.26 % and Nowsad & Sałata-Piłacińska (1987): 0.37 %. Nowsad & Sałata-Piłacińska (1987) recorded a significantly lower proportion of bats in the diet of the barn owl in the western part of Poland (0.08 %) than in the eastern part of the country (0.46%).

While we report such high rate of bat predation in barn owls for the first time, it was documented in the tawny owl (*Strix aluco*) by Kowalski & Lesiński (1990) in Poland and Obuch (1998) in Slovakia from bat hibernation sites in caves.

Until recently, all cases of predation of bats by the barn owl were described from summer roosts (Bauer 1956, März 1956, Bilo 1989, Bernd 2000). Here we demonstrate that *Tyto alba* is able to prey on the bats directly as they arrive at their hibernation site. The bats must have been caught during flight because for hibernation they use very thin spaces between the walls of the fortress, which barn owls would not be able to enter. The only bat species which hangs for hibernating in clustered colonies at the roof and would be reachable during hibernation by barn owls is the great mouse-eared bat *Myotis myotis*, which

Table 2. Results of the yearly counting of hibernating bats in the fortress of Dömitz (northeastern Germany).

Bat species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Myotis myotis	3	6	7	13		11	-	-	-	-	-
Myotis nattereri	81	31	108	79	no counting	9	35	18	31	31	27
Myotis daubentonii	1	19	5	4		70	13	1	9	8	-
Myotis sp. *(daub./natt.)*	-	-	-	-		-	2	-	-	-	-
Plecotus auritus	10	6	12	7			4	2	-	8	2
Myotis brandti	-	-	-	1		-	-	-	-	-	-
total number	95	62	132	104		90	54	21	40	47	29

is scarcely represented with two individuals. The high frequency of bats from the barn owl pellets from Dömitz seems to be strongly correlated with the fact that there is an important hibernation site for bats in the area. This resource appears to be limited temporally as the results were most emphatic from 2002.

When comparing the results of the yearly counted bats in the hibernation site (Table 2) and the number of bats from the pellets in the same year, there is no correlation between the percentages of bat species in the pellets and in the counted hibernating bats from mathematical point of view. However, as shown in Table 2, it is obvious that the barn owl is no selective but an opportunistic hunter because it catch the bat species which were most abundant in this hibernation site during the last ten years.

A c k n o w l e d g e m e n t

Special thanks to Stefan L a b e s (Parchim, Germany) for data collection of hibernating bats in the fortress of Dömitz. Udo B i n n e r (Schwerin, Germany), Axel K l a u e (†)(Schwerin, Germany), Hiltraud M ö l l e r (Jülchendorf, Germany), Guido M u n d t (Halle, Germany), Petra R u ß b ü l d t (Schwerin, Germany) and Barbara S c h l ü t e r (Berlin, Germany) were involved in the yearly counting of hibernating bats in the fortress of Dömitz during 1996–2006. We are grateful to Rob C a r t h y (Gateshead, England) and Frank Z a c h o s (Kiel, Germany) for the linguistic revision of the manuscript. Many thanks to two anonymous reviewers for their helpful comments.

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