

We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

185,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



A Review of European Owls as Predators of Bats

Alan Sieradzki and Heimo Mikkola

Abstract

Fossil evidence indicates that owls have been preying on bats from as far back as the Pleistocene. Overall, bats form quite small portions (i.e. trace to 0.2%) of the diets (by prey frequency) of European owls. An assessment of dietary studies and anecdotal accounts reveals that five species of European owls, the Eurasian scops owl *Otus scops*, Pygmy owl *Glaucidium passerinum*, Tengmalm's owl *Aegolius funereus*, little owl *Athene noctua* and Ural owl *Strix uralensis*, rarely feed on bats (with less than 0.1–0.4%) and a further two species, short-eared owl *Asio flammeus* and eagle owl *Bubo bubo*, may only take bats occasionally, while three species, long-eared owl *Asio otus*, barn owl *Tyto alba* and tawny owl *Strix aluco*, feed on bats more frequently. In this study, a total of 19,864 recorded bats have been preyed upon by these owls, with as many as 48 bat species being identified. Barn and tawny owls have captured most of this total (47.1 and 41.9%), followed by the long-eared owl (7.6%), while short-eared and eagle owls take similar amounts of bats (1.1 and 1.7%, respectively). Owl predation on bats deserves future research because it may help contribute to our knowledge on bat biodiversity and distribution and possibly identify an additional risk for small populations of endangered bats.

Keywords: European owls, bats, predation

1. Introduction

Bats are the only mammals capable of self-powered flight yet constitute some 20% of all living mammal species, with as many as 110 separate bat species coexisting within the same ecological community, a number that far exceeds that of any other mammalian group [1, 2]. Bats diversified in the Early Eocene in response to an increase in prey diversity, and Eocene bat fossils have been found on most continents leaving the geographic origin a source of debate [1]. Despite their taxonomic and ecological diversity, modern bats (order: Chiroptera) are almost exclusively nocturnal. Rydell and Speakman [3] think that predation risk could have been a significant factor preventing early bats from becoming diurnal. The only other vertebrates that exploit niches for nocturnal flying predators are the owls and nightjars. Fossil evidence indicates that owls have been predating on bats from as far back as the Pleistocene [4, 5]. Since bats are very fast in flight, predation pressure on bat populations is likely to be a minor cause of mortality. Indeed, in the owl diets from North America (23,888 prey items) and temperate Europe, plus Iraq, reviewed by Marti [6], bats did not occur. In later reviews, Mikkola [7] found that bats accounted for 0.04% of prey items of barn *Tyto alba*, tawny *Strix aluco* and long-eared owls *Asio otus* in the British Isles (67,405 prey items) with the same percentage

for short-eared *Asio flammeus* and Tengmalm's owls *Aegolius funereus* (15,147 prey items) in Europe and Finland. For the Eurasian eagle owls *Bubo bubo* (17,615 prey items), bats accounted for 0.03% of prey taken in Fennoscandia.

In this paper, we examine the ecological relationships between owls and bats and see if the larger owl species take larger bats as they tend to do with other prey [8].

2. Methods

We conducted a literature review examining bats as prey in the diets of European owls. The literature examined was published between 1886 and 2018 and covered the ecological timeframe of the Pleistocene to current day. A total of 1680 publications were examined, and a synthesis of the findings is reported here. Utmost effort has been made to avoid duplication in the counting of the same bats mentioned in the review papers and/or multiple papers by the same author. The collection of the data was limited to Eurasia and one particular case study in North Africa (short-eared owl—Algeria). Only 8 European owl species had more than 10 bats in their diet studies, namely, barn owl, tawny owl, long-eared owl, short-eared owl, Eurasian eagle owl, Tengmalm's owl, Ural owl *Strix uralensis* and little owl *Athene noctua*.

Bat weights are drawn from [9–13] as an average of values given. Species weight is the average of the species of that family. Owl weights from [14] are an average of extremes for females and males combined. Our analysis is focused on the frequency of bats in the diet of owls; we also compare the weights of the bat species to the weights of the owl species which ate them. We did not assess bats in terms of their role in the collective biomass of prey taken by the owls.

3. Results

3.1 How owls capture bats

Bats are captured by owls mainly during the periods of emergence or return from roosts, but owls are in general not well adapted for catching bats [15]. The relative benefits of capturing substandard individuals are greatest just when a predator is attacking a species of prey which is typically difficult to capture and kill [16].

Some authors have indicated that barn owls frequently capture young bats that are not yet able to fly [17] and that bats seem to be rarely captured in flight [18]. In Vickery Bat Cave, Oklahoma, barn owls were observed using a wholly unique technique to capture adult Mexican free-tailed bats *Tadarida brasiliensis*. Appearing at dusk when the bat flight from the cave was at its height, the owls dropped from a ledge only 3 m or so above the bats and moved swiftly along with them, often making a capture. Each owl appeared to select one bat before starting the chase, and the bats were caught with 'unerring precision'. Looney [19] witnessed on one September evening the capture of seven bats by one or more owls within a 45-minute period.

Another technique witnessed at a different location [20] was when a barn owl flew into a column of bats head-on from above, stalled, with head up, feet down and wings spread wide, catching a bat that struck it in the chest. It was assumed that the bats were not using their echolocation apparatus while flying in such a dense mass. The owl was observed to make four successful captures using this technique.

Research of Petrželková et al. [15] indicates that barn owls most probably prefer to prey on volant inexperienced yearling bats which are easier to catch while

reaching almost adult size. Yearling bats lack flying skills, they are conspicuous during the emergence, and they often concentrate near the roost during their early practice flights, making them more vulnerable to owl predation than adults.

Spitzenberger et al. [21] recorded, with an infrared camera and an automatic registration device, tawny owl attacks on bats entering an attic roost through an access window. At least 333 *Myotis emarginatus* bats entered the roost by flying over or past the owl which attacked 252 times but with only 31 strikes being successful. During a successful attack, the owl extended its legs, jumped upwards with raised wings and snatched and killed the entering bat with the talons of the foot, tore it apart and ate it on the spot or carried it away. The owl killed 5.3% of the maximum number of female bats roosting in the attic during 12 nights. By restricting its attacks to the period of late pregnancy, the owl took advantage of the state of highest vulnerability of the female bats in this maternity colony.

The observations of [19–21] would suggest that individual owls develop their own unique techniques for capturing bats on the wing.

Bats also seem able to avoid predation to some extent during their evening emergence and morning return to and from the roost. Güttinger [22] noted that *Myotis myotis* changed their emergence exit from a roost to avoid the attacks from tawny owls. Petrželková and Zukal [23] have shown with the use of a trained barn owl that *Eptesicus serotinus* bats are using clustering during emergence as an important anti-predation strategy although the owl presence did not induce any major changes in other measured parameters (like onset, end, rate or duration of emergence).

Boratyński [24] made an interesting observation in Poland on how a tawny owl was attempting to catch a *Nyctalus noctula* in the air, but the bat ‘hid in the predator’s shadow’ by flying very close behind it and waiting until the owl gave up hunting. Finally, the bat flew away safely after the owl ceased searching for the lost prey.

Forest-dwelling owls may experience difficulties in capturing any bats that are present, as bats tend to fly close to the trees, as the study by Russo et al. [25] suggests. This may explain why both the great grey owl *Strix nebulosa* and the hawk owl *Surnia ulula* have so far had no bats in their diet lists; and the extremely well studied Eurasian Pygmy owl *Glaucidium passerinum* has so far been recorded preying on only one *Myotis daubentonii* and one unidentified Vespertilionidae bat in Finland [26] and another in Russia [27]. Scherzinger [28] was wondering why *Plecotus auratus* is not found in the diet of the Pygmy owl as both species are known to use old *Dendrocopos major* holes.

3.2 Owl species and bat diversity

At least 48 bat species have been identified in the diet of eight Eurasian owl species (**Table 1**). A total of 19,864 bats have been preyed upon by these owls. The barn owl has captured 47.1% of all recorded bats in this review, but the tawny owl comes a close second with almost as high a percentage (41.9%), although its food samples have been studied much less than those of the barn owl (well over 5 million prey items). The long-eared owl comes far behind these two with just 7.6%. The short-eared owl and the eagle owl take similar amounts of bats (1.1 and 1.7% from this material, respectively). With only trace amounts of bats in their diets (i.e. 0.4 to 0.1%), we still list the little owl, Tengmalm’s owl and Ural owl in **Table 1** but the scops owl only in **Table 2**.

It has been said that larger owl species take larger prey [8]. This study shows, however, that all sizes of bats are widely represented in the diet of the studied owls (**Table 1**). However, there is a statistically significant correlation in the weight of eaten bats and the weight of the owl (0.736, $p < 0.05$). The heaviest owl *Bubo bubo* takes bats with an average weight of 21.5 g, while the smallest owl *Aegolius funereus*

Bat species and weight in grams	T.a.	S.a.	S.u.	A.o.	A.fl.	B.b.	A.fu.	A.n.	Total
<i>Pipistrellus pygmaeus</i> 5.1	50								50
<i>P. pygmaeus</i> or <i>P. pipistrellus</i> 5.3	36								36
<i>Pipistrellus pipistrellus</i> 5.5	661	2415		5	1	10		8	3100
<i>Myotis mystacinus</i> 6.1	69	205	1	2		8	5	2	292
<i>Myotis brandtii</i> 6.5	16	151				1			168
<i>Pipistrellus abramus</i> 6.5			1	658					659
<i>Murina huttoni</i> 6.7		1							1
<i>Rhinolophus hipposideros</i> 6.9	69	135		1		2			207
<i>Pipistrellus sp.</i> 6.9	145	1		144	7			7	304
<i>Murina hilgendorfi</i> 7.0				4					4
<i>Pipistrellus kuhlii</i> 7.3	2146	21		113				12	2292
<i>Hypsugo savii</i> 7.5	16	3						1	20
<i>Asellia tridens</i> 8.0	36			13		3			52
<i>Myotis nattereri</i> 8.3	523	71		13		4	3	1	615
<i>Myotis emarginatus</i> 8.7	54	46				1			101
<i>Myotis capaccinii</i> 8.8	36					1			37
<i>Plecotus auritus</i> 9.3	375	228		5		5	3	1	618
<i>Myotis petax</i> 9.5						2			2
<i>Myotis annectans</i> 9.7		2							2
<i>Barbastella barbastellus</i> 9.7	50	418				8			476
<i>Plecotus sp.</i> 9.8	45						2	2	49
<i>Rhinopoma microphyllum</i> 10.0	3					7			10
<i>Pipistrellus nathusii</i> 10.2	133	22				2		1	158

Bat species and weight in grams	T.a.	S.a.	S.u.	A.o.	A.fl.	B.b.	A.fu.	A.n.	Total
<i>Myotis bechsteinii</i> 10.2	38	125		1		4			168
<i>Plecotus austriacus</i> 10.3	272	11		11					294
<i>Myotis daubentonii</i> 10.9	115	85	5	18			4		227
<i>Nycteris thebaica</i> 11.5	3								3
<i>Eptesicus nilssoni</i> 11.6	17	65	3		2	3	2		92
<i>Miniopterus schreibersii</i> 11.9	55	39				1		1	97
<i>Myotis</i> sp. 12.1	69	1		2	195	4			271
<i>Rhinolophus blasii</i> 12.5	3								3
<i>Rhinolophus euryale</i> 12.9	10	36				6			52
<i>Myotis dasycneme</i> 13.2	33	16							49
<i>Rhinolophus</i> sp. 14.6	2							1	3
<i>Rhinolophus bocharicus</i> 15.1								6	6
<i>Nyctalus leisleri</i> 16.0	24	7							31
<i>Vespertilio murinus</i> 16.6	119	1725			2	51		3	1900
<i>Vespertilio</i> sp. 16.8						1			1
<i>Vespertilio sinensis</i> 17.0				12					12
<i>Rhinolophus mehelyi</i> 17.6	2								2
<i>Eptesicus</i> sp. 18.5		1							1
<i>Hesperoptenus</i> sp. 18.8		1							1
<i>Otonycteris hemprichii</i> 19.0	56					16		5	77
<i>Eptesicus bottae</i> 20.5	19	13				1			33
<i>Myotis blythii</i> 21.3	199	75		1		41		1	317
<i>Eptesicus serotinus</i> 23.4	985	281		120		28		1	1415

Bat species and weight in grams	T.a.	S.a.	S.u.	A.o.	A.fl.	B.b.	A.fu.	A.n.	Total
<i>Rhinolophus ferrumequinum</i> 23.5	135	35				10			180
<i>Taphozous nudiventris</i> 28.0	37	2			2	3			44
<i>Nyctalus sp.</i> 28.1	1								1
<i>Nyctalus noctula</i> 28.3	425	1033		274		19		10	1761
<i>Myotis myotis</i> 32.8	1981	916	1	3		46		2	2949
<i>Tadarida teniotis</i> 38.0	9	3		1					13
<i>Nyctalus lasiopterus</i> 40.1	2	1							3
<i>Cynopterus sphinx</i> 46.0	1								1
<i>Scotophilus heathi</i> 50.0		1							1
<i>Rousettus leschenaulti</i> 60.0	1								1
<i>Rousettus aegyptiacus</i> 135.0	90					4			94
Chiroptera (unidentified)	191	121	1	114	11	54	3	21	515
Total	9356	8312	12	1510	220	346	22	86	19,864
Percentage of the total	47.1	41.9	0.1	7.6	1.1	1.7	0.1	0.4	100.0

T.a. = *Tyto alba*: [29–58], S.a. = *Strix aluco*: [7, 59–90]; S.u. = *Strix uralensis*: [61, 91–96]; A.o. = *Asio otus*: [38, 42, 43, 60, 61, 81, 92, 97–127]; A.fl. = *Asio flammeus*: [46, 92, 128–133]; B.b. = *Bubo bubo*: [37, 60, 61, 92, 134–154]; A.fu. = *Aegolius funereus*: [60, 61, 86, 155–161]; A.n. = *Athene noctua*: [45, 60, 61, 74, 103, 162–177].

Table 1.
Numerical occurrence of bat species in increasing order of weight and unidentified bats in the diet of the most studied owl species in Eurasia.

has taken bats with the average weight of only 8.9 g (**Table 3**). Bat sizes range from 5.1 g, species like *Pipistrellus pygmaeus*, to 135 g species like *Rousettus aegyptiacus* (**Figure 1**). In the diet of owls, an average of 18.5 species of bats was found: barn owl 40, tawny owl 33, eagle owl 27, long-eared owl 18 and little owl 15 (**Table 3**). The remaining three species, short-eared, Tengmalm’s and Ural owls had only eaten five species, each.

The average and maximum percentages of bats that have been eaten by the most studied Eurasian owls are shown in **Table 2**. Bats comprise only a very small part of an owls’ diet; their percentage share amongst all prey is usually much less than 0.2% (**Table 2**). The very low percentage of bats in the food of owls suggests that bats are normally not a profitable prey item for owls, quite possibly because of the time and energy needed to capture them.

Owl	Average % of bats	Sample size	Author(s) and area	Maximum % of bats	Sample size	Author(s) and area
Barn owl (<i>Tyto alba</i>)	0.12	4,023,465	Roulin and Christe [29] Europe	26.6	2931	Sommer et al. [178] Germany
Tawny owl (<i>Strix aluco</i>)	0.07	19,902	Mikkola [7] Europe	30.5	13,791	Obuch [59] Slovakia
Ural owl (<i>Strix uralensis</i>)	0.06	1739	Jäderholm [91] Finland	0.3	1983	Rosina and Shokhrin [92] Far East, Russia
Eagle owl (<i>Bubo bubo</i>)	0.08	29,277	Jánossy and Schmidt [134] Eurasia	5.9	763	Rosina and Shokhrin [92] Far East, Russia
Long-eared owl (<i>Asio otus</i>)	0.04	793,309	Birrer [179] Eurasia	29.3	3561	Tian et al. [97] Beijing, China
Short-eared owl (<i>Asio flammeus</i>)	0.04	5449	Mikkola [7] Europe	39.3	516	Djilali et al. [128] El Golea, Algeria
Tengmalm's owl (<i>Aegolius funereus</i>)	0.04	9698	Mikkola [7] Finland	0.2	581	Uttendörfer [60] Germany
Little owl (<i>Athene noctua</i>)	0.01	23,899	Schönn et al. [180] Europe	2.8	360	Barbu and Sorescu [162] Romania
Scops owl (<i>Otus scops</i>)	0.03	6871	Malle and Probst [181] Europe	0.1	2152	Muraoka [182] Austria

Table 2.
Average and maximum numerical percentages of bats that have been eaten by European owls.

Owl species	Average weight of the owl	Number of bats in the diet	Number of bat species in the diet	Total weight of bats in the diet	Minimum weight of eaten bat species	Maximum weight of eaten bat species	Average weight of all bats eaten
<i>Aegolius funereus</i>	139.5	19	5	169.7	6.1	11.6	8.9
<i>Athene noctua</i>	166.0	65	15	897.3	5.5	32.8	13.8
<i>Asio otus</i>	310.3	1396	18	17,696.3	5.5	38.0	12.7
<i>Tyto alba</i>	332.5	9165	40	164,934.2	5.1	135.0	18.0
<i>Asio flammeus</i>	355.5	209	5	2525.7	5.5	28.0	12.1
<i>Strix aluco</i>	514.3	8191	33	125,874.7	5.5	50.0	15.4

Owl species	Average weight of the owl	Number of bats in the diet	Number of bat species in the diet	Total weight of bats in the diet	Minimum weight of eaten bat species	Maximum weight of eaten bat species	Average weight of all bats eaten
<i>Strix uralensis</i>	839,5	11	5	134.7	6.1	32.8	12.3
<i>Bubo bubo</i>	2542.5	292	27	6267.5	5.5	135.0	21.5
Total/average		19,348	18.5	318,500.1	5.1	135.0	16.5

Table 3. Numbers and weights of bats eaten by European owls in increasing order of weight. The correlation between owl weight and average bat prey weight is 0.736 which is significant at the level of $p < 0.05$. Weights shown are in g.



Figure 1. An eagle owl has brought to its nest a female Egyptian fruit bat with a baby still sucking when figure was taken in 2008. Courtesy of Ezra Hadad, Israel.

Leading the level of bat consumption is the barn owl, although the absolute value, compared to other prey, is a very modest 0.12% (**Table 2**). No other owl species has taken bats over 0.1% in any large study samples. But the percentage rises markedly depending on the availability of bats as owls respond to increasing overall bat abundance in the environment [183]. Small maximum value samples show that near bat caves or in otherwise bat-rich biotopes, the prey share of bats can be significantly higher, up to 25–39% (**Table 2**).

4. Discussion

Contrary to other mammalian orders, bats face a very low risk of predation. Nocturnality and the capacity to reach remote shelters by active flight offer little opportunities for diurnal avian and terrestrial mammalian predators [21]. It has been shown that non-predator and non-accidental mortality of bats (probably caused by a disease, parasites or starvation) measured inside the fortifications

is higher during transitory periods preceding and following the period of deep hibernation, in which mortality is the lowest [184].

In the Far East, it has been noted that the eagle owl eats more bats during the autumn and close to the seashore where, most probably, it hunts these bats during their seasonal spring and autumn migrations along the coast [92].

Bats flying along line landscape elements (forest edges, shore and tree lines) or in open spaces are more exposed to predation [185].

Although the diet studies are equally numerous, in Europe the short-eared owl catches many fewer bats than the long-eared owl, likely due in part to its diurnal activity in open habitat (with fewer bats). However, in Algeria (North Africa), three short-eared owl pairs had more bats (39% by number and 9.3% by biomass) in their diet when long-eared owls in the same area preferred rodents and birds [128].

In the case of the long-eared owl, Garcia et al. [98] concluded that on a geographical scale, bat abundance does not seem to reflect bat availability for owls, maybe because hunting strategies for preferred prey such as small rodents are not well suited for the capture of flying bats. Bats occurred in many long-eared owl diets across the Mediterranean region, but their contribution remained largely irrelevant, although some bat aggregations were a locally important food source for some individual owls during certain periods.

Large barn owl diet samples show well how bats are eaten more in the south than in the north: In Britain, the frequency of bats was only 0.03% of 66,276 prey [185] and was 0.03% out of 102,588 prey in Belgium [30] but was 0.06% of 18,768 prey in the Pyrenees and 0.11% of 10,716 prey in Corsica [30].

Some cave samples for the tawny owl (30.5% bats out of 13,791 prey items) date back to the second half of the eighteenth century [61]. It is not known if the climate was more favourable to bats at that time, but they must have been more abundant. Roulin and Christe [29] have also shown that bat predation by barn owls has decreased during the last 150 years, due to historical declines in bat populations during the last century [186]. This decline could be caused by the human impacts which have affected many bat species. Lesiński [187] showed that in Poland, tawny owls ate fewer bats in the 1980s, possibly due to the intensive use of toxic pesticides during those years.

5. Conclusions

Owls prey on bats rarely and opportunistically, although bat aggregations could be a locally important food source for some species and individual owls during certain periods. Also, the decrease in the main prey (rodent) abundance can lead owls to expand their diet and include bats. It has been said that pellet studies could underestimate or even miss small bats taken by owls [185]. This study shows, however, that all sizes of bats are widely represented in the diet of the studied owls. That larger owls tend to take larger bat prey could be useful in archaeological cave studies when trying to identify the original predator of recovered bone/fossil remains [188].

We found two main obstacles in the food studies of European owls: first, several studies did not present complete lists of prey numbers or frequencies (often bats are combined with shrews, as insectivorous mammals), and second, identification skills to name the bat species showed a large variation (in this material we had 515 unidentified bats). We urge future owl diet studies to include complete prey lists to provide future reviewers with more accurate bat occurrence data.

Although the number of bats found in owl pellets can be small, such data collected may represent important faunistic and biodiversity contributions, particularly for rare species. Many bat species still have a 'data deficient' conservation label, and even in the most recent atlas of Bats in many European countries, the data on distribution of some bat species remains very scarce and incomplete [31].

Acknowledgements

We thank Dr. Risto Tornberg, University of Oulu, Finland, for helping with the statistics and David H. Johnson, Director of the Global Owl project, for the helpful editorial comments and input on the project. Jevgeni Shergalin kindly obtained and translated a few Russian books and papers for this study. We also thank Ezra Hadad for the kind use of his photograph.

Author details

Alan Sieradzki¹ and Heimo Mikkola^{2*}

¹ Global Owl Project

² University of Eastern Finland, Finland

*Address all correspondence to: heimomikkola@yahoo.co.uk

IntechOpen

© 2020 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

References

- [1] Simmons NB. An Eocene big bang for bats. *Science*. 2005;**307**:527-528
- [2] BatLife-Europe. 2017. Available from: <http://batlife-europe.info/about-batlif-europe/european-bats/>
- [3] Rydell J, Speakman JR. Evolution of nocturnality in bats: Potential competitors and predators during their early history. *Biological Journal of the Linnean Society*. 1995;**54**:183-191
- [4] Williams EE. Additional notes on fossil and subfossil bats from Jamaica. *Journal of Mammalogy*. 1952;**33**(2):171-179
- [5] Sevilla P, Chaline J. New data on bat fossils from middle and upper Pleistocene localities in France. *Geobios*. 2011;**44**(2-3):289-297
- [6] Marti CD. A review of prey selection by the long-eared owl. *Condor*. 1976;**78**:331-336
- [7] Mikkola H. Owls of Europe. Calton: T. & A.D. Poyser; 1983a
- [8] Marti CD. Feeding ecology of four sympatric owls. *Condor*. 1974;**76**:45-61
- [9] Pérez-Barbería FJ. Influencia de la Variación Latitudinal en la Contribución de los Murciélagos (*Chiroptera*) a la Dieta de la Lechuza Común (*Tyto alba*). *Ardeola*. 1991a;**38**(1):61-68
- [10] Stuart C, Stuart T. Field Guide to the Mammals of Southern Africa. Cape Town: Struik Publishers; 1995
- [11] Van Den Brink PJ. A Field Guide to the Mammals of Britain and Europe. London: Collins; 1973
- [12] Lindhe Norberg UM, Norberg RÅ. Scaling of wingbeat frequency with body mass in bats and limits to maximum bat sizes. *The Journal of Experimental Biology*. 2012;**215**:711-722
- [13] Wikipedia. 2017. Available from: http://en.wikipedia.org/wiki/name_bat
- [14] Mikkola H, Lamminmäki J. Moulting, Ageing and Sexing of Finnish Owls. Saarijärven Offset Oy: Saarijärvi; 2014. Finnish and English
- [15] Petrželková KJ, Obuch J, Zúkal J. Does the barn owl (*Tyto alba*) selectively predate individual great mouse-eared bats (*Myotis myotis*)? *Lynx*. 2004;**35**:123-132
- [16] Temple SA. Do predators always capture substandard individuals disproportionately from prey population? *Ecology*. 1987;**68**:669-674
- [17] Glutz von Blotzheim UN, Bauer K. Handbuch der Vögel Mitteleuropas. In: Columbiformes-Piciformes. Vol. 9. Wiesbaden: Akademische Verlagsgesellschaft; 1980
- [18] König C. Schleiereule, *Tyto a. alba* Scop., "schlägt" fliegende Fledermäuse. *Beitr Vogelkd*. 1961;**7**:229-233
- [19] Looney MW. Predation on bats by hawks and owls. *Bulletin of the Oklahoma Ornithological Society*. 1972;**21**:1-3
- [20] Twente JW. Predation on bats by hawks and owls. *Wilson Bulletin*. 1954;**66**(2):135-136
- [21] Spitzenberger F, Engelberger S, Kugelschäfer K. Real time observations of *Strix aluco* preying upon a maternity colony of *Myotis emarginatus*. *Vespertilio*. 2014;**17**:185-196
- [22] Güttinger R. Mausohren leben gefährlich. Fledermaus-Anzeiger, Regionalbeilage für die Kantone SG/AI/AR. 1990
- [23] Petrželková KJ, Zúkal J. Does a live barn owl (*Tyto alba*) affect emergency

behaviour of serotine bats (*Eptesicus serotinus*)? Acta Chiropterologica. 2003;5(2):177-184

[24] Boratyński J. Observation of the behaviour of noctule bat *Nyctalus noctula* during the escape from a predator – Tawny owl *Strix aluco*. Polish Academy of Sciences Notatki-Notes. 2011a;2010:47-48. In Polish with Abstract in English

[25] Russo D, Cistrone L, Jones G. Emergence time in forest bats: The influence of canopy closure. Acta Oecologica. 2007;31:119-126

[26] Kellomäki E. Food of the pygmy owl *Glaucidium passerinum* in the breeding season. Ornis Fennica. 1977;54:1-29

[27] Shepel AI. Birds of Prey and Owls of the Kama Region near Perm. Irkutsk: Irkutsk State University; 1992. Only in Russian

[28] Scherzinger W. Zum Aktionssystem des Sperlingskauzes (*Glaucidium passerinum*, L.). Zoologica. 1970;41(118):1-120

[29] Roulin A, Christe P. Geographic and temporal variation in the consumption of bats by European barn owls. Bird Study. 2013b;60(4):561-569

[30] Libois RM. Etude par analyse du regime alimentaire de la Chouette Effraie *Tyto alba* (Scopoli). Cahiers d'Ethologie Appliquee. 1984a;4:1-120

[31] Vale-Gonçalves HM, Barros P, Braz L, Cabral JA. The contribution of the barn owl (*Tyto alba*) feeding ecology to confirm bat species occurrence in North Portugal. Barbastella. 2015a;8(1):1-5

[32] Brown DJ. Seasonal variations in the prey of some barn owls in Gwynedd. Bird Study. 1981;28(2):139-146

[33] Cooke D, Nagle A, Smiddy P, Fairley J, Muircheartaigh IO. The diet of

the barn owl *Tyto alba* in county Cork in relation to land use. Biology and Environment: Proceedings of the Royal Irish Academy. 1996;96B(2):97-111

[34] Dor M. Examining the diet of the barn owl. The Nature and the Land. 1947;7(7):337-344

[35] Kubik J, Leniec H, Sitkowski W. Analysis of the mammal Fauna of the Lublin Coal Basin based on owl pellets. Acta Theriologica. 1984;29(13):167-173

[36] Nader I. Animal remains in pellets of the barn owl, *Tyto alba*, from the vicinity of an-Najaf, Iraq. Bulletin of the Iraq Natural History Museum. 1968;4:1-7

[37] Rockenbach D. Ergänzungen zur Nahrungsbiologie einiger Eulenarten. Anzeiger der Ornithologischen Gesellschaft in Bayern. 1976;15:78-84

[38] Schmidt E. Vergleich zwischen der Säugernahrung der Waldohreulen, *Asio otus* (L.), in der Ungarischen Tiefebene und der in Nordeuropa. Lounais-Hämeen Luonto. 1972;45:1-10

[39] Schmidt E, Štollmann A. Nahrung der Schleiereule (*Tyto alba guttata* Brehm, 1831) in Talkessel Turčianska Kotlina (Slowakei). Zborník Slovenského Národného Múzea, Prirodné vedy, Bratislava. 1972;18(1):139-142

[40] Schnurre O, Bethge E. Ernährungsbiologische Studien an Schleiereulen (*Tyto alba*) im Berliner Raum. Milu. 1973;3(4):476-484

[41] Smal CM. The diet of the barn owl *Tyto alba* in southern Ireland, with reference to a recently introduced prey species–The Bank Wole *Clethrionomys glareolus*. Bird Study. 1987;34:113-125

[42] Alivizatos H, Goutner V. Winter diet of the barn owl (*Tyto alba*) and long-eared owl (*Asio otus*) in North-Eastern

Greece: A comparison. *Journal of Raptor Research*. 1999;**33**(2):160-163

[43] Benda P, Andreas M, Kock D, Lučan RK, Munclinger P, Nova P, et al. Bats (Mammalia: Chiroptera) of the eastern Mediterranean. Part 4. Bat fauna of Syria: Distribution, systematics, and ecology. *Acta Societatis Zoologicae Bohemicae*. 2006;**70**(1):1-329

[44] Mahmood-ul-Hassan M, Beg MA, Mushtaq-ul-Hassan M, Mirza HA, Siddique M. Nesting and diet of the barn owl (*Tyto alba*) in Pakistan. *Journal of Raptor Research*. 2007;**41**(2):122-129

[45] Manganaro A, Ranazzi L, Salvati L. Diet overlap of barn owl (*Tyto alba*) and little owl (*Athene noctua*) in a Mediterranean urban area. *Buteo*. 2001;**12**:67-70

[46] Mushtaq-Ul-Hassan M, Ghazi RR, Nisa N-U. Food preference of the short-eared owl (*Asio flammeus*) and barn owl (*Tyto alba*) at Usta Muhammad, Baluchistan, Pakistan. *Turkish Journal of Zoology*. 2007;**31**(1):91-94

[47] Pokines JT, Peterhans CK. Barn owl (*Tyto alba*) taphonomy in the Negev Desert, Israel. *Israel Journal of Zoology*. 1998;**44**:19-27

[48] Sleeman DP, Kelleher KM. Barn owl *Tyto alba* depredating Daubenton's bats *Myotis daubentonii*. *Irish Birds*. 2008;**8**:434-435

[49] Tores M, Yom-Tov Y. The diet of the barn owl *Tyto alba* in the Negev desert. *Israel Journal of Zoology*. 2003;**49**:233-236

[50] Guerra C, Garcia D, Alcover JA. Unusual foraging patterns of the barn owl, *Tyto alba* (Strigiformes: Tytonidae), on small islets from the Pityusic archipelago (Western Mediterranean Sea). *Folia Zoologica*. 2014;**63**(3):180-187

[51] Kvartalnov PV, Poyarkov ND, Popovkina AB, Dementyev MN. Barn owl in the south-east of Azerbaijan. *Ekologiya Berkut*. 2011;**20**(1-2):111-114

[52] Pande S, Dahanukar N. Reversed sexual dimorphism and differential prey delivery in barn owls (*Tyto alba*). *Journal of Raptor Research*. 2012;**46**(2):184-189

[53] Samsoor Ali AM, Santhanakrishnan R. Diet composition of the barn owl *Tyto alba* (Aves: Tytonidae) and spotted owl *Athene brama* (Aves: Strigidae) coexisting in an urban environment. *Podoces*. 2012;**7**(1/2):21-32

[54] Santhanakrishnan R, Mohamed AH, Ali S, Anbarasan U. Diet variations of the barn owl *Tyto alba* (Scopoli, 1769) in Madurai District, Tamil Nadu, southern India. *Podoces*. 2010;**5**(2):95-103

[55] Obuch J, Danko Š, Noga M. Recent and subrecent diet of the barn owl (*Tyto alba*) in Slovakia. *Slovak Raptor Journal*. 2016;**10**:1-50

[56] Obuch J, Benda P. Food of the barn owl (*Tyto alba*) in the Eastern Mediterranean. *Slovak Raptor Journal*. 2009;**3**:41-50

[57] Bekker D, Janssen R, Buys J. First records of predation of grey long-eared bats (*Plecotus austriacus*) by the Barn Owl (*Tyto alba*) in the Netherlands. *Lutra*. 2014;**57**(1):43-47

[58] Love RA, Webbon C, Glue DE, Harris S. Changes in the food of Barn Owls (*Tyto alba*) between 1974 and 1997. *Mammal Review*. 2000;**30**(2):107-129

[59] Obuch J. The representation of bats (Chiroptera) in the diet of owls (Strigiformes) in Slovakia. *Vespertilio*. 1998;**3**:65-75. Slovak with abstract in English

- [60] Uttendörfer O. Neue Ergebnisse über die Ernährung der Greivögel und Eulen. Stuttgart: Eugen Elmer; 1952
- [61] Obuch J. Spatial and temporal diversity of the diet of the tawny owl (*Strix aluco*). Slovak Raptor Journal. 2011a;5:1-120
- [62] Gruzdev LV, Likhachev GN. Contribution to feeding habits of *Strix aluco* in the Tula Zaseki. Zoologicheskii Zhurnal. 1960;39:624-627. Russian with Abstract in English
- [63] März R. "Sammler" Waldkauz. Beitr Vogelkd. 1954;1(4):7-38
- [64] Skuratowicz W. Investigations on the composition of the food of the tawny owl (*Strix aluco* L.) in the years 1946-1948. The Poznan Society of Friends of Science, Department of Mathematical and Natural Sciences, Biological Section. 1950;12(4):226-236
- [65] Adanez VA. Alimentación del Carabo (*Strix aluco* L. 1758) en España. Alytes. 1983;1(1):1-14
- [66] Ahlbom B. Kattugglans föda. Fåglar i Sörmland. 1971;4:59-62
- [67] Balčiauskienė L. Analysis of tawny owl (*Strix aluco*) food remains as a tool for long-term monitoring of small mammals. Acta Zoologica Lituanica. 2005;15(2):85-89
- [68] Beven G. The food of tawny owl in London. London Bird Report. 1964;29:56-72
- [69] Beven G. The food of tawny owls in Surrey. Surrey Bird Report for 1966. 1966;2:32-39
- [70] Galeotti P, Morimando F, Violano C. Feeding ecology of the tawny owls (*Strix aluco*) in urban habitats (northern Italy). Bollettino di Zoologia. 2009;58(2):143-150
- [71] Holmberg T. Variationer i kattugglans (*Strix aluco*) bytesval. Fauna and Flora. 1976;71:97-107
- [72] Itämies J, Mikkola H. On the diet of the tawny owl (*Strix aluco*) in Rauma. Porin Lintutieteellinen Yhdistys Vuosikirja. 1972;1:25-26. Finnish with Summary in English
- [73] Julian S, Altringham JD. Bat predation by a tawny owl. Natura. 1994;119:49-56
- [74] Kasprzyk K, Kitowski I, Czochra K, Krawczyk R. Bats in the diet of owls from the southern part of the Lublin region (SE Poland). Myotis. 2004;41-42:75-80
- [75] Lesiński G, Gryz J, Kowalski M. Bat predation by tawny owls *Strix aluco* in differently human-transformed habitats. Italian Journal of Zoology. 2009b;76(4):415-421
- [76] Lesiński G, Gryz J, Romanowski J, Olszewski A, Kowalski M, Krauze-Gryz D, et al. Small mammals of Kampinos National Park and its protection zone, as revealed by analyses of the diet of tawny owls *Strix aluco* Linnaeus, 1758. Fragmenta Faunistica. 2013;56(1):65-81
- [77] Lundberg A. Why are the Ural owl *Strix uralensis* and the tawny owl *S. aluco* parapatric in Scandinavia? Ornis Scandinavica. 1980;11:116-120
- [78] Mikkola H. Lehtopöllöt ovat yksilöllisiä. Suomenselän Lintutieteellinen. 1968;3:4-5. Only in Finnish
- [79] Nores C. Comparacion del regimen alimenticio de *Strix aluco* y *Tyto alba* en la Costa oriental Asturiana. Revista de la Facultad de Ciencias de la Universidad de Oviedo, Serie Biología. 1979;20-21:189-194
- [80] Ruprecht AL. Bats (Chiroptera) as constituents of the food of barn

owls *Tyto alba* in Poland. Ibis. 1979;**121**:489-494

zwei Standorten in der Region Trier. Dendrocopos. 2011;**38**:12-17

[81] Schmidt E, Topal G. Presence of bats in owl pellets from Hungary. Vertebrata Hungarica. 1971;**12**:93-102. Only in Hungarian

[91] Jäderholm K. Diets of the Tengmalm's owl *Aegolius funereus* and the Ural owl *Strix uralensis* in Central Finland. Ornis Fennica. 1987;**64**:149-153

[82] Wendland V. 14jährige Beobachtungen zur Vermehrung des Waldkauzes (*Strix aluco* L.). Journal of Ornithology. 1972;**113**(3):276-286

[92] Rosina VV, Shokhrin VP. Bats in the diet of owls from Russian Far East, southern Sikhote Alin. Hystrix, the Italian Journal of Mammalogy. 2011b;**22**(1):205-213

[83] Yalden DW. Dietary separation of owls in the Peak District. Bird Study. 1985;**32**:122-131

[93] Ahlbom B. Slaguggla, Päruggla och Sparvuggla–Något om deras föda i Gästrikland och Hälsingland. Fåglar i X-län. 1976;**7**:17-24

[84] Gryz J, Krauze-Gryz D. Mammals in the diet of tawny owl *Strix aluco* in western part of Skierniewice Forest district (Central Poland). Forest Research Papers. 2017;**78**(4):297-302

[94] Imaizumi Y. Analysis of ural owl pellet contents. Zoological Magazine (Dobutsugaku Zasshi). 1968;**77**(12):402-404. Japanese with Abstract in English

[85] Idouhar-Saadi H, Moulai R, Souttou K, Baziz-Neffah F, Smai A, Zenia S, et al. Diet comparison between fledgling and adult tawny owl *Strix aluco* Linné, 1758 (Aves: Strigidae) in suburban area of El Harrach (Algiers, Algeria). International Journal of Zoological Research. 2014;**4**(4):59-66

[95] Korpimäki E, Sulkava S. Diet and breeding performance of Ural owls *Strix uralensis* under fluctuating food conditions. Ornis Fennica. 1987;**64**:57-66

[86] Hagen Y. *Rovfuglene og Viltpleien*. Oslo: Byldendal Norsk Forlag; 1952

[96] Obuch J, Danko Š, Mihók J, Karaska D, Šimák L. Diet of the Ural owl (*Strix uralensis*) in Slovakia. Slovak Raptor Journal. 2013;**7**:59-71

[87] Kowalski M, Lesiński G. The food of the tawny owl (*Strix aluco* L.) from near a bat cave in Poland. Bonner Zoologische Beiträge. 1990;**41**:23-26

[97] Tian L, Zhou X, Shi Y, Guo Y, Bao W. Bats as the main prey of wintering long-eared owl (*Asio otus*) in Beijing: Integrating biodiversity protection and urban management. Integrative Zoology. 2015;**10**:216-226

[88] Schnurre O. Lebensbilder märkischer Waldkäuze (*Strix aluco* L.). Milu. 1961;**1**:83-124

[98] Garcia AM, Cervera F, Rodríguez A. Bat predation by long-eared owls in Mediterranean and temperate regions of southern Europe. Journal of Raptor Research. 2005a;**39**(4):445-453

[89] Cais L. Badania nad składem pokarmu kilku gatunków sów. Zeszyty Naukowe Uniwersytetu im Adama Mickiewicza w Poznaniu (Biologia). 1963;**44**:1-21

[90] Twietmeyer S, Angetter L-S, Böhm N. Fledermäuse in der Nahrung des Waldkauzes (*Strix aluco*) und weitere Nahrungsbestandteile von

[99] Araujo J, Rey JM, Landin A, Moreno A. Contribución al Estudio del Búho Chico (*Asio otus*) en España. Ardeola. 1973;**19**:397-428

- [100] Czarnecki Z. Observations on the biology of the long-eared owl (*Asio otus* L.). The Poznan Society of Friends of Science, Department of Mathematical and Natural Sciences, Biological Section. 1956;**18**(4):1-41. Polish with Abstract in English
- [101] Fairley JS. Food of long-eared owls in north-East Ireland. British Birds. 1967;**60**:130-135
- [102] Glue DE, Hammond GJ. Feeding ecology of the long-eared owl in Britain and Ireland. Bird Study. 1974;**67**(9):361-369
- [103] Haensel J, Walther HJ. Beitrag zur Ernährung der Eulen im Nordharz-Vorland unter besonderer Berücksichtigung der Insektennahrung. Beitr Vogelkd. 1966;**11**(6):345-358
- [104] Källander H. Food of the long-eared owl *Asio otus* in Sweden. Ornis Fennica. 1977;**54**:79-84
- [105] Schmidt E. Über die Winternahrung der Waldohreulen in der VR Ungarn. Zoologische Abhandlungen. 1965;**27**(13):307-317
- [106] Schmidt E. Die Ernährung der Waldohreule (*Asio otus*) in Europa. Aquila. 1974;**81**(1):221-235
- [107] Veiga JP. Alimentación y relaciones tróficas entre la lechuza común (*Tyto alba*) y el búho Chico (*Asio otus*) en la sierra de Guadarrama (España). Ardeola. 1978;**18**:118-142
- [108] Zimmermann K. Kleinsäuger in der Beute von Waldohreulen bei Berlin. Beitr Vogelkd. 1963;**9**:59-68
- [109] Plini P. Primi dati sull'alimentazione del Gufo comune *Asio otus* nel Lazio. Avocetta. 1986;**10**:41-43
- [110] Wendland V. Paralleler Verlauf der Fortpflanzungsrate bei Waldohreule (*Asio otus*) und Mäusebussard (*Buteo buteo*). Beitr Vogelkd. 1984;**30**(1):1-11
- [111] Wijnandts H. Ecological energetics of the long-eared owl (*Asio otus*). Ardea. 1984;**72**:1-92
- [112] Carrillo J, Nogales M, Delgado G, Marrero M. Preliminary data for a comparative study of the feeding habits of *Asio otus canariensis* on El Hierro and gran Canaria, Canary Islands. In: Meyburg B-U, Chancellor RD, editors. Raptors in the Modern World. Berlin, London, Paris: WWGBP; 1989
- [113] González AG, Ortí FC. Notas sobre la variación estacional y geográfica de la dieta del búho Chico *Asio otus*. Ardeola. 2001;**48**(1):75-80
- [114] Scott D. The Long-Eared Owl. London: The Hawk and Owl Trust; 1997
- [115] Sharikov AV. Peculiarities of winter feeding in the long-eared owl (*Asio otus*) in settlements of Stavropol Krai. Zoologicheskii Zhurnal. 2006;**85**(7):871-877. In Russian with Abstract in English
- [116] Simmi F, Martucci O, Manganaro A, De Giacomo U, Fanfani A. Dieta del Gufo Comune *Asio otus* (Linnaeus, 1758) nella riserva del Lago di Vigo (VT). Alula. 1998;**5**(1-2):140-144
- [117] Charter M, Izhaki I, Leshem I, Roulin A. Diet and breeding success of long-eared owls in a semi-arid environment. Journal of Arid Environments. 2012;**85**:142-144
- [118] Escala C, Alonso D, Mazuelas D, Mendiburu A, Vilches A, Arizaga J. Winter diet of long-eared owls *Asio otus* in the Ebro valley (NE Iberia). Revista Catalana d'Ornitologia. 2009;**25**:49-53
- [119] Sergio F, Marchesi L, Pedrini P. Density, diet and productivity of long-eared owls *Asio otus* in the Italian Alps: The importance of *Microtus* voles. Bird Study. 2008;**55**:321-328
- [120] Stolarz P, Lesiński G. The Bechstein's bat *Myotis bechsteinii* as a

prey of the long-eared owl *Asio otus* in western Roztocze. Kulon. 2017;**22**:142-145. Polish with summary in English

[121] Stolarz P, Lesiński G, Liszewska E, Karpińska O. Autumn diet of the long-eared owl *Asio otus* in the Mazowiecka lowland. Kulon. 2017;**22**:107-116. Polish with abstract in English

[122] Tulis F, Balaž M, Obuch J, Šotnar K. Responses of the long-eared owl *Asio otus* diet and the numbers of wintering individuals to changing abundance of the common vole *Microtus arvalis*. Biologia. 2015;**70**(5):667-673

[123] Hills P, Fairley JS, Smal CM, Archer P. The diet of the long-eared owl in Ireland. Irish Birds. 1988;**3**:581-588

[124] Li X-J, Bao W-D, Sun L-S. Diet of wintering long-eared owls in Beijing City. Chinese Journal of Zoology. 2007;**42**(2):52-55. In Chinese with Abstract in English

[125] Zimmermann K. Jährliche Schwankungen in der Ernährung eines Waldohreulen-Paares zur Brutzeit. Vogelwelt. 1950;**71**(1):152-155

[126] Corral JF, Cortés JA, Gill JM. Contribución al estudio de la alimentación de *Asio otus* en el sur de España. Doñana, Acta Vertebrate. 1979;**6**:179-190

[127] Standen R. Some observations by English naturalists on the fauna of Rathlin Island and Ballycastle district. Irish Naturalist. 1987;**6**:173-178

[128] Djilali K, Sekour M, Souttou K, Abadsa L, Guezoul O, Denys C, et al. Diet of short-eared owl *asio flammeus* (Pontobbidan, 1763) in desert area at Hassi El Gara (El Golea, Algeria). Zoology and Ecology. 2016b;**26**(3):159-165

[129] Aho J. The autumn food of *Asio f. flammeus* Pontopp. in the vicinity of the

city of Tampere, South Finland. Annales Zoologici Fennici. 1964;**1**:375-376

[130] Glue DE. Prey taken by short-eared owls at British breeding sites and winter quarters. Bird Study. 1971;**17**(1):39-42

[131] Glue DE. Feeding ecology of the short-eared owl in Britain and Ireland. Bird Study. 1976;**23**:70-78

[132] Calvo Macho JM. Alimentación invernol de la Lechuza Campestre *Asio flammeus* en una localidad del Norte de España. In: Chancellor RD, Meyburg B-U, Ferrero JJ, editors. Holarctic Birds of Prey. Berlin, London and Paris: ADENEX-WWGBP; 1998. pp. 467-474

[133] Jiménez-Perez J, Gomez JA, Escobar JV, Lacomba I. Estudio de la alimentación de la Lechuza Campestre (*Asio flammeus*) y la Lechuza Común (*Tyto alba*) en l'Albufera de Valencia. Mediterranean Natural. 1989;**1**:81-88

[134] Jánossy D, Schmidt E. Die Nahrung des Uhus (*Bubo bubo*) Regionale und erdzeitliche Änderungen. Bonner Zoologische Beiträge. 1970;**21**:25-51

[135] Bocheński Z. The diet of the eagle-owl *Bubo bubo* (L.) in the Pieniny Mts. Acta Zoologica Cracoviensia. 1960;**5**(8):1-23. In Polish with Abstract in English

[136] März R. Der Uhu. Wittenberg Lutherstadt: A. Ziemsen Verlag; 1958

[137] Wendland V. Aufzeichnungen über Brutbiologie und Verhalten der Waldohreule (*Asio otus*). Journal für Ornithologie. 1957;**98**:241-261

[138] Amr ZS, Handal EN, Bibi F, Najajrah MH, Qumsiyeh MB. Change in the diet of the Eurasian eagle owl, *Bubo bubo*, suggests decline in biodiversity in Wadi Al Makhrou, Bethlehem governorate, Palestinian territories. Slovak Raptor Journal. 2016;**10**:1-5

- [139] Baumgart W. An Horsten des Uhus (*Bubo bubo*) in Bulgarien. II. Der Uhu in Nordostbulgarien (Aves, Strigidae). *Zool. Abhigyan*. 1975;**33**(18):251-275
- [140] Bezzel E, Obst J, Wickl K-H. Zur Ernährung und Nahrungswahl des Uhus (*Bubo bubo*). *Journal für Ornithologie*. 1976;**117**(2):210-238
- [141] Görner M, Knobloch H. Zur Ernährungssituation des Uhus (*Bubo b. bubo* L.) in Thüringen. *Archiv für Naturschutz und Landschaftsforschung*, Berlin. 1977;**18**(3):161-176
- [142] Milchev B, Spassov N. First evidence for carrion-feeding of Eurasian eagle owl (*Bubo bubo*) in Bulgaria. *Ornis Hungarica*. 2017;**25**(1):51-62
- [143] Obuch J. Spatial diversity in the diet of the Eurasian eagle owl *Bubo bubo* in Iran. *Podoces*. 2014;**9**(1):7-21
- [144] Olsson V. Studies on a population of eagle owls, *Bubo bubo* (L.), in Southeast Sweden. *Viltrevy*. 1979;**11**(1):1-99
- [145] Papageorgiou NK, Vlachos CG, Bakaloudis DE. Diet and nest site characteristics of eagle owl (*Bubo bubo*) breeding in two different habitats in North-Eastern Greece. *Avocetta*. 1993;**17**:49-54
- [146] Piechocki R, Stubbe M, Uhlenhaut K, Dawka N. Die Ernährungsökologie des Uhus *Bubo bubo yenisseeensis* Buturlin in der Mongolischen Volksrepublik. *Zoologische Jahrbücher Abteilung für Systematik*. 1977;**104**:539-559
- [147] Ramanujam ME. A preliminary report on the prey of the Eurasian eagle-owl (*Bubo bubo*) in and around Pondicherry. *Zoos' Print Journal*. 2001;**16**(5):487-488
- [148] Rockenbach D. Untergang und Wiederkehr des Uhus *Bubo bubo* in Baden-Württemberg. *Anzeiger der Ornithologischen Gesellschaft in Bayern*. 1978;**17**(3):293-328
- [149] Sándor AD, Ionescu DT. Diet of the eagle owl (*Bubo bubo*) in Braşov, Romania. *North-Western Journal of Zoology*. 2009;**5**(1):170-178
- [150] Simeonov S, Milchev B, Boev Z. Study of the eagle owl (*Bubo bubo* (L.)) (Aves: Strigiformes) in the Strandzha Mountain (Southeast Bulgaria). II. Food spectrum and trophic specialization. *Acta Zoologica Bulgarica*. 1998;**50**(2/3):87-100
- [151] Stubbe M, Batsajchan O, Lindecke O, Samjaa R, Stubbe A. New data on feeding ecology of *Bubo bubo* and *Asio otus* (Aves: Strigidae) in Mongolia. *Erforschung biologischer Ressourcen der Mongolei (Halle/Saale)*. 2016;**13**:301-311
- [152] Suchý O. A contribution to the knowledge of the eagle Owl's (*Bubo bubo*) diet in Jeseníky Mountains in 1955-2000. *Buteo*. 2003;**13**:31-39
- [153] Wickl K-H. Der Uhu (*Bubo bubo*) in Bayern. *Garmischer Vogelkd. Berichte*. 1979;**6**:1-47
- [154] Thiollay JM. Essai sur les rapaces du midi de la France, distribution-écologie. *Hibou Grand Duc, Bubo bubo bubo* L. *Alauda*. 1969;**37**:15-27
- [155] Ahlbom B. Pärugglans föda i S-Dalarna. *Meddelande i S-Dalarna*. 1977;**10**:16-18
- [156] Kellomäki E. Varpuspöllön (*Glaucidium passerinum*) ravintobiologiasta Etelä- ja Keski-Suomessa 1960-luvulla [M.Sc. thesis]. Finland: University of Turku; 1969. Only in Finnish
- [157] Klaus S, Mikkola H, Wiesner J. Aktivität und Ernährung des Rauhfußkauzes *Aegolius funereus* (L.)

während der Fortpflanzungsperiode.
Zool. Jb. Syst. 1975;**102**:485-507

[158] Pokorný J. The diet of the Tengmalm's owl (*Aegolius funereus*) in northbohemian mountain areas damaged by immissions. Buteo. 2000;**11**:107-114. Czechish with abstract in English

[159] Pykal J, Kloubec B. Feeding ecology of Tengmalm's owl *Aegolius funereus* in Šumava National Park, Czechoslovakia. In: Meyburg B-U, Chancellor RD, editors. Raptor Conservation Today. The Banks, Mountfield: WWGBP. The Pica Press, Helm International Ltd; 1994

[160] Sulkava P, Sulkava S. Die nistzeitliche Nahrung des Rauhfusskauzes *Aegolius funereus* in Finland 1958-67. Ornis Fennica. 1971;**48**:117-124

[161] Zárybnická M, Riegert J, Št'astný K. The role of *Apodemus* mice and *Microtus* voles in the diet of the Tengmalm's owl in Central Europe. Population Ecology. 2013;**55**:353-361

[162] Barbu P, Sorescu C. Contributions concernant la nourriture de la Chouette. Analele Universitatii Bucuresti (Biologie Animale). 1970;**19**:67-72

[163] Alivizatos H, Goutner V, Zogaris S. Contribution to the study of the diet of four owl species (Aves, Strigiformes) from mainland and island areas of Greece. Belgian Journal of Zoology. 2005;**135**(2):109-118

[164] Alivizatos H, Goutner V, Athanasiadis A, Poirazidis K. Comparative temporal prey use by barn owl (*Tyto alba*) and little owl (*Athene noctua*) in the Evros Delta, northeastern Greece. Journal of Biological Research. 2006;**6**:177-186

[165] Ganya IM, Zubkov NI. The Little Owl (*Athene noctua* Scopoli) Food at

the Middle Part of Moldavia. Kishinev: Shtiintsa Press; 1975. pp. 63-72. In Russian

[166] Hibbert-Ware A. Report of the Little Owl Food Inquiry 1936-37. London: H.F. and G. Witherby Ltd.; 1938

[167] Hounscome T, O'Mahony D, Delahay R. The diet of little owls *Athene noctua* in Gloucestershire, England. Bird Study. 2004;**51**:282-284

[168] Juillard M. La Chouette chevêche. 2me éd ed. Prangins: Nos Oiseaux, Sociéte romande pour l'étude et la protection des oiseaux; 1985

[169] Obuch J, Krištin A. Prey composition of the little owl *Athene noctua* in an arid zone (Egypt, Syria, Iran). Folia Zoologica. 2004;**53**(1):65-79

[170] Rakhimov II, Pavov YI. Birds of Prey and Owls of Tatarstan. Kazan: Tatpoligraf Press; 1999. Only in Russian

[171] Rodriguez MM. Espectro Alimenticio del Mochuelo común (*Athene noctua*) en España. Alytes. 1983;**1**(1):1-15

[172] Simeonov SD. New data on the diet of the little owl (*Athene noctua* Scop.) in Bulgaria. Bulgarian Academy of Sciences, Ecology. 1983;**11**:53-60. In Russian with Abstract in English

[173] Sosnikhina TM. Practical importance of the little owl in semidesert conditions in the south Armenian SSR. Proceedings of Academy of Sciences of the Armenian SSR, Biology and Agricultural Sciences. 1950;**3**(1):95-100. Only in Russian

[174] Sukhinin AN, Bel'skaya GS, Zhernov IV. Little owl diet in Turkmenia. Ornitologiya. 1972;**10**:216-227. Only in Russian

- [175] Van Nieuwenhuyse D, Génot J-C, Johnson DH. The Little Owl – Conservation, Ecology and Behaviour of *Athene Noctua*. Cambridge: University Press; 2008
- [176] Charter M, Leshem Y, Izhaki I, Guershon M, Kiat Y. The diet of the little owl, *Athene noctua*, in Israel. *Zoology in the Middle East*. 2006;**39**(1):31-40
- [177] Lanszki J. A kuvik (*Athene noctua*) táplálék-összetétele egy Somogy megyei külvárosi élőhelyen. *Natura Somogyiensis*. 2006;**9**:315-324 (Only in Hungarian)
- [178] Sommer RS, Niederle M, Labes R, Zoller H. Bat predation by the barn owl *Tyto alba* in a hibernation site of bats. *Folia Zoologica*. 2009;**58**(1):98-103
- [179] Birrer S. Synthesis of 312 studies on the diet of the long-eared owl *Asio otus*. *Ardea*. 2009;**97**(4):615-624
- [180] Schönn S, Scherzinger W, Exo K-M, Ille R. Der Steinkauz *Athene Noctua*. Wittenberg Lutherstadt: A. Ziemsen Verlag; 1991
- [181] Malle G, Probst R. Die Zwergohreule (*Otus scops*) in Österreich. Klagenfurt am Wörthersee: Verlag des Naturwissenschaftlichen Vereins für Kärnten; 2015
- [182] Muraoka Y. Videonanalyse der Zwergohreule in Unterkärnten: Auswertung von Infrarotaufnahmen aus einem Nistkasten. Abt. 20, UAbt. Naturschutz. Wien: Projektbericht im Auftrag des Amtes der Kärntner Landesregierung; 2009
- [183] Lesiński G, Ignaczak M, Manias J. Opportunistic predation on bats by the tawny owl *Strix aluco*. *Animal Biology*. 2009a;**59**:283-288
- [184] Ruczyński I, Ruckzyńska I, Kasprzyk K. Winter mortality rates of bats inhabiting man-made shelters (northern Poland). *Acta Theriologica*. 2005a;**50**(2):161-166
- [185] Speakman JR. The impact of predation by birds on bat populations in the British isles. *Mammal Review*. 1991;**21**:123-142
- [186] Stebbings RE. Conservation of European Bats. London: Christopher Helm; 1988
- [187] Lesiński G. Long-term changes in abundance of bats as revealed by their frequency in tawny owls' diet. *Versita Biologia Section Zoology*. 2010;**65**(4):749-753
- [188] Andrews P. Owls, Caves and Fossils. London: Natural History Museum Publications; 1990