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New and Conservationally Significant Small Mammals in the Diet of Two Wintering Groups of Long-eared Owls (Asio otus L.) from the Region of Silistra (NE Bulgaria)

Nikolay D. Kodzhabashev[1], Stela M. Dipchikova[2], Teodora M. Teofilova[3*]

1 - Forestry University, Faculty of Forestry, Department of Hunting and Game Management, 10 Kliment Ohridski Blvd., 1756 Sofia, BULGARIA
2 - Institute of Biodiversity and Ecosystem Research (IBER) of the Bulgarian Academy of Sciences (BAS), 2, Y. Gagarin Str., 1113 Sofia, BULGARIA
3 - Institute of Biodiversity and Ecosystem Research (IBER) of the Bulgarian Academy of Sciences (BAS), 1 Tsar Osvoboditel Blvd., 1000 Sofia, BULGARIA
[*]Corresponding author: oberon_zoo@abv.bg

Abstract. The object of the study is the diet of two wintering groups of long-eared owls (*Asio otus* L.) from the town of Silistra. During the winter of 2013/2014, 511 pellets and other skeletal residues are collected. A total of 1538 specimens are established, of which 1500 skeletal parts of small mammals. A total of 23 species are identified: 5 species of Eulipotyphla, 3 species of Chiroptera and 15 species of Rodentia. Five species are recorded for the first time as prey of the long-eared owl in Bulgaria: *Sorex minutus* L., *Neomys anomalus* Cabr., *Barbastella barbastellus* Schr., *Nyctalus noctula* Schr. and *Apodemus uralensis* Pall. Six of the species are protected, two are included in the Red Data Book of Bulgaria and three are very rare. All identified small mammals, except synanthropic mice and rats, can be considered new to the research area. For the first time after almost 50 years, information about *A. uralensis* is given. All new species have very low abundance in owl's diet (0.07–0.3% of all preys), which could be resulting from their naturally low density or the randomness of catches as an atypical prey. These conservationally significant species show the exceptional possibilities of this method to establish rare species that are difficult to prove with other methods of research.

Key words: *Asio otus* pellets, Micromammalia, owls diet, Danube, rare and protected species.

Introduction

The dietary analyses of nocturnal birds of prey are one of the main methods of collecting scientific information on the distribution of small mammals and their quantitative significance (Simeonov, 1964; 1966; Simeonov & Petrov, 1986; Milchev, 2015; Milchev & Ivanov, 2016; Milchev et al., 2003; 2006; Birrer, 2009). Such research is extremely topical, given the multifaceted information we receive, both for birds' biological and ecological characteristics, and for a wide range of vertebrate animal preys, who are indicative for the state of the environment (Birrer, 2009).

Long-eared owl (*Asio otus* Linnaeus, 1758) is a specialised predator feeding mostly

on small mammals. The owls spend the winter in groups of up to 30 – 40 birds, preferring coniferous trees and choosing areas with good food supply (Glutz von Blotzheim & Bauer, 1994; Marks et al., 1999; Mebs & Scherzinger 2000; Birrer, 2009). Long-eared owl often and long-ago is been an object of research in Bulgaria and worldwide. The analysis of its diet gives valuable data about the state of many rare or conservationally significant species, and also about the dominant species of small mammals of the particular region. Data from the winter months when owls gather at clusters of several dozen individuals, excreting their pellets in the same place, are particularly valuable. These roosting groups are very suitable for studying owls' diet, since the grouping allows analyses based on numerous pellets. This way an information about a large number of individuals, which could not be collected in any other way, is obtained. Such information for separate regions of Bulgaria is found in the works of Simeonov (1964, 1966), Simeonov & Petrov (1986), Milchev et al. (2003), Milchev & Ivanov (2016). Information on rare and protected species in owl's diet is particularly valuable, since these species are difficult to prove by other methods, given their low density or bio-ecological specificity. Very often this is the only information about the distribution of rare species in new localities, or for relatively common species which are difficult to prove by traditional catch methods (Popov & Milchev, 2001; Popov et al., 2004; Milchev, 2006; 2009; Milchev & Georgiev, 2012). The analysis of owls' food remains can prove or confirm the presence of new species, both for a particular region and for the national fauna (Popov & Milchev, 2001), and can provide a valuable craniometric information.

Another advantage of this method is that during the winter months there are no other suitable methods for catching small mammals, and the large number of "hunters" guarantee the accurate and complete representativeness of the small mammals preys available during this period of the year. The roosting wintering *Asio otus* groups usually gather in late October – early November and disperse in late February – early March (Simeonov & Petrov, 1986).

The aim of this study is to establish the prey species composition of two groups of overwintering long-eared owls living in one region, but hunting and feeding in different landscapes, and to emphasize the conservationally significant species. The objects of the survey are the food residues in owls' pellets from NE Bulgaria.

Material and Methods

The food remains from two wintering groups of long-eared owls during the winter months of 2013/2014 from the region of the town of Silistra (Fig. 1) were collected once on 18 – 21 April 2014. The first roosting group of birds was located in the Danube City Park (N 44°07'04'' E 27°15'21'', 19 m). Birds inhabited a group of old and tall false cypresses (*Chamaecyparis* sp.). The second group of wintering birds was on the ridge part of the Medzhidi Tabia Forest Park (N 44°06'08'' E 27°15'31'', 131 m), in 2 km distance from the first group. The pellets were collected under a group of black pines (*Pinus nigra* J.F.Arnold), around 50 – 60 years of age and about 10 – 12 m in height, bordering an asphalt road.

The collected material was cleaned and all bone remains, feathers and hairs from each pellet were separated individually. The materials from the disintegrated pellets were processed together, and bones and fragments of skulls and lower jaws were separated from the post-cranial bones. The cranial dimensions, craniometric parameters, their abbreviations, and their tabular orderliness are according to Peshev et al. (2004) for each relevant group of small mammals. The measurements are made with electronic caliper. The number of preys was calculated by number of cranial, mandibular and post-cranial bones. The determination of the

mammals was according to Peshev et al. (2004), Popov et al. (2003), Görner & Hackethal (1987) and the collection of the University of Forestry, Sofia.

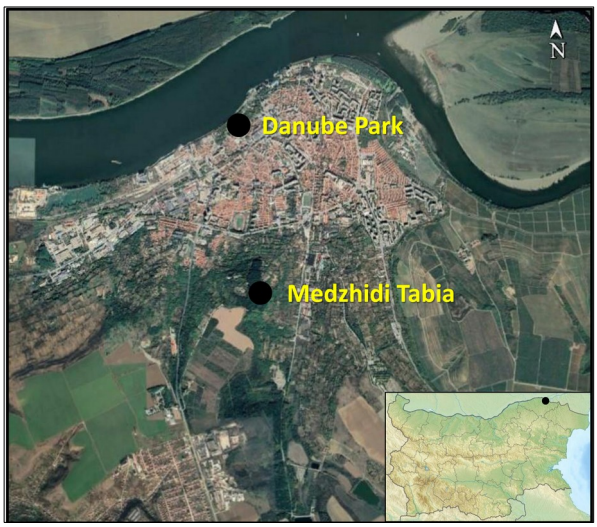

Fig. 1. Location of the two wintering *Asio otus* groups in the town of Silistra.

Results and Discussion

During the winter of 2013/2014, 511 pellets and other skeletal remains are collected from two wintering groups of *Asio otus* in Silistra. A total of 1538 prey specimens are found, of which 1500 skeletal parts of small mammals, 36 of birds and two pairs of Coleopteran elytra. Small mammals make up 97.5% of all prey specimens, and the established species represent 78% of all so far recorded mammal preys in Bulgaria. A total of 23 species of small mammals are identified: 5 insectivorous species (Eulipotyphla), 3 bat species (Chiroptera) and 15 species of Rodentia. Five species are recorded for the first time as prey of the long-eared owl in Bulgaria: *Sorex minutus* L., *Neomys anomalus* Cabr., *Barbastella barbastellus* Schr., *Nyctalus noctula* Schr. and *Apodemus uralensis* Pall. Six of the species are protected, two of them are included in the Red Data Book of Bulgaria (Golemanski, 2015). Three species can be considered very rare.

Further we discuss only the conservationally significant small mammals in the diet of the two wintering groups of long-eared owls from Silistra:

Eurasian pygmy shrew (Sorex minutus L.). It is reported for the first time in Bulgaria as a prey of the owls during the winter period. It is also new for the area of the town of Silistra. Information about the species is available from the region of the "Srebarna" Reserve (Genov, 1984; Sichanov et al., 2006; Popov et al., 2019). It has also been reported for Northern Dobrudzha (Laiu & Murariu, 1998; Murariu, 2005; Miu et al., 2018), as well as a prey of *Asio otus* in Romania (Sándor & Kiss, 2004, 2008). This species was not been established in fossil, subfossil and recent Eurasian eagle-owl (*Bubo bubo* (L.) preys in Rusenski Lom and Suha Reka on the Ludogorie Plateau (Mitev, 2004). In the same fossil deposits the author found numerous remains of other species belonging to the "mountain faunistic ensemble" (*Sorex araneus* L., *Microtus subterraneus* (S.-L.), *Myodes glareolus* Schr.). This complex has also been found in Northern Dobrudzha (Murariu & Stanciu, 2009; Miu et al., 2018) and probably represents a refugium preserved because of the microclimatic specificity of the Danube. Eurasian pygmy shrew is characteristic of the mountains, but it also occurs in mesophilic and mesohygrophilic habitats in the plains. It was found in both study sites (4 ex. in Danube Park and 2 ex. in Medzhidi Tabia). There are many suitable for the species wet and waterside habitats near the two areas, but regardless its natural density, it is a rare prey of the owl since it is a small and cryptic mammal. The material examined included fragments of skulls and lower jaws divided into left and right halves. The measurements taken of the skull fragments showed a complete overlap with those of Peshev et al. (2004) (Table 1).

Southern water shrew (Neomys anomalus Cabr.). This is the first record of this species as prey of *Asio otus* for Bulgaria. It is registered in Dobrudzha, both in Bulgaria (Genov, 1984; Sichanov et al., 2006; Popov et al., 2019) and Romania (Murariu, 2005; Miu et al., 2018). It was not established in Southern Dobrudzha (the vicinity of Dobrich)

(Simeonov, 1966; Milchev & Ivanov, 2016), as well as in late Pleistocene and Holocene eagle-owl deposits in NE Bulgaria (Mitev, 2004). The species is attached to water reservoirs and coastal territories. One individual from the Danube Park was identified. The sole sample is with a shattered brain lobe and a preserved facial lobe. The lower jaw is preserved with connected left and right halves. We did not measure this single specimen since its triviality in other regions of Bulgaria.

Bats. During the study we found three specimens of three species, of which two are reported as *Asio otus* prey for the first time in Bulgaria – western barbastelle bat (*Barbastella barbastellus* Schr.) and common noctule (*Nyctalus noctula* Schr.). The grey long-eared bat (*Plecotus austriacus* (Fischer) has been previously reported from Sofia (Milchev et al., 2003). All three specimens were determined by cranium and mandible. Some measurements are given in Table 2, Table 3 and Table 4. We found the common noctule in the Danube Park, and the western barbastelle and grey long-eared bat – in Medzhidi Tabia. Both localities offer suitable conditions for bats associated with old mesophilic canopy forests with sufficient dead, dying or living old wood. While the common noctule and grey long-eared bat are relatively widespread and their presence in the study area is traditional given the specifics of the landscape and habitats, the barbastelle bat is a typical mountain species. Its record in Silistra was quite unexpected, although it was found near the Danube Park once again in 1985, when the animal was weakly active, in hibernation (Kodzhabashev, pers. observ.). In Bulgaria, this species has been found in other plain territories near rivers: near the Vidbol River (Vidin district) (Ivan Pandurski, pers. comm.); near the Osam River (Pleven district) (Paunovic et al., 2003; Golemanski, 2015); near the mouth of the Kamchia River (Heinrich, 1936; Benda et al., 2003). There are two records of the species from the Danube Delta (Murariu et al., 2016). It is likely that the discovery of the barbastelle bat along relatively large rivers is related to its requirements for a cooler microclimate and a closed canopy of woody vegetation, such as are the natural riverine flooded forests.

All three species are relatively slow in flight, making them a potential prey. All three skulls were fully preserved, suggesting that probably the owls caught the bats in the air with their sharp claws. In capturing terrestrial mammals, owls almost always use their beak, most often aiming at the cranial area. That assures the killing of the prey and the absorbing of the caloric brain substance. The three bat species are strictly protected by Bulgarian and international legislation (see Appendix 1). The barbastelle bat is rare in the country, but its status for the region of Silistra is not clear. It is likely to be found year-round, inhabiting riparian mesohygrophilic and old mesophilic forests, where the conditions of the environment are relatively close to those in mountainous habitats. Further studies are needed to establish its status in the region of Silistra.

Table 1. Craniometric measures for *S. minutus* from Peshev et al. (2004) and our study (*here*).

	HPC		**L I_1-M_3**		**L I^1-M^3**		**LMd**		**LP^4-M^3**
	Peshev	***here***	**Peshev**	***here***	**Peshev**	***here***	**Peshev**	***here***	***here***
min.	3.05	3.09	5.7	5.9	4	6.15	6.8	6.71	3.53
max.	3.5	3.44	7.4	6.01	7.2	5.57	8.2	7.23	
aver.	3.26	3.19	6.25	6.26	5.8	6.41	7.9	6.97	
		n = 6		n = 6		n = 6		n = 2	

Table 2. Craniometric measures for *P. austriacus* from Peshev et al. (2004) and Silistra (*here*).

	HPC		L I^1-M^3		LMd		LP^4-M^3
	Peshev	***here***	**Peshev**	***here***	**Peshev**	***here***	***here***
min.	3.35	3.33		3.5	11.0	9.5	4.35
max.	3.65				11.7		

Table 3. Craniometric measures for *B. barbastellus* from Peshev et al. (2004) and Silistra.

	HPC	HMd/M_2	LMd
Silistra	3.1	1.2	9.6
Peshev et al., 2004	2.8	1.32	9.3

Table 4. Craniometric measures for *N. noctula* from Peshev et al. (2004) and our study (*here*).

	LMd		HPC		HMd/M_2		L I_1 - M_3	
	Peshev	***here***	**Peshev**	***here***	**Peshev**	***here***	**Peshev**	***here***
min.	14	14.2	4.4	4.5	2.1	2.2	8.65	8.65
max.	15.2		4.9		2.5		9.2	
	LC-M_3		LP_4-M_3		LC.-P_4			
	Peshev	***here***	**Peshev**	***here***	**Peshev**	***here***		
min.	7.7	7.45	5.95	5.8	2.6	2.63		
max.	8.15		6.4		2.85			

Dormice. Two species were established – hazel dormouse (*Muscardinus avellanarius* (L.) and forest dormouse (*Dryomys nitedula* Pall.). They were previously reported as *Asio otus* prey (Simeonov, 1964; 1966; Milchev & Ivanov, 2016), although during the winter they are in hibernation. The two species were registered, respectively, with three and two specimens, the first being found only in the Danube Park and the second – in the Medzhidi Tabia, which is probably due to the different preferences of these typical forest animals. Some measurements are given in Table 5. Unlike the more common forest dormouse, which mostly inhabits mesoxerophilic deciduous forests, the hazel dormouse is mostly a mountain species inhabiting old mesophilic forests with undergrowth well developed. The microclimatic conditions of the Danube Park, located on the banks of the Danube, the landscape, and the diverse forest canopy are a prerequisite for suitable living environment for mesophilous forest species, such as the hazel dormouse. The large current of the Danube moistens and cools the coastal air, which, combined with large-sized woody vegetation, creates conditions close to those in the low and medium mountain belts. This is an important fact, concerning the prolonged winter warmings. According to Popov & Sedefchev (2003), the awaking of the dormice in the winter months is detrimental to normal hibernation, and awakened animals die from exhaustion due to early consumption of spare fats.

Romanian hamster (Mesocricetus newtoni (Nehring). It is a protected species that has greatly reduced its range over the past 70 – 80 years as a result of the strong anthropogenic press, a consequence of the intensification in agriculture. For the region of Silistra, it has been firstly reported by Hristovich (1901). In 1925, Kovachev (1925) reported it for Silistra along with the common hamster (*Cricetus cricetus* (L.). Later, both species were also reported for the Srebarna Lake (Genov, 1984).

The Romanian hamster hibernates, but unlike the common hamster, in warmer winter days it is active (e.g. Markov, 1960). The species was found in *Asio otus* diet in the region of the towns of Dobrich (Simeonov, 1966) and Shumen (Simeonov & Petrov, 1986), too. According to Nedyalkov (2016), due to the strong anthropogenic press, the Romanian hamster has a very low density and highly fragmented range. Its main localities are in the Danube Plain and Dobrudzha, and those in southern Bulgaria are local and declining. According to Mitev (2004) and Peshev et al. (2004), the species has been dominant both throughout Bulgaria and the Balkan Peninsula during the late Pleistocene and almost throughout the early and middle Holocene, regardless the climatic changes associated with warming and humidification and the displacement of the xerophilic steppe and forest-steppe vegetation with mesophilic forests. The contemporary range of the species is greatly reduced not only by the changes in the land-use and management of agricultural land, but also by the recent climatic conditions. Coastal drained silts, loess banks of the Danube and thick chernozem soils are the refugia of the species in the region of Silistra. The Romanian hamster was found in the Danube Park, bordering with the high and drained banks of the Danube, which are suitable for the building of underground burrows. We found only one individual, which is indicative for its density. Still, this proof is important, given the high conservation value and the lack of information about the species for the whole Danubian Dobrudzha. During different studies of the small mammals in the Srebarna Reserve, the species has not been established, which makes the period since its last records more than 45 – 50 years. Romanian hamster is strictly protected (Golemanski, 2015). According to Murariu et al. (2009) it is very rare in Northern Dobrudzha and has a scattered distribution.

The specimen was determined by its lower jaws and fragments of the skull, as the brain capsule was shattered. According to the state of the teeth, the animal is old, but its measures are at the lower limits for Bulgaria, and even below the minimum (Table 6).

Ural field mouse (Apodemus uralensis Pall.). It is a species without national conservation status, but can be considered conservationally significant, given its modern status. The species has not been reported for Bulgarian fauna since 1972, when the latest studies on its bio-ecology were done (see Peshev et al., 2004). It was found in 1964 near Kostinbrod and in the Western Balkan Mountains (Peshev et al., 2004). There is no following information on the distribution of the species in Bulgaria ever since. Data on the species is available from Romanian Dobrudzha, where Murariu (2005) found it near the land border with Bulgaria, as well as in the interior of northern Dobrudzha. Mitev (2004) recorded the species in subfossil and more recent findings at a distance of less than 40 km from the city of Silistra, but without proof of the exact date of the biological material. The only other data about the past of the species are for the late Pleistocene from NW Bulgaria (Popov 2000).

Our research gives second certain location for the Ural field mouse at Medzhidi Tabia Park, after its records from the region of Sofia. Six individuals were determined confirming the existence of the species after a period of almost 50 years. Some

measurements are given in Table 7. In the region of Medjidi Tabia the other two close and common species of mice occur – yellow-necked mouse (*Apodemus flavicollis* (Melch.) and wood mouse (*A. sylvaticus* L.), which is of interest from a scientific and practical point of view. The proportions of the three species in the diet of the owls from Silistra were approximately 30: 6: 1 (*A. flavicollis*: *A. sylvaticus*: *A. uralensis*). Similar proportions were established by Mitev (2004), too.

Table 5. Craniometric measures for *D. nitedula* from Peshev et al. (2004) and Silistra (*here*).

	LaP⁴-M³		**LMd**		**La P_4-M_3**	
	Peshev	***here***	**Peshev**	***here***	**Peshev**	***here***
min.	3.4	4.2	11.4	14.52	3.2	4.2
max.	4.6		17.1		4.6	

Table 6. Craniometric measures for *M. newtoni* from Peshev et al. (2004) and Silistra (*here*).

	IOW	**LaM¹-M³**		**DL**		**LMd**		**La M_1-M_3**	
	here	**Peshev**	***here***	**Peshev**	***here***	**Peshev**	***here***	**Peshev**	***here***
min.	4.1	6.0	6.16	9.0	8.46	19.0	17.66	6.0	5.96
max.		8.8		11.0		23.0		8.8	
aver.		7.11		10.0		21.67		7.21	

Table 7. Craniometric measures for *A. uralensis* from Peshev et al. (2004) and Silistra (*here*).

	IOW		**LaM¹-M³**		**DL**		**LMd**	**La M_1-M_3**	
	Peshev	***here***	**Peshev**	***here***	**Peshev**	***here***	***here***	**Peshev**	***here***
min.	3.90	3.75	3.45	3.23	5.40	4.95	7.92	3.32	2.74
max.	4.20	4.23	3.97	3.65	6.30	5.80	8.40	3.62	3.53
aver.	4.08	3.99	3.77	3.41	5.90	5.38	8.23	3.42	3.17
	n = 17	n = 2	n = 17	n = 3	n = 17	n = 2	n = 3	n = 17	n = 5

The five species recorded for the first time as prey of the long-eared owl in Bulgaria (*S. minutus*, *N. anomalus*, *B. barbastellus*, *N. noctula*, and *A. uralensis*) have very low abundance in owl's diet (0.07–0.3% of all preys), which could be resulting from their naturally low density or the randomness of catches as an atypical prey. These conservationally significant species show the exceptional possibilities of this method of studying owls' pellets to establish rare species that are difficult to prove with other methods of research.

According to the literary data available, the established small mammals in *Asio otus* diet belong to 25(29) species from four orders: Eulipotyphla (5 or 6 species), Chiroptera (1 species), Lagomorpha (1 species; in fact this is a domestic rabbit and we think that it should not be considered as

prey), Rodentia (18 or 20 species) (Simeonov, 1964, 1966; Simeonov & Petrov, 1986; Milchev et al., 2003; Milchev & Ivanov, 2016). Six of these species are protected (Appendix 1). The difference in the number of species is due to the difficult for determination species, which are often determined by pairs of species or even only to genus level. Such taxa are *Microtus arvalis/rossiaemeridionalis*, *Apodemus flavicollis/sylvaticus/uralensis* and *Neomys anomalus/fodiens*.

In addition to already established, the possible potential small mammal preys of *Asio otus* for the region of Silistra, along with the less probable species (as southern birch mouse *Sicista subtilis* (Pall.) and grey dwarf hamster *Cricetulus migratorius* (Pall.), represent another 13 species, of which 9 are protected (see Appendix 1). In the list of the potential preys we do not include 5 species: the hedgehog (*Erinaceus roumanicus* B.-H.), the invasive rodents – muskrat (*Ondatra zibethicus* (L.) and coypu (*Myocastor coypus* (Mol.), cape hare (*Lepus capensis* L.), and from the predators – the weasel (*Mustela nivalis* L.). These species are relatively large, therefore, they are unlikely to become a prey. Furthermore, the weasel, regardless of its small size, is an extremely strong and aggressive predator, and it would become a prey only as an exception. Due to the lack of research on the bat fauna in the region of Silistra, a biological extrapolation was used according to surveys in the Srebarna Reserve, with a total of 8 established and supposed species, but it is probable more to be registered.

The full (according to literature and personal data) list of small mammals from the region of the town of Silistra includes 43 species from four orders: Eulipotiphla – 7 sp., Chiroptera – 10 sp., Lagomorpha – 2 sp., Rodentia – 24 sp. It is given in the Appendix 1, along with the conservation status of the animals. During our study we determined in owls' pellets 23 species of small mammals, which accounted 58% of the potential prey species and 77% of those established so far preys. The protected species, potential preys of *Asio otus* for the region, are 17 species, and 6 of them were found in our study. Another 4 species have been reported as owl's prey for other regions of Bulgaria.

These facts show the importance of such studies in registering terrestrial small mammals, among which some are extremely rare and difficult to prove by other methods. The registration of bats as potential preys of the owl can be carried out remotely with a detector, but the data from the diet analysis may complement the scientific information.

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Appendix 1. Species composition and conservation status of the small mammals from the region of the town of Silistra. *Legend:* BDA – Biological Diversity Act; RDB – Red Data Book; IUCN – IUCN Red List; Bern – Bern Convention; Bon – Bon Convention; EUR – EUROBATS; * - species from unpublished observations (N. Kodzabashev, pers. observ.).

№	Species	BDA	RDB	IUCN	Bern	Bon	HD	EUR
	Eulipotyphla							
1	**Erinaceus roumanicus* Barrett-Hamilton, 1906	III	LC	LC				
2	**Talpa europaea* Linnaeus, 1758		LC	LC	III			
3	*Sorex araneus* Linnaeus, 1758		LC	LC	III			
4	*Sorex minutus* Linnaeus, 1766		LC	LC	III			
5	*Neomys anomalus* Cabrera, 1907		LC	LC	III			
6	*Crocidura leucodon* (Hermann, 1780)		LC	LC	III			
7	*Crocidura suaveolens* (Pallas, 1811)		LC	LC	III			
	Chiroptera							
8	*Rhinolophus ferrumequinum* (Schreber, 1774)	II, III	LC	LC	II	II	II, IV	+
9	*Rhinolophus hipposideros* (Bechstein, 1800)	II, III	LC	LC	II	II	II, IV	+
10	*Plecotus austriacus* (Fischer, 1829)	II, III	LC	LC	II	II	IV	+
11	*Barbastella barbastellus* (Schreber, 1774)	II, III	VU	NT	II	II	II, IV	+
12	*Nyctalus noctula* (Schreber, 1774)	II, III	LC	LC	II	II	IV	+
13	*Pipistrellus pipistrellus* (Schreber, 1774)	II, III	LC	LC	II	II	IV	+
14	*Pipisterllus pygmaeus* (Leach, 1825)	II, III	LC	LC	II	II	IV	+
15	*Pipistrellus nathusii* (Keyserling, Blasius, 1839)	III	LC	LC	II	II	IV	+
16	*Eptesicus serotinus* (Schreber, 1774)	III	LC	LR	II	II	IV	+
17	*Vespertilio murinus* Linnaeus, 1758	II, III	LC	LC	II	II	IV	+
	Lagomorpha							
18	**Lepus capensis* Linnaeus, 1758							
19	**Oryctolaguus cuniculus* (Linnaeus, 1758) d.f.							
	Rodentia							
20	**Sciurus vulgaris* Linnaeus, 1758		LC	LC	III			
21	**Spermophilus citellus* (Linnaeus, 1766)	II	VU	VU	II		II, IV	
22	**Glis glis* (Linnaeus, 1766)		LC	LC	III			
23	*Muscardinus avellanarius* (Linnaeus, 1758)	II, III	LC	NT	III		IV	
24	*Dryomys nitedula* (Pallas, 1778)	II	LC	NT	III		IV	
25	*Sicista subtilis* (Pallas,1773)	III	CR	VU	II			
26	**Nannospalax leucodon* (Nordmann, 1840)		LC	DD				
27	*Micromys minutus* (Pallas, 1771)		NT	NT				
28	*Apodemus sylvaticus* (Linnaeus, 1758)		LC	LC				
29	*Apodemus flavicollis* (Melchior, 1834)		LC	LC				
30	*Apodemus uralensis* (Pallas, 1811)		LC	LC				
31	*Apodemus agrarius* (Pallas, 1771)		LC	LC				
32	*Mus specilegus* Petenyi, 1882		LC	LC				
33	*Mus musculus musculus* (Linnaeus, 1758)							
34	*Rattus norvegicus* (Berkenhout, 1769)							
35	*Rattus rattus* (Linnaeus, 1758)							
36	*Cricetulus migratorius* (Pallas, 1773)	II, III	VU	LC				
37	*Cricetus cricetus* (Linnaeus, 1758)	II, III	VU	LC	II		IV	
38	*Mesocricetus newtoni* (Nehring,1898)	II, III	VU	NT	II			
39	**Ondatra zibethicus* (Linnaeus, 1758)							
40	*Arvicola amphibius* (Linnaeus, 1758)		LC	LC				
41	*Microtus arvalis* (Pallas, 1778)		LC	LC				
42	*Microtus rossiaemeridionalis* (Ognev, 1924)		LC	LC				
43	*Microtus subterraneus* (de Selys-Longchamps, 1836)		LC	LC				