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The Eurasian eagle-owl (*Bubo bubo*) diet in the Orava Region (N Slovakia)

Potrava výra skalného (*Bubo bubo*) na Orave (severné Slovensko)

Ján OBUCH & Dušan KARASKA

Abstract: Food remains of the Eurasian eagle-owl (*Bubo bubo*) were studied in samples collected from 26 nests. The samples were collected during spring thus represent the prey brought to the nest whilst rearing of chicks. In total 15,196 items of prey were determined. The dominant food items were two smaller species of rodents, *Microtus arvalis* (39.0%), *Arvicola amphibius* (12.1%), and the common frog (*Rana temporaria*; 27.9%). Other prey recorded had low dominance, however, represented a wide range of species. 43 species of mammals and over 80 species of birds were determined. The Orava Region is climatically one of the coldest regions in Slovakia. The abundance of food for nestlings depends mostly on gradational cycles of small species of rodents and on frogs as the alternative food components. The proportion of bigger species of prey is low: from mammals it was mainly *Rattus norvegicus* (2.3%), *Erinaceus roumanicus* (0.7%) and *Lepus europaeus* (0.5%), from birds *Corvus cornix* (1.1%), *Perdix perdix* (0.6%) and *Asio otus* (0.4%). The food supply creating suitable condition for reproduction of Eurasian eagle-owls in the Orava Region has been deteriorating over the last 20 years due to a decrease in agricultural production leading to diminution of non-forest areas.

Abstrakt: Zvyšky potravy výra skalného (*Bubo bubo*) sú skúmané z 26 vzoriek, zbieraných na jeho hniezdach. Prezentujú potravu, ktorá bola prinášaná mláďatám v období ich výchovy, t. j. v jarných mesiacoch. Spolu bolo determinovaných 15 196 kusov koristi. V potrave dominujú dva menšie druhy hlodavcov, *Microtus arvalis* (39,0 %), *Arvicola amphibius* (12,1 %) a skokan hnedý (*Rana temporaria*; 27,9 %). Zastúpenie ostatných druhov sa vyznačuje nízkou dominanciou, ale vysokou druhovou diverzitou: zistili sme 43 druhov cicavcov a vyše 80 druhov vtákov. Orava patrí klimaticky k najchladnejším regiónom Slovenska. Dostatok potravy pre mláďatá je závislý najmä od gradačných cyklov malých druhov hlodavcov a od žiab ako náhradnej zložky potravy. Pomerné zastúpenie väčších druhov koristi je nízke, z cicavcov najmä *Rattus norvegicus* (2,3 %), *Erinaceus roumanicus* (0,7 %) a *Lepus europaeus* (0,5 %), z vtákov *Corvus cornix* (1,1 %), *Perdix perdix* (0,6 %) a *Asio otus* (0,4 %). V dôsledku útlmu poľnohospodárskej výroby a následného úbytku nelesných plôch sa v posledných 20 rokoch podmienky pre výživu mláďat, resp. reprodukciu výrov na Orave zhoršujú.

Key words: diet, prey items, food composition

Ján Obuch, Commenius University, Botanical Garden, SK–03815 Blatnica, Slovakia. E-mail: obuch@rec.uniba.sk.
Dušan Karaska, Orava P. O. Hviezdoslav Museum, SK–02741 Oravský Podzámok, Slovakia. E-mail: karaska@vtaky.sk.

Introduction

The Eurasian eagle owl (*Bubo bubo*) is the largest owl predator in Europe. It hunts in open unforested areas, which have been maintained in Central Europe by human activity as cultivated steppes, such as fields, meadows and pastures. In the past 40 years a part of the agricultural land in Orava Region has ceased being cultivated which has led to it becoming overgrown by shrubs and trees. A significant part of the narrow strips of agricultural land has been merged into large field parcels and some fields turned into pastures. The animal production has been concentrated into large farms located on the outskirts of the villages. These changes in habitats have been reflected in the Eurasian eagle-owl's (*B. bubo*) diet and also its nesting and breeding success.

First data concerning *B. bubo* diet in the Orava Region were collected during the research of Choč Mt., at its border with the Liptov Region (Obuch 1981). The substantial part of prey remains from its nests was collected in 1994 and 1995. Partial results were presented at the conference "Orava River And Its Natural Values" (Obuch 1995). As a result of the determination of all obtained data from the Orava Region, this region has become the most extensively studied region in Slovakia, with the highest amount of recorded prey remains.

In relation to other regions of Slovakia, the diet of *B. bubo* has also been studied in the Liptov Region (Obuch 1981, 2009, Vondráček & Obuch 1980), Turiec Region (Obuch 2002a, Obuch & Darola 1980, Lilgová 1998), in Žilinská kotlina Basin (Obuch 1980), in Považské

podolie Region (Obuch 1985a), in Upper Nitra Region (Obuch 1980), on Muránska planina Mts (Obuch 1985b), in Horehronie Region (Obuch 2002b), in Slovenský kras Mts (Obuch 1998a), in the Malé Karpaty Mts (Darolová 1990), in the Belianske Tatry Mts (Schaefer 1972, Obuch 2002c) and to a lesser extent in other regions.

Material and methods

Majority of the material for *B. bubo*'s diet study comes directly from nests, only a small part from pellets collected in the vicinity of the nest. Thus, whole examined material comes from the period of nesting and rearing of chicks in spring. The prey remains were collected together with inorganic material. Most of the obtained samples were being accumulated on nests over along period of time of 10–20(50) years. The absence of fresh pellets in some nests suggested, that they haven't been occupied by *B. bubo* for several years (localities Zázrivá – Havrania skala, Párnica – Bralo, Istebné – Žiar, Vyšný Kubín – pod Chočom, Valaská Dubová – Soliská, Dlhá nad Oravou – Ostrý vrch, Podbiel – Červená skala, Habovka – Predná Kremenná, Zuberec – Úplazíky). Bones were washed with water in order to separate them from stones and soil. The pellets were soaked in 5% NaOH to remove any soft material. After having been dried the following prey remains were selected for further determination: mandibula, maxila and dentes of mammals (Mammalia), premaxilla, mandibula, humerus, metacarpus and tarsometatarsus of birds (Aves), os ilium of frogs (Anura), premaxilla and mandibula of reptiles and fish (Reptilia, Pisces) and os pharingeum inferior of cyprinid fish (Cypriniformes). Beetle (Coleoptera) heads (caput) and internal shells of keel back slugs (Limacidae) were also recorded. The abundance of particular identified prey items were estima-

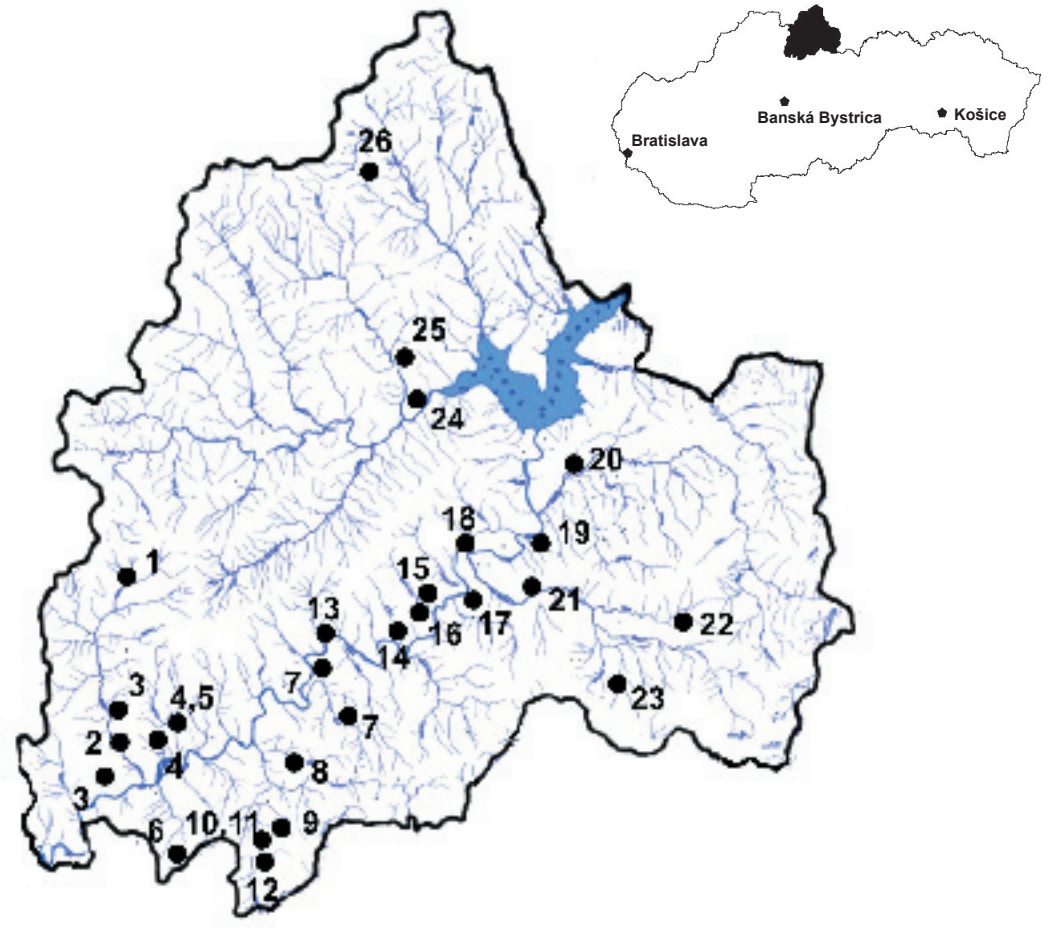


Fig. 1. Sampling sites of Eurasian eagle-owls' (*Bubo bubo*) food remains in the Orava Region. For site numbers see Tabs 1 and 2.
Obr. 1. Lokality zberu vývržkov výra skalného (*Bubo bubo*) na Orave. Číslovanie lokalít je zhodné s číslovaním v Tab. 1 a 2.

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ted according to the most numerous body parts from the respective species. In the samples from 70s and 80s the subgenus *Sylvaemus* were not divided into three species. A new determination to all of older samples from the Orava Region was carried out, except for the samples from Žilinská kotlina and Považské podolie basins. Therefore *Apodemus* sp. in Tab. 4 includes total numbers of three species, *A. flavicollis*, *A. sylvaticus,* and *A. microps*.

The name *Apodemus microps* (Kratochvíl & Rosický 1952) is used for the pannonian population of *Apodemus uralensis*, which can be differentiated from the *A. sylvaticus* by smaller sized jaws. *C. cornix* is among corvids predominantly presented in the diet of Eurasian eagle-owl.

For evaluation of quantitative data "The marked differences from the mean method" was used (MDFM, Obuch 2001). Significant deviations from mean positive (+) and negative (-) were calculated using formulas of above mentioned method. In the modified contingence tables (Tab. 3, 4) the sample order is arranged according to the similarity in representation of species with positive deviations from the mean (+ MDFM). The order of prey types is arranged into the closed blocks, bounded with a solid line.

The summary of *B. bubo* food remains determination results from particular sampling (samples 1–26) are presented in Tables 1 and 2. The nests in the localities of Istebné, Žiar and Istebné, Suchá dolina (No. 4 and 5), Pucov and Medzibrodie nad Oravou (No. 7) and the localities Dlhá nad Oravou, Skalica and Dlhá nad Oravou, Ostrý vrch (No. 15 and 16) may have been used by the same *B. bubo* pair. The samples No. 10 and 11 come from the same locality Jasenová, Bralo, but from different time periods. Position of localities, where the material was collected is depicted in the Figure 1.

Results

In 26 Eurasian eagle-owls' food samples there were 15,196 items of prey determined. Mammals were the dominant food items (Mammalia, 64.4%) with the highest proportion of the species being *Microtus arvalis* (39.0%) and *Arvicola amphibius* (12.1%). An frog *Rana temporaria* (27.9%) is of significant importance to *B. bubo* nestlings' diet, being an alternative prey at the time when the populations of the two rodent species mentioned above are affected by a temporary population decline. The proportion of birds (Aves, 7.3%) is relatively low. It is assumed that they become just 'accidental' prey due to the occurrence of a wide range of species (at least 80) and the fact that the domination of any of the species did not exceed 1%. The range of mammals was also extensive (43 species). Larger prey items were not represented significantly: *Rattus norvegicus* 2.3%, *Erinaceus roumanicus* 0.7%, *Lepus europaeus* 0.5%, *Corvus cornix* 1.1%, *Perdix perdix* 0.6%, *Asio otus* 0.4%. Habitats found in the Orava Region present relatively suitable nesting opportunities for *B. bubo*. The population was estimated to be approximately 30 – 40 pairs (Karaska, unpubl. data). Nesting and breeding success depends mainly on gradational cycles of the two relatively small rodent species and the Eurasian eagle-owls' ability to find alternative prey. Therefore, the diversity of the species found in the samples from several nests is high, with the diversity index of H' > 2.

To evaluate the similarity of the food samples, collections from the same nests were merged, furthermore united small samples with neighbouring bigger ones with similar species domination. In the Tab. 3 there is a comparison of 19 *B. bubo* food samples, using the " Method of marked differences from the mean" (Obuch 2001). When comparing the blocks of species with positive differences (+MDFM) various combinations can be identified.

The proportion of *M. arvalis* as the dominant species was singularly above-average only at two localities (Sihelné and Žaškov), in combination with more abundant *A. amphibius* (Dlhá nad Oravou, Skalica), with larger and more numerous bird species *A. otus*, *C. cornix*, *P. perdix* a *Coloeus monedula* (Medzihradné) and with larger mammals *E. roumanicus* and *Vulpes vulpes* (Jasenová). Other small rodents: *Apodemus sylvaticus*, *A. agrarius* a *Mus musculus* were more prevalent prey species in the Orava valley near Dlhá nad Oravou, Podbieľ and Krivá, in combination with a high proportion of the common frog *R. temporaria* on lower Orava near Zázrivá. There were six localities with the a higher representation of *R. norvegicus*, in four of them along with *A. amphibius*. The distinctive representation of species was in the largest sample from Úplazíky near Zuberec; along with the significantly higher proportion of *A. amphibius*, there were more numerous small mammal species: *Talpa europaea*, *Dryomys nitedula*, *Muscardinus avellanarius*, *Microtus subterraneus*, *Apodemus flavicollis*, but also the domestic pigeon *Columba livia* f. *domestica* and the trout *Salmo trutta*. The more substantial samples from Istebné and Párnica were characterized by a higher proportion of the yellow-necked mouse *A. flavicollis* and the common frog *R. temporaria*.

The data learnt from food samples of Eurasian eagle-owl is of significant importance to the knowledge of fauna change in the Orava Region. Especially bigger samples accumulated over a longer period of time (50

Tab. 1. Diet of Eurasian eagle-owls (*B. bubo*) from nests in the lower Orava Region
Tab. 1. Potrava výra skalného (*B. bubo*) z hniezdísk na dolnej Orave

sample no. / č. zberu **species / druh**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Σ**
Erinaceus roumanicus	10	1		11	5	2	3	9	2		21		64
Talpa europaea	3	2		3			2	6	6	1	3	1	27
Sorex araneus				1	2				1				4
Sorex minutus								1					1
Neomys anomalus									1				1
Neomys fodiens	1	1		1	1				3	1			8
Crocidura leucodon		1											1
Myotis myotis		1		1				2	1				5
Vespertilio murinus		1											1
Eptesicus serotinus	1	2			1								4
Nyctalus noctula												1	1
Pipistrellus pipistrellus											1		1
Plecotus auritus								2					2
Lepus europaeus	5	3	1	6	3		4	5	4	2	4	1	38
Sciurus vulgaris	4			2	2	2		2	2	1	4	1	20
Glis glis	2	2		2		1		3			4	2	16
Eliomys quercinus	2									1			3
Dryomys nitedula		1		1	2				1				5
Muscardinus avellanarius		2		1	3			1			1		8
Sicista betulina	1												1
Mus musculus	24	5		1	2			1	20	2	1	6	62
Micromys minutus		1						1			1		3
Apodemus flavicollis	23	40	1	22	43	1	2	10	13	2	2	1	160
Apodemus sylvaticus	74	15		18	6	3		34	119	9	6	5	289
Apodemus microps	1	1			1				4				7
Apodemus agrarius	2	10		3	2			3	9				29
Rattus norvegicus	16	1		2	1	3	16	25	7		19		90
Myodes glareolus	2	3		3	5			1	1		1		16
Arvicola amphibius	80	4	3	45	8	21	51	125	39	12	67	1	456
Microtus subterraneus			1	1	1			2	2	1			8
Microtus tatricus									3				3
Microtus arvalis	284	95	22	394	280	139	47	605	377	52	331	8	2634
Microtus agrestis				2	4		1	3			1		11
Vulpes vulpes	1							1	2	1	5		10
Martes martes										1			1
Mustela erminea				2			1			1	3		7
Mustela nivalis	3			2				3	1	1	4		14
Putorius putorius								1	1				2
Felis catus domestica	1												1
Cervus elaphus											1		1
Mammalia	**540**	**192**	**28**	**524**	**372**	**172**	**127**	**846**	**619**	**88**	**480**	**27**	**4015**
Anas platyrhynchos				2			1				3		6
Anas querquedula				1									1
Accipiter gentilis					1								1
Buteo buteo				3	1			1	1		5		11
Falco tinnunculus				1	1	1	3	6	4		4		20
Falco subbuteo											2		2
Tetrastes bonasia			1		1				2		1		5

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Tab. 1. continuation
Tab. 1. pokračovanie

sample no. / č. zberu **species / druh**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Σ**
Lyrurus urogallus				1									1
Perdix perdix	4	1	1	4	2		1	14	2	2	2	1	34
Coturnix coturnix	1			3	1			5	6	4	3		23
Galliformes sp.									1		1		2
Rallus aquaticus									1				1
Crex crex						1		2					3
Gallinula chloropus				1			1						2
Fulica atra	1												1
Charadrius dubius				1									1
Vanellus vanellus				1				1			1		3
Actitis hypoleucos	1												1
Philomachus pugnax								1					1
Scolopax rusticola	3			3	2	1		1		1	1		12
Chlidonias niger												1	1
Columba livia f. *domestica*		1		10		1	5	6	2		4	1	30
Columba oenas					1								1
Columba palumbus				1	1								2
Streptopelia decaocto				1			1	1					3
Streptopelia turtur	2						1	2					5
Cuculus canorus	1												1
Bubo bubo	1							1					2
Asio otus	2			7	2	1	4	10	4		2		32
Aegolius funereus					1			1	1				3
Strix aluco	1	1	2	2	2	1		1	3		1		14
Caprimulgus europaeus				1									1
Alauda arvensis	9			1	2	2		2	1	3	1		21
Lullula arborea	1												1
Galerida cristata				1									1
Delichon urbicum				1									1
Riparia riparia				1									1
Anthus trivialis					2			1	1				4
Bombycilla garrulus							1						1
Lanius minor												1	1
Lanius collurio	2							1	2				5
Sylvia atricapilla												1	1
Muscicapa striata		1											1
Erithacus rubecula				1		1							2
Turdus merula		1		1		1		7			1		11
Turdus torquatus	3			1	3			1					8
Turdus pilaris	1			4	2	4	1	2	2		11		27
Turdus philomelos	3			9	4	2	3	10	3	1	1	1	37
Turdus viscivorus					1		1	3	1		4		10
Parus major								1					1
Cyanistes caeruleus				1									1
Emberiza citrinella	2			2				1					5
Fringilla coelebs		2									2	1	5
Carduelis carduelis				2							1		3
Carduelis cannabina								1					1

Tab. 1. continuation
Tab. 1. pokračovanie

sample no. / č. zberu **species / druh**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Σ**
Carduelis chloris									1				1
Pyrrhula pyrrhula								1					1
Serinus serinus									1				1
Fringillidae sp.		1											1
Passer domesticus				1				2	1		1		5
Sturnus vulgaris							1	2					3
Garrulus glandarius	3	1		1		1	3	4			3		16
Nucifraga caryocatactes					1			1					2
Pica pica	1			1	1			1					4
Corvus cornix	9	1	9	9	5	4	10	36	15	4	9	1	112
Coloeus monedula				2	1		2	9	2		2		18
Passeriformes sp.	1	2				1		1	1		1		7
Aves sp.	1												1
Aves sp.juv.	1			1									2
Aves	**54**	**12**	**13**	**83**	**38**	**22**	**39**	**140**	**58**	**15**	**67**	**8**	**549**
Bombina sp.				1									1
Bufo bufo					1								1
Rana temporaria	604	374	5	249	499	14	13	126	289	61	77	55	2366
Lacerta agilis	1				3								4
Lacerta sp.								1			1		2
Colubridae sp.											1		1
Salmo trutta		1		2	1						1		5
Cypriniformes sp.			1	3			2						6
Pisces sp.								1	1				2
Amphibia, Reptilia, Pisces	**605**	**375**	**6**	**255**	**504**	**14**	**15**	**128**	**290**	**61**	**80**	**55**	**2388**
Limacidae sp.	2												2
Σ	**1201**	**579**	**47**	**862**	**914**	**208**	**181**	**1114**	**967**	**164**	**627**	**90**	**6954**

Legend / Vysvetlivky: 1 – Zázrivá, Havrania skala, 22. 8. 1995, 2 – Párnica, Bralo, 22. 8. 1995, 3 – Párnica, Lazy, 1994 + Sokolec, 27. 5. 1980, 4 – Istebné, Žiar + Suchá dolina, 11. 9. 1994, 5 – Istebné, Žiar, 14. 10. 1996, 6 – Žaškov, dolina Uhlisko, 18. 5. 1994, 7 Pucov, zlepencová skala, 17. 5. + 21. 6. 1994 + Medzibrodie nad Oravou, 4. 9. 1994, 8 – Dolný Kubín, Medzihradné, 17. 5. 1994, 9 – Vyšný Kubín, pod Chočom, 14. 10. 1977 (Obuch 1981), 10 – Jasenová, Bralo, 14. 10. 1977 (Obuch 1981), 11 – Jasenová, Bralo, 17. 5. 1994, 12 – Valaská Dubová, Soliská, 26. 5. 1977 (Obuch 1981).

and more), while the approach to agricultural cultivation of land gradually changed. Therefore, it led to diminution of some of the species. For example, the recent occurrence of garden dormouse *Eliomys quercinus*, recorded in four food samples, and also of yellow-necked mouse *Apodemus microps*, recorded in five samples, is questionable. Both of the species were bound to fully exploited meadows and pastures. They subsided as a result of being overgrown by grasses and bushes. The presence of the northern birch mouse *Sicista betulina* in six samples and the forest dormouse *Dryomys nitedula* in seven samples gives evidence about their dispersed occurrence in the whole region of Orava. The data about occurrence of six species of bats and the bicoloured white-toothed shrew *Crocidura leucodon* near Žaškov are also valuable. The data about Tatra pine vole *Microtus tatricus* under Choč mountains is mentioned by Dudich et al. (1981). Occurrence of synanthropic owls *Athene noctua* and *Tyto alba* in the region of central Orava is also interesting.

Discussion

The Orava Region is climatically one of the coldest regions in Slovakia for the Eurasian eagle-owls (*B. bubo*). The breeding conditions for *B. bubo,* species dependent on gradational cycles of two rodent species *M. arvalis* and *A. amphibius*, in this area can be severe. The main

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Tab. 2. Diet of Eurasian eagle-owls (*B. bubo*) from nests in the middle and upper Orava Regions
Tab. 2. Potrava výra skalného (*B. bubo*) z hniezdísk strednej a hornej Oravy

sample no. / č. zberu **species / druh**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**Σ**
Erinaceus roumanicus	2	2	4	2		3		14	1	7	3		3	1	42
Talpa europaea			2	6	1	4					19		1		33
Sorex araneus		1	2	2	1						3		1	1	11
Sorex minutus				1											1
Neomys fodiens				1							4				5
Myotis nattereri										1					1
Vespertilio murinus				1											1
Eptesicus serotinus						1							1		2
Nyctalus noctula											1				1
Plecotus auritus										1					1
Lepus europaeus	1	4		4	2	7		5	2		16		1	3	45
Sciurus vulgaris	1		1	1	1	1		2		1	8		1		17
Glis glis				5											5
Eliomys quercinus				1		1									2
Dryomys nitedula			1			1					9				11
Muscardinus avellanarius				5		2		1		1	15				24
Sicista betulina			3	2	2			2			4				13
Mus musculus				5		32			1		3				41
Apodemus flavicollis	2	1	10	19	6	21		2		1	120		1	2	185
Apodemus sylvaticus		2	1	67		97	1	2			43	2	3		218
Apodemus microps						4									4
Apodemus agrarius		3	1	9	8	60	1	2			5		1		90
Rattus norvegicus	40	25	8	17		42	2	48	8		55	1	16		262
Myodes glareolus		1	2	6	2	2		1			2		1		17
Ondatra zibethicus	5														5
Arvicola amphibius	30	30	159	213	31	147	2	89	19	18	589	14	43	3	1387
Microtus subterraneus			1	1		1				1	10				14
Microtus arvalis	14	133	543	883	35	501	8	166	11	11	751	68	62	100	3286
Microtus agrestis			1	2		6		1	1	1			1	2	15
Chionomys nivalis											3				3
Vulpes vulpes				1							4			1	6
Mustela erminea			3	2				1			2				8
Mustela nivalis	1	3	1	4		2		1			2	2		1	17
Putorius putorius						1									1
Mammalia	**96**	**205**	**743**	**1260**	**89**	**936**	**14**	**337**	**43**	**43**	**1671**	**87**	**136**	**114**	**5774**
Tachybaptus ruficollis				1											1
Ixobrychus minutus	1														1
Anas platyrhynchos	2	1			1			2			1				7
Anas crecca											2				2
Anas querquedula		2				1							1		4
Aythya fuligula								1							1
Anatidae sp.								1							1
Buteo buteo	1	1	2	1				2		1	1			1	10
Falco tinnunculus				1		1					3				5
Tetrastes bonasia				2											2
Lyrurus tetrix											1				1
Lyrurus urogallus											1				1
Perdix perdix		2	3	4	1	11	3	9	1		12	2	5		53

Tab. 2. continuation
Tab. 2. pokračovanie

sample no. / č. zberu species / druh	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Σ
Coturnix coturnix			1	1		2					3		1		8
Rallus aquaticus					1	1									2
Porzana porzana			1			1				1					3
Crex crex			2	1		2							1		6
Gallinula chloropus					1	1							2		4
Charadrius dubius											1				1
Vanellus vanellus		1	2				1	1			1	1			7
Tringa glareola			1												1
Actitis hypoleucos						4							1		5
Philomachus pugnax						1									1
Scolopax rusticola				2	2	1				3	7	1		1	17
Gallinago gallinago											1				1
Limicolae sp.		1													1
Columba livia domestica	4	1	2	2				6	1		1		1		18
Columba oenas						2									2
Columba palumbus		1				1					13				15
Streptopelia decaocto			1				2	2			1				6
Cuculus canorus								2							2
Tyto alba		1				1									2
Bubo bubo				1		1					1				3
Asio otus		3	3	6		1		5		1	3	1	6	2	31
Aegolius funereus			1								1		1		3
Athene noctua						1									1
Strix aluco	1	1	3	1		2		1			1				10
Caprimulgus europaeus								1							1
Dryocopus martius											1				1
Jynx torquilla						1									1
Alauda arvensis		1	2	3	1	7		2	1	1	14			1	33
Lullula arborea					1	1					1				3
Hirundo rustica								1							1
Delichon urbicum					1	1	1				3		1		7
Riparia riparia				1											1
Anthus trivialis									1	1					2
Lanius collurio					1	3					1				5
Sylvia atricapilla						1									1
Regulus sp.				1											1
Erithacus rubecula				1	1			1			1				4
Turdus merula			1	5	4	1		3	2		3				19
Turdus torquatus		2		3	1	1		1			2	1			11
Turdus pilaris	4	4	7		3	2	4	7		1	1		1		34
Turdus philomelos		1	4	10	3	8			2	1	10		3		42
Turdus viscivorus			1	1					1		8				11
Cyanistes caeruleus								1							1
Emberiza citrinella			1	1	1				1		2		1		7
Emberiza calandra				1											1
Fringilla coelebs											4				4
Carduelis carduelis							1	1							2
Loxia curvirostra											1				1

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Tab. 2. continuation
Tab. 2. pokračovanie

sample no. / č. zberu **species / druh**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**Σ**
Passer domesticus													1		1
Sturnus vulgaris		1		1	1			2							5
Garrulus glandarius		1	3	4	1	1	1	5	2			2			20
Nucifraga caryocatactes											3				3
Pica pica		1	2	1		2		2			5				13
Corvus cornix+frugilegus	1	8	3	5		9		2		1	18	1	2		50
Coloeus monedula		3				19							1		23
Passeriformes sp.	1		2			1					2				6
Aves sp.	1														1
Aves sp.juv.								1							1
Aves	**16**	**37**	**48**	**61**	**25**	**93**	**13**	**62**	**12**	**11**	**135**	**9**	**29**	**5**	**556**
Bufo bufo								1							1
Rana temporaria	3	52	48	187	49	417	30	51	48	37	904	7	44	1	1878
Lacerta agilis			1	1				1							3
Lacerta sp.											1				1
Salmo trutta						1					10				11
Cypriniformes sp.	5	4				1			1						11
Pisces sp.				1									2		3
Amphibia, Reptilia, Pisces	**8**	**56**	**49**	**189**	**49**	**419**	**30**	**53**	**49**	**37**	**915**	**7**	**46**	**1**	**1908**
Coleoptera sp.							1								1
Limacidae sp.			1	2											3
Evertebrata	**0**	**0**	**1**	**2**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**
Σ	**120**	**298**	**841**	**1512**	**163**	**1448**	**58**	**452**	**104**	**91**	**2721**	**103**	**211**	**120**	**8242**

Legend / vysvetlivky: 13 – Oravský Podzámok, hradné bralo, 9. 8. 1995 (Obuch 1995), 14 - Sedliacka Dubová, 6. 6. 1995 (Obuch 1995), 15 - Dlhá nad Oravou, Skalica, 18. 5. 1994 (Obuch 1995), 16 - Dlhá nad Oravou, Ostrý vrch, 18. 5. 1994 (Obuch 1995), 17 - Krivá, Priboj, 10. 8. 1995 (Obuch 1995), 18 – Podbiel, Červená skala, 10. 8. 1995 (Obuch 1995), 19 – Tvrdošín, Krásna Hôrka, 29. 4. 1995, 20 – Trstená, lom Hálečková, 11. 8. 1995 + 14. 6. 2009, leg. O. Suchánek, 21 - Oravský Biely Potok, lom, 18. 5. 1994, 22 – Habovka, Predná Kamenná, 11. 8. 1995, 23 – Zuberec, Úplazíky, 9. 1990, 24 – Oravská Jasenica, lom, 19. 5. 1994, 25 – Oravská Jasenica, Bredov, 19. 5. 1994, 26 – Sihelné, Hrádok, 19. 5. 1994.

alternative prey are frogs (*R. temporaria*). Similar conditions also apply to other submountain regions of Slovakia. A specific diet type of *B. bubo* with three dominant species was described in the Upper Hron River Region by Obuch (2002b). The criteria for such type of diet were determined as follows: representation of *A. amphibius* > 15%, *R. temporaria* > 10%, *M. arvalis* < 40%. It has been stated, that the largest sample from the Orava Region collected at Úplazíky near Zuberec represented this type of diet. Additionally other smaller samples of *B. bubo* diet from the area of Upper Orava Region can be assigned to this type from Oravský Biely Potok, Trstená and Oravská Jasenica. Samples with a significantly higher proportion of +*M. arvalis* (6 samples) did not fulfil the criteria, due to exceeding the lower limit for dominance of this species. There are three larger samples of *B. bubo* diet with +*R. temporaria* from the lower Orava Region, with >30% dominance of this species, however, with significantly under-average representation of *A. amphibius* (Istebné, Párnica and Zázrivá). These are examples of the most extreme conditions shaping the nutrition of nestlings in dealing with insufficient supplies of rodents *B. bubo* become dependent on preying on frogs, when they are concentrated in shallow waters during reproduction period. The highest proportion of frogs (> 50%) was detected on historic (subrecent) nests in the Nízke Tatry Mts in Demänovská dolina and Jánska dolina valleys (Obuch 2009). Higher proportion of frogs in the diet of *B. bubo* was detected in the Liptov Region, in comparison with the summarised data from other mountain basins (Tab. 4). The highest proportion of *A. amphibius* was present in samples from the Horehronie Region; the proportion of dominant species *M. arvalis* in six submountain samples, represented a relatively narrow range: from 22.8%

Tab. 3. Species representation similarity in the diet of Eurasian eagle-owl (*B. bubo*) in the Orava Region
Tab. 3. Podobnosť v zastúpení druhov v potrave výra skalného (*B. bubo*) na Orave

site / lokalita species / druhy	1		2		3		4		5		6		7		8		9	
Microtus arvalis	1+	100	1+	139	1+	605	1+	383	1+	883	1+	543		501		377	1-	35
Asio otus		2		1	1+	10		2		6		3	1-	1		4		
Perdix perdix					1+	14		4		4		3		11		2		1
Corvus cornix				4	1+	36		13	1-	5	1-	3	1-	9		15		
Coloeus monedula					1+	9		2	1-	0			2+	19		2		
Turdus merula				1	1+	7		1		5		1		1				4
Turdus pilaris				4		2	1+	11	1-	0		7		2		2		3
Coturnix coturnix						5	1+	7		1		1		2		6		
Vulpes vulpes		1				1	1+	6		1						2		
Erinaceus roumanicus		1		2		9	1+	21	1-	2		4	1-	3	1-	2		
Apodemus sylvaticus				3		34	1-	15	1+	67	3-	1	1+	97	2+	119	1-	0
Mus musculus					1-	1		3		5	1-	0	2+	32	1+	20		
Apodemus agrarius					1-	3	1-	0		9	1-	1	2+	60		9	1+	8
Rattus norvegicus				3		25		19	1-	17	1-	8		42	1-	7		
Garrulus glandarius				1		4		3		4		3		1				1
Ondatra zibethicus																		
Cypriniformes sp.														1				
Columba l. f. *domestica*				1		6		4		2		2	1-	0		2		
Arvicola amphibius	1-	3		21		125		79		213	1+	159		147	2-	39	1+	31
Talpa europaea						6		4		6		2		4		6		1
Dryomys nitedula												1		1		1		
Muscardinus avellanarius						1		1		5				2				
Microtus subterraneus						2		1		1		1		1		2		
Columba palumbus														1				
Salmo trutta								1						1				
Apodemus flavicollis		2		1	1-	10	2-	4	1-	19	1-	10	1-	21	1-	13		6
Rana temporaria	3-	1	2-	14	1-	126	1-	138	1-	187	2-	48		417		289		49
Lepus europaeus		3				5		6		4	1-	0		7		4		2
Turdus philomelos				2		10		2		10		4		8		3		3
Alauda arvensis		1		2		2		4		3		2		7		1		1
Sciurus vulgaris				2		2		5		1		1		1		2		1
Myodes glareolus						1		1		6		2		2		1		2
Mustela nivalis		1				3		5		4		1		2		1		
Scolopax rusticola		1		1		1		2		2				1				2
Microtus agrestis		2				3		1		2		1		6				
Falco tinnunculus				1		6		4		1				1		4		
Strix aluco				1		1		1		1		3		2		3		
Buteo buteo		1				1		5		1		2				1		
Turdus viscivorus						3		4		1		1				1		
Mammalia	**1+**	**114**	**1+**	**172**		**846**		**568**	**1+**	**1260**	**1+**	**743**		**936**		**619**		**89**
Aves		**5**		**22**	**1+**	**140**	**1+**	**82**	**1-**	**61**		**48**		**93**		**58**	**1+**	**25**
Amph., Rept., Pisces	**3-**	**1**	**2-**	**14**	**1-**	**128**	**1-**	**141**	**1-**	**189**	**2-**	**49**		**419**		**290**		**49**
Evertebrata		**0**		**0**		**0**		**0**		**2**		**1**		**0**		**0**		**0**
Σ		**120**		**208**		**1114**		**791**		**1512**		**841**		**1448**		**967**		**163**
H'		0.86		1.44		1.93		2.06		1.6		1.37		2.04		1.89		2.23

Legend / vysvetlivky: 1 – Sihelné, 2 – Zaškov, 3 – Medzihradné, 4 – Jasenová, 5 – Dlhá nad Oravou, Ostrý vrch, 6 – Dlhá nad Oravou, Skalica, 7 – Podbiel, 8 – Vyšný Kubín, 9 – Krivá, 10 – Trstená + Tvrdošín, 11 – Pucov, 12 – Sedliacka Dubová, 13 – Oravský Podzámok, 14 – Oravský Biely Potok, 15 – Oravská Jasenica, 16 – Zuberec + Habovka, 17 – Istebné, 18 – Párnica, 19 – Zázrivá.

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Tab. 3. continuation
Tab. 3. pokračovanie

10		11		12		13		14		15		16		17		18		19		Σ	%
	174	1-	47		133	2-	14	2-	11		130	1-	762		674	1-	117	1-	284	5912	39.1
	5		4		3					1+	7	1-	4		9				2	63	0.4
1+	12		1		2				1	1+	7		12		6		2		4	86	0.6
	2	1+	10	1+	8		1				3	1-	19		14		10		9	161	1.1
			2		3						1	1-	0		3					41	0.3
	3								2				3		1		1			30	0.2
1+	11		1		4		4				1	1-	2		6				1	61	0.4
											1		3		4				1	31	0.2
													4						1	16	0.1
1+	14		3		2		2		1		3	1-	10		16		1		10	106	0.7
2-	3	1-	0	1-	2					1-	5	1-	43	1-	24		15	1+	74	502	3.3
									1			2-	3	1-	3		5	1+	24	97	0.6
	3				3						1	2-	5	1-	5	1+	10	1-	2	119	0.8
2+	50	1+	16	2+	25	3+	40	1+	8	1+	17		55	3-	3		1	1-	16	352	2.3
1+	6		3		1				2		2	1-	0		1		1		3	36	0.2
						1+	5													5	0.0
			2		4	1+	5		1						3		1			17	0.1
1+	6	1+	5		1		4		1		1	1-	1		10		1			47	0.3
1+	91	1+	51		30	1+	30		19	1+	57	1+	607	2-	53	3-	7	1-	80	1842	12.2
			2								1	1+	19		3		2		3	59	0.4
												1+	9		3		1			16	0.1
	1											1+	16		4		2			32	0.2
												1+	11		2		1			22	0.2
					1							1+	13		2					17	0.1
												1+	10		3		1			16	0.1
1-	2		2	1-	1		2			1-	1	1+	121	1+	65	1+	41		23	344	2.3
1-	81	2-	13	1-	52	3-	3	1+	48	1-	51	1+	941	1+	748	1+	379	1+	604	4189	27.7
	5		4		4		1		2		1		16		9		4		5	82	0.5
			3		1				2		3		11		13				3	78	0.5
	2				1				1				15		3				9	54	0.4
	2						1				1		9		4				4	36	0.2
	1				1						1		2		8		3		2	33	0.2
	1				3		1				2		2		2				3	31	0.2
											1		10		5				3	29	0.2
	1		1						1		1		1		6					26	0.2
			3										3		2					25	0.2
	1				1		1						1		4		3		1	24	0.2
	2				1		1						2		4					21	0.1
			1						1				8		1					21	0.1
	351		**127**		**205**		**96**	**1-**	**43**		**223**		**1714**	**1-**	**896**	**1-**	**220**	**1-**	**540**	**9762**	**64.6**
1+	**75**	**1+**	**39**	**1+**	**37**	**1+**	**16**		**12**	**1+**	**38**	**1-**	**146**		**121**	**1-**	**25**	**1-**	**54**	**1097**	**7.3**
1-	**83**	**2-**	**15**	**1-**	**56**	**2-**	**8**	**1+**	**49**	**1-**	**53**	**1+**	**952**	**1+**	**759**	**1+**	**381**	**1+**	**605**	**4241**	**28.1**
	1		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**2**	**6**	**0.0**
	510		**181**		**298**		**120**		**104**		**314**		**2812**		**1776**		**626**		**1201**	**15106**	**100.0**
	2.27		2.33		2.03		2.11		1.85		2.05		1.93		1.73		1.5		1.72	2.05	

Tab. 4. Comparison of diet of Eurasian eagle-owl (*B. bubo*) from the Orava Region with some mountain basins in Slovakia
Tab. 4. Porovnanie potravy výra skalného (*B. bubo*) z Oravy s niektorými horskými kotlinami na Slovensku

region / oblasť species / druhy	Orava		Horehronie		Liptov		Turiec		Žilinská kotlina		Považie		Σ	%
Sicista betulina	1+	14		3		2							19	0.1
Apodemus agrarius	1+	119	2-	4	1-	7	2-	5		17	2-	0	152	0.4
Turdus torquatus	1+	19				1							20	0.1
Turdus pilaris	1+	61	1-	4		4		16		6	1-	2	93	0.3
Spermophilus citellus	1-	0	2+	15								1	16	0.0
Talpa europaea		59	1+	37		20		23		20		12	171	0.5
Dryomys nitedula		16	1+	14		1	1-	0		2		1	34	0.1
Arvicola amphibius		1842	1+	1565	1-	227	2-	299	2-	127	3-	41	4101	11.1
Microtus agrestis		26	1+	29		6	1-	2	1-	0	1-	0	63	0.2
Porzana porzana		3	1+	9				3				1	16	0.0
Streptopelia turtur	1-	5	1+	15		1		4		1		2	28	0.1
Alauda arvensis		54	1+	42		1		15		7	1-	4	123	0.3
Neomys fodiens		13		6	1+	8		1					28	0.1
Columba palumbus		17	2-	0	2+	37	1-	4	1-	0	1-	0	58	0.2
Vanellus vanellus	1-	10	1-	3	1+	12	1+	20		5		9	59	0.2
Columba livia dom.		47	1-	5	1+	22	1+	44	2-	0		1	119	0.3
Rana temporaria		4189		1434	1+	1495		1840	1+	1284	2-	234	10476	28.2
Microtus subterraneus	1-	22		15	1+	15	2-	2	1+	24	1+	22	100	0.3
Strix aluco	1-	24	1-	5	1+	14		15		12	1+	23	93	0.3
Mustela nivalis	1-	31		16		17	1+	45		17		10	136	0.4
Streptopelia decaocto		9		1		5	1+	12				3	30	0.1
Pica pica		17		11		6	1+	19		5		1	59	0.2
Salmo trutta	1-	16		11		10	1+	28	1-	0	1-	0	65	0.2
Apodemus sp.		857	1-	171		178	1+	553	1+	424	1+	276	2459	6.6
Mus musculus	1-	97	2-	17		22	1+	82	1+	45	1+	47	310	0.8
Myodes glareolus	2-	33	2-	14	1-	17	1+	95		29	2+	108	296	0.8
Anas platyrhynchos	1-	13	1-	1		1	1+	19		4	1+	13	51	0.1
Falco tinnunculus		25	1-	4		3	1+	24		3	1+	13	72	0.2
Asio otus		63	1-	14		17	1+	46		14	1+	34	188	0.5
Sciurus vulgaris		36	1-	10		9		20	1+	23		13	111	0.3
Coturnix coturnix	1-	31		24		6		25	1+	17		8	111	0.3
Perdix perdix	1-	86	2-	18	1-	22	1-	50	1+	63	3+	161	400	1.1
Rana cf. *esculenta*	2-	0	1-	1			1-	1	2+	24	1+	8	34	0.1

in the Liptov Region to 40.2% in the Turiec Region. In the Orava Region in comparison with the other studied regions a particularly higher proportion of *S. betulina*, *A. agrarius*, *Turdus torquatus* and *T. pilaris* species with the dominance of < 1% were found. In a more southerly located area of 'Považké podolie', the proportion of *A. amphibius* and *R. temporaria* was significantly lower. The higher proportion of larger items of prey is represented, mainly by species such as *P. perdix*, *Phasianus colchicus*, *E. roumanicus* and *L. europaeus*.

The diet of *B. bubo*, not only in the Orava Region, but also in other mountain basins in Slovakia, is characterised by a high proportion of frogs, mainly *R. temporaria*. Frey (1973) reported the proportion of vertebrate classes in the diet of *B. bubo* from seven European countries.

The highest proportion of amphibians was found in Norway (20.4%) and in Switzerland (10.0%). Uttendörfer's data (1952) from Germany (6.2%) also includes results obtained by Schaefer (1938) from the Spiš Region in Slovakia, where the dominance of *R. temporaria* (31.8%) was recorded. In Switzerland a high proportion of frogs were recorded in Valais Alps in 1800–2000 m a. s. l. (Wagner & Springer 1970). Brüll (1984) published a similar overview of vertebrate classes in *B. bubo* diet

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Tab. 4. continuation
Tab. 4. pokračovanie

region / oblasť species / druhy	Orava		Horehronie		Liptov		Turiec		Žilinská kotlina		Považie		Σ	%
Cypriniformes sp.	1-	17	2-	0	2-	0	1-	11	1+	25	2+	45	98	0.3
Phasianus colchicus	2-	0	1-	0			1-	1		2	3+	34	37	0.1
Erinaceus roumanicus	1-	106	1-	20	1-	15		56		25	2+	117	339	0.9
Lepus europaeus		82	1-	20		16	1-	18		18	2+	53	207	0.6
Coloeus monedula		41	2-	2		10	1-	7		5	2+	29	94	0.3
Corvus cornix		161	1-	36		29		73		44	1+	74	417	1.1
Turdus merula		30		13	1-	3		19		14	1+	15	94	0.3
Cricetus cricetus								3			1+	6	9	0.0
Rattus norvegicus		352		143		69		213		102	1+	123	1002	2.7
Nyctalus noctula		1		1		1					1+	7	10	0.0
Eliomys quercinus	1-	5		2		5		9		3		3	27	0.1
Buteo buteo		21	1-	1		1		12				5	40	0.1
Muscardinus avellanarius		32		15		4	1-	3		4		8	66	0.2
Microtus arvalis		5912		1920	1-	721		2644	1-	1043		1051	13291	35.8
Turdus philomelos		78		19		10		34	1-	7		13	161	0.4
Garrulus glandarius		36		10		3		18		3		2	72	0.2
Scolopax rusticola		29		8		7		7		5		3	59	0.2
Mustela erminea		15		8		2		11		4		2	42	0.1
Glis glis		19		4		7		10					40	0.1
Sorex araneus		15		7		5		3		5		2	37	0.1
Turdus viscivorus		21		5		4		4		1		1	36	0.1
Vulpes vulpes		16		3		5		3		3		5	35	0.1
Crex crex		9		7		4		3				2	25	0.1
Eptesicus serotinus		6		5		6				1		4	22	0.1
Mammalia		**9762**		**4080**	**1-**	**1400**		**4117**		**1956**		**1919**	**23234**	**62.6**
Aves		**1097**	**1-**	**341**		**255**		**566**		**312**	**1+**	**544**	**3115**	**8.4**
Amphibia, Reptilia, Pisces		**4241**		**1455**	**1+**	**1512**		**1892**	**1+**	**1338**	**2-**	**293**	**10731**	**28.9**
Evertebrata		**6**		**5**		**0**		**1**		**0**		**0**	**12**	**0.0**
Σ		**15106**		**5881**		**3167**		**6576**		**3606**		**2756**	**37092**	**100.0**
Index diverzity H'		2.01		1.95		1.99		2.05		2.13		2.61	2.16	

Legend / vysvetlivky: **Orava** (this paper / táto práca), **Horehronie** (Obuch 2002), Liptov (Obuch 1981, Vondráček & Obuch 1980), **Turiec** (Lilgová 1998), **Žilinská kotlina** (Obuch 1980b), **Považie** – Považské podolie (Obuch 1985)

compiled using data from six authors. The highest abundance of amphibians found was 6.4% (Norway, Willgohs 1974). In Czech Republic Eurasian eagle-owl's diet was studied mainly in border mountains: in the northern Moravia in Jeseníky (Suchý 1980, 1990, Havelková 2007), in the north-western Bohemia (Honců et al. 1974, Vondráček 1977), in the southern Bohemia from the region of Klatovsko to the Třeboňsko Region (Červený & Obuch 1999) and in the south of Moravia in the region of Podyjí (Reiter et. al. 1997) and in the Pálava Region (Gaisler et al. 1996). In Czech Republic, as in other regions of central, western and southern Europe, a high density of mammals and birds in nesting territories is a sufficient source of food for *B. bubo*. The proportion of lower class vertebrates and invertebrates did not exceed 10% of all preyed individuals (Fig. 5). The higher abundance of the species *R. temporaria* and *A. amphibius* as an analogy with the diet type of *B. bubo* in the Horehronie Region was recorded only at one locality in the central part of the Šumava Region (Obuch 2002). Willgohs (1974) studied Eurasian eagle-owl's diet on the rugged western coast of Norway. The sea birds represented the substantial part of its diet in this habitat. Hagen's data (1989) showed that mammals are more numerous inland. Schaefer (1970)

Tab. 5. Comparison of representation of *Rana temporaria* and the higher taxa in the diet of *B. bubo* in the Orava Region, Czech Republic and Scandinavia
Tab. 5. Porovnanie zastúpenia *Rana temporaria* a vyšších taxonomických jednotiek v potrave *Bubo bubo* na Orave, v Českej republike a v Škandinávii

regions / oblasti taxa / taxóny	1	2	3	4	5	6	7	8	9	10	Σ	%
Mammalia	**9789**	**1+ 8060**	**1532**	**5049**	**733**	**432**	**1- 1074**	**428**	**375**	**1- 1181**	**28653**	**68.2**
Aves	**2- 1105**	**1- 1012**	**1+ 1085**	**1460**	**1+ 394**	**1+ 292**	**2+ 2088**	**1+ 180**	**108**	**1- 229**	**7953**	**18.9**
Rana temporaria	1+ 4244	6- 16	6- 5	3- 89	5- 2	5- 0	2- 92	1- 63	3- 9	2+ 763	5283	12.6
Amphibia, Reptilia, Pisces	**1+ 4296**	**6- 18**	**5- 10**	**3- 96**	**4- 11**	**5- 0**	**2- 120**	**1- 68**	**2- 12**	**2+ 763**	**5394**	**12.8**
Evertebrata	**1- 6**	**1- 0**	**0**	**8**	**1**	**0**	**2+ 20**	**0**	**0**	**0**	**35**	**0.1**
Suma	**15196**	**9090**	**2627**	**6613**	**1139**	**724**	**3302**	**676**	**495**	**2173**	**42035**	**100.0**

Legend / vysvetlivky: 1 – Orava, 2 – Jeseníky (Suchý 1980, 1990, Havelková 2007), 3 – Severozápadné Čechy (Honců et al. 1974, Vondráček 1977), 4 – Pošumaví (Červený & Obuch 1999), 5 – Podyjí (Reiter et al. 1997), 6 – Pálava (Gaisler et al. 1996), 7 – Nórsko (Willgohs 1974), 8 - Nórsko (Hagen 1989), 9 – Laisvall, Švédsko (Schaefer 1970), 10 – Hommelvik, Nórsko, zber 21. 9. 2009, unpublished data / nepublikované údaje.

collected food remains from *B. bubo* nests in the Laisvall Valley, near the Arctic Circle. In these extreme conditions, frogs were a rare prey. Together with G. Bangjord we collected bones from an abandoned nest of *B. bubo*, located 3 km away from a fjord, near Trondheim in the cental part of Norway (unpubl. data). A high proportion of *R. temporaria* species (35.1%) and a low proportion of birds (10.5%) were noted, however with a wide range of species (50 species). Representation of vertebrates in this sample greatly resembles some of those collected in the Orava Region.

The data obtained from the Eurasian eagle-owl's food samples is of significant importance to the contribution of knowledge relating to the changes of fauna in the Orava Region. Particularly larger samples were accumulated over a longer period (50 years and more), during which the agricultural landscape management gradually changed, resulting in the diminution of some species. For example, still up for debate are the recent occurrence of garden dormouse *Eliomys quercinus*, recorded in four food samples, and also of the yellow-necked mouse *Apodemus microps*, recorded in five samples. Both of these species preferred extensively managed meadows and pastures. The dwindled of these species occurred as a consequence of their habitats being overgrown with tall grass and bushes. The presence of the northern birch mouse *Sicista betulina* in six samples and the forest dormouse *Dryomys nitedula* in seven samples gives evidence about their dispersed occurrence throughout the whole region of Orava. The data about occurrence of six species of bats and the bicoloured white-toothed shrew *Crocidura leucodon* near Žaškov are also valuable. The data about Tatra pine vole *Microtus tatricus* on the foothills of the Choč mountains is noted by Dudich et al. (1981). Also of interest is the occurrence of synanthropic owls *Athene noctua* and *Tyto alba* in the region of central Orava.

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