Slovak Rapt J 2008, 2: 1–18

Diet of the Lesser Spotted Eagle (*Aquila pomarina*) in Slovakia

Potrava orla krikľavého (*Aquila pomarina*) na Slovensku

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Dravecký M, Danko Š, Obuch J, Kicko J, Maderič B, Karaska D, Vrána J, Šreibr O, Šotnár K, Vrlík P & Bohačík L 2008: Diet of the Lesser Spotted Eagle (*Aquila pomarina*) in Slovakia. Slovak Rapt J 2: 1–18.

Abstract: In the period 1964–2007, data on 1472 ex. of prey was acquired from whole Slovakia. It was confirmed that the location of the breeding population on the foothills and mountains of the Carpathian Arc has a cardinal contribution to diet diversity. The breeding sites and hunting-grounds were found from 100 to 1 000 meters above sea level. The dominant part of the diet created mammalian species (88.11 %, 19 species and *Sorex* sp., *Apodemus* sp., undetermined Artiodactyla). Birds were less represented but with higher diversity of species (6.25 %, 24 species and *Columba* sp., undetermined Passeriformes). In comparison with birds, the share of Amphibia, Reptilia and Pisces together (4.89 %, 5 species and *Rana* sp., *Lacerta* sp., undetermined Serpentes and Reptilia) was lower. Pisces constituted only 0.007 % with 1 ex. of prey species *Cyprinus carpio*. Evertebrata constituted 0.75 % and species from orders Orthoptera, Coleoptera, and Diptera were found. The dominant prey of *A. pomarina* in Slovakia was *Microtus arvalis* (69.57 %), followed by *Arvicola terrestris* (5.16 %) and *Microtus agrestis* (3.94 %) constituting significantly lower proportion. These three species from the category small rodents composed 75.67 % of diet. Less abundant species in range 2.24–1.00 % were *Talpa europaea* (2.31 %), *Rana temporaria* (2.24 %), *Cricetus cricetus* (1.70 %), *Phasianus colchicus* (1.15 %), and *Lepus europaeus* (1.09 %). In lesser extent (1.0–0.5 %) also other mammalian species such as *Apodemus flavicollis* (0.88 %) and *Mustela nivalis* (0.88 %) were represented. The most frequently encountered birds were Galliformes such as *P. colchicus* (1.15 %), *Gallus gallus domesticus* (0.48 %), and *Coturnix coturnix* (0.54 %). Other more abundant prey bird species were *Alauda arvensis* (0.48 %), *Columba* sp. (0.48 %), and *Crex crex* (0.34 %). From the class Reptilia relatively high share of *Anguis fragilis* (0.95 %) and *Lacerta* sp. (0.68 %; most probably *Lacerta agilis*) were recorded. Other species with representation lower than 0.3 % were a random prey of *A. pomarina*.

Abstrakt: V rokoch 1964–2007 sa získali údaje o 1472 kusoch koristi z celého Slovenska. Potvrdilo sa, že zásadný podiel na diverzite potravy má situovanie hniezdnej populácie do predhorí a pohorí Karpatského oblúka. Hniezdiská a loviská sa zistili v nadmorských výškach od 100–1000 m. Dominantnú zložku tvorili cicavce (88,11 %, 19 druhov a *Sorex* sp., *Apodemus* sp., neurčené Artiodactyla). Vtáky sú zastúpené oveľa menej početne, no s väčšou druhovou diverzitou (6,25 %, 24 druhov a *Columba* sp., neurčené Passeriformes). V menšej miere v porovnaní s vtákmi je zastúpenie spoločnej skupiny Amphibia, Reptilia a Pisces (4,89 %, 5 druhov a *Rana* sp., *Lacerta* sp., neurčené Serpentes a Reptilia). Z toho Pisces tvorili len 0,007 % s jediným kusom koristi druhu *Cyprinus carpio*. Evertebrata tvorili 0,75 %, tvorených zástupcami radov Orthoptera, Coleoptera a Diptera. Dominantnou korisťou *A. pomarina* na Slovensku je hraboš poľný (*Microtus arvalis*, 69,57 %), po ňom nasleduje so značným odstupom hryzec vodný (*Arvicola terrestris*, 5,16 %) a hraboš močiarny (*Microtus agrestis*, 3,94 %). Tieto tri druhy z kategórie drobných hlodavcov tvorili 75,67 % potravy. Menej početnými druhmi zistenými v potrave v rozsahu 2,24–1,00 % boli krt obyčajný (*Talpa europaea*, 2,31 %), skokan hnedý (*Rana temporaria*, 2,24 %), chrček poľný (*Cricetus cricetus*, 1,70 %), bažant poľovný (*Phasianus colchicus*, 1,15 %) a zajac poľný (*Lepus europaeus*, 1,09 %). Z ostatných cicavcov sa v menšej miere (1,0–0,5 %) vyskytovali ryšavka žltohrdlá (*Apodemus flavicollis*, 0,88 %) a lasica myšožravá (*Mustela nivalis*, 0,88 %). Z vtákov boli najčastejšie zastúpené kurotvaré (Galliformes), a to bažant poľovný (*P. colchicus*, 1,15 %), kura domáca (*Gallus gallus dom*., 0,48 %) a prepelica poľná (*Coturnix coturnix*, 0,54 %). Ďalšie početnejšie lovené druhy vtákov boli škovránok poľný (*Alauda arvensis*, 0,48 %), holuby (*Columba* sp., 0,48 %) a chriašteľ poľný (*Crex crex*, 0,34 %). Z triedy Reptilia sa zistilo pomerne vysoké zastúpenie u slepúcha lámavého (*Anguis fragilis*, 0,95 %) a jašterice (*Lacerta* sp., 0,68 %; s najväčšou pravdepodobnosťou jašterica krátkohlavá, *Lacerta agilis*). Ostatné druhy s dominanciou pod 0,3 % sú náhodnou korisťou *A. pomarina*.

Key words: Lesser Spotted Eagle, *Aquila pomarina*, diet, Slovakia

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Acknowledgement: We would like to thank our colleagues who participated in this comprehensive study focusing on the diet of the Lesser Spotted Eagle in Slovakia during the above mentioned period. They assisted with locating of the Lesser Spotted Eagle's nests, nest control, field observation, pellet collection, camera system installation, monitoring of adult-young interactions including feeding, with photo documentation and specific prey species (insect) determination. They also helped to acquire data from ringers during ringing season as well as data about food at the nests. We are grateful to our following collaborators (in alphabetical order): J. Babic, V. Baláška, P. Belák, B. Beniska, T. Bělka, I. Bryndza, P. Bryndza, M. Čierny, M. Demko, M. Dúbrava, Ľ. Dzúriková, T. Flajs, Z. Gálfyová, E. Gulak, B. Hájek, M. Hančin, E. Hapl, J. Hoľma, V. Hrúz, J. Janoviak, M. Jasík, M. Kaliský, K. Kicková, J. Kormančík, A. Krištín, F. Kuna, M. Lehocký, Š. Matis, L. Matejovičová, H. Matušík, J. Mihók, R. Michalec, V. Michalec, Š. Mikiara, M. Olekšák, V. Pečeňák, J. Platko, Z. Pochop, J. Popovics, P. Potocký, L. Prešinský, M. Riník, S. Senk, J. Siman, S. Siryová, and I. Valach.

Introduction

Sládek (1955, 1959) published the first description of the Lesser Spotted Eagle's diet in Slovakia. He acquired material from taxidermists as well as by stomach content analyses of 22 shot eagles from various parts of East and Central Slovakia. Furthermore, the author monitored prey and their remains brought by adult birds to their young on 4 nests near Zvolen city. He also analyzed pellets of adult birds on 2 breeding sites near Zvolen. Palásthy & Meyburg (1973) published another article about diet of this species from Eastern Slovakia based on survey of 9 nesting territories and on observations of food brought by parent to young. Besides these papers, only partial and sparse information on the Lesser Spotted Eagle's diet appeared in Reports of the Group for Research and Protection of Raptors and Owls in Czechoslovakia (1975–1992), the Group for Research and Protection of Raptors and Owls in Slovakia (1993–1995), diploma thesis (Siryová 2000), and in several other articles (for example Šotnár 2006, Vrlík 2007).

Uttendörfer (1939, 1952) studied the diet of the Lesser Spotted Eagle in Northern Germany and his articles also included the result of Rörig´s research (1905). Rörig analyzed 69 stomach contents. Uttendörfer (1952) reported the results of 22 nest surveys where he analyzed the diet by studying food and pellet remains. Folitarek and Goloduško published data from Belarus in the period 1948–1961 (ex Palásthy & Meyburg 1973). In aspecific textbook about eagles (Meyburg & Chancellor 1996) there are articles about diet of the Lesser Spotted Eagles from these countries: Georgia (Abuladze 1996), Hungary (Haraszthy et al. 1996), Belarus (only percentage ratio of mammals, birds, amphibians and reptiles; Ivanovsky 1996), Germany (only partial data; Scheller & Meyburg 1996), and Greece (Vlachos & Papageorgiou 1996). Zawadska (1999) studied the diet of this species in the Wigry National Park in Northeastern Poland. In Georgia, Azerbaijan, and Armenia, Abuladze (2001) reported the ratio of amphibians, mammals, reptiles, and birds in 1566 pellets and 232 food remains. In Estonia, Väli (2003) processed data about diet. Treinys & Dementavičius (2004) monitored the change in the proportion of small rodents and amphibians as main prey in Latvia. Kabisch & Belter (1968) focused on feeding of amphibians and reptiles by birds, including the Lesser Spotted Eagles.

Material and methods

Data collecting – area

Slovakia has a large range of altitude from 94.3 m to 2654.4 m above sea level, from lowlands to the highest peaks of the Carpathian Arc, from hardwoods through mixed forests to softwoods. This also affects the prey selection in various parts of Slovakia. This article presents data of diet as observed in the whole area of Slovakia as individual authors collected data from different regions as follows (names of orographical units and their codes are based on the Databank of Slovak Fauna; Kroupová 1980):

1. Š. Danko, Eastern Slovakia, the period of data collecting (reffered to as "period") 1964–2007, number of prey (reffered to as "n") = 387, obtained in the area of following orographical units (reffered to as "oro"): 022 – "Slovenský raj" Mts, 040 – "Revúcka vrchovina" highlands, 070 – "Volovské vrchy" Mts, 080 – "Čierna hora" Mts, 252 – "Popradská kotlina" basin, 260 – "Hornádska kotlina" basin, 400 – "Košická kotlina" basin, 440 – "Slanské vrchy" Mts, 450 – "Zemplínske vrchy" Mts, 670 – "Levočské vrchy" Mts, 710 – "Vihorlatské vrchy" Mts, 740 – "Ondavská vrchovina" highlands, 750 – "Laborecká vrchovina" highlands, 760 – "Beskydské predhorie" foothill, 810 – "Východoslovenská pahorkatina" heights, and 820 – "Východoslovenská rovina" plane.

2. M. Dravecký, Middle and South of Eastern Slovakia, period 1989–2007, n = 147, oro: 022 – "Slovenský raj" Mts, 040 – "Revúcka vrchovina" highlands, 050 – "Rožňavská kotlina" basin, 060 – "Slovenský kras" Mts, 070 – "Volovské vrchy" Mts, 080 – "Čierna hora" Mts, 190 – "Nízke Tatry" Mts, 200 – "Kozie chrbty" Mts, 260 – "Hornádska kotlina" basin, 400 – "Košická kotlina" basin, 670 – "Levočské vrchy" Mts, and 690 – "Spišsko-šarišské medzihorie" intermountain.

3. D. Karaska, North of Northern Slovakia (Orava region), period 1982–2007, n = 115, oro: 550 – Oravské Beskydy Mts, 560 – "Podbeskydská brázda" highlands, 570 – "Podbeskydská vrchovina" highlands, 580 – "Oravská Magura" Mts, 590 – "Oravská vrchovina" highlands, 630 – "Oravská kotlina" basin, 640 – "Skorušinské vrchy" Mts.

4. J. Kicko, Middle of Central Slovakia, period 1995–2007, n = 459, oro: 280 – "Vtáčnik" Mts, 310 – "Kremnické vrchy" Mts, 340 – "Javorie" Mts, 360 – "Zvolenská kotlina" basin, 190 – "Nízke Tatry" Mts, and 251 – "Liptovská kotlina" basin.

5. B. Maderič, North of Eastern Slovakia, period 1989–2007, n = 216, oro: 710 – "Vihorlatské vrchy" Mts, 740 – "Ondavská vrchovina" highlands, 750 – "Laborecká vrchovina" highlands, 760 – "Beskydské predhorie" foothill, and 810 – "Východoslovenská pahorkatina" heights.

6. K. Šotnár, West of Central Slovakia, period 2002–2007, n = 24, oro: 120 – "Strážovské vrchy" Mts, 230 – "Hornonitrianska kotlina" basin, 280 – "Vtáčnik" Mts, 310 – "Kremnické vrchy" Mts, and 300 – "Štiavnické vrchy" Mts.

7. J. Vrána and O. Šreibr, North of Eastern Slovakia, period 1989–2003, n = 124, oro: 600 – "Pieniny" Mts, 610 – "Ľubovnianska vrchovina" highlands, 660 – "Spišská Magura" Mts, 670 – "Levočské vrchy" Mts, 690 – "Spišsko-šarišské medzihorie" intermountain, 700 – "Šarišská vrchovina" highlands.

Method of the prey determination

On the basis of the number of cases and importance of the method of the prey determination, the following 4 categories were created: (1) pellets – determination of pellets and other skeletal remains, (2) video camera – diet determined using installed camera system, (3) at the nest – determination of the prey species at the nest, (4) in beak – the prey brought by adult eagle to the nest in beak or in claws.

To data "at the nest" in the basic table of the methods of prey determination we also added cases which, with regards to their character and rarity, did not belong to any of the above defined 4 categories. This included prey found under the nest (4 ex.), cases of locusts (Orthoptera 6 ex.) known to be captured by eagles walking on the ground. In one case an adult male with craw full of locusts (without specific number) was identified.

Evaluating and processing of tables

The pellets were evaluated only from the area of the "Nízke Tatry" Mts and the "Liptovská kotlina" basin, where the species *A. terrestris* was more abundant than in lower mountains and basins. Prey determination by camera monitoring was used exclusively in the "Nízke Tatry" Mts. The abundance of the *M. agrestis* was assessed on the basis of its ratio to *M. arvalis* in pellets. Undetermined prey was marked as Mammalia sp.

Exact determination of prey found at the nests or under trees around the nest was possible. Thus, the most exact determination of prey species was allowed, for example distinguishing of *A. flavicollis* from 3 other species of the genus *Apodemus*. Using this method, higher abundance of species (*T. europaea*, *C. cricetus*, *P. colchicus* and *R. temporaria*) was found than via other methods. This is the prevailing method used for collection of data about diet of the *A. pomarina* (almost one half of our data).

In Tab. 1 data from several authors were modified to make them comparable to each other and to increase their informative value (for example data on Rodentia and *Microtus* sp. are divided according to proportional representation to *M. arvalis* or *M. agrestis*). The starting point of calculations in Tab. 1–3 is a summary of modified data from individual authors shown in Tab. 1. The results from Orava region are not included in Tab. 4 because they are not divided into particular years. In Tab. 5 original unmodified records were used, in addition our data and literature information were added to data from Slovakia (Sládek 1959, Palásthy & Meyburg 1973). The blocks with different taxonomic value were created in Tab. 5, to incorporate several literature data with incomplete taxo-

Tab. 1. Outline of the Lesser Spotted Eagle (*Aquila pomarina*) prey from various areas of Slovakia obtained by individual authors
Tab. 1. Prehľad koristi orlov krikľavých (*Aquila pomarina*) z rôznych oblastí Slovenska zistenej jednotlivými autormi

Species / Author Druhy / Autor	Danko	Dravecký	Karaska	Kicko	Maderič	Šotnár	Vrána & Šreibr	∑	%
Erinaceus concolor	2		1	1			1	5	0.34
Talpa europaea	6	3	11	4		1	9	34	2.31
Sorex sp.							1	1	0.07
Lepus europaeus	8	2		4		1	1	16	1.09
Spermophilus citellus	1	4						5	0.34
Glis glis		1						1	0.07
Apodemus flavicollis	2	2		9				13	0.88
Apodemus sylvaticus					1			1	0.07
Apodemus agrarius	1	2						3	0.20
Apodemus sp.		2		1			1	4	0.27
Rattus norvegicus	1	1	1	1	1			5	0.34
Cricetus cricetus	25							25	1.70
Clethrionomys glareolus		4						4	0.27
Arvicola terrestris	3	1	10	47	4		11	76	5.16
Microtus arvalis	279	91	59	317	176	18	84	1024	69.57
Microtus agrestis	1		11	29	17			58	3.94
Canis domesticus		1						1	0.07
Vulpes vulpes			1					1	0.07
Mustela erminea				1			1	2	0.14
Mustela nivalis	1	1	1	9		1		13	0.88
Capreolus capreolus			1					1	0.07
Artiodactyla sp.				1				1	0.07
Mammalia sp.	2	1						3	0.20
Mammalia	**332**	**116**	**96**	**424**	**199**	**21**	**109**	**1297**	**88.11**
Anas platyrhynchos			1					1	0.07
Falco tinnunculus			1					1	0.07
Perdix perdix				1		1		2	0.14
Coturnix coturnix	1	6		1				8	0.54
Phasianus colchicus	13	1		1	2			17	1.15
Gallus gallus dom.	3	2		1	1			7	0.48
Meleagris gallopavo dom.			1					1	0.07
Crex crex	1	2	1				1	5	0.34
Scolopax rusticola				1				1	0.07

nomic determination (for example in Estonia the birds were determined only as Passeriformes sp. and Aves sp.). In Tab. 5 the countries were listed according to similarity of diet species spectra. Whilst the first listed, are more Northern countries, the results from Slovakia are similar with the results from Hungary. The results from Greece and Georgia are markedly different from others as a result of a high representation of reptiles.

During data evaluation in Tab. 2–5, the method marked differences from the mean (MDFM, Obuch 2001) was used. The symbol "+" means significantly higher abundance than the mean value of species in the evaluating file. The mean value was expressed as a sum and its percentage value in the last columns of the table. The values with significantly lower abundance than the mean are marked with symbol "-". Number before "+" and "–" indicate the degree of differences from the mean. In Tabs 2–5 species are placed in order in such a way that positive (+) values of MDFM created clusters which are highlighted by solid lanes in a separate data field. More abundant species without MDFM are placed in order under the dashed line from the most abundant to less

Tab. 1. continued / pokračovanie

Species / Author Druhy / Autor	Danko	Dravecký	Karaska	Kicko	Maderič	Šotnár	Vrána & Šreibr	∑	%
Columba livia dom.			2	2				4	0.27
Columba oenas		1						1	0.07
Columba palumbus		1		2				3	0.20
Columba sp.		2		4			1	7	0.48
Strix uralensis	1							1	0.07
Dendrocopos major		1						1	0.07
Alauda arvensis	1	3		1	1		1	7	0.48
Anthus trivialis			1					1	0.07
Erithacus rubecula	1							1	0.07
Turdus merula	2			1				3	0.20
Turdus philomelos	1			1			1	3	0.20
Emberiza citrinella			1					1	0.07
Fringilla coelebs	1							1	0.07
Sturnus vulgaris	1	1				1		3	0.20
Garrulus glandarius		1		1				2	0.14
Pica pica	1							1	0.07
Passeriformes sp.	2			5				7	0.48
Aves sp.				2				2	0.14
Aves	**29**	**21**	**8**	**24**	**4**	**2**	**4**	**92**	**6.25**
Rana temporaria	8	2	9	4			10	33	2.24
Rana sp.	3	2						5	0.34
Anguis fragilis	6	1	2		3	1	1	14	0.95
Lacerta agilis	2							2	0.14
Lacerta sp.	6	1			3			10	0.68
Natrix natrix				1				1	0.07
Serpentes sp.		3						3	0.20
Reptilia sp.				2	1			3	0.20
Cyprinus carpio		1						1	0.07
Amphibia, Reptilia, Pisces	**25**	**10**	**11**	**7**	**7**	**1**	**11**	**72**	**4.89**
Orthoptera sp.	1				6			7	0.48
Coleoptera sp.				3				3	0.20
Diptera sp.				1				1	0.07
Evertebrata	**1**	**0**	**0**	**4**	**6**	**0**	**0**	**11**	**0.75**
∑	**387**	**147**	**115**	**459**	**216**	**24**	**124**	**1472**	**100.00**

abundant. Other species are not shown in tables. In Tab. 3 the representation of dominant prey species *M. arvalis* is shown in absolute values as well as in percentage. At the bottom of the tables are sums for the class Vertebrata, Evertebrata as well as diversity index calculated according to formula of Shannon & Wiever (1949).

Comparison of the diet spectra

Areas of Slovakia differ from each other with regard to geographical and climatic conditions and consequently provide different access to food as well as qualitatively and quantitatively different diet spectrum for Lesser Spotted Eagles. To compare such differences we divided the area of Slovakia into 6 regions (Tab. 3):

1. "Strážovské vrchy" Mts, "Vtáčnik" Mts, "Štiavnické vrchy" Mts, "Kremnické vrchy" Mts, "Hornonitrianska kotlina" basin, "Žiarska kotlina" basin, and "Zvolenská kotlina" basin (K. Šotnár, J. Kicko),

2. "Nízke Tatry" Mts, "Horehronské podolie" basin, and "Liptovská kotlina" basin (J. Kicko),

3. Orava region – "Oravské Beskydy" Mts, "Podbeskydská brázda" highlands, "Podbeskydská vrchovina"

Tab. 2. Comparison of results obtained using 4 different methods of diet data collection
Tab. 2. Porovnanie výsledkov zo 4 spôsobov získavania údajov o potrave

Species / Method Druhy / Spôsob	pellets / vývržky	camera / kamera	on the nest / na hniezde	in beak / v zobáku	∑	%
Apodemus flavicollis	1+ 9		4		13	0.88
Arvicola terrestris	1+ 24	1+ 19	32	2- 1	76	5.16
Microtus agrestis	10	1+ 18	1- 17	13	58	3.94
Talpa europaea	1- 0	3	1+ 31	1- 0	34	2.31
Cricetus cricetus			1+ 25	1- 0	25	1.70
Phasianus colchicus	1		1+ 16		17	1.15
Rana temporaria	1- 0	4	1+ 29	1- 0	33	2.24
Lacerta sp.			1- 0	1+ 10	10	0.68
Microtus arvalis	114	176	488	1+ 246	1024	69.57
Lepus europaeus	4		12		16	1.09
Anguis fragilis			7	7	14	0.95
Mustela nivalis	2	6	5		13	0.88
Coturnix coturnix	1		7		8	0.54
Gallus gallus dom.	1		6		7	0.48
Alauda arvensis			7		7	0.48
Orthoptera sp.			6	1	7	0.48
Erinaceus concolor			5		5	0.34
Spermophilus citellus			4	1	5	0.34
Rattus norvegicus		1	4		5	0.34
Crex crex			5		5	0.34
Mammalia	**164**	**225**	**646**	**262**	**1297**	**88.11**
Aves	**17**	**2- 2**	**1+ 73**	**3- 0**	**92**	**6.25**
Amphibia, Reptilia, Pisces	**2- 0**	**1- 5**	**42**	**1+ 25**	**72**	**4.89**
Evertebrata	**4**	**0**	**6**	**1**	**11**	**0.75**
∑	**185**	**232**	**767**	**288**	**1472**	**100.00**
Diversity index / Index diverzity H'	1.56	0.97	1.85	0.68	1.60	

highlands, "Oravská Magura" Mts, "Oravská vrchovina" highlands, "Oravská kotlina" basin, "Skorušinské vrchy" Mts (D. Karaska),

4. "Spišská Magura" Mts, "Levočské vrchy" Mts, "Slovenský raj" Mts, "Volovské vrchy" Mts, "Čierna hora" Mts, "Šarišská vrchovina" highlands, "Popradská kotlina" basin, and "Spišsko-šarišské medzihorie" intermountain (M. Dravecký, J. Vrána, O. Šreiber),

5. "Laborecká vrchovina" highlands, "Ondavská vrchovina" highlands, "Vihorlatské vrchy" Mts, and "Beskydské predhorie" foothill (B. Maderič, J. Vrána, O. Šreibr, Š. Danko),

6. "Revúcka vrchovina" highlands, "Slovenský kras" Mts, "Slanské vrchy" Mts, "Rimavská kotlina" basin, "Rožňavská kotlina" basin, "Košická kotlina" basin, and "Východoslovenská pahorkatina" heights (Š. Danko, M. Dravecký).

The above areas were chosen to include particular compact units, where the Lesser Spotted Eagle's diet were studied but also to include specific geographical and climatic units (Central and Eastern Slovakia, North and South). The names of orographical units are based on the Databank of Slovak Fauna.

Results

Diet composition

The presence of the Lesser Spotted Eagles breeding population in the foothills and mountains of the Carpathian Arc play a substantial role in the composition of their diet. Their breeding sites and hunting territories were located from 100 to 1000 m a. s. l. Generally, the predominant food source was small rodents, especially *Microtus arvalis*.

From 1964, the first record of diet in this study (Danko) to the end of the year 2007 (the end of the study) we acquired data on 1472 ex. of prey species. The dominant part of the diet was composed of mammalian species (88.11 %, 19 species and *Sorex* sp., *Apodemus* sp., undetermined Artiodactyla). Birds were less represented but

S. Harvančík

Fig. 1. The Lesser Spotted Eagle with *Microtus arvalis* in beak. The most common prey species as well as a technique of prey carrying to chicks at the nest in Slovakia. Nováky – Laskár, 28 April 2008.
Obr. 1. Orol krikľavý s uloveným hrabošom (*Microtus arvalis*) v zobáku. Najčastejšia korisť a spôsob odnášania koristi mláďatám na hniezdo na Slovensku. Nováky – Laskár, 28. apríl 2008.

B. Maderič

Fig. 2. Dominant prey species of *A. pomarina* in Slovakia is Common Vole (*Microtus arvalis*). The food supply in the nest close to the young. Svetlice,17 July 2004.
Obr. 2. Základnou potravou *A. pomarina* na Slovensku je hraboš poľný (*Microtus arvalis*). Zásoba na hniezde pri mláďati. Svetlice,17. júl 2004.

Tab. 3. Comparison of *A. pomarina* diet from different regions of Slovakia
Tab. 3. Porovnanie potravy *A. pomarina* z rôznych oblastí Slovenska

Species / Region[1] **Druhy / Oblasť[1]**	**1**	**2**	**3**	**4**	**5**	**6**	**∑**	**%**
Apodemus flavicollis	1+ 9			2		2	13	0.88
Arvicola terrestris	1- 3	1+ 44	10	15	2- 4	2- 0	76	5.16
Microtus agrestis	5	1+ 24	1+ 11	2- 0	18	2- 0	58	3.94
Talpa europaea	1	4	1+ 11	1+ 13	4	1- 1	34	2.31
Rana temporaria	1- 0	4	1+ 9	1+ 13	5	6	37	2.51
Phasianus colchicus	1			2	1+ 10	4	17	1.15
Anguis fragilis	1		2	2	1+ 9		14	0.95
Orthoptera sp.					1+ 7		7	0.48
Cricetus cricetus		1- 0		1- 0	3	2+ 22	25	1.70
Microtus arvalis ind. / ks	127	208	1- 59	190	277	163	1024	69.57
Microtus arvalis %	73.0	67.5	51.3	66.7	77.2	70.9	69.6	
Lepus europaeus	5			2	5	4	16	1.09
Mustela nivalis	3	7	1	1		1	13	0.88
Lacerta sp.				2	6	2	10	0.68
Coturnix coturnix		1		4		3	8	0.54
Alauda arvensis	1			4	1	1	7	0.48
Gallus gallus dom.	1			1	1	3	6	0.41
Erinaceus concolor		1	1	1	1	1	5	0.34
Spermophilus citellus				5			5	0.34
Rattus norvegicus		1	1		1	2	5	0.34
Crex crex			1	2		2	5	0.34
Mammalia	**154**	**291**	**96**	**240**	**316**	**200**	**1297**	**88.11**
Aves	**15**	**1- 11**	**8**	**1+ 27**	**16**	**15**	**92**	**6.25**
Amphibia, Reptilia, Pisces	**1- 2**	**1- 6**	**1+ 11**	**18**	**20**	**15**	**72**	**4.89**
Evertebrata	**3**	**1**	**0**	**0**	**7**	**0**	**11**	**0.75**
∑	**174**	**309**	**115**	**285**	**359**	**230**	**1472**	**100.00**
Diversity index / Index diverzity H'	1.34	1.25	1.80	1.64	1.13	1.36	1.60	

[1]for number of different regions see text (pages 5–6) / čísla oblastí pozri v texte (strany 5–6)

with higher diversity of species (6.25 %, 24 species and *Columba* sp., undetermined Passeriformes). In comparison with birds, the proportion of Amphibia, Reptilia and Pisces together (4.89 %, 5 species and *Rana* sp., *Lacerta* sp., undetermined Serpentes and Reptilia) was lower. Of this amount the Pisces constituted only 0.007 % with 1 ex. of prey species *Cyprinus carpio*. Evertebrata constituted 0.75 % and species from orders Orthoptera, Coleoptera, and Diptera were recorded.

The dominant prey of *A. pomarina* in Slovakia was *Microtus arvalis* (69.57 %), followed by *Arvicola terrestris* (5.16 %) and *Microtus agrestis* (3.94 %). These three species belonging to small rodents constituted 75.67 % of the diet. Less abundant species in range 2.24–1.00 % were *Talpa europaea* (2.31 %), *Rana temporaria* (2.24 %), *Cricetus cricetus* (1.70 %), *Phasianus colchicus* (1.15 %), and *Lepus europaeus* (1.09 %). From other mammalian species in lower range 1.0–0.5 % also *Apodemus flavicollis* (0.88 %) and *Mustela nivalis* (0.88 %) were recorded. Most frequently detected birds were Galliformes such as *P. colchicus* (1.15 %), *Gallus gallus dom*. (0.48 %), and *Coturnix coturnix* (0.54 %). Other abundant prey bird species were *Alauda arvensis* (0.48 %), *Columba* sp. (0.48 %), and *Crex crex* (0.34 %). From the class Reptilia relatively high proportion of *Anguis fragilis* (0.95 %) and *Lacerta* sp. (0.68 %; most likely *Lacerta agilis*) were recorded. Other species with representation lower than 0.3 % were a random prey of *A. pomarina*.

The accuracy of prey determination is different. The highest accuracy was in prey determination by direct control at the nest. 767 ex. of prey (52.11 %) were determined in this way with the highest value of the diversity index H´ 1.85. Determination of prey from the pellets had also

Tab. 4. Prey representation in realation to time periods
Tab. 4. Zastúpenie koristi v časových periódach

Species / Period Druhy / Perióda	1964–1979		1980–1989		1990–1999		2000–2007		∑	%
Cricetus cricetus	2+	18		3	1-	2	2-	2	25	1.84
Phasianus colchicus	1+	6	1+	6		1	1-	4	17	1.25
Rana temporaria		5		1	1+	13	1-	5	24	1.77
Arvicola terrestris	1-	0	1-	0	1-	9	1+	57	66	4.86
Microtus agrestis	1-	0		1	1-	6	1+	40	47	3.46
Microtus arvalis		84		62		263		556	965	71.11
Talpa europaea		4		1		9		9	23	1.69
Lepus europaeus		2		3		5		6	16	1.18
Apodemus flavicollis		1		1				11	13	0.96
Mustela nivalis		1				1		10	12	0.88
Anguis fragilis				1		7		4	12	0.88
Coturnix coturnix				1		2		5	8	0.59
Gallus gallus dom.		3				1		3	7	0.52
Alauda arvensis				1		2		4	7	0.52
Orthoptera sp.				1				6	7	0.52
Spermophilus citellus						1		4	5	0.37
Mammalia		**110**		**73**		**310**		**708**	**1201**	**88.50**
Aves	**1+**	**15**		**9**		**16**		**44**	**84**	**6.19**
Amphibia, Reptilia, Pisces		**8**		**4**	**1+**	**28**	**1-**	**21**	**61**	**4.50**
Evertebrata		**0**		**1**		**0**		**10**	**11**	**0.81**
∑		133		87		354		783	1357	100.00
Diversity index / Index diverzity H‘		1.46		1.31		1.36		1.46	1.54	

relatively high accuracy in amount 186 ex. (12.63 %) with the diversity index H´ 1.59. Prey determination via camera system was not so accurate; number of detected prey was 232 ex. with the diversity index H´ 0.97. The determination of prey carried in beak or in claws to young at the nest by their parents was least accurate; the number of detected species was 288 ex. (19.56 %) with the diversity index. H´ 0.68. During 1976–2008 the prey in the following composition were recorded at the Lesser Spotted Eagle's nest in the "Turčianska kotlina" basin: *Microtus arvalis* 18×, *Mustela nivalis* 2×, *Rattus norvegicus* 2×, *Lepus europaeus* – young 1×, *Anthus sp.* 1× and *Serpentes sp.* 1× (Bohačík)*.

Rare cases of obtaining and hunting, respectively and prey species

J. Kicko, during nest control on July 16, 2004 in locality Liptovský Hrádok (Central Slovakia, "Nízke Tatry" Mts) found *Erinaceus concolor* (Fig. 5) lying close to completely feathered Lesser Spotted Eagle chick. We found relatively few cases when Lesser Spotted Eagle's pair in "Hornádska kotlina" basin specialised on the European Souslik (*S. citellus*). On July 11, 2003, according to 2 observations of eagle flying with the prey (European Souslik) at 2 hour intervals. The nest with one intact souslik was found (Fig. 6). Moreover a clean fresh skull and another older skull were found close to the chicks in the middle of the nest (Dravecký, Lehocký). Another pair nesting in the "Kozie chrbty" Mts near Spišská Teplica was observed hunting European Sousliks (Danko). Thanks to pellet analysis Kicko found that 8 from 9 ex. of *Apodemus flavicollis* were from one pair nesting near the village H. Trnávka. It is noted that this pair hunted this species more frequently in higher mountain forests which are 200–250 m above other hunting-grounds in the basin.

On July 1, 2006, in locality Hrhov near Hrhovské rybníky (Eastern Slovakia, "Slovenský kras" Mts) an unusual prey was recorded. There were also remains of *Cyprinus carpio* (40 cm from the head to the end of tail fin, Fig. 7) with a preserved head and vertebra until the end of the tail fin. The chick fed on muscles under broken carp's skin.

*note: this data were obtained after the deadline and therefore were not integrated into the statistical evaluation.

Tab. 5. Comparison of *A. pomarina* diet from several parts of its breeding area in Europe
Tab. 5. Porovnanie potravy *A. pomarina* z niektorých častí jeho hniezdneho areálu v Európe

No. / Č.	**2**		**3**		**4**		**5**		**1**		**6**		**7**			
Species / Country Druhy / Krajina	**D**		**EE**		**PL**		**H**		**SK**		**GR**		**GE**		Σ	%
Garrulus glandarius	1+	5			2				1-	1			6		14	0.40
Microtus oeconomus	2+	10			3				1-	0					13	0.37
Talpa europaea	1+	19	2+	152	14		1-	3	1-	49	2-	0	3-	0	237	6.79
Erinaceus concolor			1+	13					1-	5	1+	7			25	0.72
Microtus agrestis		2	1+	24	1-	0				25			1-	0	51	1.46
Microtus sp.	3-	0	1+	211	1-	18	3-	0		338	3-	0	2-	17	584	16.72
Rana temporaria			1+	21	1-	0				35			1-	0	56	1.60
Amphibia sp.			1+	22					3-	0			2+	24	46	1.32
Rana sp.		5	1+	24	2+	36		1	2-	11			2-	0	77	2.21
Passeriformes sp.			1+	36	2+	35		1	2-	7				12	91	2.61
Aves sp.			1+	18		6	1+	7	2-	2			1-	0	33	0.95
Muridae sp.			1+	12		1			2-	0			1+	7	20	0.57
Rodentia sp.	1-	0	3-	0	3+	94	1-	0	1-	36	1-	0		14	144	4.12
Coleoptera sp.		3	3-	0	2+	56				45			2-	0	104	2.98
Phasianus colchicus			1-	0			1+	8		17				6	31	0.89
Cricetus cricetus			2-	0	1-	0	2+	23		26			1-	0	49	1.40
Microtus arvalis		36	1-	109	3-	8	1+	64	1+	776	4-	0	5-	0	993	28.44
Arvicola terrestris		5	1-	15	1-	3	1-	0	1+	78				16	117	3.35
Apodemus flavicollis						1		1	1+	15					17	0.49
Lepus europaeus		2		4		1			1+	24		2	1-	0	33	0.95
Anguis fragilis		1	1-	0					1+	19					20	0.57
Testudo sp.											1+	5			5	0.14
Apodemus sylvaticus										2	1+	6			8	0.23
Orthoptera sp.		1	2-	0						21	2+	18	1-	0	40	1.15
Elaphe situla									1-	0	2+	10			10	0.29
Natrix natrix			2-	0	1-	0			3-	1	3+	42	1+	26	69	1.98
Lacerta sp.			2-	0	1-	0			2-	10	2+	20	2+	43	73	2.09
Lacerta strigata									1-	0			2+	15	15	0.43
Natrix tessellata									1-	0			1+	11	11	0.32
Serpentes sp.									1-	0			1+	9	9	0.26
Rana ridibunda			3-	0	1-	0			4-	0			3+	94	94	2.69
Bufo viridis									1-	0			2+	12	12	0.34
Bufo sp.													1+	7	7	0.20
Hyla arborea									1-	0			1+	10	10	0.29
Insecta sp.									1-	0			1+	11	11	0.32

Intact egg of *Coturnix coturnix* was found in the middle of the nest close to the chick. The egg had to come out of an adult *C. coturnix* during dismembering it.

On July 9, 2008 in locality Nevidzany (Prievidza district, "Strážovské vrchy" Mts) an adult eagle came flying towards the nest and when it saw a man arranging branches under the nest the eagle released the prey (a big snake) close to the young at the nest and immediately flew away. An interesting diet composition was recorded at this nest: *Elaphe longissima* (1 m long without head), *Dendrocopos* sp., feather from *Sturnus vulgaris* and partially deplumed *Passer montanus* (Šotnár)*. During direct control on July 5, 2008 in locality Roškovce ("Laborecká vrchovina" highlands) 3 ex. of intact *Anguis fragilis* (Fig. 8) were found (Maderič)*.

On April 18, 2002 in hunting-ground of the Lesser Spotted Eagles near Krásnohorské Podhradie (Eastern Slovakia, "Rožňavská kotlina" basin) during cold, win-

Tab. 5. Continued / pokračovanie

No. / Č.	**2**	**3**	**4**	**5**	**1**	**6**	**7**		
Species / Country Druhy / Krajina	**D**	**EE**	**PL**	**H**	**SK**	**GR**	**GE**	**∑**	**%**
Corvus corone							1+ 7	7	0.20
Apodemus uralensis		2- 0	1- 0		3- 0		3+ 49	49	1.40
Microtus obscurus					1- 0		1+ 9	9	0.26
Microtus socialis							1+ 5	5	0.14
Mus sp.							1+ 6	6	0.17
Mustela nivalis		8		3	18			29	0.83
Alauda arvensis			1	3	11			15	0.43
Clethrionomys glareolus	4	2	1	3	4			14	0.40
Rattus norvegicus	2	2			7			11	0.32
Gallus gallus dom.	2		1		8			11	0.32
Spermophilus citellus				1	5	4		10	0.29
Mammalia	**88**	**575**	**1- 150**	**104**	**1432**	**2- 21**	**1- 123**	**2493**	**71.39**
Aves	**1+ 27**	**54**	**1+ 51**	**1+ 28**	**1- 102**	**2- 0**	**37**	**299**	**8.56**
Amphibia, Reptilia, Pisces	**1- 10**	**1- 74**	**36**	**2- 2**	**2- 89**	**2+ 80**	**2+ 253**	**544**	**15.58**
Evertebrata	**4**	**3- 0**	**2+ 56**	**1- 0**	**67**	**1+ 18**	**1- 11**	**156**	**4.47**
∑	**129**	**703**	**293**	**134**	**1690**	**119**	**424**	**3492**	**100.00**
Diversity index / Index diverzity H'	2.84	2.26	2.14	1.99	2.20	1.96	2.81	3.00	

Country / Krajina: country abbrevation, region or site, literary source / skratka krajiny, oblasť alebo lokalita, literárny údaj: **2, D**: NE Germany / SV Nemecko, Uttendörfer (1952); **3, EE**: Estonia / Estónsko, Väli (2003); **4, PL**: NE Poland, Wigry NP / SV Poľsko, NP Wigry, Zawadzka (1999); **5, H**: Hungary / Maďarsko, Haraszthy et al. (1996); **1, SK**: Slovakia / Slovensko, own data / vlastné údaje, Sládek (1959), Palášthy & Meyburg (1973); **6, GR**: NE Greece, Dadia forest / SV Grécko, les Dadia, Vlachos & Papageorgiou (1996); **7, GE**: E Georgia / V Gruzínsko, Abuladze (1996)

Other species (country number – numbers) / Ostatné druhy (poradové číslo krajiny – počet):
Sorex araneus (**3**–2), *Sorex minutus* (**3**–1; **1**–2), *Sorex* sp. (**2**–2; **3**–2; **1**–1), *Oryctolagus cuniculus* (**2**–2), *Sciurus vulgaris* (**2**–2; **3**–2), *Glis glis* (**1**–1), *Dryomys nitedula* (**6**–2), *Muscardinus avellanarius* (**5**–1), *Sicista betulina* (**3**–4), *Mus* cf. *musculus* (**3**–1; **5**–1; **1**–1), *Micromys minutus* (**3**–1; **1**–2), *Apodemus agrarius* (**1**–3), *Apodemus* sp. (**3**–5; **4**–1; **5**–4; **1**–4), *Ondatra zibethicus* (**3**–1; **4**–1), *Canis domesticus* (**1**–1), *Vulpes vulpes* (**1**–1), *Mustela erminea* (**3**–2; **1**–2), *Capreolus capreolus* (**2**–2; **1**–1), Artiodactyla sp. (**1**–1), Mammalia sp. (**3**–2; **4**–4; **1**–4), *Anas platyrhynchos* (**2**–1; **1**–1), *Falco tinnunculus* (**2**–1; **1**–1), *Perdix perdix* (**2**–1; **4**–1; **1**–4), *Coturnix coturnix* (**1**–8), *Meleagris gallopavo dom.* (**1**–1), *Rallus aquaticus* (**2**–2), *Porzana porzana* (**2**–1), *Crex crex* (**1**–5), *Vanellus vanellus* (**2**–2), *Scolopax rusticola* (**1**–1), *Columba livia dom.* (**2**–2; **1**–4), *Columba oenas* (**1**–1), *Columba palumbus* (**2**–2; **4**–1; **1**–3), *Columba* sp. (**1**–7), *Cuculus canorus* (**2**–1), *Strix uralensis* (**1**–1), *Coracias garrulus* (**2**–1), *Dendrocopos major* (**4**–1; **1**–1), *Anthus trivialis* (**2**–1; **5**–1; **1**–1), *Saxicola rubetra* (**5**–1), *Erithacus rubecula* (**1**–1), *Turdus merula* (**5**–2; **1**–4; **7**–2), *Turdus philomelos* (**4**–2; **1**–3), *Turdus* sp. (**5**–2), *Sitta europaea* (**2**–1), *Emberiza citrinella* (**2**–1; **5**–1; **1**–1), *Fringilla coelebs* (**2**–1; **1**–2), *Passer montanus* (**1**–1), *Sturnus vulgaris* (**2**–1; **5**–1; **1**–3), *Pica pica* (**2**–1; **1**–1; **7**–4), *Corvus corax* (**4**–1), *Corvus frugilegus* (**5**–1), *Corvus monedula* (**1**–1), *Rana arvalis* (**2**–1; **3**–1), *Rana* cf. *esculenta* (**5**–1), *Lacerta agilis* (**1**–7), *Lacerta vivipara* (**3**–2), *Lacerta trilineata* (**7**–2), *Vipera berus* (**3**–2), *Coluber* sp. (**6**–3), Reptilia sp. (**2**–3; **1**–5), *Cyprinus carpio* (**1**–1), Cypriniformes sp. (**3**–1), *Esox lucius* (**3**–1), Diptera sp. (**1**–1)

dy, and rain 2 adult birds were observed with one sitting on a carcass of livestock guard dog (*Canis familiaris* f. *domestica*; likely "Slovak Cuvac" according to coloured remains and the size of the carcass). The eagle picked up remains of the meat sticking its entire head into the dog's thorax. It whipped out its head and watched surrounding in short intervals. It looked similar to a vulture feeding on a carcass (Dravecký). The eagle in the hunting-ground near the village Hrabušice (Eastern Slovakia, "Slovenský raj" Mts) fed on a carcass of a cat (*Felis catus* f. *domestica*) (Lehocký in verb.). On July 4, 1996 in the hunting-ground near the village Kamienka under "Spišská Magura" Mts an adult pair of Lesser Spotted Eagle fed on the intestines of a boar hunted by hunters (Vrána & Šreibr). At the nest near the village Podbiel in Orava region a fragment of a fox (*Vulpes vulpes*) skull was found. We assume that the eagles did not kill the fox but rather they found it as it was most probably killed by a car. A leg of a roe-calf

M. Dravecký

Fig. 3. Young *Phasianus colchicus* and small *Lepus europaeus* at the nest of *A. pomarina*. Ordzoviany, 1 July 2002.
Obr. 3. Mladý bažant (*Phasianus colchicus*) a malý zajac (*Lepus europaeus*) na hniezde *A. pomarina*. Ordzoviany, 1. júl 2002.

J. Kicko

Fig. 4. *Columba* sp. as a prey at the nest. Červená Skala, 7 July 2006.
Obr. 4. Holub (*Columba* sp.) ako potrava na hniezde. Červená Skala, 7. júl 2006.

J. Kicko

Fig. 5. The Lesser Spotted Eagle chick with *Erinaceus concolor* as a prey at the nest. L. Hrádok, 16 July 2004.
Obr. 5. Mláďa orla krikľavého s ježom bledým (*Erinaceus concolor*) ako potravou na hniezde. L. Hrádok, 16. júl 2004.

M. Dravecký

Fig. 6. The Lesser Spotted Eagle pair focused on hunting sousliks (*S. citellus*). Smižanská Maša, 11 July 2003.
Obr. 6. Zameranie sa jedného páru orlov krikľavých na lov sysľov (*S. citellus*). Smižanská Maša, 11. júl 2003.

was found at the nest near Podbiel in Orava region. In addition it is believed that the eagles brought part of a dead body killed by a mowing machine. A turkey leg was recorded at the nest near the Dolný Kubín city – Kňažia. The eagles could have brought it from the nearby waste--dump (Karaska).

Occasionally members of Passeriformes such as thrushes were found at the nests of Lesser Spotted Eeagles. In 1989 in the "Západné Tatry" Mts a juvenile *Turdus pilaris* was found as a prey at the nest (Vrlík). An eagle trapped in the net disgorged from its craw a big amount of *Decticus verrucivorus* as well as big pieces of meat from some carcass (Danko). P. Potocký determined a beetle found in pellets as *Mesosa curculionides*, regarded as a rare species in Slovakia (Kicko).

Ethological findings (obtained with camera system)

Using camera system we found that the female often ate the head of the prey before it begun to feed chicks. This is likely the reason why the skulls, which are more resistant

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Fig. 7. Curious prey of the Lesser Spotted Eagle – the carp (*Cyprinus carpio*). Hrhov, 1 July 2006.
Obr. 7. Výnimočná potrava u orlov krikľavých – kapor (*Cyprinus carpio*). Hrhov, 1. júl 2006.

to digestion, are rarely found in pellets from chicks. The female disgorging has never been observed (Kicko). During survey recorded an interesting event involving a mole was recorded (*Talpa europaea*). The male brought 3 ex. but neither female nor chick were interested. The female ate only part of one of them and then took away remains of approximately 2.5 moles. Owing to its behaviour at the nest it was assumed that it did not eat them and took them away. In another example on 3 occasions the female took away the prey or its share from the nest likely to eat alone. It seems moles are not the favourite prey species for either adult birds or chicks (this could be verified due to the findings of intact or almost intact moles (Fig. 9) at the nest.

It was anticipated that using the camera system we would record a greater variety of bird prey species, however only 2 unspecified young birds were observed. This monitoring technique did not confirm a higher representation of smaller prey species (Rutz 2003), such as insect, in comparison with the results of known diet analyses from pellets and stomach (Sládek 1959). It was confirmed by the fact that only adult birds eat insects by walking on the ground. Insect and other evertebrata were not recorded in diet brought by parents to chicks.

Discussion

Hunting techniques

Generally, the Lesser Spotted Eagle obtains food using 3 techniques. The most common one is the eagle watching its prey whilst circling above the hunting ground. They fly relatively high, and unlike other birds of prey that fly directly to it, the Lesser Spotted Eagles drop slowly like a parachute then accelerate quickly in the final phase. The special feature of this species is that they carry captured prey mostly in their beak. Lesser Spotted Eagles can also locate prey by watching from elevated sites, such as trees, shrubs, etc. which they use especially during absence of wind or during low thermals. They very often track prey by walking on the ground where they also capture Evertebrata. Prešinský (ex Šotnár 2006) who at close

B. Maderič

Fig. 8. Three specimens of *Anquis fragilis* with young at the nest. Roškovce, 5 July 2008.
Obr. 8. Tri jedince slepúchov lámavých (*Anquis fragilis*) na hniezde s mláďaťom. Roškovce, 5. júl 2008.

range observed the Lesser Spotted Eagle female recorded some interesting findings. The eagle flew down from its nest to the nest of *Turdus philomelos* and ate its young. Prešinský also observed earthworm (*Lumbricus* spec.) being collected by eagles walking on the ground. Vrlík (2007) observed Lesser Spotted Eagle capturing and eating earthworms on 28 April 2001 in the area of "Lazisko" locality ("Nízke Tatry" Mts). During observation from 18:30 to 19:05 the eagle ate at least 20 ex. by pulling them from the ground or collecting those which were there as a result of rainfall. The same author described seeing of 3 likely non-breeding individuals during hunting and capturing grasshoppers in the area of Liptovský Trnovec at the end of August 1999.

Prey carrying in beak or in claws

This technique is restricted to May – September when males carry the food to the females incubating eggs or feeding chicks. Furthermore, when the chicks are older both parents carry the food to the nest or to the young in forest after the young have fledged. The food is carried in beak (Fig. 10) or in claws or the prey can be removed from the beak to claws during flight and vise versa. The diet determination is relatively difficult, especially to distinguish small rodents to the species level.

Catching the prey on the ground

This technique is not seasonal because the eagles can capture the prey by walking on the ground either as a food for young at the nest or as a food for adult birds themselves. This hunting technique includes capturing rodents, birds nesting on the ground, locusts, earthworms, additionally eating carcasses. The determination is difficult only in the cases of insects. The identification of carcass on the ground is less problematic but much less frequent than in other techniques of obtaining prey.

B. Maderič

Fig. 9. *Talpa europaea* often found intact at the nests. Topoľovka, 5 July 2006.
Obr. 9. Krt obyčajný (*Talpa europaea*) býva často nájdený nedotknutý na hniezdach. Topoľovka, 5. júl 2006.

Diet at the nest

The diet determination at the nest is strictly restricted to the breeding season and allows recording of all prey or its remains brought to chicks by adult eagles (Fig. 11). In this case the identification is the most precise but with regard to diet of the Lesser Spotted Eagles it is food provided to chicks as opposed to food adult birds would prefer. The results were improved when we identified the prey of smaller chicks which ate food that was ripped by the female. The disadvantage of later controls of nests with older chicks is the fact that they gobble up or rip the prey itself so the possibility of prey determination is lower.

Food found under the nest

It often happens that the prey fall from eagles close to the nest when they sit on the branches and need to remove the prey from claws to beak or when the male pass the food to the female. These findings are relatively rare as the prey is often remove by animals such as fox.

Food collection and determination from pellets and feather remains

This method is restricted to knowledge about nest location or resting places of eagles which either stay close to the nest and control chicks or for the female waiting for the prey brought by the male. At the nest, under the nest and under resting places around the nest pellets were collected. The pellets and skeletal remains were pre-treated in sodium hydroxide, flushed, thus the skeletal parts were separated. Following determination of skeletal remains was carried out.

Prey monitoring using camera system

The advantage of this method is recording a large amount of prey species in a relatively short period of time; howe-

Š. Danko

Fig. 10. The Lesser Spotted Eagle (*Aquila pomarina*) with captured lizard. Šebastovce, 2 May 1976.
Obr. 10. Orol krikľavý (*Aquila pomarina*) s ulovenou jaštericou. Šebastovce, 2. máj 1976.

ver the disadvantage is the intensive resources required and low significance as only one nest can be monitored through one season. A camera system was used from the 20 June to August 4, 2006 to record the breeding attempt of the Lesser Spotted Eagle. During this period its diet was also recorded. The records were monitored by 9 people (with various zoological knowledge) and the period when the prey was visible only for a very short time (mostly shorter than 1 second, additionally the video camera was fitted only a little bit above nest, thus it was impossible to see directly into the nest). Therefore, the possibility of determination was limited. As in other studies of video camera monitoring (Tornberg & Reif 2007) this study of the diet determination was limited. For example we could not distinguish *M. arvalis* and *M. agrestis* at all. Besides the afore mentioned 232 ex. of prey species which we succeeded to determine, at least approximately, (species, genus or for example as "big rodents") from analysing video camera footage, we did not identify 39 ex. of prey.

Diet in Slovakia and in Europe

There is a high variability regarding diet diversity in the European distribution range of the Lesser Spotted Eagle. Significant differences in representation of particular comparative groups were recorded in diet of *A. pomarina* from several countries compared with Slovakia (Tab. 5). The results suggested the importance of Amphibia in Estonia, Germany and Georgia, small rodents in Slovakia and Hungary, and Reptilia in Greece. Northwards to Slovakia larger voles were more abundant: *M. oeconomus* (NE Germany) and *M. agrestis* together with *T. europaea* and *R. temporaria* (Estonia). In Slovakia and Hungary *M. arvalis* had the highest representation and more abundant were *C. cricetus* and *P. colchicus*. The highest ratio of the following species *A. terrestris*, *A. flavicollis*, *L. europaeus* and *A. fragilis* were only in Slovakia. In warmer drier countries such as Greece and Georgia, the ratio of reptiles was significantly higher: genera *Lacerta*, *Natrix*, *Elaphe*, *Testudo*. *R. ridibunda* a *B. viridis* were abundant in Georgia.

The differences from comparative areas of Slovakia are shown in Tab. 3. The species *M. arvalis* was predominantly represented in diet of *A. pomarina* from 51 % in Orava region to 77 % in northeastern Slovakia. The accessorial forest species *A. flavicollis* was more abundant in lower mountains and basins of Central Slovakia. The ration of non-forest species (*A. terrestris*, *M. agrestis*, *R. temporaria* and *T. europaea*) occurring in the diet composition increased in higher mountains and in Northern Slovakia. In lower altitude in Eastern Slovakia, species *P. colchicus*, *A. fragilis* and *C. cricetus* were more abundant locally.

In addition, prey species representation was relatively balanced between decades. (Tab. 4). High ratio of *C. cricetus* in first period of diet monitoring which was realized mainly in lower altitude of Eastern Slovakia was significant. Less significant was the higher abundance of *P. colchicus* in the first two time periods. Later, monitoring of *A. pomarina* diet was extended to higher mountains and basins which manifested in higher abundance of *R. temporaria* during 1990–1999 and was followed by a decrease at the end of 2000, mainly species such as *A. terrestris* and *M. agrestis* in last period after 2000. *M. arvalis* as a dominant species was equally represented in all 4 evaluated time periods.

As an interesting fact we mention also one hunting technique of Lesser Spotted Eagles during wintering in Africa. Kemp (2001) on February 1997 in the Kruger National Park observed approximately 1000 ind. of the Lesser Spotted Eagles, Biggs (2001) on January 2001 observed a group of raptors, mainly eagles, approx. more than 1000 individuals of which 60-80 % were Lesser Spotted Eagles. In this area large nesting colonies of birds from the family Ploceidae occurred, mainly species *Quelea quelea* and the eagles fed on them in that season.

Š. Danko

Fig. 11. The Lesser Spotted Eagles with captured frog (*Rana* sp.) at the nest closed to chick. Košická Belá, 29 June 1975.
Obr. 11. Orly krikľavé s uloveným skokanom na hniezde pri mláďati. Košická Belá, 29. jún 1975.

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