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Temporal variation in the peregrine falcons (*Falco peregrinus*) diet after the extinction of the original population and the emergence of a new population in Slovakia

Časové zmeny v potrave sokola sťahovavého (*Falco peregrinus*) na Slovensku v súvislosti so zánikom pôvodnej a vznikom novej populácie.

Ján OBUCH & Jozef CHAVKO

Abstract: We made an analysis of the osteological remains of prey that had been captured by the peregrine falcon (*Falco peregrinus*) and was collected from eyries perched high in rocky cliffs of Slovakia. Birds dominated the 7,233 vertebrates identified (class Aves, with minimum of 98 species and 97.2% of the total). Bones from mammals (class Mammalia, 24 species, 2.5%) were rarely found, and sporadic remains from lower vertebrate species (classes Amphibia, Reptilia, Pisces, 0.3%) were also noted. The collected specimens were divided over three distinct periods. Before domestic pigeons became a major component in the juvenile peregrine falcon diet (Period A), wild pigeons and doves were the most common prey; specifically stock doves (*Columba oenas*) caught at lower elevations, and wood pigeons (*Columba palumbus*) in mountainous areas. The Eurasian woodcock (*Scolopax rusticola*) was a frequent prey . The diversity of peregrine falcon diet reached its maximum between the 1930s and the 1950s (Period B), with the domestic pigeon (*Columba livia domestica*) present in the diet at a similar abundance (16.1%) to wild pigeons and doves. The peregrine falcon population tailed off in the 1960s as pesticides became more commonly used in agriculture. A new population started expanding from Western Europe during the 1990s and has stabilised at around 150 breeding pairs in recent years. Since the turn of the millennium (Period C), domestic pigeons have become the dominant prey (51.1%) along with smaller songbirds such as hawfinches (*Coccothraustes coccothraustes*) and common starlings (*Sturnus vulgaris*), at 15.5% and 14.6% of total osteological remains collected, respectively.

Abstrakt: Analyzujeme osteologické zvyšky koristi sokola sťahovavého (*Falco peregrinus*), zbierané na jeho skalných hniezdach na Slovensku. Z determinovaných 7 233 kusov stavovcov dominujú vtáky (Aves, minimálne 98 druhov, 97.2%). Zriedkavé sú kosti z cicavcov (Mammalia, 24 druhov, 2.5%) a sporadické zvyšky z nižších druhov stavovcov (Amphibia, Reptilia, Pisces, 0.3%). Zbery sme rozdelili do 3 časových období. Skôr, než sa stali domáce holuby významnou zložkou výživy mláďat sokolov sťahovavých (obdobie A), ich najčastejšou potravou boli divé holuby holub plúžik (*Columba oenas*) v nižších polohách a holub hrivnák (*Columba palumbus*) vyššie v horách. Častou korisťou bola sluka hôrna Scolopax rusticola. V období 30. až 50. rokov 20. storočia (obdobie B) bola diverzita koristi sokolov sťahovavých najvyššia a domáce holuby (*Columba livia domestica*, 16.1%) boli v potrave zastúpené v podobnom množstve, ako divé holuby. Táto populácia zanikla v 60. rokoch 20. storočia v dôsledku používania pesticídov v poľnohospodárstve. Nová populácia sa začala šíriť zo západnej Európy v 90. rokoch 20. storočia a v posledných rokoch sa ustálila na počte okolo 150 hniezdnych párov. V novom miléniu (obdobie C) sú domáce holuby dominantnou korisťou (51.1%) spolu s menšími druhmi spevavcov glezgom obyčajným (*Coccothraustes coccothraustes*, 15.5%) a škorcom obyčajným (*Sturnus vulgaris*, 14.6%).

Key words: prey diversity, dominant prey, Central Europe, reintroduction, Falconidae

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Introduction

Peregrine falcons (*Falco peregrinus)*, swiftly swooping down on other birds flying above the ground, have always fascinated people. This method of attacking has long been exploited by falconers, who have been training them to hunt prey since the medieval era. On the other side, fanciers of racing and homing pigeons would get annoyed at these falcons outpacing and catching their fastest birds. The pigeons became a fatal attraction to these raptors in the 1950s when the former started feeding on pesticide-dressed grain that had been sown in fields. During the 1960s and 1970s, the falcon population collapsed in most of Europe after the raptors died of toxins they had ingested from contaminated pigeons (Newton, 1988). After the spraying of harmful pesticides was prohibited, and some Western European countries launched breeding programmes in the 1990s to rescue the peregrine falcon, the birds started returning to Slovakia and, since the turn of the 21st Century, the population has rebounded to the level at which it stood in the early 1950s.

Between 1977 and 1982, an intensive search was conducted in mountainous parts of Slovakia for nests that peregrine falcons had previously used. The remains of their prey were collected from eighteen identified eyries, where the bones of birds dominated among the findings (Obuch, 1982, 1996). These were published especially from studies of collections that had been brought from the Choč Mountains (Obuch 1981), the Malá Fatra mountain range (Obuch, 1985a) and from the Muránska Planina (Muráň Plateau) National Park (Obuch, 1985b). The first analysis of food remnants found around a newer peregrine falcon nest in the Malé Karpaty Mts. , carried out in 1993-95, was published in a study of the falcon's diet (Obuch & Chavko, 1997).

Historical data sets on peregrine falcon breeding in Slovakia were summarised by Ferianc (1964, 1977), along with more information coming from Mošanský (1972) and Hudec & Černý (1977). Peregrine falcons breed in most of Slovakia's mountain ranges, except those few situated in lowland regions, where the highest concentration of breeding sites are found in the central part of the country. The earliest data on peregrine falcons breeding in central and east Slovakia were published by Schenk (1918). Probably the highest abundance of the species in Slovakia was recorded between 1930s and 1950s (Hudec & Černý, 1977), with numbers slowly declining at first and then dramatically falling after 1960s (Ferianc, 1977). The intensity of the drop in population was such that by 1970s it had reached a critically low level. In subsequent years, an apparent absence of this species was evident at all known eyries in Slovakia where the falcons bred. In addition, adult falcons were rarely observed in Slovakia between 1970 and 1993, while juvenile birds were hardly seen during the breeding season (Chavko, 2008). The occurrence at eyries was only observed again in 1992, with the first nesting and breeding recorded only two years later in the Malé Karpaty Mts and Veľká Fatra Mts range farther north.

The diet of peregrine falcons was studied intensively in interwar Germany. Uttendörfer (1952) summarised results he had obtained from the determination of skeletal remains and feathers of prey collected at breeding sites, and Schnurre (1973, 1996) continued his research after the World War II. Sladek & Mošanský (1957) surveyed peregrine falcons foraging (1953-55) similarly from feather remains at a nest located in central Slovakia. A study of peregrine falcon diets in Europe at the beginning of the 21st Century provides evidence of how the current population has adapted to hunting domestic pigeons (e.g. López-López et al. 2009; Dixon et al., 2018). Attracted by the abundant supply of birds in urban environments, some pairs have been breeding directly in urban areas (Mlíkovský & Hruška, 2000; Rejt, 2001; Drewitt & Dixon, 2008).

The actual study is directed to evaluate the diet trend taken by current Slovakia's peregrine falcon population between 1994 and 2021. Further, to compare its food spectra with earlier peregrine falcon populations in the two defined periods (A and B) and, in the case of the current population, also with seasonal changes in the population's diet between 2003 and 2018 throughout the actual peregrine falcon's range in Slovakia (Period C).

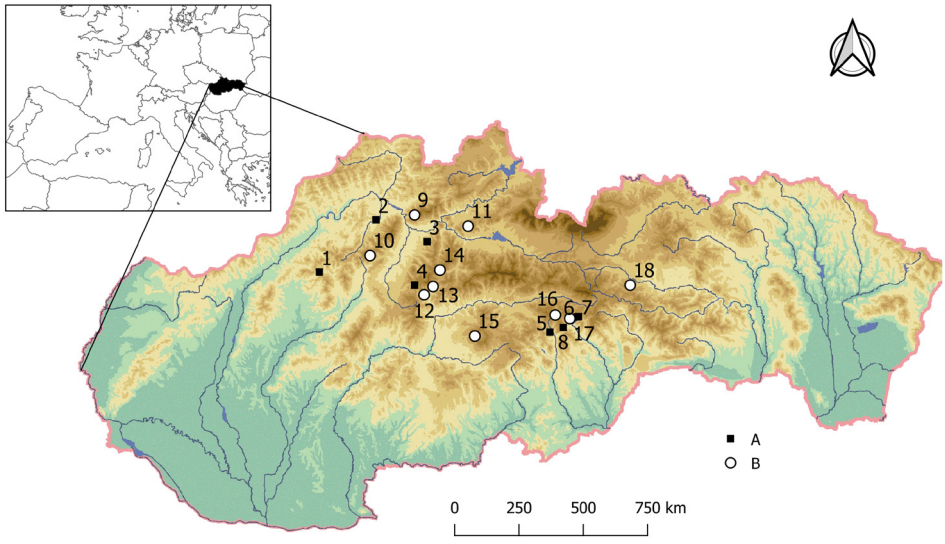
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Material and methods

Members of Raptor Protection of Slovakia monitored the breeding population of peregrine falcons in Slovakia between 1994 and 2021. The birds were observed in the field by 25-30 members of the organisation. They directly searched nests they had first located after reading historical data in the references and subsequently referred to observations that had been recorded of falcon occurrence. Several occupied nesting grounds and eyries that had been detected, along with successfully breeding pairs, were observed, and the number of fledglings was counted and watched.

Appendix 1 provides an overview of the food remnants found at the sites with findings from previous Periods A and B. Figure 1 shows the locations in mountainous areas and plots them on a physical map of Slovakia. Radiocarbon analysis of the oldest habitat (No. 2 on the map) above Rajecké Teplice has dated it to 1,360 years ago with an error factor of ± 50 years (Kaizer et al., 2018). We estimate that all of the samples are older than 100 years. Nine collections were from Period A, wherein 1,585 specimens were determined to be from the diet of peregrine falcons. Period B, is defined by the data on the rings around the pigeons' legs , predominantly from the twenty years between 1931 and 1951. Only one ring came from a later date – 1961. The years during which the samples have been eaten range between 1920 and 1965. There are 11 collections from which 2,018 food items were identified. Food remains were collected from 264 samples over a wider area during Period C – the most recent period in our study, running mainly between 2003 and 2018.

Material from the older collections was washed in water. After it dried, the bones were then sorted for determination. Meat residues were stripped from fresh food scraps, taken at peregrine falcon eyries, by putting them in a 5% sodium hydroxide (NaOH) solution. We determined four types of bones coming from the parts of birds: the rostrum (beak), tarsometatarsus (lower leg), humerus, and metatarsus (digits). Mammals were determined from the mandible and maxilla found in cranial remains to have constituted only a minor diet component (2.5%). Among the lower vertebrates, remains of frogs were identified from the sacral vertebra, while reptiles and fish were identified from the jawbones. Our comparative collection of vertebrate skeletons was used in the determination. The minimum number of individuals (MNI) for each species collected was set as the least possible number that could be determined from the most abundant part of the skeleton. The results are presented in tables adjusted for marked differences from the mean (MDFM) (Obuch, 2001), i.e., the relative abundance of the species in the whole set, expressed as a percentage in the right-hand most column of the tables. Species in the assessed set with a significantly higher abundance than the mean (1+, 2+) are shown at the top of the tables in blocks whose are in grey color. The numbers before the plus (+) or minus (-) sign indicate the degree of deviation from the mean. Below the dashed line, more abundant species with no significant deviation are ranked from the highest total abundance to less abundant species. The remaining less abundant species or species assigned to higher taxonomic units are listed below in an appendix of the Table 1. These species are not listed



Fig,1. Location of sites where older peregrine falcon food was found (A – period before the introduction of domestic pigeons (more than 100 years before the present); B – introduction of domestic pigeons (1920-1965)).
Obr. 1. Poloha nálezísk staršej potravy sokola sťahovavého. (A – obdobie pred výskytom domácich holubov (> 100 rokov BP), B - obdobie s výskytom domácich holubov (1920 – 1965)).

in Tables 2-5 because Table 1 already presents them. The diversity index H' was calculated from the formula used by Shannon & Weaver (1949). ZBER, a local database software programme, was used to compile the tables (Šipöcz 2004).

Results and discussion

Comparing the diet of peregrine falcons from three different periods

For all three observed periods, birds (class Aves, 97.2%, minimum 98 species) dominated the diet of peregrine falcons breeding in the mountainous regions of Slovakia. Yet mammal bones were also found at food sites (class Mammalia, 2.5%, 24 species) mixed with sporadic amounts of lower vertebrate bones (classes Amphibia, Reptilia, Pisces, 0.3%). The most common prey items were three species from the pigeon and dove family: the domestic pigeon (*Columba livia domestica*, 30.1%, the stock dove (*Columba oenas*, 8.9%) and the common wood pigeon (*Columba palumbus*, 5.5%). Other birds more frequently hunted by the falcons were the Eurasian woodcock (Scolopax rusticola, 6.2%), several passerine species from the Corvidae family and, from among smaller prey, the hawfinch (*Coccothraustes coccothraustes*, 11.9%) and the common starling (*Sturnus vulgaris*, 7.8%).

Before free-ranging domestic pigeons appeared (Period A), the peregrine falcon's dominant prey was stock doves and wood pigeons, together with woodcocks abundant during their spring migration when the falcons were breeding. Among larger prey, waterfowl were more abundant, especially ducks from the family Anatidae, the European honey buzzard (*Pernis apivorus*) from among the raptors and the Eurasian jay (*Garrulus glandarius*) from among the passerine birds. Significant numbers of wild pigeons and doves persisted in the diet even into the period from the 1930s to the 1950s (Period B) along with domestic pigeons (16.1%). This period was distinguished from the others by the highest diversity of prey, mainly composed of an increasing amount of the common kestrel (*Falco tinnunculus*), northern lapwing (*Vanellus vanellus*), and common cuckoo (*Cuculus canorus*) in the diet along with several species from the corvid family (Corvidae) and the true thrushes (genus *Turdus*). In the most recent period (Period C), prey diversity fell as domestic pigeons (51.1%), and the smaller hawfinches and starlings grew more dominant in the diet (Table 1). Overall, Table 1 shows species diversity in the diet of peregrine falcon H' to have fallen from 3.13 in Period B to 1.90 in Period C, while the European turtle dove (*Streptopelia turtur*) and common blackbird (*Turdus merula*) remained relatively stable prey in all three periods.

Compared to other osteological sites on rocks, bird bones are dominantly represented among the remnants found in the peregrine falcon's diet (Obuch, 1994). They are primarily uneaten remains of the birds preyed upon by the falcons. The humerus was the predominant bone among the bird bones that had been determined, often pierced from the beak when the flesh was separated from the bone (Larouladie, 2002). Carpal (*metacarpus*) and lower leg (*tarsometatarsus*) bones were rare as they offer little meat and the falcons tend to consume and digest them whole. The mixture of mammal and lower vertebrate bones at the sites may have been partly due to falcons because other predators could have eaten their prey and deposited droppings there. For example, Mošanský (l959) reported ravens foraging at peregrine falcon nests. The occurrence of food from other vertebrae classes was also found at more recently constructed peregrine falcon nests. Likewise, Heredia et al. (1988) found in Spain bones from mammals, primarily bats but also the black rat (*Rattus rattus*), and the European rabbit (*Oryctolagus cuniculus*) and from lower vertebrates, also frogs and lizards.

Oldest Period (A)

Before domestic pigeons flew freely in Slovakia, the main prey for peregrine falcons consisted of stock doves (18.8%) and wood pigeons (13.1%), with woodcocks (15.5%) comprising the remaining larger prey and hawfinches (14.3%) the smaller one. By comparing peregrine falcon food from eight foraging sites, we found that the main difference was that stock doves were the dominant prey in nests located in warmer sections of Slovakia. Smaller species, such as hawfinches, starlings and the mistle thrush (*Turdus viscivorus*), were more frequently hunted at the southern edge of the Strážov Mountains. At eyries in higher elevations, wood pigeons and woodcocks were the most common prey. The oldest site above Rajecké Teplice (No. 2, Tab. 2, Fig. 1) contained more ducks (Anatidae) and other aquatic bird species, reflecting the period 1,400 years ago when the basin of the Rajčanka River between Rajecká Lesná and Turie had extensive wetlands. The number of honey buzzards counted from this site was exceptionally high. Corvidae were more often hunted above the Turiec basin at Katova skala in the Veľká Fatra Mountains. There were no significant deviations from the mean in the percentages

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Tab. 1. Comparison of peregrine falcon diets in Slovakia from three different periods
Tab. 1. Porovnanie potravy sokola sťahovavého na Slovensku z 3 období

Years		**1920<**		**1920 - 1965**		**1999 - 2018**			
Species \ Period		**1 /A/**		**2 /B/**		**3 /C/**	**Total**	**%**
Anas platyrhynchos	1+	14		3	2-	0	17	0.24
Anas crecca	1+	7		3	1-	1	11	0.15
Anas querquedula	1+	11		4	1-	1	16	0.22
Pernis apivorus	1+	13		4	2-	0	17	0.24
Upupa epops	1+	8		4	1-	0	12	0.17
Coturnix coturnix	1+	6		1		0	7	0.10
Scolopax rusticola	2+	243	1+	186	4-	17	446	6.17
Columba oenas	1+	296	1+	288	3-	56	640	8.85
Columba palumbus	1+	208	1+	167	3-	23	398	5.50
Coloeus monedula	1+	74	1+	111	3-	11	196	2.71
Garrulus glandarius	1+	37	1+	44	1-	22	103	1.42
Falco tinnunculus		3	1+	14	1-	1	18	0.25
Vanellus vanellus		4	1+	12	1-	3	19	0.26
Cuculus canorus		15	1+	37	2-	5	57	0.79
Asio otus		1	1+	7	1-	0	8	0.11
Turdus viscivorus		36	1+	61	1-	34	131	1.81
Turdus pilaris		14	1+	38		32	84	1.16
Turdus torquatus		4	1+	29	1-	5	38	0.53
Nucifraga caryocatactes		3	1+	11	1-	1	15	0.21
Pica pica	1-	4	1+	32	1-	11	47	0.65
Corvus cornix+frugilegus		54	1+	188	2-	52	294	4.6
Columba livia dom. N	7-	0	1-	325	1+	1854	2179	30.13
%		0.00		16.11		51.07		
Coccothraustes coccothr.	2-	225	2-	79	1+	556	860	11.89
Sturnus vulgaris	3-	27	3-	18	1+	518	563	7.78
Carduelis chloris	1-	2	1-	0	1+	20	22	0.30
Dendrocopos major	1-	2	1-	2	1+	22	26	0.36
Dryocopus martius		6		7	1-	2	15	0.21
Crex crex		5		3	1-	0	8	0.11
Picus canus		3		6	1-	0	9	0.12
Alauda arvensis		8		11	1-	7	26	0.36
Streptopelia turtur	1-	23		43		90	156	2.16
Turdus merula		26		26		63	115	1.59
Turdus philomelos		15		29		31	75	1.4
Fringilla coelebs		9		14		25	48	0.66
Loxia curvirostra		9		13		13	35	0.48
Perdix perdix		6		9		7	22	0.30
Picus viridis		7		5		3	15	0.21
Oriolus oriolus		3		3		8	14	0.19
Pyrrhula pyrrhula		2		4		6	12	0.17
Apus apus		3		4		5	12	0.17
Strix aluco		5		4		2	11	0.15
Mammalia, 24 species		**50**	**1+**	**85**	**1-**	**48**	**183**	**2.53**
Aves, 98 species		**1529**		**1921**		**3578**	**7028**	**97.17**
Amphibia,Reptilia,Pisces		**6**	**1+**	**12**	**1-**	**2**	**20**	**0.28**
Evertebrata		**0**		**0**		**2**	**2**	**0.03**
Total		**1585**		**2018**		**3630**	**7233**	**100.00**
Diversity Inex H'		2.94		3.13		1.89	2.86	

Tab. 1. Continuation
Tab. 1. Pokračovanie
Other species 1(**Period No** - number of individuals) / Ostatné druhy (**Obdobie č**.-počet):
Erinaceus roumanicus (**1**-5; **2**-2); *Talpa europaea* (**1**-2; **2**-9; **3**-2), *Myotis bechsteinii* (**2**-1), *Vespertilio murinus* (**1**-2; **3**-1), *Eptesicus serotinus* (**1**-1; **2**-2; **3**-1), *Nyctalus noctula* (**1**-1; **2**-5; **3**-10), Chiroptera sp. (**1**-1), *Lepus europaeus* (**1**-1; **2**-1; **3**-1), *Sciurus vulgaris* (**2**-1), *Spermophilus citellus* (**1**-2; **2**-2; **3**-9), *Glis glis* (**1**-6; **2**-4; **3**-2), *Eliomys quercinus* (**2**-1), *Muscardinus avellanarius* (**1**-1; **2**-2), M*us musculus* (**2**-1), *Apodemus flavicollis* (**3**-1), *Apodemus* sp. (**1**-6; **2**-9), *Rattus norvegicus* (**2**-2; 3-4), *Cricetus cricetus* (**2**-1), *Myodes glareolus* (**1**-5; **2**-7; **3**-1), *Arvicola amphibius* (**1**-5; **2**-12; **3**-3), *Terricola subterraneus* (**1**-1; **2**-3), *Microtus arvalis* (**1**-9; **2**-19; **3**-10), *Microtus agrestis* (**2**-1), *Mustela nivalis* (**1**-1; **3**-2), *Meles meles* (**1**-1), *Felis catus dom.* (**3**-1), *Podiceps nigricollis* (**2**-1; **3**-1), *Anas strepera* (**1**-5; **2**-1), *Aythya fuligula* (**2**-1), Anatidae sp. (**1**-7; **2**-5), *Accipiter gentilis* (**2**-1), *Accipiter nisus* (**1**-2; **2**-3; **3**-2), *Buteo buteo* (**3**-1), *Circus* sp. (**1**-2), *Falco peregrinus* (**2**-4; **3**-4), *Falco sp.* (**1**-4; **2**-5), *Tetrastes bonasia* (**1**-3; 3-1), *Lyrurus tetrix* (**1**-3; **2**-1), *Phasianus colchicus* (**3**-1), *Gallus gallus dom.* (**1**-3), Galliformes sp. (**2**-2), *Rallus aquaticus* (**1**-1; **2**-1), *Gallinula chloropus* (**2**-2; **3**-1), *Fulica atra* (**1**-1; **2**-2), *Charadrius dubius* (**2**-1), *Tringa sp.* (**2**-1), *Philomachus pugnax* (**1**-1; **2**-1), *Numenius arquata* (**1**-2; **2**-1), *Gallinago* sp. (**1**-1), Limicolae sp. (**1**-3), *Chroicocephalus ridibundus* (**1**-1), *Sterna hirundo* (**1**-1; **2**-5), *Chlidonias niger* (**2**-1), *Streptopelia decaocto* (**2**-1; **3**-7), *Otus scops* (**3**-1), *Glaucidium passerinum* (**2**-1), *Aegolius funereus* (**1**-2; **2**-1), *Athene noctua* (**2**-3), *Caprimulgus europaeus* (**1**-1), *Coracias garrulus* (**1**-1; **2**-1), Psittacidae sp. (**3**-1), *Dendrocopos syriacus* (**1**-1), *Dendrocopos medius* (**3**-1), *Dendrocopos leucotos* (**3**-2), *Jynx torquilla* (**1**-1; **3**-3), *Lullula arborea* (**2**-1), *Galerida cristata* (**3**-1), *Hirundo rustica* (**2**-1), *Anthus trivialis* (**3**-1), *Anthus* sp. (**1**-1), *Motacilla alba* (**3**-5), *Motacilla cinerea* (**3**-1), *Lanius excubitor* (**1**-1), *Lanius minor* (**1**-2), *Lanius collurio* (**2**-1), *Sylvia communis* (**3**-1), *Sylvia atricapilla* (**3**-1), *Sylvia* sp. (**3**-1), *Erithacus rubecula* (**3**-1), *Parus major* (**2**-1; **3**-2), *Periparus ater* (**2**-1), *Poecile palustris* (**3**-1), *Poecile montanus* (**3**-1), *Sitta europaea* (**3**-1), *Cinclus cinclus* (**3**-2), *Emberiza citrinella* (1-3; 2-1; 3-3), *Emberiza calandra* (**1**-1; **3**-2), *Emberiza schoeniclus* (**3**-1), *Carduelis carduelis* (**3**-1), *Carduelis cannabina* (**3**-1), *Passer domesticus* (**2**-1; **3**-7), *Passer montanus* (**2**-1; **3**-3), *Corvus corax* (**3**-1), Passeriformes sp. (**1**-8; **2**-8; **3**-6), Aves sp. (**1**-5; **3**-1), Aves sp.juv. (**1**-21; **2**-10), *Bufo bufo* (**2**-2; **3**-1), *Rana temporaria* (**1**-3; **2**-8; **3**-1), *Lacerta viridis* (**1**-1), *Lacerta agilis* (**1**-2; **2**-1), *Salmo trutta* (**2**-1), *Lucanus cervu*s (**3**-1), Limacidae sp. (**3**-1)

of species from findings at smaller sites in the Veľká Fatra range at the valley around Žarnovica and on the Muráň Plateau (Kášter, Šance) (Table 2).

Predominant diet between the 1930s and 1950s (Period B)

Ten sites were studied whose domestic pigeon remnants were dated from their rings to the period between 1930 and 1960. There were similar numbers of domestic pigeons (15.8%), stock doves (14.3%) and wood pigeons (8.4%) found. Eurasian woodcocks and corvids were also abundant. Significant differences were only evident among the five more numerous samples of the peregrine falcon diet. On the rocks above the Hoskora valley (No. 9, Tab. 3, Fig. 1) in the Malá Fatra Mountains, peregrine falcons have nested high in the narrow gorge through which the Váh river flows. It was here where they could follow the Eurasian woodcock's spring migratory route. This species and wild pigeons and doves formed the falcon's main prey. The rock wall at Sokol above the Ružomberok, Liptov Region (No. 11) once hosted nesting grounds for a colony of western jackdaws (*Coloeus monedula*). These were the most accessible prey for falcons whose eyries lay at the same location. The falcons in the cliffs above Dolný Harmanec, Veľká Fatra Mts (No. 12) hunted for the hooded crow (*Corvus cornix*), turtle doves and hawfinches along the Hron river valley near Banská Bystrica and domestic pigeons flying through the mountain pass at Šturec to the Turiec Region. Domestic pigeons were likewise common prey for the falcons bred at Majerová skala in the south-eastern Veľká Fatra Mts (No. 13). At higher elevations, common prey was the ring ouzel (*Turdus torquatus*). Falcons nesting in the enclosed valley below Mála Stožka (No. 16) in the Muránska planina Mts would hunt carrier pigeons flying from various directions. Rings on these birds indicated that they had been caught, banded and then released in Hungary, the Czech Republic and Košice further east. The nest located at Site 16 was abandoned after one falcon of the pair died. Its skeleton was found at the bottom of a deep chasm in the eastern face of Mála Stožka, along with the skeleton of a pigeon banded in 1950 (Tab. 3).

The most comprehensive material about food that had been foraged by peregrine falcons from 221 breeding sites in Germany was collected during the interwar period by Uttendörfer (1952). Table 4 thus summarises our material from Period B and of a similar age, which differs mainly in the higher abundance of stock doves, wood pigeons, woodcocks and crows. Being predominately flat, Germany already had a lot of domestic pigeons, starlings and wetland species, particularly the northern lapwing (*Vanellus vanellus*) and the black-headed gull (*Chroicocephalus ridibundus*) during that period. Although smaller songbird species had already become abundant by that time, too. The peregrine falcon diet was subsequently studied in eastern Germany by Schnurre (1966, 1973). Even after 1950, the diet was dominated by three species mentioned earlier: domestic pigeons, common starlings and northern lapwings, with a high diversity of other bird species.

The presence of domestic pigeons in the samples was used to distinguish the earlier Period A from Period B. Even though they had been bred since medieval times, the pigeons used to be kept in closed aviaries. Among

Tab 2. Peregrine falcon diet before the introduction of domestic pigeons (Period A)
Tab 2. Potrava sokola sťahovavého pred výskytom domácich holubov (obdobie A)

Species \ Locality No	1		7		8		2		3		4		5		6		Total	%
Turdus viscivorus	1+	19		1		2		6		4		1		3			36	2.29
Sturnus vulgaris	1+	20				1	1-	0		1				3		2	27	1.72
Coccothraustes coccothr.	1+	115	2-	2		20		54	1-	10	1-	0	1-	1		22	224	14.28
Columba oenas	1+	127	1+	29	1+	80	2-	15	2-	7		8		9	1-	20	295	18.80
Streptopelia turtur		5		4	1+	9		1		1				1		2	23	1.47
Anas platyrhynchos		3					1+	8		2		1					14	0.89
Pernis apivorus		1					1+	11		1							13	0.83
Scolopax rusticola	1-	61		12	1-	10	1+	86	1+	41		6	1-	2		25	243	15.49
Columba palumbus	1-	50		16	1-	7		56	1+	36		10		3		28	206	13.13
Corvus cornix+frugilegus	1-	7		2		8		13	1+	13		5				2	50	3.19
Coloeus monedula		24		1	1-	2		12	1+	22		5		2		3	71	4.53
Turdus philomelos	1-	0				3		3		6		1		1		1	15	0.96
Garrulus glandarius		11		3		6		9		3				2		3	37	2.36
Turdus merula		6		2		6		4		3				3		2	26	1.66
Cuculus canorus		7		3				2		1						2	15	0.96
Turdus pilaris		5				3		1		2						1	12	0.76
Anas querquedula		4		1		1		3								2	11	0.70
Fringilla coelebs		2				2		3		1				1			9	0.57
Loxia curvirostra		3						4		1		1					9	0.57
Upupa epops		2		1		3								1		1	8	0.51
Alauda arvensis		3		3		1										1	8	0.51
Anas crecca		2						3				1				1	7	0.45
Perdix perdix		2						1		2				1			6	0.38
Coturnix coturnix		1		1				3						1			6	0.38
Dryocopus martius		1				1		1		1						2	6	0.38
Picus viridis		2				1		1		1		1					6	0.38
Mammalia		**12**		**6**		**3**		**11**	**1-**	**0**		**0**		**5**	**1+**	**13**	**50**	**3.19**
Aves		**517**		**87**		**171**		**333**		**180**		**44**		**40**		**141**	**1513**	**96.43**
Amphibia, Reptilia		**0**		**0**		**0**		**4**		**0**		**0**		**1**		**1**	**6**	**0.38**
Total		**529**		**93**		**174**		**348**		**180**		**44**		**46**		**155**	**1569**	**100.00**
Diversity Index H'		2.60		2.44		2.17		2.81		2.64		2.24		2.99		2.86	2.94	

Locations, date of collection/ **Lokality,** dátum zberu: **1** - Čierna Lehota, Sokolie skaly, 3.3.1979, **7** – Muráň, Šance, right edge, 11.10.1979, **8** – Muráň, Javorníčkova dolina, 15.5.1979, **2** - Rajecké Teplice, Skalky, 26.7.1978, **3** – Sklabinský podzámok, Katova skala, 4.9.1979, **4** – Čremošné, Žarnovická dolina, 8.6.1995, **5** – Tisovec, Kášter, 30.7.1980, **6** – Muráň, Šance, left edge, 23.9.1980.

free-flying pigeons, homing pigeons released beyond the borders of former Czechoslovakia for training flights and racing pigeons in the competition became attractive prey for the peregrine falcons nesting in the country. In 1921, the Racing Pigeon Union of Czechoslovakia (CHPV) was established in Prague. Two years later, a law was adopted, which vested in the interior ministry the authority to protect racing and homing pigeons and required them to be registered. The first meeting of the CHPV was held in Liptovský Mikuláš, Slovakia, in 1923, followed by another meeting in Zvolen a year later and in the Spiš region in 1928 (Alexaj 1971). Breeders would often complain at these meetings about huge losses of pigeons caught by birds of prey whenever the route of races took them over central Slovakia. These complaints would appear in the local carrier pigeon magazine. The breeders were calling for raptors to be eliminated by all means possible. Matoušek (1947) explained that most birds of prey catch pigeons only in exceptional circumstances, and the relatively rare peregrine falcons were at the time protected by law. Hudec & Šťastný (2005) mentioned that falcon numbers slowly increased after the peregrine falcon received protection in 1929. Likewise, World War II contributed to the limited shooting of these birds. The population continued to rise until 1950 when numbers started falling again. Newton (1988) cites the agricultural use of DDT and mainly cyclodienes, including aldrin and dieldrin dressings in grain, as the cause of the decline in the falcon population in most European countries

Tab. 3. Predominant peregrine falcon diet in the period from 1930s to 1960s (Period B)
Tab. 3. Potrava sokola sťahovavého prevažne z 30. až 50. rokov 20. storočia (obdobie B)

Rings, Years	**1942 - 52**		**1944 - 54**		**1933 - 51**		**1931 - 46**		**1932 - 51**		**1932 - 34**		**1961**		**1939 - 52**			
Species \ Locality No	**9**		**11**		**12**		**13**		**16**	**10**	**14**		**15**		**17**	**18**	**Total**	**%**
Turdus philomelos	1+	11		3		5				5			1		1		3		29	1.46
Scolopax rusticola	1+	79		38	1-	38	1-	6	1-	4	4		1		3		10	1	184	9.25
Columba oenas	1+	95		68	1-	64	2-	1		26	4	1-	1		5		15	5	284	14.27
Columba palumbus	1+	43	1+	48	1-	29		15	1-	5	4		1		3		11	8	167	8.39
Coloeus monedula		22	1+	45		28	1-	2	1-	0	6				1		3	4	111	5.58
Nucifraga caryocatactes			1+	7		1		1							1			1	11	0.55
Streptopelia turtur		9	1-	3	1+	20		1		5	2				1		1	1	43	2.16
Corvus cornix + frugilegus	1-	13		30	1+	105		11	1-	6	4		1		3		10	4	187	9.40
Coccothraustes coccothr.		11		12	1+	40		4	1-	1			1		4		3	3	79	3.97
Columba livia domestica	2-	13		57	1+	121	1+	62		29	6		6		7	2-	2	11	314	15.78
Turdus torquatus		3		2	1-	1	2+	15					4				3		28	1.41
Turdus viscivorus		9		10		14		2	1+	14	5		2		2		2		60	3.2
Cuculus canorus		7		4		12			1+	9	1				1		1	1	36	1.81
Turdus pilaris	1-	1		12		15		3		1							1	3	36	1.81
Turdus merula		4		4	1-	3				2	4		2		1		4	2	26	1.31
Garrulus glandarius		8		10	1-	5		3		3	2		1		4		3	2	41	2.6
Pica pica		9		12		5		1			4						1		32	1.61
Sturnus vulgaris		1		5		7					3						2		18	0.90
Falco tinnunculus		2		2		5		2					1				2		14	0.70
Fringilla coelebs		4		2		4				1			1		2				14	0.70
Vanellus vanellus		1		7				1			1				1			1	12	0.60
Loxia curvirostra		3		3		5									1				12	0.60
Alauda arvensis		4		3		1		2			1								11	0.55
Perdix perdix				2		3									2		1	1	9	0.45
Asio otus		1		1		4		1											7	0.35
Dryocopus martius		1		4		1		1											7	0.35
Picus canus		1		3		1												1	6	0.30
Mammalia	**3-**	**0**	**1-**	**7**	**1-**	**9**		**7**	**1+**	**16**	**2**	**2+**	**17**	**1+**	**14**	**1+**	**11**	**2**	**85**	**4.27**
Aves		**376**		**416**		**578**		**138**		**116**	**56**	**1-**	**28**		**48**		**87**	**50**	**1893**	**95.13**
Amphibia,Reptilia,Pisces		**0**		**0**		**3**		**0**		**2**	**1**		**0**		**1**	**1+**	**5**	**0**	**12**	**0.60**
Total		**376**		**423**		**590**		**145**		**134**	**59**		**45**		**63**		**103**	**52**	**1990**	**100.00**
Diversity Index H'		2.60		2.90		2.85		2.24		2.67	2.91		2.77		3.24		3.9	2.58	3.13	

Locations, date of collection/ **Lokality,** dátum zberu: **9** – Turčianske Kľačany, Nad Hoskorou, 11.6.1980; **11** – Valaská Dubová, Sokol, 1.7.1977; **12** – Dolný Harmanec, Bystrická dolina, 4.11.1978 + 17.7.2004; **13** – Staré Hory, Majerova skala, 15.4.1980; **16** – Závadka nad Hronom, Malá Stožka, 16.5.1979; **10** – Vrícko, Vrania skala, 27.6.1982; **14** – Liptovské Revúce, Čierny Kameň, 13.5.1980; **15** - Hrochoť, Jánošíkova skala, 10.7.1978; **17** - Muráň, Klin, 29.7.1980; **18** - Smižany, Klauzy, 14.9.1980.

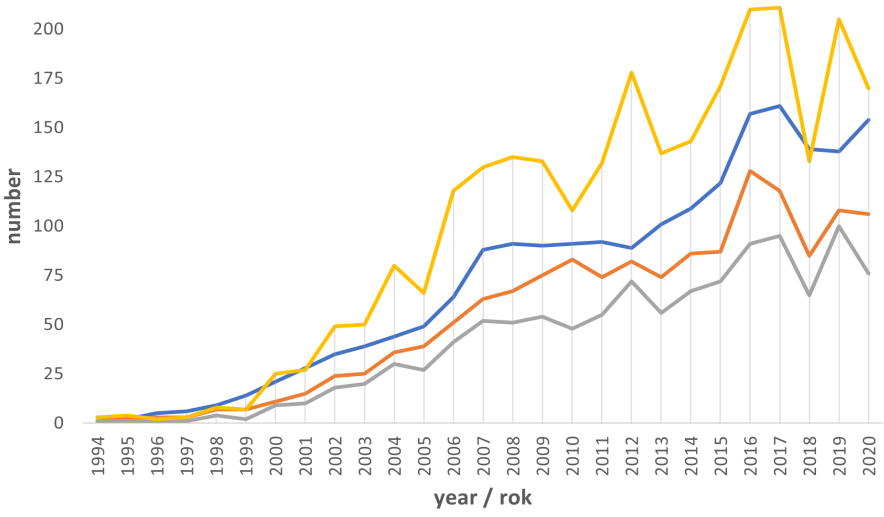


Fig. 2. Peregrine falcon monitoring results for 1994-2021 (collection of results from 2021 was curtailed by the reduction of biotope mapping staff caused by measures to combat the COVID-19 pandemic).
Obr. 2. Výsledky monitoringu populácie sokola sťahovavého za obdobie rokov 1994 – 2021 (výsledky z roku 2021 boli čiastočne ovplyvnené znížením počtu mapovateľov v dôsledku COVID-19 opatrení).

starting in the 1950s. These organochlorine compounds were banned in Western Europe during the 1980s and the peregrine falcon population began to soar with the ban. Kubiš (1946) promoted DDT as an excellent means against pigeon ectoparasites, recommending that crops be dusted with it several times a year. Hudec (1988) estimated the peregrine falcon population in Czechoslovakia in the early 1970S as 10-20 pairs, falling between 1975 and 1985 to 2-4 pairs.

New populations and their diet in recent decades (Period C)

Chavko (2002) reported the regular breeding of peregrine falcons in western Slovakia starting in 1993 and spreading of other pairs were further east. In 1994-2001, 272 nesting pairs were recorded in Slovakia that had raised young 1,941 times. After subtracting nesting successes that could not be checked, only 1,460 active cases of breeding were evaluated by us, of which 1,119 were successful and 2,638 chicks fledged from the nests. For all breeding, the average success rate index covering all years was 1.8 chicks, and 2.5 chicks per successful breeding. Figure 2 shows an increase observed in the peregrine falcon population during the period studied, with first gradual and subsequently dynamic growth in breeding abundance until 2016. Breeding was also recorded by us at new, previously unpublished sites in Slovakia (Fig. 3). A similar upward trend in the development of new populations and colonisation of earlier breeding sites over the last three decades is shown in Figures 4, 5 and 6 for other European countries (Keller et al. 2020).

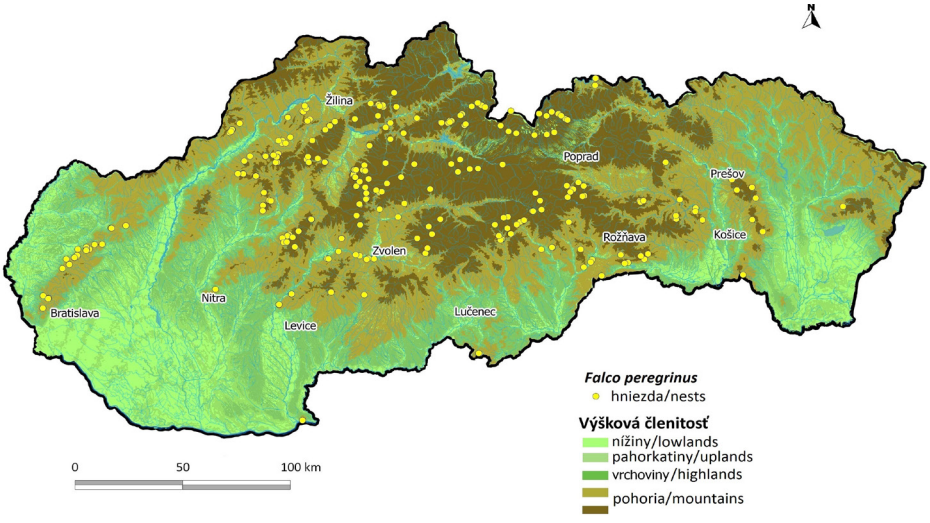


Fig. 3. Recent distribution of peregrine falcon nests (status up to 2016).
Obr. 3. Recentná distribúcia hniezd sokola sťahovavého (stav do roku 2016).

Tab. 4. Comparing the earlier diet of peregrine falcons in Slovakia (Period B) to findings by Uttendörfer (1952) in Germany
Tab. 4. Porovnanie staršej potravy sokola sťahovavého (obdobie B) s výsledkami Uttendörfera (1952) z Nemecka

Species \ Country	Slovakia		Germany		Total	%
Coloeus monedula	2+	111	2-	42	153	1.83
Scolopax rusticola	2+	186	4-	10	196	2.35
Coccothraustes coccothr.	2+	79	2-	15	94	1.13
Turdus torquatus	2+	29	3-	0	29	0.35
Columba oenas	2+	288	3-	41	329	3.94
Columba palumbus	1+	167	1-	122	289	3.46
Streptopelia turtur	1+	43	1-	51	94	1.13
Corvus cornix+frugilegus	1+	188	1-	123	311	3.72
Pica pica	1+	32	1-	17	49	0.59
Nucifraga caryocatactes	1+	11	2-	0	11	0.13
Cuculus canorus	1+	37	1-	21	58	0.69
Falco tinnunculus	1+	14	1-	2	16	0.19
Asio otus	1+	7	1-	1	8	0.10
Loxia curvirostra	1+	13	1-	8	21	0.25
Vanellus vanellus	3-	12	1+	489	501	6.00
Chroicocephalus ridibundus	4-	0	1+	168	168	2.1
Alauda arvensis	3-	11	1+	298	309	3.70
Turdus iliacus	3-	0	1+	88	88	1.5
Emberiza citrinella	2-	1	1+	82	83	0.99
Sturnus vulgaris	4-	18	1+	1209	1227	14.69
Parus major	2-	1		47	48	0.57
Fringilla coelebs	2-	14		181	195	2.34
Columba livia dom.	1-	325		2039	2364	28.3
Perdix perdix	1-	9		90	99	1.19
Sterna hirundo	1-	5		39	44	0.53
Dendrocopos major	1-	2		26	28	0.34
Turdus philomelos	1-	29		137	166	1.99
Carduelis chloris	1-	0		28	28	0.34
Passer domesticus	1-	1		28	29	0.35
Passer montanus	1-	1		23	24	0.29
Garrulus glandarius		44		170	214	2.56
Turdus viscivorus		61		148	209	2.50
Turdus pilaris		38		139	177	2.12
Turdus merula		26		105	131	1.57
Mammalia	**2+**	**85**	**3-**	**8**	**93**	**1.11**
Aves		**1921**		**6325**	**8246**	**98.74**
Amphibia,Reptilia,Pisces	**1+**	**12**	**2-**	**0**	**12**	**0.14**
Total		**2018**		**6333**	**8351**	**100.0**
Diversity Index H'		3.13		2.69	3.2	

Out of 264 collections between 2003 and 2018, evenly distributed over the peregrine falcon's range in Slovakia, 3,537 prey items were identified, of which birds constituted 98.6% and mammals 1.3%. The dominant component in Period C was domestic pigeons (*Columba livia domestica*, 51.0%), which was more abundant in the earlier seasons from 2003 to 2008 and at the end of the observation period in 2015-18. In the first year of monitoring (2003), the hooded crow (*Corvus cornix*), the rook (*Corvus frugilegus*) and the European turtle dove (*Streptopelia turtur*) were the most common prey found in the peregrine falcon diet. The stock dove (*Columba oenas*) was the most common prey in the second year (2004) and the common blackbird (*Turdus merula*) during the subsequent year. In the second decade of Period C (starting from 2010), there were alternate years when there was a higher proportion of hawfinches (15.5%) and common starlings (14.6%), while the dominance of other species was less than 1%. Compared to earlier periods, the percentage of the common noctule (*Nyctalus noctula*) rose to 0.3% of prey items collected, while the proportion



Fig. 4. The Eurasian golden oriole (*Oriolus oriolus)* as prey in the nest of a peregrine falcon
Obr. 4. Vlha obyčajná (*Oriolus oriolus*) ako korisť na hniezde sokola sťahovavého



Fig. 5. Peregrine falcon flying with prey
Obr. 5. Let sokola sťahovavého s korisťou

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Tab. 5. Peregrine falcon recent diet in the period from 2003 to 2018 (Period C)
Tab. 5. Potrava sokola sťahovavého v recentnom období (sezóny 2003 – 2018, obdobie C)

Number of samples	**22**	**25**	**22**	**17**	**35**	**13**	**9**	**30**	**19**	**14**	**30**	**9**	**16**	**3**		
Species / Season	**2003**	**2004**	**2005**	**2006**	**2008**	**2009**	**2010**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**∑**	**%**
Corvus cornix+frugilegus	2+ 18	7	2	6	2	1		3	2	1-	3				44	1.24
Streptopelia turtur	1+ 16	13	7	1	9		1	17	6	3	1- 9	2	3		87	2.46
Columba livia dom. N	156	1+ 226	123	112	261	53	37	1- 182	1- 84	1- 42	333	81	64	51	1805	51.03
%	55.8	63.7	60.6	59.3	54.6	44.2	50.7	38.4	38.4	33.1	52.2	55.9	40.5	66.2		
Columba oenas	3	1+ 11	4	7	5	1	1	4	6	1-	3	3	2	1	51	1.44
Turdus merula	3	8	1+ 10	8	6	4	2	10	3		7		1	1	63	1.78
Nyctalus noctula					1+ 5				2	2	1				10	0.28
Sturnus vulgaris	2- 11	1- 34	1- 10	1- 12	75	18	1+ 19	1+ 108	38	1+ 32	91	29	1+ 35	1- 5	517	14.62
Coccothraustes coccothr.	1- 29	1- 27	1- 18	1- 16	65	15	1- 3	88	1+ 49	25	1+ 133	24	1+ 37	18	547	15.47
Carduelis chloris	2				5			2	1+ 6		2	1	2		20	0.57
Turdus viscivorus	6	6	3	2	7	1	1	3	1	2	2				34	0.96
Turdus pilaris	4	4	2	1	1	5	2	5	2	1	3				30	0.85
Turdus philomelos	3	2	5	5	3	3		4			3		2		30	0.85
Fringilla coelebs	3		1	3	6			3	1	3	5				25	0.71
Dendrocopos major	1				6	1	2	5		1	4	1	1		22	0.62
Garrulus glandarius	1	1	5	1	2	2		3			4		2		21	0.59
Columba palumbus	2	3	2		2	2		6	1						18	0.51
Scolopax rusticola	3	1	3	1	3			2	1		2		1		17	0.48
Loxia curvirostra	2	2			1	1		1	1	1	1		1	1	12	0.34
Pica pica		2	1	1	2			2			1	1			10	0.28
Coloeus monedula	4		1	1		1		1	1		1				10	0.28
Spermophilus citellus					3		1	1	2		1		1		9	0.25
Oriolus oriolus				1	4		1	1			1				8	0.23
Perdix perdix	1		1		1	1		1			1		1		7	0.20
Streptopelia decaocto		1			1	1					4				7	0.20
Alauda arvensis	1		1								4		1		7	0.20
Passer domesticus				1					1	2	3				7	0.20
Microtus arvalis	1		1			1				1	2		1		7	0.20
Pyrrhula pyrrhula									2	3	1				6	0.17
Cuculus canorus								3	1				1		5	0.14
Motacilla alba				1				1	1	1	1				5	0.14
Mammalia	4	2	1	1	5	1+ 7	1	3	5	4	9	0	3	0	45	1.27
Aves	276	353	202	188	473	113	72	470	213	123	628	145	155	77	3488	98.61
Amphibia	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2	0.06
Evertebrata	1	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0.06
Total	281	355	203	189	478	120	73	474	219	127	638	145	158	77	3537	100
Diversity Index H'	1.89	1.51	1.69	1.77	1.67	2.3	1.57	1.99	1.99	1.98	1.62	1.29	1.69	0.96	1.89	

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Fig 6. Peregrine falcon with catch brought to the nest to feed its young
Obr. 6. Sokol sťahovavý s úlovkom, prineseným na hniezdo mláďatám

of wild pigeons and doves fell significantly, with stock doves dropping to 1.4% and wood pigeons to 0.5%. There were also a low number of Eurasian woodcocks (0.5%) and corvids, as seen in Table 5.

The current population of peregrine falcons in Central and Western Europe heavily depends on the predation of domestic pigeons. A study of the diet in eastern Spain by López-López et al. (2009) implies that the peregrine falcon population increases in direct proportion to the percentage of domestic pigeons measured in their diet. Some studies of their foraging are from pairs nesting in urban areas, where domestic pigeons comprise more than 40% of their prey (e.g., Mlíkovský & Hruška, 2000; Rejt, 2001; Drewitt & Dixon, 2008).

Assessment of population trends of some prey species eaten by peregrine falcons in Slovakia

Comparing the foraging spectra of peregrine falcons in three different periods indicated changes in the relevant abundance of birds in Slovakia over the last 100 years. The most significant finding is the decline in the European woodcocks abundance during Period C, the most recent of the periods studied. Karaska (2002) considered it a species of least concern with a stable population trend. Water birds have also declined in the diet of peregrine falcons, although when comparing the changes to the diet of Eurasian eagle-owl, the opposite trend was observed (Obuch, 2021). There has likewise been a significant decline in crows in the diet, especially of western jackdaws, which were still nesting in colonies on rock cliffs in the 1980s. The population of hooded crows was severely reduced in the 1970s due to hunters' poisoning and pesticides sprayed on fields. The northern lapwing population also decreased with the reclamation of wetlands where they used to nest (Krištín, 2002). Conversely, there has been a marked rise in the abundance of smaller bird species, especially hawfinches and starlings, in the most recent Period C, in addition to domestic pigeons, whose increase has mostly come from growth in urban populations. This increase may also be due to samples from earlier periods (A and B) having come from higher elevations, while lower elevations in neighbouring lowland meadows and rolling hills lowlands have figured in recent collections. Among mammals, bats from the species *Nyctalus noctula* have recently been predominant. Their hibernating colonies use cavities found in panel houses built in urban housing estates during the socialist era (1948-89). The higher densities are reflected in the diet of several raptor and owl species (Danko et al., 2012). In comparative periods, the turtle dove (*Streptopelia turtur*) has been a similar rise in the abundance of about 2%. Even though the Eurasian collar dove (*Streptopelia decaocto*) arrived in Slovakia in the 1950s, the species remains low in the diet of many predators. An exception to that rule was the abundant hunting by the Ural owl (*Strix uralensis*) in the centre of Košice winters (Dravecký & Obuch, 2009).

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Appendix 1. Overview of old peregrine falcon diet collections in Slovakia
Príloha 1. Prehľad starých zberov potravy sokola sťahovavého na Slovensku

ID	Mountain / Pohorie	Cadaster / Kataster	Lokality / Lokalita	Date of collection / Dátum zberu	
A. Collections without domestic pigeons / Zbery bez výskytu domácich holubov					
1	Strážovské vrchy	Černa Lehota	Sokolie skaly	3.3.1979	
2	Súľovské vrchy	Rajecké Teplice	Skalky	26.7.1978	
3	Veľká Fatra	Sklabinský Podzámok	Katova skala	4.9.1979	
4	Veľká Fatra	Čremošné	Žarnovická dolina	8.6.1995	
5	Muránska planina	Tisovec	Kášter	30.7.1980	
6	Muránska planina	Muráň	Šance ľavý okraj	23.9.1980	
7	Muránska planina	Muráň	Šance pravý okraj	11.10.1979	
8	Muránska planina	Muráň	Javorníčkova dolina	15.5.1979	
	Malá Fatra	Terchová	Poludňpvé skaly	4.6.1997	
B. Collections with domestic pigeons / Zbery s výskytom domácich holubov					Rings - Years Krúžky-Roky
9	Malá Fatra	Turčianske Kľačany	Nad Hoskorou	11.6.1980	1942 - 52
10	Malá Fatra	Vrícko	Vrania skala	27.6.1982	
11	Chočské vrchy	Valaská Dubová	Sokol	1.7.1977	1944 - 54
12	Veľká Fatra	Dolný Harmanec	Bystrická dolina	4.11.1978	1933 - 51
13	Veľká Fatra	Staré Hory	Majerova skala	15.4.1980	1931 - 46
14	Veľká Fatra	Liptovské Revúce	Čierny Kameň	13.5.1980	1932 - 34
15	Poľana	Hrochoť	Jánošíkova skala	10.7.1978	1961
16	Muránska planina	Závadka n. Hronom	Malá Stožka	16.5.1979	1932 - 51
17	Muránska planina	Muráň	Klin	29.7.1980	
18	Slovenský Raj	Smižany	Klauzy	14.9.1980	1939,1952
	Nízke Tatry	Liptovský Ján	Bielo	18.9.2008	