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SPATIAL VARIATION IN PREY COMPOSITION AND ITS POSSIBLE EFFECT ON REPRODUCTIVE SUCCESS IN AN EXPANDING EASTERN IMPERIAL EAGLE (*AQUILA HELIACA*) POPULATION

HORVÁTH, M.[1], SZITTA, T.[2], FIRMÁNSZKY, G.[3], SOLTI, B.[4], KOVÁCS, A.[1] and MOSKÁT, C.[5]

[1]MME BirdLife Hungary, H-1121 Budapest, Költő u. 21, Hungary
[2]Bükk National Park Directorate, H-3304 Eger, Sánc u. 6, Hungary
[3]Aggtelek National Park Directorate, H-3758 Jósvafő, Tengerszem oldal 1, Hungary
[4]Mátra Múzeum, H-3200 Gyöngyös, Kossuth u. 40, Hungary
[5]Animal Ecology Research Group of the Hungarian Academy of Sciences and Hungarian Natural History Museum, H-1083 Budapest, Ludovika tér 2, Hungary

Reproductive success of raptor species is significantly affected by the quantity and/or quality of available prey. In our study we analysed prey composition of breeding imperial eagles (*Aquila heliaca*) in East Hungary, where 434 nesting events in 81 different territories had been monitored between 1995 and 2004. We identified 1297 prey items originating from 43 bird and 16 mammalian species (532 and 764 specimens, respectively). Three prey species, the brown hare (*Lepus europaeus*), the hamster (*Cricetus cricetus*) and the pheasant (*Phasianus colchicus*), seem to have especially important role in the diet of imperial eagles in Hungary, although their relative frequencies varied greatly among different regions. We found that eagles were less productive in a region where hamster was the main prey (West Zemplén Mts) as compared to a recently colonized hare-dominated region (Heves Plain), suggesting that hares may provide a better food source than hamsters. The increase of game species in the diet of imperial eagles could generate hostility in hunters. Possible conflict between nature conservation and small-game management may be resolved by raising public awareness and by common projects to improve hare and pheasant habitats.

Key words: breeding success, raptor, *Cricetus cricetus*, *Lepus europaeus*, *Phasianus colchicus,* Hungary

INTRODUCTION

The eastern imperial eagle (*Aquila heliaca*) is a large-sized raptor (2450–4530 g) with a broad breeding distribution range along the forest-steppe zone from East-Central Europe to the Lake Baikal in Asia (DEL HOYO *et al.* 1995). In Hungary, the imperial eagle had become a rare breeder by the 1970's, when only 15–25 breeding pairs were estimated in remote mountainous forested areas (HARASZTHY *et al.* 1996, BAGYURA *et al.* 2002). From 1989 the eagles have gradually increased their range of distribution by occupying lowland agricultural habitats, first in the vicinity of their former breeding areas (BAGYURA *et al.* 2002). As a result of such continuous increase during the last two decades, the eagles now inhabit a large part of the Hungarian Great Plain, and their known population size has reached 105 breeding pairs by 2009 (85% of those nest in lowland areas; HORVÁTH *et al.* 2010). The breeding pairs in South Slovakia, East Austria and the Czech Republic show similar trends in habitat selection and together with Hungarian eagles they constitute a unified population in the Carpathian Basin (HORVÁTH *et al.* 2002).

The diet of the eastern imperial eagle predominantly consists of small and medium sized mammals, birds and reptiles in most parts of its range, although their relative frequencies vary significantly among regions (DEL HOYO *et al.* 1995). Decades ago sousliks (*Spermophilus* spp.), and hamsters (Cricetinae) were considered the main prey species of the imperial eagle (DEL HOYO *et al.* 1995). Sousliks are still the most important food items for the largest eastern populations of Russia and Kazakhstan (BELIK *et al.* 2002, KARYAKIN *et al.* 2008). However, the severe decline of souslik populations apparently forced the eagles to adapt to other prey species in the western part of their distribution area resulting in significant changes in their diet composition. Rook (*Corvus frugilegus*) was reported to be the main prey in Serbia (VASIC & MISIRLIC 2002), and in some regions of western Russia (BELIK *et al.* 2002). In the Caucasus high frequency of reptiles (30%) and small rodents (54%) was found in the diet (ABULADZE 1996), whereas the European brown hare (*Lepus europaeus*) and chicken (*Gallus domesticus*) were the main prey species (26% and 21 %, respectively) in South Bulgaria (MARIN *et al.* 2004).

In the Carpathian Basin early literature mentioned souslik (*Spermophilus citellus*) as the main prey of the imperial eagle (CHERNEL 1899), although hamster (*Cricetus cricetus*) and occasionally hare and poultry were also noted (SZEMERE 1912, VASVÁRI 1938, NAGY 1943, PÁTKAY 1947). The first comprehensive survey on the diet of imperial eagle in Hungary was conducted between 1980 and the early 1990's (HARASZTHY *et al.* 1996) and revealed that four species comprised more than 80% of the diet including hamster (51%), hare (12%), pheasants (*Phasianus colchicus*, 12%) and souslik (7%). CHAVKO *et al.* (2007) studied the diet composition in the Slovakian part of the Carpathian Basin between 1970 and 2005, where hare (35%) was the most frequent prey, followed by hamsters (19%) and pheasants (13%), and souslik reached only 4% of the identified prey items.

Prey composition and density are among the most important factors determining the breeding success of large raptors (NEWTON 1979, GONZALEZ *et al.* 2006*a*, STEENHOF & KOCHERT 1988), as well as the settling strategies of dispersing juveniles (PENTERIANI *et al.* 2006), however, data on possible relationships between diet composition and productivity of imperial eagles are sporadic. KATZNER *et al.* (2005) compared four different breeding areas with different availability of food supplies in a dense imperial eagle population in Kazakhstan. They found that dietary diversity varied between regions, as eagles nesting near a high-density prey resource used that resource almost exclusively, while in locations with no single high-density prey species, their diet was more diverse (KATZNER *et al.* 2006). The closest relative of the eastern imperial eagle is the Spanish imperial eagle (*Aquila adalberti*). This endangered raptor confined to the Iberian peninsula is highly dependent on its main prey species, the rabbit (*Oryctolagus cuniculus*) (FERRER & NEGRO 2004). SÁNCHEZ *et al.* (2009) found variability in the diet of the Spanish imperial eagle between different regions, and suggested that where their main prey was scarce, eagles were able to adapt to the habitat by utilizing alternative prey species, such as pigeons (*Columba* spp.) or carrion crows (*Corvus cornix*).

In the present study we compared prey composition of breeding imperial eagles in different areas of Hungary. We predicted that prey composition and main prey species vary among geographical regions. Because changes in diet composition reflect the quality of food supplied to chicks, as a pilot study we compared reproductive success of eagles living in a traditional mountanious habitat where the main prey is the hamster with those settled in the plain where nestlings are fed mainly with hares.

MATERIAL AND METHODS

Study area

Diet composition of imperial eagles was analysed in the Hungarian Great Plain (Jászság, Heves, Borsod, Nagykunság and Békés Plains) and adjacent low mountains (Mátra, Bükk and Zemplén Mts) (46°30'–48°30'N, 19°30'–21°40'E, 12 600 km^2), where the great majority (> 95%) of eastern imperial eagle pairs breeding in Hungary can be found (Fig. 1). In the traditional mountainous habitats (200–700 m a.s.l.) eagles are breeding in oak (*Quercus petrea, Q. cerris*), beech (*Fagus sylvatica*) and introduced pine (*Pinus silvestris, P. nigra, Larix decidua*) forests, sometimes even ten kilometres from the nearest open foraging habitats. Recently more and more pairs have been moving closer to the edge of the mountains, and some of these pairs have even shifted their breeding territory to the foothill foraging areas. In the lowland plain habitats (80–120 m a.s.l.) small groups of poplars (*Populus spp.*) and black locust trees (*Robinia pseudoacacia*) comprise the main nesting sites. Intensive agricultural fields and smaller grasslands are the main foraging habitats usually within 3–8 km around the nest.

We compared the reproductive success of eagles in the two most intensively studied regions (see below) representing the two main habitat types (i.e. low mountains and plains) in East Hungary. The western part of the Zemplén Mountains (48°00'–48°30'N, 21°00'–21°20'E, 1800 km^2) is one of the traditional breeding habitats, where the presence of imperial eagles has been reported from as early as 1913 (VASVÁRI 1938). Intensively cultivated agricultural fields and the small-sized pastures of the Hernád River valley (110–160 m a.s.l.) provide the most important foraging areas for imperial eagles in this mountainous region. The other intensively studied region is the Heves Plain (47°30'–47°45'N, 19°50'–20°40'E, 2000 km^2) seventy kilometres from the Zemplén mountains. The Heves plain has mosaics of intensively cultivated agricultural fields and grassland habitats (85–100 m a.s.l.). The first recent breeding of the species was recorded here in 1989, and due to an intensive population expansion this region has now the biggest and densest sub-population in Hungary (HORVÁTH *et al.* 2010).

Population and prey survey

The identified and potential breeding territories of the eastern imperial eagles were monitored in the entire study area by the members of the Hungarian Imperial Eagle Working Group between 1995 and 2004. Food remains and pellets were collected twice a year. In June, during the ringing procedure, remains were collected directly from the nests and its surroundings, while following fledging (August–September) only the ground below the nests and roost sites were checked for food remains. Collected remains, including pellets, feathers, bones, hairs and skins of prey animals were identified in comparison with reference materials. The remains from each nest sites were ordered by species and type (e.g. skulls, femurs etc.). To avoid overestimation of the number of specimens two remains of the same species were considered to represent two specimens only when size differences were significant (e.g. a skull of an adult hare and a leg of a young one). This method therefore estimates the minimal number of a given prey species in the diet. A limitation of our study is that analysis of prey

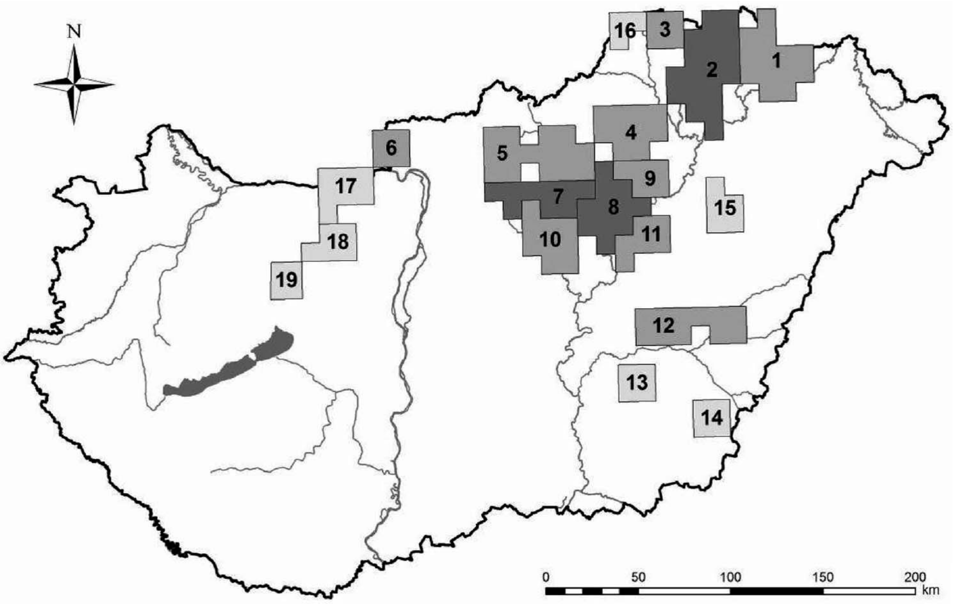

Fig. 1. Breeding distribution of the imperial eagle in Hungary between 1995 and 2004. Data are presented in a 10 km × 10 km UTM grid. Regions: (1) Eastern Zemplén Mts, (2) Western Zemplén Mts, (3) Cserehát Mts, (4) Bükk Mts, (5) Mátra Mts, (6) Börzsöny Mts, (7) West-Heves Plain, (8) East-Heves Plain, (9) Borsodi Mezőség Plain, (10) Jászság Plain, (11) Nagykunság Plain, (12) Dévaványa Plain, (13) West-Békés Plain, (14) South-Békés Plain, (15) Hortobágy Plain, (16) Aggtelek Mts, (17) Gerecse Mts, (18) Vértes Mts, (19) Eastern Bakony Mts. Dark grey: two sample areas, where diet composition and reproductive success were compared. Grey: data on prey composition presented. Light grey: no data on prey composition were available

remains and/or pellets might estimate inaccurately the proportion of larger (e.g. hare and pheasant) and smaller size preys (e.g. hamster) according to SÁNCHEZ *et al.* (2008). In the present study we applied the same sampling method at every site and used relative frequencies of the three main prey species only to compare territories, and not the proportion of prey species to each other.

We selected the two most representative study sites for the comparison of diet composition and reproductive success. These two sites represented the highest number of territories (n > 10) and contained the largest sample sizes on identified prey items (n > 200), moreover they also represented the two most typical specialization on one of the main prey species (see Results). Here the active nests were checked by distant observations for at least once per month during the breeding period (from April to August) to estimate breeding success (i.e. number of fledglings). Observations were carried out from a distance (> 1000 m) to avoid disturbance (GONZALEZ *et al.* 2006b), except one occasion in June, when 4–7 week old chicks were ringed in the nests.

We used territories as sampling units to avoid pseudoreplication that would occur if each breeding attempt of the same pair was handled separately (KATZNER *et al.* 2005). Breeding success was calculated as the average number of fledglings per successful breeding in a territory.

Statistical analysis

A hierarchical cluster analysis was carried out by the SYN-TAX 2000 for Windows programs package (PODANI 2001). We clustered the different regions on the basis of the average diet composition of imperial eagle territories in the region, choosing the similarity ratio index for the calculation of the procedure matrix and the UPGMA method for fusion strategy. Further statistical analyses were carried out with the SPSS ver. 17 programme package (SPSS Co.). As our data-sets deviated from the normal approximation, we used non-parametric tests for the comparison of the proportion of main prey species and breeding success variables between the two selected study sites. Territories with less than five identified prey items were excluded from the analyses. Statistical tests were two-tailed.

RESULTS

Diet composition in the Great Hungarian Plain

Over the 10-year study period a total of 434 nesting events in 81 different breeding territories were observed in the study area, and a total of 1297 prey items in 71 territories were collected and identified. Altogether we identified 532 bird specimens belonging to at least 43 species (Table 1) and 764 mammal specimens of 15 species (Table 2) in the diet of imperial eagles in East Hungary. Besides birds and mammals only a single reptile, remains of an unidentified Colubridae, was found (< 0.1%). We found that hare, hamster and pheasant were the most frequently taken prey species composing 65.8% of the identified specimens.

The relative frequencies of the three main species in the diet varied greatly among the different regions of the study area (Table 3). Cluster analysis according to the frequency of the three main prey species aggregated all plain regions with a single mountainous site in one cluster at dissimilarity 0.3 (Fig. 2). The single

Table 1. Summary of bird species found at imperial eagle nests and roost sites between 1995 and 2004 in Hungary. Prey item data represents the number and percentage of specimens comparing to the total number of identified prey. Territory data represents the number and percentage of territories, where at least one specimen of the given prey species was found.

	Prey item		Territory	
Species	pieces	%	pieces	%
Alauda arvensis	4	0.3	4	5.6
Anas crecca	2	0.2	2	2.8
Anas domestica	3	0.2	3	4.2
Anas platyrhynchos	21	1.6	15	21.1
Anas querquedula	2	0.2	2	2.8
Anser sp.	1	0.1	1	1.4
Anser domestica	1	0.1	1	1.4
Ardea cinerea	5	0.4	5	7.0
Asio flammeus	2	0.2	2	2.8
Asio otus	23	1.8	18	25.4
Buteo buteo	11	0.8	8	11.3
Ciconia ciconia	1	0.1	1	1.4
Circus aeruginosus	1	0.1	1	1.4
Columba sp.	11	0.8	10	14.1
Columba livia forma *domestica*	82	6.3	35	49.3
Columba oenas	2	0.2	2	2.8
Columba palumbus	22	1.7	16	22.5
Corvus sp.	8	0.6	7	9.9
Corvus corax	8	0.6	6	8.5
Corvus cornix	11	0.8	8	11.3
Corvus frugilegus	9	0.7	6	8.5
Corvus monedula	2	0.2	2	2.8
Cuculus canorus	1	0.1	1	1.4
Egretta alba	2	0.2	2	2.8
Emberiza calandra	1	0.1	1	1.4
Falco tinnunculus	7	0.5	7	9.9
Fulica atra	3	0.2	3	4.2
Galerida cristata	4	0.3	2	2.8
Gallus domesticus	19	1.5	16	22.5
Garrulus glandarius	2	0.2	1	1.4
Larus ridibundus	2	0.2	2	2.8
Limosa limosa	1	0.1	1	1.4

Table 1 (continued)

	Prey item		Territory	
Species	pieces	%	pieces	%
Numida meleagris	1	0.1	1	1.4
Perdix perdix	11	0.8	9	12.7
Pernis apivorus	2	0.2	1	1.4
Phasianus colchicus	196	15.1	53	74.6
Philomachus pugnax	1	0.1	1	1.4
Pica pica	22	1.7	15	21.1
Picus viridis	1	0.1	1	1.4
Platalea leucorodia	1	0.1	1	1.4
Scolopax rusticola	1	0.1	1	1.4
Streptopelia turtur	1	0.1	1	1.4
Strix aluco	2	0.2	2	2.8
Sturnus vulgaris	5	0.4	4	5.6
Turdus merula	1	0.1	1	1.4
Vanellus vanellus	7	0.5	6	8.5
Unidentified passerine	1	0.1	1	1.4
Unidentified bird	5	0.4	4	5.6
Total birds	532	41.0	61	85.9

mountainous site in that cluster was the Mátra Mountains where diet contained hares and pheasants with high frequency, similarly to the plain regions. Diet compositions of three mountainous sites (Börzsöny, Bükk and East Zemplén Mountains) were very similar to each other with more balanced occurrence of all three dominant prey species. One mountainous sites was found unique, because of the exceptionally high occurrence of hamsters in the diet (West Zemplén mountains).

Effects of diet composition on reproductive success

Diet composition was similar in the East and West Heves Plains (Fig. 2), therefore these two sites were aggregated into a single Heves Plain region for further analyses. Diet composition and reproductive success was compared between the aggregated Heves Plain region and the West Zemplén Mountains including those territories where successful breeding occurred during the study period (n = 14 and 10, respectively). We found significant differences between the two regions reflected in higher frequency of hares, and lower frequency of hamsters in Heves as compared to the West Zemplén Mountains (hare: Fig 3a, Mann-Whitney U test,

Table 2. Summary of mammal species found at imperial eagle nests and roost sites between 1995 and 2004 in Hungary. Prey item data represents the number and percentage of specimens comparing to the total number of identified prey. Territory data represents the number and percentage of territories, where at least one specimen of the given prey species was found.

	Prey item		Territory	
Species	pieces	%	pieces	%
Capreolus capreolus	32	2.5	25	35.2
Cricetus cricetus	271	20.9	44	62.0
Erinaceus concolor	7	0.5	5	7.0
Felis sp.	3	0.2	3	4.2
Felis catus	3	0.2	3	4.2
Lepus europaeus	387	29.8	61	85.9
Lutra lutra	1	0.1	1	1.4
Microtus sp.	3	0.2	3	4.2
Microtus arvalis	24	1.9	18	25.4
Mustela sp.	1	0.1	1	1.4
Ondatra zibethica	1	0.1	1	1.4
Ovis musimon	1	0.1	1	1.4
Rattus norvegicus	6	0.5	5	7.0
Sciurus vulgaris	1	0.1	1	1.4
Spermophilus citellus	11	0.8	9	12.7
Sus scrofa	4	0.3	4	5.6
Vulpes vulpes	8	0.6	7	9.9
Total mammals	764	58.9	69	97.2

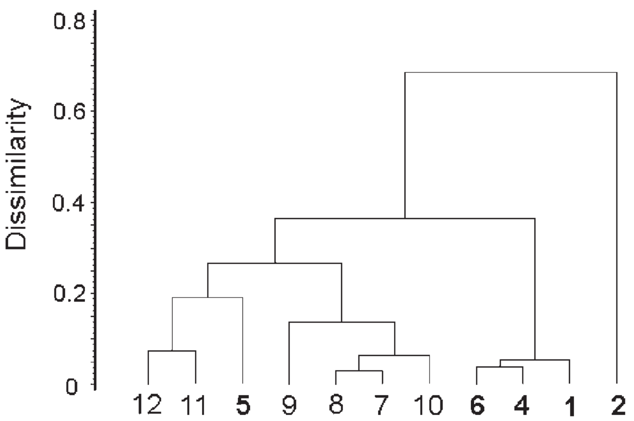

Fig. 2. Cluster analyses of imperial eagle breeding areas based on prey composition data. Region codes are presented in Fig. 1. Codes with bold characters represent mountainous habitats. The single breeding pair of the Cserehát Mountains was excluded from the analysis, because of low sample size

Table 3. Relative frequencies of the three main prey species in the diet of imperial eagles. Territorial data are averaged according to the twelve regions of the study area (standard deviations in parentheses, except for the Cserehát Mts, where only a single territory can be found).

Code	Region	Territory	Prey item	Hare	Hamster	Pheasant
1	East-Zemplén Mts	6	80	0.198 (0.124)	0.216 (0.210)	0.244 (0.214)
2	West-Zemplén Mts	12	270	0.069 (0.083)	0.558 (0.270)	0.080 (0.087)
3	Cserehát Mts	1	9	0.000	0.000	0.111
4	Bükk Mts	5	34	0.318 (0.419)	0.121 (0.138)	0.121 (0.138)
5	Mátra Mts	10	104	0.334 (0.280)	0.019 (0.043)	0.212 (0.148)
6	Börzsöny Mts	3	20	0.205 (0.056)	0.169 (0.150)	0.169 (0.150)
7	West-Heves Plain	8	242	0.465 (0.288)	0.040 (0.056)	0.127 (0.106)
8	East-Heves Plain	12	316	0.454 (0.219)	0.094 (0.069)	0.132 (0.077)
9	Borsodi Mezőség Plain	5	155	0.443 (0.320)	0.161 (0.115)	0.101 (0.069)
10	Jászság Plain	4	38	0.444 (0.134)	0.179 (0.155)	0.125 (0.144)
11	Nagykunság Plain	2	13	0.321 (0.253)	0.000 (0.000)	0.226 (0.084)
12	Dévaványa Plain	3	16	0.360 (0.096)	0.000 (0.000)	0.210 (0.214)
	Total	71	1297	0.316 (0.260)	0.173 (0.233)	0.147 (0.129)

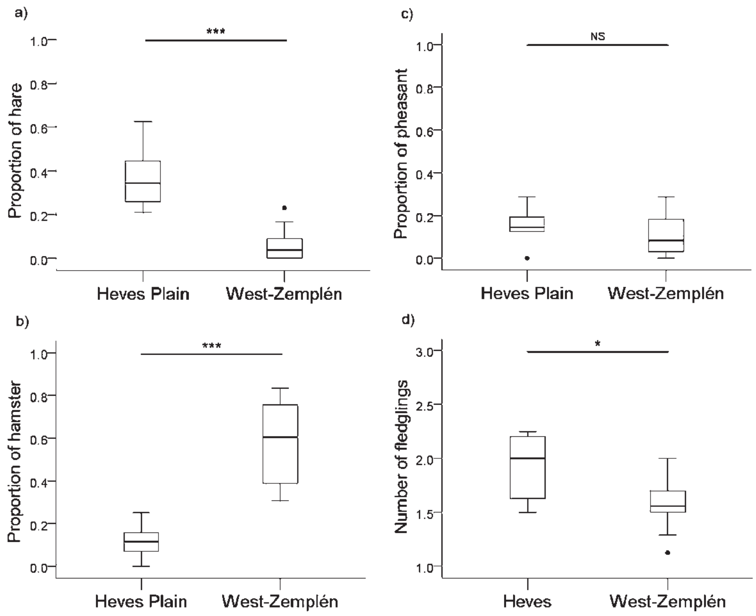

Fig. 3. Frequency of the three main prey species (a-c) and reproductive success (d) of imperial eagles in two East-Hungarian regions. Boxplots presents the minimum-maximum (whiskers), lower and upper quartiles (box) and the median (line) of the data. Dots are outliers. Significance of difference is indicated above the boxplots (NS: $P > 0.05$, *: $P < 0.05$, ***: $P < 0.001$)

$Z = -3.991$, $P < 0.001$; hamster: Fig. 3b, Mann-Whitney U test, $Z = -4.104$, $P < 0.001$). The occurrence of pheasants in the diet was intermediate in both regions without any significant difference (Fig. 3c, Mann-Whitney U test, $Z = -1.089$, $P = 0.285$). The number of fledglings was significantly higher in the hare-dominated Heves Plain than in the hamster-dominated Zemplén region (Fig. 3d; Mann-Whitney U test, $Z = -2.072$, $P = 0.042$).

DISCUSSION

Our data suggest that three prey species, the brown hare, hamster and pheasant, have especially important role in the diet of imperial eagles in Hungary. Compared to earlier data from the 1980's, our study indicates dramatic changes in prey composition (HARASZTHY *et al.* 1996). The importance of hamsters decreased (from 51% to 21%), pheasant remained more or less stable (12% vs. 15%), while hares became more abundant (from 12% to 30%) in the recently analysed prey remains. The change in the consumption of the souslik is also remarkable, as souslik used to be the 4th most frequently identified prey (7%), and now it comprises less than 1% of the consumed specimens. However, it should be noted that sousliks are still reported as the main prey in some western Hungarian breeding areas (three territories in Vértes Mts. and Gerecse Mts.), which were not included in our analyses (VISZLÓ & CSONKA unpubl. data). Although analysis of food remains and pellets might estimate inaccurately the proportion of prey species according to their body size (SÁNCHEZ *et al.* 2008), the data collection methods of the earlier and the recent study were identical, and both studies covered the great majority of the population in the given periods. Therefore we belive that the observed dramatic temporal changes in prey composition are realistic and it was not caused by the possible bias in the methodology.

Changes in diet composition are apparent not only by time, but also by habitat type. Diet of eagles nesting in the plain habitat was dominated by brown hare, whereas in most mountainous areas the hamster remained an important prey species. Such changes in time and space can reflect tendencies in population dynamics of prey species on the one hand, and changes in habitat occupied by eagles on the other hand. The European souslik is considered vulnerable and despite efforts to reintroduce them into their traditional range their numbers are currently in serious decline (VÁCZI 2006). Hamsters of similar body size provide a good alternative to souslik for the eagles, and they are still widespread and locally abundant in the agricultural habitats of East Hungary, although their populations have also been shrinking during the last decades (BIHARI 2004). The increased prevalence of the brown hare in the diet cannot be explained by the population dynamics of the prey species, because hare population size has also been continuously declining since the 1960's (BÁLDI & FARAGÓ 2007). Despite of this decline, the brown hare is still one of the most abundant medium-sized mammals in the lowland agricultural habitats currently occupied by imperial eagles, while their density is remarkably lower in the foothills of adjacent mountains, where alternative prey species are dominating in the diet (KOVÁCS *et al.* 2005). Thus imperial eagles apparently can successfully adapt to changes in the availability of prey species. Similar adaptations were reported from Spain and Kazakhstan (KATZNER *et al.* 2005, SÁNCHEZ *et al.* 2009).

Although imperial eagles can modify their diet composition as a response to the dynamics of prey populations, quantity and/or quality of available prey species is fundamentally affecting the distribution and reproductive success of imperial eagles, as it was shown for several other raptor species as well (MCINTYRE 2002, NEWTON 1979, STEENHOF & KOCHERT 1988). We found that reproductive success in the Zemplén Mountains, where the diet is dominated by hamsters, was significantly lower than in the nearby plain region (Heves Plain) with brown hare in abundance. Hamster is a predominantly nocturnal mammal with a weight of 140–400 g (BIHARI *et al.* 2007). Hares are ten times heavier than hamsters and more active at daylight, so if hamsters are not much more abundant than hares, eagles may not able to kill and transport enough hamsters to compensate for their smaller body size. Moreover the amplitude of the hamster population cycle is more pronounced than that of hares, resulting a more unpredictable food source in the hamster-dominated habitats. This is in agreement with the findings of BIHARI *et al.* (2008), who reported that the frequency of hamsters in the diet of imperial eagles in the Zemplén Mountains reflected the population cycle of the prey. Nevertheless we are aware of the limitations of the comparison of only two, albeit large habitats. As imperial eagles naturally breed in low densites and disturbance of the nests had to be avoided we were not able to collect enough prey items as to analyse the association between diet and reproduction at the level of individual territories for the whole study range.

Expansion of the imperial eagle to the plain habitat, where their main prey species are larger and/or more abundant, provides a good prospect for the survival of this globally threatened species, although this novel move creates new challenges for nature conservancy as increasing conflict of interest with small-game management and hunting associations can be predicted. There are already signs of increasing trend in illegal poisoning and shooting incidents (HORVÁTH *et al.* 2010), which if not halted can make the eagle population extremely vulnerable, as it was shown for other eagle species with similar foraging habits in Western Europe (FERRER & PENTERIANI 2008, WHITFIELD *et al.* 2004). Thus the conflicts of interest should be handled carefully. Nature conservation organizations should establish a more effective communication and cooperation with hunting associations by raising public awareness and by initiating common projects to improve hare and pheasant habitats (KOVÁCS *et al.* 2005). In parallel more attention should be focused on the decline of traditional prey species, such as the hamster (BIHARI 2004) and the souslik (BÁLDI *et al* 1995), especially in those regions, where they still constitute the main prey of imperial eagles and/or other globally threatened predators, such as the saker falcon (*Falco cherrug*).

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