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The influence of raptors (Falconiformes) and ravens (*Corvus corax*) on populations of game animals

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Abstract: *The influence of raptors* (Falconiformes) *and ravens (Corvus corax) on populations of game animals*
A study of the influence of raptors on populations of small game animals was conducted in the vicinity of Rogów (central Poland) in 2001-2003. The results obtained were compared to those obtained in studies performed in the same area during the period 1982-1992. A significant increase in the density of the population of common buzzards was reported, as well as a significant decrease in the density of the goshawk populations. In each period, the amount of small-game prey in the diets of the raptors was minimal.

Keywords: central Poland, birds of prey, raven, population dynamics, food, small game animals

INTRODUCTION

Research into the biocoenotic role of birds of prey (raptors) and their interactions with small game in central Poland was last carried out in the 1980s (Goszczyński 1985, 1991, 1997, Goszczyński & Piłatowski 1986). However, when changes in the agricultural landscape and changes in the relative abundance of predators and prey over the last 10 years were taken into account, it was decided that studies should be performed for a second time in the same area to compare the findings.
More specifically, the research described here sought to establish the distribution and density of the populations of raptors and ravens in the given area and to try to determine the composition of their diets, especially the role played by small game animals.

STUDY AREA

Research was carried out in central Poland around Rogów (51º48'N, 19º53'W), within a 105 km^2 study area comprising a mosaic of forests (23%), arable land (59%), permanent grassland (5%) and orchards (5%). The forests here take the form of 7 complexes (Fig. 1), ranging in size between 60 and 1000 ha. The dominant types of forest habitat are fresh mixed/broadleaved forest (46%) and fresh broadleaved forest (38%) (Zielony 1993), while the prevalent forest-forming species is Scots pine (*Pinus sylvestris)*, which accounts for a 70% share. The average age of the tree stands is approximately 55 years. The study area is traversed by two rivers, the Mroga and the Rawka, while the southern part contains managed fishponds. In the cultivated areas, cereal crops prevail, grown on land of soil-quality classes IV and V. The study area also coincides with Hunting Districts nos. 59, 71 and 72, with game management being the responsibility of the Game Rearing Centre (*Ośrodek Hodowli Zwierzyny*), subordinate to the Forest Experimental Station of the Warsaw University of Life Sciences (SGGW).
A decline in the abundance of small game animals has been observed for many years now. The densities of brown hares (*Lepus europaeus*) in the area's fields in the second half of the 1980s ranged from 21-31 animals per 100 ha (Dzięciołowski *et al.* 1999) (Wasilewski, unpublished data), but by 2001-2003, the densities had dropped to approximately 10 hares (data from the Department of Forest Zoology and Wildlife Management) and, by October 2005, to just 8 per 100 ha. The annual takes of hares in turn fell from the 275 noted in the late

1980s to just a couple of specimens by the 2003-2006 period (data from the Rogów Forest Experimental Station). A similar situation would seem to apply to pheasants (*Phasianus colchicus)* and grey partridges (*Perdix perdix)*, the latter the subject of a self-imposed ban on shooting in place since 1998. The numbers of the non-native rabbit *Oryctolagus cuniculus* fell to practically zero at the beginning of the 20th century.

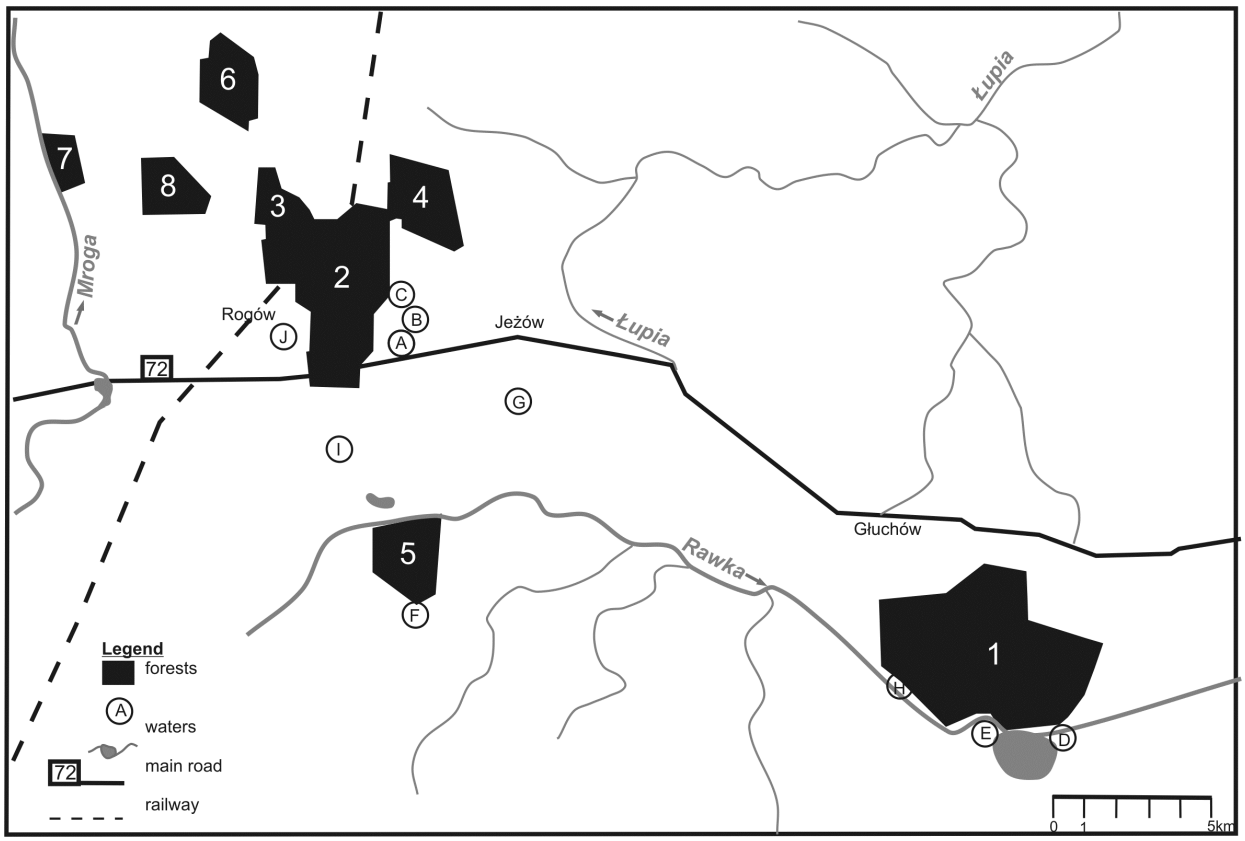

Figure 1. Distribution of forest complexes (1-8) and villages (A-J) in the study area: 1 – Głuchów (968.5 ha), 2 – Zimna Woda i Wilczy Dół (449.5 ha), 3 – Doliska (202.3 ha), 4 – Górki (206.98 ha), 5 – Popień (168.3 ha), 6 – Zacywilki (166.4 ha), 7 – Kołacin (60.0 ha), 8 – Jasień (134.1 ha); A – Strzelna, B – Jasienin Mały, C – Jasienin Duży, D – Stare Byliny, E – Łochów, F – Wola Łokotowa, G – Kosiska, H – Wola Naropińska, I – Popień, J – Marianów Rogowski. Area of forest complexes according to Zaręby (1993).

MATERIAL AND METHODS

Within the framework of the field studies pursued between 2001 and 2003, a standard method based on searches for nests and preceded by observations of courting pairs was applied to determine the numbers of pairs of different raptor species breeding. In turn, the material used to determine dietary composition took the form of regurgitated pellets and remains of prey collected through the February-July period, and analysis again following a standardised procedure (based on Ruprecht 1979). The keys used to identify bone material followed the methods of Engelmann *et al.* (1985), März (1987) and Pucek (1984). In the many cases where the pellets contained only fragments of bone, microscopic observation of hair and fur was used, according to the methods of Dziurdzik (1973) and Teerink (1991). The assignment of feathers to given identified species in turn referenced the comparative collections of the Department of Forest Zoology and Wildlife Management of SGGW.

In these ways, the percentage contributions of different species to the overall biomass in the diet were determined, as were the frequencies of occurrence of different types of prey. It was decided not to continue with the analysis of the composition of the winter diet that had been performed within the framework of previous studies (Bielecki 1992, Piłatowski 1986) because those studies had demonstrated that game species played only a limited role in the diets of birds of prey, which ate carrion and treated active predation of the species in question as nothing more than a complementary activity.

RESULTS AND DISCUSSION

Goshawk (*Accipiter gentilis)*

The survey revealed 11 breeding pairs of this species (Gryz *et al.* 2006), and comparison with the previous period of research revealed a marked decline in abundance (Table 1) – a trend also noted for other parts of Poland (Matusiak *et al.* 2002, Olech 2004, Keller and Buczek unpublished). Feral pigeons (*Columba livia* f. *domestica)* represent the main component of the diet of this species, although 6 game species were also noted, i.e., grey partridge, pheasant, mallard (*Anas platryhynchos)*, wood pigeon (*Columba palumbus)*, roe deer (*Capreolus capreolus)* and brown hare (Table 2). However, as in the previous period of study, the shares of the diet accounted for by these species were always very low. Indeed, a comparison with the results obtained in the 1980s revealed no significant changes in dietary composition, with the exception of an increased presence noted for jays (*Garrulus glandarius)* ($t=3.75$, $p<0.05$ in the test for the comparison of two percentages according to Bailey 1959) (Table 3). Furthermore, the remains of roe deer found beneath a nest bore evident signs of mechanical injury, most likely caused by a rotary mower.

Table 1. The number of breeding pairs of four raptor species in the study area in the two analyzed periods

Species	1982-1992 [1]	2002-2003 [2]
Accipiter gentilis	17	11
Buteo buteo	18	31
Accipiter nisus	?	16
Corvus corax	6	8

[1] Goszczyński 1997, Goszczyński J. unpbl.
[2] Gryz et al. 2005

Table 2. Diet composition of the goshawk in the breeding period in the years 2001-2002 (Krauze et al. 2005)

OFIARA	biomass [g]	N of prey	% of prey items	total biomass [g]	% of biomass
Columba livia f. *domestica*	400	100	32,3	40000	57,4
Columba palumbus	475	21	6,8	9975	14,3
Streptopelia decaocto	225	3	1,0	675	1,0
Garrulus glandarius	175	25	8,1	4375	6,3
Pica pica	200	2	0,6	400	0,6
Corvus corax	500	1	0,3	500	0,7
Dendrocopos major	70	8	2,6	560	0,8

Picus spp.	70	4	1,3	280	0,4
Turdus philomelos	50	3	1,0	150	0,2
Turdus merula	70	5	1,6	350	0,5
Turdus viscivorus	80	2	0,6	160	0,2
Turdus pilaris	70	1	0,3	70	0,1
Turdus spp.	65	4	1,3	260	0,4
Sturnus vulgaris	80	2	0,6	160	0,2
Phasianus colhicus	500	3	1,0	1500	2,2
Gallus domesticus	500	6	1,9	3000	4,3
Perdix perdix	430	1	0,3	430	0,6
Numidia meleagris	500	1	0,3	500	0,7
Strix aluco	400	1	0,3	400	0,6
Asio otus	230	4	1,3	920	1,3
Buteo buteo ad.	200	1	0,3	200	0,3
Buteo buteo juv.	100	2	0,6	200	0,3
Anas platyrhynchos	500	1	0,3	500	0,7
Passer sp.	25	1	0,3	25	0,0
Parus sp.	20	1	0,3	20	0,0
Luscinia sp.	23	1	0,3	23	0,0
Alauda arvensis	35	2	0,6	70	0,1
Phyloscopus sp.	8	2	0,6	16	0,0
Anthus trivialis	20	1	0,3	20	0,0
Coccothraustes coccothraustes	55	2	0,6	110	0,2
Corduelis spinus	12	1	0,3	12	0,0
Emberiza citrinella	30	2	0,6	60	0,1
Fringilla coelebs	20	1	0,3	20	0,0
Lanius collurio	33	1	0,3	33	0,0
Lanius excubitor	66	1	0,3	66	0,1
Lanius sp.	50	1	0,3	50	0,1
Smal bird indet.	25	38	12,3	950	1,4
Medium bird indet.	75	8	2,6	600	0,9
∑Aves		**264**	**85,2**	**67640**	**97,1**
Myodes glareolus	20	14	4,5	280	0,4
Rodentia indet.	20	6	1,9	120	0,2
Talpa europea	80	2	0,6	160	0,2
Sciurus vulgaris	300	1	0,3	300	0,4
Lepus europeus	100	4	1,3	400	0,6
Capreolus capreolus	200	2	0,6	400	0,6
Canis familiaris	200	1	0,3	200	0,3
Mammalia indet.	20	2	0,6	40	0,1
∑Mammalia		**32**	**10,3**	**1900**	**2,7**
Reptilia	18	4	1,3	72	0,1
Rana sp.	15	1	0,3	15	0,0
Geotrupes sp.		6	1,9	+	+
Melolontha melolontha		1	0,3	+	+
Aglais urticae		1	0,3	+	+
Insecta indet.		1	0,3	+	+
Total number of prey/biomass		**310**	**100**	**69629**	**100**

+ trace biomass

Table 3. Diet composition of goshawks (prey percentage) in the area of Rogów in the two analyzed periods

Prey	1982–1990 [1]	2001–2002 [2]
Pigeons	40,9	39,7
Poultry	2,9	2,3
Garrulus glandarius	2,9	8,2
Picidae	5,2	3,9
Turdus spp.	4,2	3,6
Perdix perdix + *Phasianus colchicus*	1,0	1,3
Lepus europaeus	1,2	1,0
∑ Aves	92,1	84,9
∑ Mammalia	7,8	10,5
N	1513	310

[1] Goszczyński 1991
[2] Krauze et al. 2005

Common Buzzard (*Buteo buteo)*

The inventory total of 31 breeding pairs represented a marked increase in abundance when compared with the 1980s (Goszczyński *et al.* 2005), when the study area supported just 18 nesting pairs (Table 1). The trend for the numbers of buzzards seen here is in line with those noted nationally (review in Tomiałojć & Stawarczyk 2003). The diets in this case were found to encompass 5 game species, i.e., grey partridge, brown hare, wood pigeon, roe deer and wild boar (*Sus scrofa)*, but the role played in the diet in terms of both the numbers of individuals and overall biomass was vanishingly small (Table 4). The remains of roe deer found around buzzard nests resembled those preyed upon by goshawks in that they showed signs of injury by agricultural machinery. By frequency of occurrence, voles (*Microtus* spp.) plus small birds formed the main part of the diet. In contrast, feral pigeons dominated in the biomass (Table 4). Comparisons with the 1982-1992 study suggest an increase in the share of the diet of common buzzards taken by birds, as well as a decrease in the role played by mammalian prey (Table 5).

Table 4. Diet composition of the common buzzard in the breeding period in the years 2001-2002

OFIARA	biomass [g]	N of prey	% of prey items	total biomass [g]	% of biomass
Microtus arvalis	20	21	2,6	420	0,9
Microtus oeconomus	42	4	0,5	168	0,4
Microtus spp.	31	190	23,4	5890	13,1
Microtus subterranus	20	1	0,1	20	0,0
Myodes glareolus	20	39	4,8	780	1,7
Mus musculus	20	7	0,9	140	0,3
Apodemus spp.	25	22	2,7	550	1,2
Muridae	20	3	0,4	60	0,1
Rattus sp.	250	1	0,1	250	0,6
Rodentia indet.	20	100	12,3	2000	4,5
Talpa europea	80	87	10,7	6960	15,5
Sorex spp.	9	17	2,1	153	0,3

Mustela nivalis	60	1	0,1	60	0,1
Capreolus capreolus	200	1	0,1	200	0,4
Lepus europeus	100	6	0,7	600	1,3
Sus scrofa	200	1	0,1	200	0,4
Felis catus	200	1	0,1	200	0,4
∑Mammalia		**502**	**61,8**	**18651**	**41,6**
Columba livia f .*domestica*	400	33	4,1	13200	29,4
Columba palumbus	475	3	0,4	1425	3,2
Streptopelia decaocto	225	1	0,1	225	0,5
Dendrocopos major	70	3	0,4	210	0,5
Picus spp.	70	5	0,6	350	0,8
Garrulus glandarius	175	10	1,2	1750	3,9
Gallus domesticus	500	6	0,7	3000	6,7
Perdix perdix	430	1	0,1	430	1,0
Asio otus	230	1	0,1	230	0,5
Turdus pilaris	80	4	0,5	320	0,7
Turdus viscivorus	80	2	0,2	160	0,4
Turdus philomelos	50	5	0,6	250	0,6
Turdus merula	70	3	0,4	210	0,5
Sturnus vulgaris	80	3	0,4	240	0,5
Fringilla coelebs	20	3	0,4	60	0,1
Sitta europaea	20	1	0,1	20	0,0
Bombycilla garrulus	50	1	0,1	50	0,1
Regulus regulus	6	1	0,1	6	0,0
Alauda arnensis	35	1	0,1	35	0,1
Corduelis spinus	12	1	0,1	12	0,0
Smal bird indet.	25	146	18,0	3650	8,1
∑Aves		**234**	**28,8**	**25833**	**57,6**
Anguis fragilis	40	2	0,2	80	0,2
Natrix natrix	93	1	0,1	93	0,2
Reptilia	18	10	1,2	18	0,4
Carabus auronitens		1	0,1	+	+
Carabidae sp.		2	0,2	+	+
Melolonyha melolontha		8	1,0	+	+
Geotrupes sp.		9	1,1	+	+
Leptinotarsa decemlineata		1	0,1	+	+
Insecta indet.		42	5,2	+	+
Total number of prey/biomass		**812**	**100**	**44842**	**100**

+trace biomass

Table 5. Diet composition of buzzards (prey percentage) in the area of Rogów in the two analyzed periods

Ofiara	1982–1990 [1]	2001–2002 [2]
Pigeons	3,3	4,1
Poultry	1,0	0,7
Picidae	0,8	1,0
Turdus spp.	0,5	1,7

Perdix perdix + *Phasianus colchicus*	0,2	0,1
Lepus europaeus	1,7	0,7
∑ Aves	18,1	28,8
∑ Mammalia	79,9	61,8
Amphibia	1,2	-
Reptilia	0,8	1,2
N	4925	812

[1] *Goszczyński 1991*
[2] *original data*

Sparrowhawk (*Accipiter nisus)*
The study area was found to support 16 pairs of this species (Gryz *et al.* 2006). No comparison with the past is possible in this case, however, as sparrowhawks were not surveyed in the earlier period. Pellets and remains at plucking posts provided for the identification to the species level of just 31 prey items, among which small birds prevailed, with no game animals whatsoever being present.

Raven (*Corvus corax)*
The eight breeding pairs noted (Gryz *et al.* 2006) represented a 2-pair increase compared with the 1980s (Table 1), although the numbers of breeding birds were found to be augmented greatly by some 30-35 non-territorial (most likely young) birds forming flocks of various sizes. These ravens were regularly observed feeding on bait items put out by hunters and on post-slaughter wastes dumped in forests illegally. Unfortunately, it did not prove possible to collect enough material for useful research to be carried out on dietary composition among ravens. However, the four pellets of this species that were obtained comprised cereal grains, non-organic residues (plastic film and string) and the hair of livestock (i.e., cattle (*Bos primigenius* f. *domestica)* and horses (*Equus ferrus* f. *domestica*).

Other birds nesting in the area under study were the hobby (*Falco subbuteo*), kestrel (*F. tinnunculus)*, marsh harrier (*Circus aeruginosus)* and Montagu's harrier (*Circus pygargus)*. Non-breeding white-tailed eagles (*Haliaeetus albicilla)* were also observed, as well as migrating ospreys and wintering rough-legged buzzards (*Buteo lagopus)*.

Work on the influence of the assemblage of birds of prey on brown hares in the area around the SGGW Forest Experimental Station was performed by Juszko (2005), whose data revealed still smaller shares accounted for by game animals in the diets of goshawks and buzzards. In that case, the only species found to reduce the populations of hares in any meaningful way was the red fox (*Vulpes vulpes)*. The long-term studies run in the Rogów area reveal that only a vanishingly small influence on the populations of small game is exerted by birds of prey – a finding in line with the results obtained in, for example, the Białowieża Primaeval Forest (Jędrzejewski *et al.* 1994, Jędrzejewska and Jędrzejewski 2001) and the Suwałki region of NE Poland (Zawadzka and Zawadzki 1998, Zawadzka *et al.* 2002). Only work done in the Kampinos Forest near Warsaw was able to point to a greater share in the diet of goshawks accounted for by game animals (Olech 1997), albeit on the basis of different collection methods from those employed in the present study and thus capable of exaggerating the role played in the diet. In any case, data on the abundance of small game within the Kampinos National Park are unfortunately lacking.
The fact that most bird of prey species in Poland have rebuilt their populations (see the review in Tomiałojć & Stawarczyk 2003) at a time when the abundance of small game has been in

marked decline (see Bryliński *et al.* 2005) has led to such a direct association of the two phenomena that a majority of hunters now perceive birds of prey as among the main causal factors underpinning the disastrous situation that now characterises the populations of the brown hare, pheasant and grey partridge in Poland.
While still "unofficial" in character, calls are now clearly heard for a response to the above situation by culling common buzzards, goshawks and even species featured on the Polish Red List of Endangered Species such as the hen harrier (*Circus cyaneus)* (Manelski 1999). Such behaviour is hardly conducive to the favourable image of Polish hunting and certainly leaves hunters compromised in the eyes of birdwatchers and ornithologists.
Data on the illegal persecution of raptors – extending even to such extreme rarities as the osprey (*Pandion haliaetus)*, spotted eagle (*Aquila clanga)* and hen harrier – may be found on the website of Poland's Eagle Conservation Committee (*Komitet Ochrony Orłów*) (www.koo.org.pl), as well as elsewhere (*Las Polski* 6/2006, data from the Department of Forest Zoology and Wildlife Management SGGW). Furthermore, it is clear that these data represent just the tip of the iceberg of current poaching using hunters' weapons. The 21st century is sadly bringing a resurgence of activity among adherents to the 19th century "German School", whereby indicators of correct game management included efforts to combat all predators and supply game with hundreds of tonnes of supplementary food.
All of this should be set against the true causes of the decline of small game species, which need to be sought first and foremost among the far-reaching changes taking place in the habitats where these species live. For many years now, the biodiversity of agrocoenoses throughout Europe has been the subject of an ongoing process of near-annihilation. In light of unstinting efforts at game management, the decline or disappearance of game animals is in fact the last link in the chain of agroecosystem degradation. For example, the fields have long been deprived of many once-typical weeds of cultivation, such as summer pheasant's-eye (*Adonis aestivalis*) (Zając and Zając 2001), pheasant's-eye (*Adonis annua*) (Kwiatkowska and Nowak 2002), hare's-ear mustard (*Conringia orientalis*) (Zając *et al.* 2001) and perfoliate pennycress (*Thlaspi perfoliatum*) (Kwiatkowska and Nowak 2002). The false flax *Camelina alyssum* – regarded as a persistent weed just a few decades ago – has gone extinct worldwide and is not saved even in botanical gardens (Mirek 2001). This example demonstrates how a change in crop structure combined with the use of herbicides and better cleaning of material for sowing may lead to the complete disappearance of a species that farm practices had previously made abundant. Likewise in Poland, in just over 10 years, it has become much harder to spot corncockles (*Agrostemma githago)* (Kącki 2002) and cornflowers (*Centaurea cyanus)* (Gibbons & Brough 1995) in the agricultural landscape – notwithstanding the fact that both species have been thought of as weeds within recent memory. Similar phenomena may be noted for elements of the farmland's invertebrate and vertebrate fauna of no direct interest to hunters. For example, almost every species of bird associated with Europe's farmed landscape is in decline, often steep decline (see the reviews in Tryjanowski 1999, Błaszkowska 2004, Jawińska 2004, www.mppl.pl). Modern farming seeks to create optimal conditions for just a single plant species over very large areas, which is linked irrevocably with the direct or indirect disappearance of (all) other elements of the biocoenosis. It is therefore to be expected that the conservation situation will worsen as agriculture continues to modernise in the direction of "European standards", while other areas of land in classes V and VI deemed unsuitable for farming are earmarked for either afforestation or building. The remaining arable land will in turn be given over to monocultures, mainly of wheat, maize and oilseed rape.
Farmers in Poland have yet to note any link between game populations and their incomes, thus far ignoring matters of nature conservation altogether. This in part reflects the lack of any connection in Polish law between the ownership of land and the ownership of the game

present on it. Bearing in mind the current ownership structure characterising Poland's arable land, there are no mechanisms (besides material ones) by which multifunctional, game-friendly farming might come to be promoted. It also seems unlikely that agri-environmental programmes will become more widespread here because the fuller use of these initiatives mainly characterises farming in countries with climatic and geomorphologic conditions unfavourable to agriculture, such as Austria, Switzerland, Finland and Sweden (Dobrzyńska *et al.* 2004).

REFERENCES

1. BAILEY N.T.J. 1959: Statistical methods in biology. English Universities Press. London.
2. BIELECKI P. 1992: Liczebność ptaków drapieżnych w krajobrazie rolniczym w sezonie zimowym. Praca magisterska, Katedra Zoologii Leśnej i Łowiectwa SGGW.
3. BŁASZKOWSKA B. 2004: Ptaki – rolnictwo - Unia Europejska. Ptaki, biuletyn OTOP. Gdańsk.
4. BRYLIŃSKI R., KAMIENIARZ R., PANEK M. 2005: Sytuacja zwierząt łownych w Polsce 2004-2005. Stacja Badawcza PZŁ. Czempiń.
5. DOBRZAŃSKA N., JOBDA M., LISOWSKA A., LIRO A., SZEMPLIŃSKA M. 2004: Przewodnik po krajowym programie rolnośrodowiskowym. MRiRW. Warszawa .
6. DZIĘCIOŁOWSKI R., WASILEWSKI M., PRZYPAŚNIAK J., WAWRZYNIAK P. 1999: Recent changes in European hare (*Lepus europaeus*) population in Poland. In THOMAIDIS C., KYPRIDEMOS N. (eds.), Agriculture Forestry – Game, Integrating Wildlife in Land Management. Proceedings of XXIV th Congress International Union of Game Biologists, Thessaloniki, Greece: 401-408.
7. DZIURDZIK B. 1973: Klucz do oznaczania włosów ssaków Polski. Acta zool. cracov. 18: 73-92.
8. ENGELMANN W., FRITZSCHE J., GUNTHER R., OBST F. 1985: Lurhe und Kriechtiere Europas. Neuman Leipzing. Leipzig Redebeul.
9. GIBBONS B., BROUGH P. 1995: Atlas roślin Europy Północnej i Środkowej. Mulico. Warszawa.
10. GOSZCZYŃSKI J. 1985: Wpływ strukturalnego zróżnicowania krajobrazu ekologicznego na przebieg interakcji drapieżnik – ofiara. SGGW. Warszawa.
11. GOSZCZYŃSKI J. 1991: The food habit of Buzzards and Goshawks during the nesting period. In: CASANYI S., ERNHAFT J. (eds.). Trans. XXth Congres Int. Union Game Biologists, Univ. Agricult. Sci., Gödölö, Hungary. Part 1: 377-390.
12. GOSZCZYŃSKI J. 1997: Density and productivity of Common Buzzard *Buteo buteo* and Goshawk *Accipiter gentilis* population in Rogów, Central Poland, Acta Ornithol. 32; 149-155.
13. GOSZCZYŃSKI J. 2001: The breeding performance of the Common Buzzard *Buteo buteo* and Goshawk *Accipiter gentilis* in Central Poland. Acta Ornithol. 36; 105-110.
14. GOSZCZYŃSKI J., GRYZ J., KRAUZE D. 2005: Fluctuations of a Common Buzzard *Buteo buteo* population in Central Poland. Acta. Ornithol. 40; 75-78.
15. GOSZCZYŃSKI J., PŁATOWSKI T. 1986: Diet of the common buzzards (*Buteo buteo* L.) and goshawks (*Accipiter gentilis* L.) in the nesting period. Ecol. pol. 34; 655-667.
16. GRYZ J., KRAUZE D., GOSZCZYŃSKI J. 2006: Liczebność ptaków szponiastych *Falconiformes* i kruka *Corvus corax* w okolicach Rogowa (środkowa Polska). Not. Orn. 47; 43-57.
17. JAWIŃSKA D. 2004: Monitoring pospolitych ptaków lęgowych. Ptaki, biuletyn OTOP. Gdańsk.
18. JĘDRZEJEWSKA B., JĘDRZEJEWSKI W. 2001: Ekologia zwierząt drapieżnych Puszczy Białowieskiej. PWN. Warszawa.

19. JĘDRZEJEWSKI W., SZYMURA A., JĘDRZEJEWSKA B. 1994: Reproduction and food of the Buzzard *Buteo buteo* in relation to the abundance of rodents and birds in Białowieża National Park, Poland. Ethol. Ecol. Evol; 179-190.
20. JUSZKO S. 2005: Wpływ drapieżnictwa na śmiertelność zająca szaraka w środkowej Polsce. Praca magisterska, Zakład Zoologii Leśnej i Łowiectwa SGGW.
21. KRAUZE D., GRYZ J., GOSZCZYŃSKI J. 2005: Food composition of goshawk (*Accipiter gentilis* L. 1758) during nesting season in the Rogów Forest (central Poland), Folia Fores. Pol., Series A, 48; 45-51.
22. KWIATKOWSKA A. J., Nowak S. 2002: Miłek letni *Adonis aestivalis*. W: Czerwona księga roślin Województwa Opolskiego. NOWAK A., SPAŁEK K. (red.): 70. Przyroda Polska. Opole.
23. KWIATKOWSKA J., NOWAK S. 2002: Tobołki przerosłe *Thlaspi perfoliatum*. W: Czerwona księga roślin Województwa Opolskiego. NOWAK A., SPAŁEK K. (red.): 123. Przyroda Polska. Opole.
24. MANELSKI 1999: Propozycje gospodarowania populacją bażanta. W: Zwierzyna drobna jako elementy bioróżnorodności środowiska przyrodniczego. KUBIAK S. (red.): 152-157. Włocławskie Towarzystwo Naukowe, Włocławek.
25. MATUSIAK J., WÓJCIAK J., KELLER M. 2002: Rozmieszczenie, liczebność i efekty lęgów ptaków szponiastych *Falconiformes* w Lasach Strzeleckich. Not. Orn. 43; 145-161.
26. MARZ R. 1987: Gewöll-und Rupfungskunde. Akademie- Verlang. Berlin.
27. MIREK Z. 2001: Lnicznik właściwy *Camelina alyssum*. W: Polska Czerwona Księga Roślin. KAŹMIERCZAKOWA R., ZARZYCKI K (red.): 170-171. IB PAN. Kraków.
28. NOWAK S., NOWAK A. 2002: Kąkol polny *Agrostemma githago*. W: Czerwona księga roślin Województwa Opolskiego. NOWAK A., SPAŁEK K. (red.): 44. Przyroda Polska. Opole.
29. OLECH B. 1997: Diet of Goshawk *Accipiter gentilis* in Kampinoski National Park (Central Poland) in 1982-1993. Acta Ornithol. 32; 191-200.
30. OLECH B. 2004: Kampinoski Park Narodowy- ptaki drapieżne. KPN. Izabelin.
31. PIŁATOWSKI T. 1986: Skład pokarmu myszołowa i gołębiarza. Praca magisterska, Katedra Zoologii Leśnej i Łowiectwa SGGW.
32. PUCEK Z. (red,) 1984: Klucz do oznaczania ssaków Polski. PWN. Warszawa.
33. RUPRECHT A.L. 1979: Food of the Barn owl, *Tyto alba guttata* (C.L.Br) from Kujawy. Acta Ornithol. 16; 493-511.
34. TERRINK B. J. 1991: Hair of West-European Mammals. Research Institute for Nature Management. Cambridge University Press, Cambridge.
35. TOMIAŁOJĆ L., STAWARCZYK T. 2003: Awifauna Polski. Rozmieszczenie, liczebność i zmiany. PTPP „pro natura". Wrocław.
36. TRYJANOWSKI P. 1999: Efekt of habitat diversity on breeding birds: comparison of farmland bird community in the region of Wielkopolska (W Poland) with relevant data from other European studies. Pol. J. Ecol. 47; 153-174.
37. ZAJĄC M., ZAJĄC A. 2001: Miłek szkarłatny *Adonis flammea*. W: Polska czerwona księga roślin. KAŹMIERCZAKOWA R., ZARZYCKI K. (red.): 144-145. Instytut Botaniki im. Władysława Szafera PAN. Kraków.
38. ZAJĄC M., ZAJĄC A., KUCHARCZYK M. 2001: Pszonacznik wschodni *Conringia orientalis*. W: Polska czerwona księga roślin. KAŹMIERCZAKOWA R., ZARZYCKI K. (red.): 172-173. IB PAN. Kraków.
39. ZAWADZKA D., ZAWADZKI J. 1998: The Goshawk *Accipiter gentilis* in Wigry National Park (NE Poland) - numbers, breeding results, diet composition and prey selection. Acta Ornithol. 33; 181-190.

40. ZAWADZKA D., ZAWADZKI J., SKUBIS L. 2002: Skład pokarmu myszołowa *Buteo buteo* w gradiencie lesistości na Suwalszczyźnie. Not. Orn. 43; 9-19.
41. ZIELONY R.1993. Warunki przyrodnicze lasów doświadczalnych SGGW w Rogowie. SGGW. Warszawa.

Streszczenie: *Wpływ ptaków szponiastych* (Falconiformes) *i kruka* (*Corvus corax*) *na populacje zwierzyny*
Badania na wpływem ptaków szponiastych na populacje zwierzyny drobnej prowadzono w okolicach Rogowa (środkowa Polska) w latach 2001-2003. Uzyskane wyniki porównywano z danymi pochodzącymi z tego terenu z lat 1982-92. Wykazano znaczny wzrost liczebności myszołowa oraz istotny spadek liczebności jastrzębia. W obydwu porównywanych okresach udział zwierzyny drobnej w diecie drapieżników skrzydlatych był minimalny.

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