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The response of Eurasian kestrel *Falco tinnunculus* to falconry at Deblin Military Airfield, East Poland

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Abstract: Birds, including kestrels, constitute a serious impediment to air traffic and are considered pests when they disrupt aviation operations. This study investigated the behaviour of kestrels at Deblin Military Airfield (eastern Poland) in response to bird strike risk management by means of falconry. Trained raptors changed the behaviour of kestrels. During the period when trained raptors worked at the airfield, kestrels were less often found there compared to the control period. During falconry sessions, kestrels perched less often compared to the control period. Kestrels also hovered less during falconry sessions compared to the control period. Falconry reduced the risk of bird strikes at the airfield and also changed the composition of kestrels' diets.

Key words: Avian pests, pest management, bird strike, airfields, kestrel

1. Introduction

Birds, including the Eurasian kestrel *Falco tinnunculus* (L.), a species of falcon fairly common in Eurasia, constitute a very serious threat to air traffic in Europe and the countries of Eurasia. Birds including kestrels present at airfields may be considered pests if they disturb aviation operations.

They have caused a number of serious collisions on many airfields (Satheesan and Grubh, 1992; Richardson, 1996; Jacoby, 1998; Krupka, 2000; Kitowski, 2011). For example, in 2002–2004, at 12 major airfields of Germany, diurnal birds of prey caused 215 (26.5%) out of 810 strikes in which the systematic position of the birds involved was identified. Among those, kestrels had the record for known species, responsible for 25.2% of the collisions (Breuer, 2005). In Italy, where 275 cases of bird strikes on 27 airfields were analysed in 2007, as many as 24.0% were caused by diurnal birds of prey. Kestrels were clearly dominant among them (86.4%) (ENAC and BSCI, 2007). British data concerning the 10 bird species most frequently hit by aircrafts in 2009 showed that kestrels caused 2.6% out of 1517 collisions (CAA, 2010). Data for 2008 identified kestrels as being involved in 3.9% of 1154 occurrences (CAA, 2009).

This makes it important to study the behaviour of kestrels on those airfields where falconers manage bird populations. Knowledge of their behaviour allows us to judge the effectiveness of this sustainable method of bird strike risk management. On the other hand, other diurnal birds of prey, including other falcons such as goshawk *Accipiter gentilis*, peregrine *Falco peregrinus*, saker *Falco cherrug*, and gyrfalcon *Falco rusticolus*, are used with increasing frequency to manage birds on airfields, supplanting invasive methods such as mass culling or poisoning of birds or destroying their eggs (MacKinnon et al., 2001; ENAC and BSCI, 2007; Kitowski, 2011). The aim of this study was to assess the effectiveness of falconry on kestrel behaviour on airfields and food composition.

2. Materials and methods

2.1. Study area

The studies were conducted in the area of the Deblin Military Airfield (DMA) (51°33′N, 21°53′E, eastern Poland). The area of the airfield is a rectangle with a length of about 4.5 km and a width of about 1.5 km. The location in the warm valley of the Vistula River allows the airfield to be used year-round. During summer, the grassy part of the DMA is mowed. The airfield has 2 runways, including 1 grass runway, as well as many access roads and taxiways. Near the concrete runway in the central part of the airfield there are about 300 structural devices responsible for the execution of air traffic procedures, including beacons, flags, lighting and navigation lamps, main runway curb signs, approach path indicators, critical area signs, photocells, masts, antennas, and radar units. About 40% of these are located in the proximity of the runway. Because the peripheral areas of the airfields are near small

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watercourses, they are more humid than the drier centre. The DMA is characterised by a high frequency of bird strikes (Kitowski, 2011).

2.2 Methods

The studies were conducted using the method of scanning (Altman, 1974; Skonieczny and Dunk, 1997; Kitowski 2003) the critical zones of the runway from 2 observation points. For the purpose of analysing the response of kestrels to bird strike risk management implemented by a falconer, their behaviours were grouped into 4 categories as perching, cruising, hovering (for details, see Jimenez and Jaksic, 1989), and other. Perching and hovering often precede attacks on prey (Village, 1990). We also recorded perch sites. Observations were made from 2 elevated points. The first was near the critical touchdown zone. The other near the take-off critical zone. Scans spanned an angle of 120° with 60° on either side of these zones. Between 1 May 2007 and 30 August 2008, a total of 6 sessions of 12 h and 2 sessions of 6 h were carried out. This study period will be further referred to as the control period. During observations, 10 scans of the apron area were performed in 1 h. This gave a total of 84 observation hours and 840 scans. In the control period, no effective or widespread bird dispersal methods were used at the airfield. The exception was the very occasional use of one propane gas cannon for the entire area of the airfield. Probably because the position of the cannon had remained unchanged for many years, birds, including kestrels, ignored this tool completely. This was most probably due to advanced habituation. The second period dealt with the time when birds on the airfield were dispersed by a falconer. Observations were carried out on the same days of the months and within the same period of the year: between 1 September 2008 and 30 April 2009. The experimental period also included 84 h during which 840 scans were performed, for 1680 scans in all. Scans were performed with a 60-power telescope and 10 × 60 binoculars. The falconer was not informed about the location of focal points. His activity was aimed at dispersing target species of birds (Kitowski, 2011; Kitowski, 2013), namely rook *Corvus frugilegus*, starling *Sturnus vulgaris*, jackdaw *Corvus monedula*, and gull *Larus* spp., the species that constituted the most numerous threats to air traffic at the DMA.

Another measure of kestrels was the present pellets cast by particular individuals. Pellets were collected monthly below perches on structures related to landing and take-off. The first collection of pellets of the studied species was preceded by the removal of old pellets. Kestrel pellets were collected on the last day of each month during both experimental periods.

Pellets were dissected using standard methods (Ruprecht et al., 1998). The numbers of vertebrate-type prey were determined on the basis of skulls, mandibles, teeth, and other important remains (Arnold and Burton, 1980; Pucek, 1984; Cuisin, 1989). Highly fragmented remains could sometimes be identified only to the genus or family level (e.g., Arvicolidae, *Sylvaemus*, Muridae, etc.). To calculate the biomass of kestrels' consumed prey in the form of birds and mammals, data from previous studies were used (Pucek, 1984; Romanowski, 1988; Jedrzejewska and Jedrzejewski, 2001, Kitowski, 2013).

The breadth of the food niches of owls was estimated using the formula proposed by Levins (1968): $B = 1/S\ p_i^2$, where p_i is the proportion of the prey category i in the total biomass of the owl's diet. Shannon–Wiener diversity (H) indices were calculated for trophic diversity at the species levels. In the formula provided, H is $\Sigma\ [P_i \log (P_i)]$ (Krebs, 1994). Trophic niche overlap for both study periods was measured by Pianka's index, using the percentage of biomass consumed of particular food items ($O_{jk} = \Sigma\ p_{ij}\, p_{ik} / \sqrt{}\ \Sigma\ p_{ij}^2\ \Sigma\ p_{ik}^2$, where p_i is the percentage of prey item "i" in the diet during the "j" and "k" periods of the study, respectively) (Pianka, 1973). Pianka's index varies between 0 (total separation) and 1 (total overlap). It was multiplied by 100 and expressed as a percentage. Simpson diversity index D (Krebs, 1994) was employed for describing the diversity of perching sites used by kestrels and the behaviour of these birds. For estimation of the impact of wind on kestrels' behaviour, division of wind velocity based on 6 degrees as proposed by Wos (1999) was modified. This modification allowed the creation of 3 classes of wind velocity. The first class of wind velocity was <1–11 km/h. The second class of wind velocity was 12–28 km/h and the third class was >29 km/h.

The falconer worked with classical methods, mainly consisting of 1) releasing trained raptors towards pest birds (alone or flocks) and 2) flights of trained raptors around the desired area (Beebe and Webster, 1994; Candil García and Hartman, 2007). The falconer worked 5 days a week from 0800 to 2000 hours, alternately using 3 adult raptors: a goshawk, a saker, and a peregrine. The goshawk was used exclusively in the morning (0800–1200 hours), the saker in the middle of the day (1200–1600), and the peregrine in the afternoon and evening (1600–2000). During the second study period the gas cannon was very occasionally used, but it was totally ignored by birds for reasons mentioned above.

3. Results

3.1. Behaviour

During 1 scan, from 0 to 3 kestrels were observed within the scanned area. In the control period, at least 1 kestrel was found within the scanned area during 215 scans, which constituted 25.6% of all the scans performed then. During the falconry period, kestrels were spotted during only 111 scans (13.2%). Differences in the frequency of scans during which kestrels were observed were statistically significant: $\chi^2 = 40.9$, $df = 1$, $P < 0.001$.

For 275 observation cases in the control period and 118 cases in the experimental period, we could determine behaviour (Table 1). The frequency of 3 major categories of behaviour, perching, cruising, and hovering, differed significantly between the 2 study periods ($G = 27.38$, $df = 2$, $P < 0.001$).

Both in the first and in the second period, the dominant behaviour of kestrels observed at the moment of spotting was perching (Table 1). Kestrels were perching in 69.7% of 393 scans in both study periods. However, when the 2 periods were compared, differences in the frequency of perching birds turned out to be insignificant (Table 1). Hovering was less statistically frequent during the experimental period (Table 1). In 50 cases, kestrels when spotted were cruising. However, the differences between the control and experimental periods were not significant (Table 1). In a few cases, the cruising flights of kestrels were a prelude to futile chases after lone individuals of starlings (N = 2) or lark *Alauda arvensis* (N = 1), which had been flushed out by a raptor working with the falconer. These incidents happened outside the scanning sessions. In a total of 261 cases, kestrels used 7 types of elevated perches, and in 13 cases kestrels were sitting on the concrete runway or on the ground when spotted (Table 2).

In the second study period, perched kestrels much less often used infrastructures located far from the main runway (more than 150 m) for perching: 5 (5.6%) vs. 164 (88.6%), $\chi^2 = 171.8$, $df = 1$, $P < 0.0001$ (Table 2). In the first study period, the dominant type of perch (70.5%) was grass runway curb signs, running about 220 m from the main runway (Table 2). In the second period, no cases were recorded of kestrels using this category of perch, strongly connected with the grass runway.

Compared to the first study period, a considerable increase occurred in the percentage of birds using perches connected with the main runway, such as curb signs, the main concrete runway, different runway lights connected with the main runway, and photocells: 21 (12.8%) vs. 57 (64.0%), $\chi^2 = 79.4$, $df = 1$, $P < 0.0001$ (Table 2). Moreover, in the second period, kestrels clearly preferred elevated perches compared to low perches such as the ground and the runway: 12 (6.5%) vs. 1 (1.1%), Fisher's test (1-tailed): $P = 0.04$.

In the control period, 29 cruising flights were performed. Of these flights, 11 (38.0%) occurred during <1–11 km/h wind velocity, while during 12–28 km/h wind velocity, 13 (44.8%) were performed. Only 5 (17.2%) such flights took place when wind speed was <29 km/h. Differences in the frequency in cruising flights during the control period were not statistically significant: $\chi^2 = 3.58$, $df = 2$, $P < 0.166$. Differences were found in the case of the experimental period, when no cruising flights were observed during the <1–11 km/h wind velocity. Such flights were either performed (n = 6) during 12–28 km/h wind velocity or when (n = 15) wind speed was <29 km/h. Kestrels preferred faster wind during cruising flights between perches ($\chi^2 = 3.86$, $df = 1$, $P < 0.49$). During the control period, the majority 20 (71.4%) of hovering sessions were perform when wind speed was <29 km/h. These preferences were statistically significant ($\chi^2 = 5.14$, $df = 1$, $P < 0.023$). During the period of the falconer's presence, only 1 hovering session was perform when wind speed was <29 km/h.

Kestrels in the experimental period showed less diversified behaviour. This is shown by the values of Simpson's index, being 0.512 and 0.395 for the first and the second period, respectively. Changes in the behaviour of kestrels are easily seen if we consider the perches that are most closely connected with the curbs of the main runway. Falconer activity in the second period of the study led to an increase in the frequency of using main runway curb signs as perch sites: 13 (7.0%) vs. 34 (38.2%), $\chi^2 = 38.9$, $df = 1$, $P < 0.0001$. The same results was observed for various types of runway lights: 8 (4.3%) vs. 19 (21.3%), $\chi^2 = 13.7$, $df = 1$, $P < 0.0002$.

Table 1. Behaviour of first-seen Eurasian kestrels *Falco tinnunculus* (L.) in critical zone of Deblin Military Airfield, East Poland. *: Fisher exact test.

Behaviour of Eurasian kestrels during stage 1 of observations			Behaviour of Eurasian kestrels during stage 2 of observations			Statistics: $df = 1$	
Activities	N	%	Activities	N	%		
Perching	185	67.3	Perching	89	75.4	$\chi^2 = 2.23$	P = 0.1356
Cruising	29	10.5	Cruising	21	18.0	$\chi^2 = 3.28$	P = 0.0700
Hovering	28	10.2	Hovering	1	0.8	-	P = 0.0003*
Others	33	12.0	Others	7	5.8	$\chi^2 = 2.69$	P = 0.110
Total	275	100	Total	118	100	-	-

Table 2. Perch sites of Eurasian kestrels *Falco tinnunculus* (L.) used on Deblin Military Airfield, East Poland. *: Threshold lights, runway lights, lighting runway end identifier lights; **: critical area of instrument landing system equipment and critical area of the main runway.

Perch sites	Perch sites of Eurasian kestrels during stage 1 of observations		Perch sites of Eurasian kestrels during stage 2 of observations	
	N	%	N	%
Grass runway curb signs	130	70.5	-	-
Main runway curb signs	13	7.0	34	38.3
Road lamps	8	4.3	-	-
Flags	13	7.0	4	4.5
Runway lights*	8	4.3	19	21.3
Runway	6	3.2	-	-
Ground	6	3.2	1	1.1
Fence	1	0.5	-	-
Critical area signs**	-	-	27	30.3
Photocells	-	-	4	4.5
Total	185	100	89	100

The diversity of perch sites used by kestrels in the 2 study periods was compared. During the control period preceding the falconer's presence, perching kestrels used 8 categories of perches 185 times, most frequently the grass runway curb signs (Table 2). Simpson's diversity index also served to characterise the diversity of perch sites used: its value was D = 0.490 then. In the experimental period, the value of the D index increased to 0.712. While kestrels used only 6 categories of perch sites, 2 types of perch sites were used more frequently than others (Table 2).

3.2. Hunting success and food composition

In the control period, 33 attacks on prey were recorded. Of these attacks, 14 (42.3%) occurred during hovering sessions and 19 (58.3%) while perching, but the difference in frequency was insignificant: $\chi^2 = 0.50$, $df = 1$, P = 0.479.

In the experimental period when the falconer worked at the airfield, 23 attacks on prey were recorded, but 20 of them (87.0%) took place during perching. The remaining 3 were during hovering flights. Differences between the contexts of attacks on prey were significant: $\chi^2 = 4.23$, $df = 1$, P = 0.04. In the control period, 5 attacks (15.2%) were successful; in the experimental period only 2 (8.7%) were. However, differences in hunting success were not significant between the periods: Fisher's exact test (2-tailed), P = 0.68.

The study revealed differences in food composition between the 2 periods. When kestrels were subjected to the falconer's activity, they ceased to hunt insectivores of Insectivora, which had been important in diets previously (Table 3). The biomass of voles (*Microtus* Schrank) in their diet increased by nearly one-fourth. In the second period, avian prey appeared and the amount of insects (Insecta) in the food increased by nearly one-half. The frequency of 3 main categories of kestrel prey, *Microtus* sp., *Apodemus* sp., and Insecta (Table 3), differed between the periods discussed here (G = 42.6, P < 0.01). After the introduction of the falconer to the airfield, the value of Levins' index of food niche breadth (B) for individual months fell insignificantly (Student's t-test = 1.28, $df = 14$, P = 0.085) from 3.04 ± 0.99 (range: 1.98–4.71) to 2.28 ± 0.59 (range: 1.80–3.57). However, the introduction of the falconer to the airfield resulted in a significant decrease in the value of the Shannon–Wiener biodiversity index (Student's t-test = 2.11, $df = 14$, P = 0.049). During the control period, the mean value of the H index was 1.94 ± 0.43 (range: 0.99–2.30), and the corresponding figure for the experimental period was 1.55 ± 0.34 (range: 0.92–1.95). The similarity of food in the 2 periods turned out to be high. The total prey overlap of the 2 study periods, expressed as Pianka's index, was O = 0.832 (83.2%).

4. Discussion

As a species strongly associated with extensive meadows and pastures (Village, 1990; Garratta et al., 2011), the kestrel can effectively use the regularly mown grasslands of airfields as feeding grounds. Moreover, buildings near

Tabel 3. Food composition of Eurasian kestrel *Falco tinnunculus* (L.) at Deblin Military Airfield, East Poland. %N: Percent of individuals. %M: percent of biomass. +: <0.1%.

Prey categories	Mass [g]	Food of Eurasian kestrels during control period of observations		Food of Eurasian destrels during experimental period of observations		Overall	
		%N	%M	%N	%M	%N	%M
Sorex minutus	3.5	0.5	0.1			0.3	0.1
Sorex araneus	8	0.9	0.4			0.6	0.3
Crocidura leucodon	8	0.9	0.4			0.6	0.3
Neomys fodiens	14	0.5	0.3			0.3	0.2
Talpa europea	95	0.5	2.3			0.3	1.6
Arvicola terrestris	130	0.5	3.2			0.3	2.2
Microtus oeconomus	26	1.4	2.0	4.5	7.4	2.4	3.6
Microtus agrestis	23	0.5	0.6			0.3	0.4
Microtus arvalis	19	35.9	36.3	22.3	27.1	31.3	33.5
Microtus sp.	19	26.7	27.0	45.5	55.2	33.1	35.5
Micromys minutus	8			0.9	0.5	0.3	0.1
Apodemus agrarius	17	2.8	2.3	1.8	1.9	2.4	2.3
Apodemus sp.	24	0.9	1.2			0.6	0.8
Micromammalia	19	16.1	16.3	1.8	2.2	11.2	12.1
Mammalia	300	0.5	7.3			0.3	5.1
Passeriformes	30			1.8	3.4	0.6	1.0
Emberizidae	30			0.9	1.7	0.3	0.5
Insecta	0.4	4.1	0.1			2.7	0.1
Coleoptera	0.3	5.0	0.1	12.5	0.2	7.6	0.1
Carabidae	0.2			3.6	+	1.2	+
Orthoptera	1	2.3	0.1	4.5	0.3	3.0	0.2
Total		217	4086.4 g	112	1754 g	329	5840.4 g

airfields and abandoned corvid (Corvidae) nests in trees provide kestrels with good nesting places (Village, 1990; Sliwa, 2004).

Trained raptors caused a decrease in the frequency of scans during which kestrels were spotted at the airfield; the same effect was true for other birds (Kitowski, 2011). This confirms what others have found (Ericson et al., 1990; Soldatini et al., 2008). Moreover, the kestrels at the airfield were more mobile (with higher frequency of cruising flights and a simultaneous decrease in the frequency of hovering flights), which could reduce the possibility of a predator attack.

This was accompanied by the abandonment of perches located in the curb-side part of the airfield, such as grass runway curb signs. Under the falconer's influence, the behaviour of kestrels underwent a strong uniformisation, their behavioural repertoire became less diversified, and the role of perching as the dominant behaviour was reinforced. In the period preceding the falconer's work, kestrels were observed sitting on the runway, which made them visible from long distances. This phenomenon is also observed at other Polish and European airfields, e.g., Babice, Babie Doly, or Gdansk (Kitowski, 2011). The presence of trained raptors working with the falconer led to a total abandonment of this practice. The above changes in behaviour undoubtedly constitute a response aimed at avoiding capture by trained raptors and making the presence of kestrels harder to detect. Goshawks are effective in killing kestrels (Petty et al., 2003). There is also presumptive evidence of kestrels being killed by peregrines (Village, 1990).

Studies showed that kestrels can use wind energy to optimise their energy expenditures by use faster wind for supporting cruising flights among perches during the period of falconry pressure. This may reduce the possibility of being caught by falconer-managed raptors. Faster winds also supported hovering sessions during the control period. Village (1990) also noted such preferences in kestrels. It is difficult to estimate the importance of wind for kestrels' hovering during the experimental period because only one such session was noted. However, Village (1990) noted a relation between frequency of hovering and wind intensity.

Rather than leave the airfield completely, kestrels significantly reduced their time on it and made more frequent use of perches near the concrete runway. Studies on hunting behaviour indicate that kestrels are highly effective in attacking prey (up to 60% successful) when launching from perches (Village, 1990). Some studies show that a lack of perches can limit the exploitation of some hunting areas despite the abundance of appropriate prey. They propose that adding perches should be introduced as a factor attracting raptors to that area (Meunier et al., 2000; Lihu et al., 2007). Our behaviour data show that in response to falconry, kestrels increased the diversity of perch types used. This resulted from an abandonment of one type of perch (runways). This makes it impossible to determine the preferred perch type during the control period. It can also be interpreted as an antipredator response. Elevated perches allow for expending less energy during hunting than flight. Thus, the availability of perches is important in making an area attractive to kestrels (Meunier et al., 2000; Lihu et al., 2007). Perches often serve as safe places to consume food (Reinert, 1984; Wolff et al., 1999). In this case the kestrels faced a trade-off between achieving optimal foraging benefits and avoiding danger from trained raptors.

The analysis of pellets collected at the airfield revealed differences in food composition between the control and experimental periods. Admittedly, in both periods the food was dominated in terms of both number and mass by voles, which corresponds with the results of other studies and is typical for the kestrel (Korpimäki, 1985; Village, 1990; Schmidt et al., 2002, Kubacka et al., 2010). Other changes in food composition can also be connected with falconer activity. The fact that kestrels hunted pursued birds in the second study period may result from opportunistic hunting behaviour, typical of many raptors (Ellis et al., 1993; Kitowski, 2003), and their taking advantage of the avian prey being flushed by the trained raptors. Their abandonment of hunting insectivores undoubtedly resulted from the kestrels having been pushed away by trained raptors from the more humid peripheral areas towards the drier centre of the airfield. These processes were accompanied by a nearly 50% increase of the number of insects taken. This again was apparently a response to the threats from the trained raptors. When kestrels had to optimise the effects of hunting using perches, in the conditions of the DMA they did this by exploiting the prey that was the easiest to catch due to its abundance. Comprehensive studies point to insects as the live prey easiest to catch for raptors (Newton, 1979), including kestrels (Bustamante, 1994; Village, 1990).

Due to the importance of perching sites to the hunting and resting of kestrels (Village, 1990) and other birds that can potentially collide with aircrafts (Fuisz and Yosef, 2001; Moskat, 2001; Hromada et al., 2008, Wikar et al., 2008; Tome et al., 2011), it is essential to eliminate the access to perches near the main runway. Perches can be fitted with porcupine wire. This operation should primarily concern all potential places for rest that are connected with critical zones of airfield navigation infrastructure and runways. In the conditions of Central European airfields, accessible perches are also used by other birds present there such as rooks, jackdaws, and many species of gull (*Larus* spp.) (Krupka, 2000; Fennessy et al., 2005; ENAC and BSCI, 2007).

Another measure is the long grass policy (LGP) at airfields. Keeping grass long reduces the presence of many birds (Brought and Bridgman, 1980). The kestrel presence is also diminished by the LGP. Being short-legged, it will be effectively limited in this way (Village, 1990; Aschwanden et al., 2005; Garratta et al., 2011). In some places on airfields, however, grass must be mowed to ensure good visibility of the runway lights (MacKinnon et al., 2001).

For this reason, some perches must be fitted with porcupine wire systems. Otherwise, they may attract raptors, corvids, and shrikes. After the introduction of the falconer to the airfield, the breadth of the food niche and the diversity of prey decreased. By reducing the availability of potential prey, for the reasons mentioned above, the LGP would undoubtedly support the process of discouraging bird presence on the airfield, forcing kestrels to seek new feeding grounds elsewhere.

Some bird strike management teams promote culling (direct killing) of raptors. However, experience has shown this method to be ineffective. For example, Aas (2006) showed that the culling of kestrels proved to be ineffective on Scandinavian airfields, since culled individuals were quickly replaced by new ones that took over their territories. The translocation of raptors from airfields can be done with combined knowledge on the ecology and behaviour of raptors. This method consists in catching individual raptors in traps appropriate for each species and then transporting them far enough away to prevent them from returning to the airfield (Anderson, 2005). When carrying out translocations of kestrels from the airfields of Europe, it is important to realise that, in the case of many populations, males stay in the territory for the whole year (Village, 1990). This was undoubtedly the case at the DMA, because in winter only male kestrels were found in the area (Kitowski and Grzywaczewski, unpublished data).

When translocating kestrels from an airfield, only young, migratory birds should be removed, preferably 70–80 km away. This is because adults in the territory play the role of "sentinel" falcons, preventing the penetration of the airfield by numbers of young, inexperienced birds, which also constitute the greatest danger to air traffic (Anderson, 2005).

The following conclusions can be drawn from this study:

1. The flying trained raptors reduced the presence of Eurasian kestrels in the critical zones of the DMA.

2. The trained raptors fundamentally changed the behaviour of kestrels at the airfield, and influenced diet to a smaller degree.

3. New perches installed at airfields, particularly in the immediate vicinity of the runway, must be fitted with porcupine wire so that they do not attract Eurasian kestrels and other birds using them for hunting and resting. Such temporary measures should be implemented with long-term polices such as allowing grass to grown and translocating some individual kestrels.

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