Bird Study (2005) **52,** 93–95

SHORT REPORT

Woodpigeons *Columba palumbus* breeding in open land associate with Kestrel *Falco tinnunculus* nests

JOHANNES BANG[1], BENT JENSEN[2] and PETER SUNDE[3]*
[1]*Stenvænget 15, DK-3400 Hillerød, Denmark,* [2]*Kagerup Byvej 1, DK-3200 Helsinge, Denmark and*
[3]*Department of Animal Ecology, Lund University, Ecology Building, SE-223 62 Lund, Sweden*

Capsule Woodpigeons bred adjacent to 38% of all occupied Kestrel nests, whereas no pigeons bred near the same nestboxes when not used by Kestrels.

The inclination of some birds to breed near other species with an aggressive nest defence has long been assumed to be aimed at achieving improved nest protection ('predator protection hypothesis', Koskimies 1957). This hypothesis has been supported by several recent studies showing increased reproductive success of pairs breeding in proximity to predators despite the predators themselves sometimes accounting for some loss of offspring (Norrdahl *et al.* 1995, Blanco & Tella 1997, Richardson & Bolen 1999, Quinn *et al.* 2003). Woodpigeons *Columba palumbus* sometimes appear to select breeding sites near raptor nests, seeking protection.

In open farmland in The Netherlands and in Italy, they have been found to breed adjacent to Hobby *Falco subbuteo* nests (Biljsma 1984, Bogliani *et al.* 1999). In the Dutch study, on average 5.4 Woodpigeon pairs bred per Hobby nest. The breeding of the Woodpigeon pairs was synchronized with the breeding cycle of the Hobbies, resulting in almost double the breeding success of pairs not associated with Hobbies (Biljsma 1984). Evidently, the benefit of nesting near the Hobbies is an improved protection against nest predators. This is also illustrated in the Italian study (Bogliani *et al.* 1999), where reduced nest predation risk was found on artificial nests within 50 m from Hobby nests. Reports of similar associations with Black Kites *Milvus migrans* (Cain & Hillgarth 1974) suggest that the preference of Woodpigeons for nesting near powerful nest defenders is not exclusive to Hobbies.

We document, for the first time, that Woodpigeons commonly nest near Kestrels *Falco tinnunculus* in Danish farmland. Apart from anecdotal reports (Wittenberg 1958, Biljsma 1984), this is the first time this behaviour has been described.

For some decades, two of the authors (J.B., B.J.) have ringed Kestrel nestlings in the farmland on Zeeland, Denmark. The nestboxes are widely spread (>1 km apart) in two different study areas separated by 60 km: one in the northwestern part of Zeeland (Allerød, Farum, Frederikssund, Frederiksværk, Helsinge, Hillerød and Skævinge municipalities: 567 km^2) and one in the southwestern part (the triangle between Kalundborg, the island of Omø and Næstved: about 1400 km^2). The farmlands are very similar in both study areas, although woods are more common in northwest Zeeland than in the southwest part. In both study areas, Kestrels breed in nestboxes erected at a height of 5–8 m in isolated deciduous trees (single trees or groups of 2–4) surrounded by fields or meadows in all directions.

To test the assumption that Woodpigeons preferentially bred near Kestrels, the presence and absence of pigeon nests was systematically registered near nestboxes, occupied or unoccupied by Kestrels during 1999–2003. Each year in late May or early June, all nestboxes were visited (climbed) once, and checked for breeding attempts of Kestrels. During these visits, the number of occupied Woodpigeon nests within 3 metres of the nestbox was registered. Woodpigeon nests observed >3–10 m from the nestbox were also noted, but this number is a minimum estimate, as pigeon nests can be difficult to detect in a canopy more than 3 metres distant. The effort to find Woodpigeon nests

*Correspondence author. Email: peter.sunde@zooekol.lu.se

was the same for occupied and unoccupied Kestrel nests.

Breeding association (Woodpigeons present or absent/Kestrels present or absent) was tested using a chi-squared test, using annual visits to the nestboxes as the observational unit, including observations from nests where Kestrels bred at least once. We compared the breeding association for those nesting sites where both species had bred in some years but not in others (sign test: number of nest sites where Woodpigeons bred in years where Kestrels were absent versus nest sites where Woodpigeons only bred when Kestrels were present).

We used logistic regression analysis (PROC GENMOD in SAS, with a logit link function and binomial errors) to test whether the presence of Woodpigeons was determined by factors other than the presence of Kestrels. By using the nestbox as the observation unit (considering the number of years of occupation by Kestrels as cases and the years of occupation by Woodpigeons as events) it was possible to test for differences between the two study areas, adjusting for differences among individual nest sites. [a] While testing the effects of variables that varied among years (date of visit, Kestrel brood size, year), the individual nesting attempt was used as the observation unit.

The 226 nesting attempts by Kestrels were distributed between 98 nestboxes (55 in northeast Zeeland and 43 in southwest Zeeland), each used 1–5 times. Woodpigeon nests were found within 3 metres of occupied Kestrel nests in 29% of cases (Table 1). Another 9% of the occupied Kestrel nests had Woodpigeons nesting 3–10 metres away. Accordingly, Woodpigeons adjoined at least 38% of the nesting attempts of Kestrel (Table 1) at 50 nest sites. Usually (78 cases) only a single Woodpigeon nest was found, but there were five cases in which two and two cases in which three pairs nested within 10 m of a Kestrel nest. No pigeon nests were ever found adjacent to unoccupied nestboxes (Table 1, $\chi^2_1 = 164$, $P < 0.0001$). At all 45 nesting places, when Kestrels were absent at least one year, Woodpigeons were only found to breed in years when Kestrels were present (sign test: $P < 0.0001$).

The probability of an occupied Kestrel nest being associated with Woodpigeons was somewhat higher in the southwest (46%, 95%CI: 32–59%) than in northeast Zeeland (28%, 20–38%, log-likelihood $\chi^2_1 = 4.06$, $P = 0.044$) and varied among nests (residual deviance = 142.23, residual df = 95), but was independent of year ($\chi^2_4 = 2.03$, $P = 0.73$), Kestrel brood size ($\chi^2_1 = 2.65$, $P = 0.10$) and date for the visit ($\chi^2_1 = 0.75$, $P = 0.39$).

This study documents with a high statistical confidence that Woodpigeons in open farmland actively preferred to nest adjacent to Kestrels. We conclude that the preference of this species to breed near Hobbies (Biljsma 1984, Bogliani *et al.* 1999) also applies to Kestrels, at least in Denmark where Hobbies are rare. As the investigation includes two different study areas 60 km apart, the observed pattern was at least a regional rather than a local phenomenon.

It remains to be investigated whether widespread preference of Woodpigeons to breed adjacent to Kestrels is unique to Danish farmland or a more general but overlooked phenomenon. Anecdotal evidence of Woodpigeon nesting near Kestrels from Germany and The Netherlands (Wittenberg 1958, Biljsma 1984), suggest the latter. Hypothetically both species might have preferred the same nesting sites in certain years due to small rodents (the primary prey for Kestrels in farmland, Village 1990) being favoured by the same

Table 1. Distribution of occupied and unoccupied Kestrel nests (nestboxes in trees), with and without adjacent Woodpigeon nests. Only nestboxes occupied by Kestrels in one of the five years are included.

	Nestboxes used by Kestrels					Nestboxes not used by Kestrels		
		Woodpigeon nests						
		<3 m		3–10 m			Woodpigeon nests <10 m	
Year	Total	No.	%	No.	%	Total	No.	%
1999	59	15	25	7	12	73	0	0
2000	37	10	27	4	11	56	0	0
2001	54	16	30	6	11	79	0	0
2002	44	11	25	0	0	94	0	0
2003	32	13	41	3	9	80	0	0
Total	226	65	29	20	9	382	0	0

crops that attract Woodpigeons. In that case, however, some cases of Woodpigeons breeding near unoccupied Kestrel nests would have been expected. Although we have no data on breeding success of the Woodpigeons, the most likely benefit of breeding near Kestrels would be an enhanced protection against avian nest predators as has been found near Hobby nests (Bogliani *et al.* 1999). Decreased predation risk near Kestrel nests has previously been demonstrated on artificial Curlew *Numenius arquata* nests (Norrdahl *et al.* 1995). Curlews have also been found breeding in closer proximity to Kestrel nests than expected by chance, despite Kestrels killing 5.5% of all chicks in nests adjacent to Kestrels. Danish farmland supports dense populations of Crows *Corvus corone*, Magpies *Pica pica*, Rooks *Corvus frugilegus* and Jackdaws *Corvus corone*. It is therefore reasonable to assume that Woodpigeon nests not protected by Kestrels suffered a high nest predation risk from corvids, as reported from other agricultural areas (Inglis *et al.* 1994). The variation in nest-site selection probability between the two study areas, and between different nests within each study area, were probably due to local variation in habitat composition and perhaps individual behaviour of Kestrels using the same nestbox through several years. As breeding near predators might be seen as a result of density dependence in prime habitat, forcing the population surplus to breed in alternative habitats, temporarily favoured by the presence of the predator (Quinn *et al.* 2003), it would be interesting to investigate whether the presence of Kestrels increases the overall breeding density of Woodpigeons in the those areas. Alternatively Woodpigeons might have nested in alternative places such as hedgerows and larger tree lots.

ACKNOWLEDGEMENTS

We are grateful to the many landowners, for permitting us to access their land. Frederiksborg County sponsored some of the nestboxes. Søren K. Pedersen and Poul E. Hansen kindly assisted in controlling nestboxes. The Kestrel survey was licensed by the Ringing Centre of the Zoological Museum, University of Copenhagen. During the preparation of this manuscript, P.S. was supported by a grant from the Carlsberg foundation. The paper was improved by the comments from Will Cresswell and an anonymous referee.

ENDNOTE

a. After having accounted for the variation between the study areas, the breeding frequency of Woodpigeons was more clumped among the nesting sites than expected by chance, as the ratio between residual deviance and residual df was larger than 1 (over-dispersion). This dependency was corrected for by scaling the deviance (McCullagh & Nelder 1989) using the DSCALE option in SAS.

REFERENCES

Bijlsma, R.G. 1984. Over de broedassociatie tussen Houtduiven *Columba palumbus* en Boomvalken *Falco subbuteo* [On the breeding association between Woodpigeons *Columba palumbus* and Hobbies *Falco subbuteo*]. *Limosa* **57:** 133–139 (in Dutch with English summary).

Blanco, G. & Tella, J.L. 1997. Protective association and breeding advantage of choughs nestling in lesser kestrel colonies. *Anim. Behav.* **54:** 335–342.

Bogliani, G., Sergio, F. & Tavecchia, G. 1999. Woodpigeons nesting in association with hobby falcons: advantage and choice rules. *Anim. Behav.* **57:** 125–131.

Cain, A.P. & Hillgarth, N. 1974. Nesting relationships between *Columba palumbus* and *Milvus migrans*. *Doñana Acta Vert.* **1:** 97–102.

Inglis, I.R., Isaacson, A.J. & Thearle, R.J.O. 1994. Long term changes in the breeding biology of the woodpigeon *Columba palumbus* in eastern England. *Ecography* **17:** 182–188.

Koskimies, J. 1957. Terns and gulls as features of habitat recognition for birds nesting in their colonies. *Ornis Fenn.* **34:** 1–6.

McCullagh, P. & Nelder, J.A. 1989. *Generalized Linear Models.* Chapman & Hall/CRC, London.

Norrdahl, K., Suhonen, J., Hemminki, O. & Korpimaki, E. 1995. Predator presence may benefit: Kestrels protect curlew nests against nest predators. *Oecologia* **101:** 105–109.

Quinn, J.L., Prop, J., Kokorev, Y. & Black, J.M. 2003. Predator protection or similar habitat selection in red-breasted goose nestling associations: extremes along a continuum. *Anim. Behav.* **65:** 297–307.

Richardson, D.S. & Bolen, G.M. 1999. A nesting association between semi-colonial Bullock's orioles and yellow-billed magpies: evidence for the predator protection hypothesis. *Behav. Ecol. Sociobiol.* **46:** 373–380.

Village, A. 1990. *The Kestrel.* T & A.D. Poyser, Calton.

Wittenberg, J. 1958. Anschluss der Ringeltaube an den Turmfalken. *Vogelwelt* **79:** 107–108 (in German).

(MS received 13 February 2004; revised MS accepted 13 May 2004)