Do breeding Ural owls Strix uralensis protect ground nests of birds?: an experiment using dummy nests

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SHORT COMMUNICATION

Short communication articles are short scientific entities often dealing with methodological problems or with byproducts of larger research projects. The style is the same as in original articles

Do breeding Ural owls *Strix uralensis* protect ground nests of birds?: an experiment using dummy nests

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Predatory birds were formerly suggested to have only negative effects on the breeding success of other birds that breed in the vicinity of their nests. However, the predator may also protect these breeding birds by chasing away other nest predators whilst either defending its own nest or by eating other predators in its territory. Ural owl *Strix uralensis* is known to be an aggressive nest defender. Although its diet mainly consists of voles, it also preys upon bird species (e.g. Corvidae) and even weasels *Mustela nivalis*, particularly when the vole densities are low. We carried out a dummy nest experiment on six Ural owl territories in central Finland to study whether Ural owls affect the nest predation rates of ground nesting birds. We found that although dummy nest predation differed between Ural owl territories, in every territory the predation risk was lowest in close proximity to Ural owl nests. The protecting effect of the predator continued for a distance of up to several hundred metres from its nest; a much further distance than could be expected if the effect was due solely to the defence of its own nest. Consequently, as suggested for other predatory birds, it may be that breeding Ural owls influence the bird community both directly by predating upon some species and/or indirectly by providing protection for other species. However, natural evidence on breeding habitat selection and predation risk of ground nesting birds should be obtained before detailed inferences on the effects of Ural owl nests on bird community levels are made.

Key words: artificial nests, edge effect, nest predation, Strix uralensis, Ural owl

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Predators were formerly recognised as the most frequent source of reproductive failure in birds (Ricklefs 1969). However, there are an increasing number of studies showing that reproductive success is increased for some bird species when avian predators breed in their vicinity (Wiklund 1982, Paine, Wootton & Boersma 1990, Norrdahl, Suhonen, Hemminki & Korpimäki 1995, Ueta 1994, Blanco & Tella 1997, Bogliani, Sergio & Tavecchia 1999, Mönkkönen, Tornberg & Väisänen 2000, Ueta 2001). These studies suggest that breeding predators exclude other predators from the area either by aggressive nest defence or by exploiting them as food sources. However, as far as we know it, there are no examples where top predators could protect other species in their territories using both mechanisms at the same time.

Our study species, the Ural owl *Strix uralensis*, is an aggressive nest defender (Saurola 1989), and it also predates many nest predator species such as red squirrels *Sciurus vulgaris*, weasels *Mustela nivalis* and even stoats *Mustela erminea* (Korpimäki & Sulkava 1987, Jäderholm 1987). In good microtine years the diet of the Ural owl consists mainly of *Microtus*-voles, but when the abundance of their preferred prey decreases, they hunt alternative prey to a greater extent (Korpimäki & Sulkava 1987).

The aim of our study was to examine whether breeding Ural owls have a protective effect on ground nesting birds in their territories. We tested this hypothesis using dummy nests placed at different distances from the nests of six pairs of Ural owls.

Material and methods

We carried out the study during May-June 2001 at Konnevesi, central Finland, on six Ural owl territories. No good estimates are available on vole densities in the study area, but evaluated on the basis of the number of breeding owls, the amount of voles was rather high. We made the dummy nests of a plywood plate (40x40 cm) covered with lubrication grease and sand which allowed us to see the pugs of the nest predators. Unfortunately, exceptionally heavy rains during the first days of our study destroyed most of the pugs left on the plates by the nest predators. But, on the basis the remaining pugs, we can say that at least red squirrels, great-spotted woodpeckers *Dendrocopos major* and raccoon dogs *Nyctereutes procyonoides* or red foxes *Vulpes vulpes* were involved in predation of the dummy nests. A handful of bedding used by domestic hens *Gallus domesticus* was placed in the middle of each plate to mimic a real bird nest and its odour. We also left one brown egg from a domestic hen on the bedding. The same method, though without the bedding, has been used earlier, for example by Andrén (1992).

On a line transect at each Ural owl territory, we placed 10 dummy nests with the first one placed underneath the nest box of the owl. The inter-nest distance was 100 m so that the tenth nest was 900 m from the Ural owl nest box. We found no published data on the size of Ural owl's summer time hunting areas, but according to P. Saurola (unpubl. data), it may cover up to 3,000 metres from the nest box for male Ural owls. The female, however, stays closer to the nest guarding the nestlings. In a study performed in central Norway on tawny owl *Strix aluco*, the mean distance the female moved from the nest after fledging was 360 metres (Sunde, Overskaug, Bolstad & Øien 2001).

The dummy nests were placed in forested habitats in which Ural owls commonly hunt. The nest transects were directed in such a way that there was no significant correlation between the distance of dummy nest from the Ural owl nest and the nearest forest edge (Pearson: $r = -0.153$, $P = 0.242$, $N = 60$; similar for each owl territory, all $P > 0.1$). The nests were placed under old Norway spruces *Picea abies* to prevent exposure to direct sunlight or heavy rain. At the time when the dummy nests were placed in the territories, the owl nestlings were about three weeks old, so they were expected to fledge within two to three weeks. During this period in central Finland, most bird nests are in the hatching phase or have small nestlings.

We checked the dummy nests twice: first, after four to six days and then 13-18 days after establishment of the nest. At the time of the second check, the owl nestlings had already fledged in five of the six nest boxes. A nest was considered preyed upon if the domestic hen egg was missing or broken.

Results

At the first check, all of the dummy nests placed underneath the nest of the Ural owl were untouched, and 8.3% of all nests within a distance of 100 m from the Ural owl nest were predated. The average percentage of predated dummy nests situated within 200-400 m from the owl's nest was 38.9%, and for those placed within 500-900 m it was 76.7%. At the second check, the average percentages were 58.3, 77.8 and 100%, respectively.

We analysed the factors that affect dummy nest predation (egg untouched or missing/broken) using logistic regression models with distance to the owl nest (distance), nearest distance to the forest edge (edge), owl ter-

Table 1. Logistic regression models used to study the predation of dummy nests (egg untouched or missing/broken) in relation to distance from the owl nest (Distance), distance from forest edge (Edge) and owl territory (added as categorical covariate) on six Ural owl territories during May-June 2001.

	G	df	P
First check			
Model	33.88	6	< 0.001
Distance	20.28	1	< 0.001
Owl territory	18.81	5	0.002
Second check			
Model	25.69	7	0.001
Distance	25.41	1	< 0.001
Edge	5.66	1	0.017
Owl territory	12.417	5	0.03

ritory (territory, added as categorical covariate) and the interactions between distance and territory and edge and territory as explanatory variables. The models were hierarchically simplified as far as possible by removal of the non-significant effects one by one, starting with the two-way interactions. Owl territory, however, was maintained in all models.

For the first check, the logistic regression model was significant and showed that predation rates on dummy nests differed significantly between owl territories and increased significantly with the distance from the owl nest (Table 1, Fig. 1). At the second check, the effects of distance and territory were still significant, but the distance to the edge also affected nest predation, so that the probability of predation became higher the closer to the forest edge the dummy nest was situated (see Table 1).

After the overall analyses, we aimed at examining whether the increased nest survival in close proximity of Ural owl nests was either due to their aggressive nest defence or direct exploitation of nest predators as food sources. For this purpose, we re-analysed the data including only the dummy nests that were at least 200 m from the Ural owl's nest box. At the first check, the model ($G = 20.83$, $df = 6$, $P = 0.002$) was significant, and the predation rates on the dummy nests increased significantly with the distance from the owl nest (Distance: $G = 5.48$, $df = 1$, $P = 0.019$; Owl territory: $G = 16.92$, $df = 5$, $P = 0.005$). At the second check ($G = 13.77$, $df = 6$, $P = 0.032$), distance still affected dummy nest 'survival' (Distance: $G = 7.29$, $df = 1$, $P = 0.007$; Owl territory: $G = 7.576$, $df = 5$, $P = 0.181$).

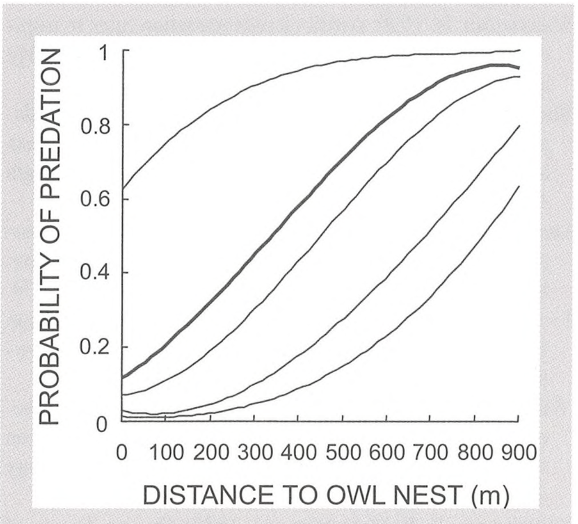

Figure 1. Probability of dummy nest predation in relation to distance from Ural owl nests (N = 6). The thick line indicates that two territories had overlapping values.

Discussion

According to our results, the Ural owl has a strong protecting effect on dummy nests in the centre of its territory. In all of the six Ural owl territories, predation of dummy nests increased with increasing distance from the owl nest. Earlier studies have suggested that the breeding predators exclude other predators from the proximity of their nests either by aggressive nest defence or by exploiting them as food sources. In our study, the protecting effect of the Ural owl was evident even when we repeated the analyses by including only the dummy nests situated at least 200 m from the owl's nest. This indicates that the decrease in nest predation risk with decreasing distance from the Ural owl nests is not likely to be solely due to nest defence behaviour.

It has been found in several studies (Andrén 1992, Mönkkönen et al. 2000, see also reviews in Söderström, Pärt & Rydèn 1998 and Söderström 1999) that the nest predation rate is higher near the forest edge than in the middle of the forest. In our study, the dummy nest transects were orientated so that the possible edge effects could be controlled for rather than specifically studied. However, distance to the forest edge was added into the models when we studied whether dummy nest predation depends on the nest's position in relation to the owl territory. At the second check, about two weeks after the establishment of the line transects, the edge had a significant effect on the predicted direction, and also the effect of distance to the owl nest was significant. In between the first and the second check, the chicks had left five of the six Ural owl nests. As the Ural owls' defence areas possibly change as chicks fly away from the nest box, this might give nest predators more possibilities to enter the former owl territory and use the forest edges as hunting areas.

Experiments that use dummy nests do not always lead to accurate rates of natural nest predation (see e.g. Willebrand & Marcström 1988). However, the dummy nests can give evidence of relative measures of nest predation in relation to the type of the landscape or location of the nest, as shown in our study. In most studies where dummy nests have been used, the effect of odour has been ignored (Mönkkönen et al. 2000, Andrén 1992, Norrdahl et al. 1995). This may have led to an overestimation of the effect of birds in nest predation in relation to other predators (Andrén 1992, Söderström et al. 1998). In our study, we used excrement and feathers as bedding in the dummy nests to mimic the smell of natural bird nests, in order to obtain more reliable estimates of natural predation rates.

Our results are more applicable to open-nesting than to hole-nesting birds, and further research should be carried out to ascertain whether the phenomenon could be valid in hole-nesting birds. Bird species that are in some way capable of protecting their nestlings from owl attacks could benefit from nesting in the vicinity of Ural owl nests. It could also be beneficial for nidifugous species, if females lead their chicks further away from owl nests within the first few days after hatching. For instance, curlews *Numenius arquata* have been found to nest closer to kestrel *Falco tinnunculus* nests than should be expected from random distribution (Norrdahl et al. 1995). Differences in the nest predator fauna in relation to the distance from Ural owl nests, which we also aimed at studying, would be an important area to investigate further. Moreover, breeding habitat selection of ground and hole-nesting birds, as well as nest predator densities, should be studied before detailed inferences on the effects of owl nests on bird community levels are made.

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