Predation of artificial nests in a marshland: site and visibility effects

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I studied the effects of site (location) and nest visibility on the predation rate of artificial ground nests in islands of the Kis-Balaton marshland, Hungary. There was a strong site effect, i.e. nest predation was different among the three studied sites. No difference was found between visible (100% visibility) and hidden (<20% visibility) nests. In addition, the identified predators (Corvidae and Mustelidae) of hidden and visible nests were similar, but different at the three sites. The lack of visibility effect was unexpected, but can be explained by the increased water level of the marshland after drought years. This may have resulted in the concentration of both predators and nests on islands, causing extremely high predation pressure.

Key words: artificial ground nest, brood survival, Hungary, water level change

1. Introduction

The loss of nests due to predation is probably the most important factor determining the survival of clutches (e.g. Martin 1988, Hoi & Winkler 1994, Schmidt & Whelan 1998, Batáry & Báldi 2004, Purger et al. 2004). Nest predation is often studied by artificial nest experiments to avoid disturbance to target species and habitats. Although the experiments seem to provide sufficient data for comparative purposes (Major & Kendal 1996, Matessi & Bogliani 1999), several experiments were conducted on plots of comparable size to the home range of potential predators (e.g. Corvidae). Consequently, the results may be biased, reflecting simply the presence of one or a few predators (Møller 1988), or the proximity of predator dens or nests (Rönkä & Koivula 1997, Lariviére & Messier 1998). Besides the site (locality) effect, the visibility of nests seems to be the most important factor determining depredation rates. More visible nests suffer higher predation rates than less visible nests (Leimgruber *et al*. 1994, Vanderhaegen & Degraaf 1996, Jobin & Picman 1997, Miller 1999, Rangen *et al*. 1999, but see Götmark *et al*. 1995, Wiebe & Martin 1998), although not all studies supported this hypothesis (Burhans & Thompson 1998, 2001, Braden 1999).

In the present study I investigated the effects of site and nest visibility on nest predation of passerine ground nests in a marshland in Western Hungary.

2. Study area and methods

The study area was in the 15,000 ha Kis-Balaton marshland, W-Hungary (46°42'N,

17°21'E). I used artificial nests resembling the nest of Stonechat (*Saxicola rubetra*) in the breeding season of 1999 (detailed area description is in Lőrincz *et al*. 1990, Báldi 1999, Moskát & Báldi 1999), selecting islands on Lake Fenéki for three study sites within 3 km. The islands had similar size and isolation, mainly by reedbeds. Grasses with a few trees and bushes covered the islands. The average height of grass layer was ca. 30 cm, with 100% cover on all islands. Artificial passerine nests made of chicken wire and lined with grasses were used, containing 1 quail egg, and one plasticine egg with similar size and pattern to a small passerine egg. The nests were placed in pairs at 3 m distance from each other. One nest had 100% visibility, without any cover. The other nest of the pair was hidden in the grass, under a tussock, and only small part of the nest (<20%) was visible from above. Ten pairs of nests at 20 m intervals were used at the three sites (a total of 60 nests). The nests were exposed for 2 days.

3. Results and discussion

More than 60% of the nests were predated within two days. Similarly high predation pressure was found for open ground nests with chicken eggs along the dikes in the area (Báldi 1999). The number of lost nests were significantly different, by site and treatment (*G* test of homogeneity on the 2×3 contingency table of treatments x sites: G=11.4, $d.f.$=2, P<0.01). Visibility alone, however, had minor influence on the differences, because the daily nest survival rates, calculated by the Mayfield method (Mayfield 1975), were not different between treatments, within sites (Tab. 1). Therefore, hidden and visible nests were pooled within sites. The nest losses were significantly different among sites: the number of predated nests at sites I, II and III were 7 (35%), 10 (50%) and 20 (100%), respectively (*G* test of homogeneity with Williams' correction: G_{cor}=7.2, $d.f.$=2, P<0.05).

I tested the hypothesis that the predation of paired (hidden and visible) nests is aggregated, that is, the chance of being predated of one of the nests is non-independent of the fate of the other. Only the first two sites were included, because at the third site all nests were predated. Predation of a nest, however, did not depend on the fate of its paired nest (G_{cor}=0.7, $d.f.$=2, *NS*).

Nest predators were identified based on their beak or tooth marks in the plasticine eggs. Eleven marks were identified from the 37 predated nests. Six were of medium sized birds, probably Corvidae, and 5 were mammal traces, probably by Mustelidae. Surprisingly, there was no difference between the predators of hidden and visible nests. There were 3 bird and 3 mammal marks on hidden eggs, and 2 mammal and 3 bird marks on open eggs (G_{cor}=0.1, $d.f.$=1, *NS*). Again, however, there was a significant site effect, one mammal at site I, 5 birds at site II, and 4 mammals + one bird at site III (G=10.2, $d.f.$=2, P<0.01). The hypothesis that visible nests are predated by birds, using visibility keys for searching, and hidden nests by mammals, using olfactory keys, was rejected. There was no difference in the predators of hidden and visible nests. This is not surprising for mammals, since both hidden and visible nests have similar olfactory attractiveness. For birds, the finding of hidden nests at a similar rate

Tab. 1. Mayfield's daily nest survival rates of open passerine ground nests (100% visibility), and hidden nests (<20% visibility) at three study sites in the marshland Kis-Balaton, Western Hungary. The degree of freedom was 18 for all cases.

	Open	Hidden	*z*	Significance
Site I.	0.0297	0.0902	0.499	$P > 0.1$
Site II.	0.0004	0.0178	1.045	$P > 0.1$
Site III.	0.0000	0.0000	–	–

that the visible nests was an unexpected result.

Is there any explanation for the unexpected lack of visibility effect, lack of aggregation of depredated nests, and lack of difference between bird and mammal predations on hidden and visible nests? Although it is not possible to rule out alternative hypotheses, the most possible explanation is based on the changes in the environmental conditions. After several years of drought there was a lot of winter precipitation in 1998/99, and an artificial inundation occurred covering about 30% of the marshland. Therefore, formerly dry areas disappeared, and only the islands remained available for terrestrial species. They included both the potential predator mammal and bird species, as well as the ground nesting passerine species. As a consequence, the crowding of nest predators might led to a diverse and dense predator community. Consequently, many individuals and species with different searching strategies predated the nests. This high predation pressure of the diverse predatory community may have resulted in the lack of the expected differences.

The site (location) had strong effect on the depredation rate, and on the predatory community, which is not surprising. Therefore, in spite of the supposed high density of the predators on the islands, still a high level of differences among the communities may exist.

The results of this study from a rarely studied habitat and geographic area supports earlier findings of site effects in nest predation studies. Further, the results highlight that environmental changes may confuse the expected "natural" patterns of nest predation.

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Összefoglalás

Mesterséges fészekaljak predációja a Kis-Balatonon: a hely és a láthatóság hatása

A mintavételi hely és a fészek láthatóságának hatását vizsgáltam mesterséges madárfészkek predációjára a Kis-Balatonon. Erős lokalitáshatást találtam, azaz a három mintavételi hely között szignifikánsan eltérő predációs ráták voltak. Azonban nem volt különbség a rejtett (<20% látható a fészekaljból), és látható (100% láthatóság) fészkek között. A predátorok (elsősorban varjúfélék és kisemlős ragadozók) között sem volt különbség a rejtett és a látható fészkek között, de jelentős különbség volt a három mintavételi hely között. A láthatóság hatásának hiánya meglepő eredmény, de a Kis-Balaton vízszintjének emelése talán magyarázattal szolgálhat. Feltételezhető ugyanis, hogy a megemelkedett vízszint a még szárazon maradt területeken, mint ahol a vizsgálati helyek is voltak, kiugróan magas predátor sűrűséget koncentrált, ami extrém magas predációt eredményezett.

References

Báldi, A. 1999. Spatial variations of nest predation rate in the Kis-Balaton reservoir. – Természetvédelmi Közlem. 8: 81-88. (In Hungarian with English summary.)

Batáry, P. & A. Báldi. 2004. Evidence of an edge effect on avian nest success. – Conserv. Biol. 18: 389-400.

Braden, G. T. 1999. Does nest placement affect the fate or productivity of California Gnatcatcher nests? – Auk 116: 984-993.

Burhans, D. E. & F. R. Thompson III. 1998. Effects of time and nest-site characteristics on concealment of songbird nests. – Condor 100: 663-672.

Burhans, D. E. & F. R. Thompson III. 2001. Relationship of songbird nest concealment to nest fate and flushing behavior of adults. – Auk 118: 237-242.

Götmark, F., Blomqvist, D., Johansson, O. C. & J. Bergkvist. 1995. Nest site selection: a trade-off between concealment and view of the surroundings? – J. Avian Biol. 26: 305-312.

Hoi, H. & H. Winkler. 1994. Predation on nests: a case of apparent competition. – Oecologia 98: 436-440.

Jobin, B. & J. Picman. 1997. Factors affecting predation on artificial nests in marshes. – J. Wildl. Manage. 61: 792-800.

Lariviére, S. & F. Messier. 1998. Effect of density and nearest neighbours on simulated waterfowl nests: can predators recognize high-density nesting patches? – Oikos 83: 12-20.

Leimgruber, P., McShea, W. J. & J. H. Rappole. 1994. Predation on artificial nests in large forest blocks. – J. Wildl. Manage. 58: 254-260.

Lőrincz, G., Moskát, C., Waliczky, Z. & A. Bankovics. 1990. Faunal mapping and environmental quality analysis by a new GIS technique. Pp. 45-50. In: Stastny, K. & V. Bejcek, (eds). Bird census and atlas studies. – Proceedings of the XIth International Conference on Bird Census and Atlas work. Prague, Czech Rep.

Major, R. E. & C. E. Kendal. 1996. The contribution of artificial nest experiments to understanding avian reproductive success: a review of methods and conclusions. – Ibis 138: 298-307.

Martin, T. E. 1988. On the advantage of being different: nest predation and the coexistence of bird species. – Proc. Natl. Acad. Sci. USA, 85: 2196-2199.

Matessi, G. & G. Bogliani. 1999. The effects of nest features and surrounding landscape on predation rates of artificial nests. – Bird Study 46: 184-194.

Mayfield, H. F. 1975. Suggestions for calculating nest success. – Wilson Bull. 87: 456-466.

Miller, M. W. 1999. Relative effects of plumage coloration and vegetation density on nest success. - Condor 101: 255-261.

Møller, A. P. 1988. Nest predation and nest site choice in passerine birds in habitat patches of different size: a study of magpies and blackbirds. – Oikos 53: 215-221.

Moskát, C. & A. Báldi. 1999. The importance of edge effect in line transect censuses applied in marshland habitat. – Ornis Fenn. 76: 33-40.

Purger, J. J., Mészáros, L. A. & D. Purger. 2004. Ground nesting in recultivated forest habitats - a study with artificial nests. – Acta Orn. 39: 141-145.

Rangen, S. A., Clark, R. G. & K. A. Hobson. 1999. Influence of nest-site vegetation and predator community on the success of artificial songbird nests. – Can. J. Zool. 77: 1676-1681.

Rönkä, A. & K. Koivula. 1997. Effect of shore width on the predation rate of artificial wader nests. - Ibis 139: 405-407.

Schmidt, K. A. & C. J. Whelan. 1998. Predator-mediated interactions between and within guilds of nesting songbirds: experimental and observational evidence. – Am. Nat. 152: 393-402.

Vanderhaegenm W. M. & R. M. Degraaf. 1996. Predation rates on artificial nests in an industrial forest landscape. – Forest Ecol. Manage. 86: 171-179.

Wiebe, K. L. & K. Martin. 1998. Costs and benefits of nest cover for the ptarmigan: changes within and between years. – Anim. Behav. 56: 1137-1144.