hanar hade vingar längre än 74,1 mm och bara honor hade vingar kortare än 70 mm. Om man antar att vinglängden är normalfördelad följer att sannolikheten att göra en felaktig könsbestämning är 0,04 för hanar och 0,06 för honor.

Med användning av detta kriterium kan 35% av rödhakarna könsbestämmas vintertid. Denna siffra är lägre än vid Ottenby (60%), vilket torde bero på att flera olika geografiska bestånd med olika genomsnittliga mått blandas i vinterområdet.

Mariano Cuadrado, Department of Ecology, Ecology Building, S-223 62 Lund, Sweden

https://doi.org/10.34080/os.v1.23099

Notes on the breeding biology of the Barred Warbler *Sylvia nisoria* at Ottenby, Sweden

ANDERS HEDENSTRÖM & SUSANNE ÅKESSON

The Barred Warbler *Sylvia nisoria* breeds from the Baltic and France eastwards to Mongolia (Moreau 1972, Harrison 1982). In Sweden it is a scarce breeder mainly in the southeastern part of the mainland (SOF 1990), but it is rather common on Öland (Waldenström 1976). The breeding biology of Swedish Barred Warblers is very poorly known; the only studies are from Ottenby (Aulén 1976) and from central and northern Öland (Pettersson 1976). Here we present some information on clutch size, hatchability, nesting success, and nest sites extracted from nest cards from our ongoing study of Barred Warblers at Ottenby, Öland.

Study site and methods

Barred Warblers were studied in 1984-1990 at Ottenby (56° 12'N, 16° 24'E) on the southernmost point of the island of Öland, SE Sweden. The study area is characterized by an old deciduous forest surrounded by shrubby grassland. The main breeding area of the Barred Warbler is the forest edge, an area dominated by shrubs of the genera *Prunus*, *Crataegus*, *Rubus* and *Juniperus*. We searched for nests mainly in June and early July. Adult birds were mist-netted near their nests, aged and sexed according to criteria in Williamson (1968), Schmidt (1981), Busse (1984), Svensson (1984) and own observations. Breeding birds were sexed according to the incubation patch (see Hasselquist et al. 1988). Each nest was given a number in a year and information about the nest site, parent birds and nest content was filed on a nest card after each visit. In this study we use information from 63 nest cards obtained in 1984 (8), 1985 (15), 1986 (23), 1987 (8), 1988 (3), 1989 (3) and 1990 (3). As the information contents varied on different nest cards only subsets of the cards could be used in different analyses.

Results and discussion

Nests were mostly placed in dense scrub close to the forest edge (cf. Aulén 1976). Their distribution among bush species is presented in Table 1 together with information on their height above the ground. Aulén (1976) did not find any Barred Warblers nesting in *Juniperus communis* during his study (1971-1975) at Ottenby. In contrast we found *J. communis* to be the most common nest site (Table 1). This can be due to either a change in the birds' preference or a sampling bias between the two studies. *J. communis* has probably not become significantly more abundant since 1971-1975 so we think a sampling bias is the most likely explanation. In northern Germany most Barred Warblers nests were found in *Rubus* spp. (Neuschulz 1981). If *J. communis* was preferred as nest site we would expect a lower predation rate among nests in *J. communis* compared to nests in other bush species. However, the predation tended to be higher for nests in *J. communis* compared to nests in other bushes, although it was not significantly different (G-test, $p>0.05$). Nest site distribution among bush species probably reflects availability rather than preference. The mean height of nests in our study (0.78m, Table 1) does not differ significantly from what Neuschulz (1981) found in Germany (0.65 m). Nests tended to be placed higher up in *J. communis* than in other bush species, probably because of the latter's architecture.

The first birds arrive in the breeding area about 20 May (Aulén 1976, Enquist & Pettersson 1986, own

Table 1. Nest sites of Barred Warblers *Sylvia nisoria* at Ottenby in 1984-1990.

Boplatser för höksångare Sylvia nisoria vid Ottenby under 1984-1990.

Species of shrub *Art av buske*	No. of nests *Antal bon*	% of nests *% bon*	Mean height of nests (m) *Bonas medelhöjd (m)*
Juniperus communis	18	35	1.05
Crataegus sp.	14	27	0.72
Rubus fruticosus	10	19	0.57
Potentilla fruticosa	4	8	0.65
Rosa sp.	3	6	0.63
Prunus spinosa	2	4	0.45
Rubus idaeus	1	2	0.50
Total	52		0.78

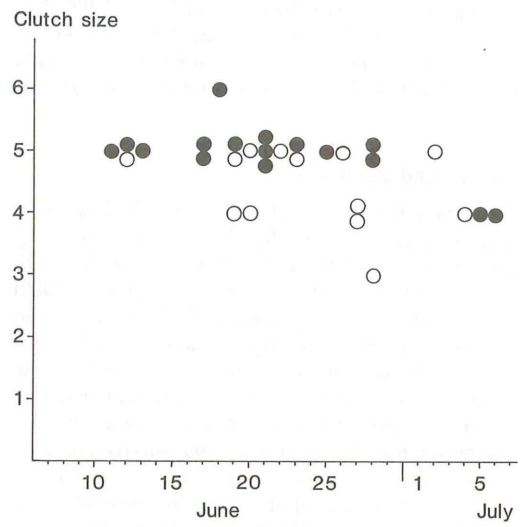

Fig. 1. Clutch size in relation to date of hatching for Barred Warbler females breeding for the first time (open circle) and older females (filled circle). Regression equation for first breeders is: y=5.38-0.038x; older birds: y=5.76-0.38x, where y is clutch size and x is date with 1 June as day one. Only the regression for older females was statistically significant ($p<0.01$).

Kullstorlek i relation till kläckningsdatum för äldre hök–sångarhonor (fyllda punkter) samt för honor som häckar för första gången (ofyllda punkter). Regressionsekvationen för förstagångshäckare är: y=5,38-0,038x; för äldre fåglar: y=5,76-0,38x, där y är kullstorleken och x är kläckningsdatum med första juni som dag ett. Endast regressionen för äldre honor var statistiskt signifikant (p<0,01).

observations), but new birds continue to settle in the area up to the beginning of June. Median hatching day was 21 June (n=16) for clutches of adult (3y+) females and 23 June (n=13) for those of females breeding for their first time (2y), which is about one week later than in northern Germany (cf. Neuschulz 1981).

Average clutch size was 4.80 eggs (S.D.=0.51, range 3-6, n=44), which is smaller than in northern Germany (5.02, Neuschulz 1981), but not significantly so (t-test, $p>0.05$). Adult females had on average larger clutches (mean=4.94, S.D.=0.44, n=16 (than females breeding for the first time (mean=4.46, S.D.=0.66, n=13; t-test, $p<0.05$). Clutch size decreased with the progress of the season for females of both age classes, although only significantly so among older females (Fig. 1). A decline of clutch size in relation to the season is a common pattern among passerines (Klomp 1970).

Out of 48 clutches 9 (19%) were completely destroyed by predators. The frequency of known unhatched eggs was 8 (3.7%) out of 219, distributed among 6 clutches out of 48. Including also probably unhatched eggs this figure increases to 19 (8.7%). The total losses during the egg and early nestling stages (until nestlings were at least 6 days old) amounted to 24.7% including losses of the whole clutch. The corresponding losses from hatching onwards were 13.4%. Among 38 broods we observed a reduction (mortality or partial predation) in the number of young in three (7.9 %). On the whole, losses of eggs and young during various stages of the nesting cycle were smaller than in Germany (cf. Neuschulz 1981).

Acknowledgements

We are grateful to Staffan Bensch, Dennis Hasselquist, Noel Holmgren, Hans Källander, Åke Lindström, Ulf Ottosson and Jan Pettersson for assistance during field work and to Hans Källander for comments that improved the manuscript. The study was financially supported by funds from Axel Bucht's Ottenby Foundation and from the Elis Wide Foundation. This is contribution no. 133 from Ottenby Bird Observatory.

References

Aulén, G. 1976. The occurrence of Barred Warblers, *Sylvia nisoria* at Ottenby, SE Sweden in 1971-1975. *Calidris* 5:113-124.

Busse, P. 1984. *Key to ageing and sexing of European passerines. Beitr. Naturk. Niederchs.* 37, Sonderheft.

Enquist, M. & Pettersson, J. 1986. The timing of migration in 104 bird species at Ottenby - an analysis based on 39 years trapping data. *Spec. rept. Ottenby Bird Observatory* no. 8, Degerhamn.

Harrison, C. 1982. *An atlas of the birds of the Western Palearctic.* Collins, London.

Hasselquist, D., Hedenström, A., Lindström, Å. & Bensch, S. 1988. The seasonally divided flight feather moult in the Barred Warbler *Sylvia nisoria* - a new moult pattern for European passerines. *Ornis. Scand.* 19:280-286.

Klomp, H. 1970. The determination of clutch-size in birds. A review. *Ardea* 58:1-124.

Moreau, R. E. 1972. *The Palaearctic-African bird migration systems.* Academic Press, London and New York.

Neuschulz, F. 1981. Brutbiologie einer Population der Sperbergrasmücke (*Sylvia nisoria)* in Norddeutschland. *J. Ornithol.* 112:231-257.

Pettersson, H. 1976. The Barred Warbler, *Sylvia nisoria*, at the northernmost point of Öland and at Beijershamn 1971-1976. *Calidris* 5:125-130.

Schmidt, E. 1981. Die Sperbergrasmücke *Sylvia nisoria. Neue Brehm Bücherei* No. 542. A Ziemsen Verlag, Wittenberg Lutherstadt.

SOF 1990. *Sveriges fåglar.* 2:a upplagan. Stockholm.

Svensson, L. 1984. *Identification guide to European passerines.* Svensson, Stockholm.

Waldenström, C. 1976. Höksångarens *Sylvia nisoria* utbredning på Öland. *Calidris* 5:131.

Williamson, K. 1968. Identification for ringers 3. The genus Sylvia. 2nd ed. *BTO Guide* 9, Tring.

Sammanfattning

Häckningsdata för höksångare Sylvia nisoria vid Ottenby.

Höksångaren häckar sparsamt i framförallt sydöstra Sverige. På Öland och Gotland förekommer den dock tämligen allmänt. Våra kunskaper om de svenska höksångarnas häckningsbiologi är mycket små. Vi presenterar därför här information om häckningstid, kullstorlek och boplatsval från vår studie av höksångare vid Ottenby. Vi har sammanställt data från 63 bokort från åren 1984-1990. Val av buskart och höjd över marken för boets placering redovisas i Tabell 1. Troligen återspeglar fördelningen bland buskarter den relativa tillgången av buskar av olika arter snarare än speciella preferenser hos höksångarna. De första fåglarna anländer till häckningsområdet ca. 20 maj. Mediandatum för ungarnas kläckning var 21 juni för äldre honors (3K+) kullar och 23 juni för förstagångshäckare (2K). Medelkullstorleken var 4.80 (n=44). Äldre honor lade signifikant större kullar än honor som häckade för första gången (3K+ 4.94 ägg, 2K 4.46 ägg). Kullstorleken tenderar att minska ju senare på säsongen häckningen sker (Fig. 1). Av 48 kullar rövades 9 (19%). Från äggstadiet fram till det ungarna är sex dagar gamla reducerades antalet ungar med ca. 25% genom predation av hela kullen, partiell predation eller mortalitet.

Anders Hedenström, Department of Ecology, Theoretical Ecology, University of Lund, S-223 62 Lund, Sweden.
Susanne Åkesson, Department of Ecology, Animal Ecology, University of Lund, S-223 62 Lund, Sweden.

Preference for nest site height in the Starling *Sturnus vulgaris* - an experiment with nest-boxes

SÖREN SVENSSON

Introduction

The use of nest-boxes and other types of artificial nesting facilities has become a very important method in both descriptive and experimental ornithology. With nest-boxes it is easy to collect rapidly large amounts of information on breeding biology and behaviour. It is also easy to design controlled experiments with sufficient sample sizes also when several variables are being manipulated.

Nest-box breeding species have been studied more intensively than almost any other species, at least among the passerines. It is certainly not a mere coincidence that the Pied Flycatcher *Ficedula hypoleuca*, the Great Tit *Parus major*, and the Starling *Sturnus vulgaris* belong to this category of well studied species. These same species have also been used more often than other species when testing different hypothesis about evolution, adaptation, and behaviour.

However, the use of nest-boxes introduces several artificial components that may affect the behaviour of the birds. If nest-boxes are put up in an area without natural cavities, the birds will have no choice: they must accept the surface area and hole diameter of the box and the height above ground, tree species, and position of the box in other respects chosen by the designer of the study. In many studies the birds will have little or no choice between different types and locations of nest-boxes, simply because it is often a part of the design to minimize the number of variables: all nest boxes are similar and placed at the same height above ground, often very low to facilitate inspection.

It is well known that different species of hole-nesting birds have different preferences for height above ground, hole diameter, and cavity size (e.g. Löhrl 1970). Although there are several studies on the selection of natural cavities by birds there are few controlled experiments on the choice of nest boxes, apart from those aimed at establishing cavity size and entrance hole diameter for different species (e.g. Enemar 1980, Löhrl 1986, 1987). An important variable is height above ground, studied by, for example, Löhrl (1986, 1987). There was a height segregation between different tit species, Great Tits showing a preference

Table 1. Number of breeding attempts and breeding success of the Starling *Sturnus vulgaris* in nest-boxes at different height above ground at two localities, Silvåkra (S) and Västra Tvet (T). All young at Västra Tvet were taken by a Marten.

Antal häckningar och häckningsresultat för stare i holkar på olika höjd över marken i två holkgrupper, en vid Silvåkra (S) och en vid Västra Tvet (T). Alla ungar vid Västra Tvet togs av en mård.

Height of nest boxes *Holkarnas höjd*	1.5 m		3.0 m		4.5 m	
Site *Lokal*	S	T	S	T	S	T
No of nest boxes *Antal holkar*	8	8	8	8	8	8
Nests with at least 1 egg *Bon med minst 1 ägg*	6	6	6	6	8	8
Completed clutches *Fulla kullar*	5	6	5	5	8	7
Hatched clutches *Kläckta kullar*	5	6	5	4	8	7
Fledged broods *Flygga kullar*	3	0	4	0	6	0