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Habitat preferences and population trends in the Barred Warbler *Sylvia nisoria* in the Ottenby area, southeast Sweden

Habitatval och populationsförändringar hos höksångaren Sylvia nisoria *i Ottenby-området*

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Abstract

We performed a detailed census of the breeding population of Barred Warblers *Sylvia nisoria* in the Ottenby area on the southernmost part of the island Öland, SE Sweden, in the years 1999 and 2000. The number of territories in the study area was similar to the census conducted in 1971–1975, although the distribution of territories had changed. In 1999–2000 most territories were located in the grazed Alvar habitat (a limestone rich steppe found on some island in the southern Baltic Sea) in the north part of the study area, whereas areas in which grazing had ceased since 1971–1975 had been more or less abandoned. Data from the standardized trappings at Ottenby Bird Observatory showed no significant changes in the annual number of trapped juvenile Barred Warblers, also suggesting a stable population size. We investigated the vegetation (species composition and spatial structure) in occupied territories and compared these with randomly distributed plots in the same habitats. Occupied territories were overall more spatially varied, with a large proportion of the vegetation consisting of low and middle-sized bushes. We also use these habitat preference data to outline management advice for this rather uncommon species with fragmented distribution pattern.

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Introduction

The Barred Warbler *Sylvia nisoria* has a large distribution in continental Eurasia, occurring in a broad belt from Germany, Italy and Balkans in the west well into central Russia in the east (Cramp 1992). The Swedish population is small, 260–350 pairs (Svensson et al. 1999), and it is situated at the westernmost limit of the species' European distribution. Consequently, the Barred Warbler is rare and local in Sweden, confined mainly to suitable habitats at the large islands Öland and Gotland in the Baltic Sea. Outside this region, there are only scattered small populations (<10 pairs) along the eastern coast of Sweden, e.g. on islands in the archipelagos of eastern Småland and Stockholm. Occasionally, it is found at inland localities or in western Sweden, but nowhere in larger numbers than a few pairs (SOF 1990).

With this metapopulation-like distribution of small scattered breeding populations, Barred Warblers in Sweden should be vulnerable to any kind of negative changes. Hence, to safeguard the long-term survival of the species in Sweden, information on the population trends and on habitat preferences is needed. Studies from other breeding areas in Europe may not be directly applicable to the Swedish situation. There are a few studies from the Swedish population, but nearly all date back some 25 years (Aulén 1976, Pettersson 1976, Waldenström 1976, Hedenström & Åkesson 1991, Pettersson 1995).

In the present study we surveyed one of Sweden's most viable populations of Barred Warblers, located in the Ottenby area at the southernmost tip of Öland. This population has been studied in detail by Aulén in the 1970s (Aulén 1976), and by the staff of Ottenby Bird Observatory in the 1980s and 1990s (Hasselquist et al. 1988, Hedenström & Åkesson

1991, Lindström et al. 1993, Pettersson 1995), allowing for studies of changes in population size since the 1970s to present. Furthermore, we have investigated which specific vegetation parameters that influence the distribution of breeding pairs in the area – crucial knowledge for implementation of management plans to safeguard the long-time survival of the species in Sweden.

Material and methods

Study area

The study area was situated within the Ås parish, which comprises the southernmost part of the island Öland. The northern border of the study area was the "Karl X mur"; a stonewall built in 1653 stretching almost linearly from the western to the eastern shore of Öland (Figure 1). The surveyed area, 1400 ha, belongs, at least in parts, to the Ottenby Nature Reserve, and comprises a variety of diverse habitats: shore meadows, intensively and extensively managed pastures, limestone-rich Alvar, deciduous forest, and farmlands.

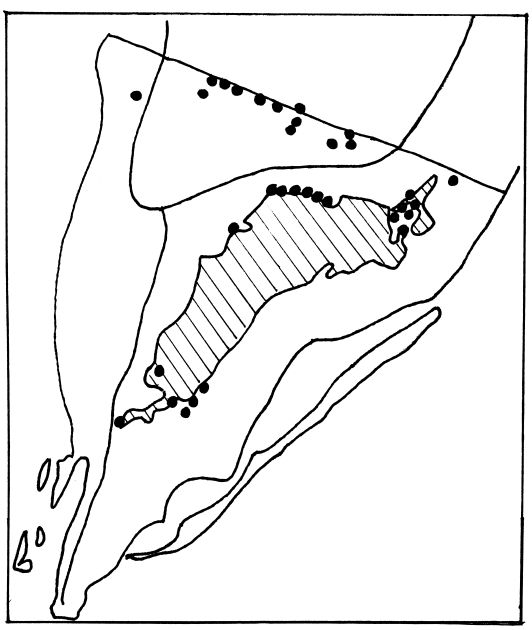

Figure 1. The distribution of Barred Warbler *Sylvia nisoria* territories within the study area 1999–2000. The straight line shows the Karl X wall, which constituted the northern boundary of the investigated area.
Höksångarrevirens fördelning inom studieområdet 1999–2000. Karl X mur avgränsade området i norr, och är utmärkt som en linje på kartan.

We surveyed all suitable breeding habitats for Barred Warblers within the study area, i. e. forest edges, shrubby pastures, and Alvar land during the 1999 and 2000 breeding seasons (in total 358 hours in May–July). All parts of the study area were surveyed at least three times during the song period each season (mid May – early June). In areas where Barred Warblers were found, additional visits (three to six visits per season) were conducted.

Assessing number of territories

When encountering a Barred Warblers in the field, we noted its sex, plumage, song activity, alarm calls, feeding activities, nest visits and food provisioning to young. We divided the survey material into breeding criteria on the basis of number of observations: (1) single observation of a singing male, (2) two observations of singing male, (3) observation of a female or pair in suitable breeding habitat, (4) more than two observations of singing male, and (5) feeding by adults to nestlings or newly fledged young. All sites in which criteria 4 or 5 were noted were treated as a confirmed territory (hereafter named territory), and all sites with breeding criteria of 1–3 were regarded as potential territories.

Habitat descriptions

In all territories, and in the random plots (see below), we made descriptions of the vegetation. In a circle with a 50 m radius, using the male's main singing site as centre (usually the top of a tall tree), we scored the proportion of the area covered by different vegetation types (types and their spatial structure are listed in Table 1). To reach as confident approximations as possible, two persons always did the scoring independently, and the final score was the average of the two scores. In cases where a territory wbâ inhabited in both census years, we used only the vegetation scores from 2000.

We chose the male's main singing site as the central point from which the circular habitat descriptions were taken. This then only provides an approximation of how the true territories looked like. However, locating singing sites is undoubtedly easier than finding nests, or to define territory borders with aid of playback experiments, thereby providing more data points to the study. The singing site is most likely situated in the defended territory, but it has been observed occasionally, usually in dense Barred Warbler populations, that more than one individual can utilise the same site (Cramp 1992).

Table 1. Vegetation classification and its spatial structure.
Vegetationstyper och deras spatiala struktur.

Classification *Klassificering*	Dominant species *Dominerande arter*	Structure *Struktur*
Tall deciduous trees (>3 m) *Höga lövträd (> 3 m)*	*Querqus robur, Betula pendula, Populus tremula*	Tree level *Trädskikt*
Low deciduous trees and shrubs (<3 m) *Låga lövträd och lövbuskage (< 3 m)*	*Querqus robur, Betula pendula, Salix sp.*	Higher bush level *Högre buskskikt*
Juniper *En*	*Juniperus communis*	Higher bush level *Högre buskskikt*
Blackthorn *Slån*	*Prunus spinosa*	Lower bush level *Lägre buskskikt*
Hawthorn *Hagtorn*	*Crataegus sp.*	Higher bush level *Högre buskskikt*
Shrubby Cinquefoil *Tok*	*Potentilla fruticosa*	Lower bush level *Lägre buskskikt*
Wild roses *Vildros*	*Rosa* sp.	Lower bush level *Lägre buskskikt*
Raspberries *Björnbär/hallon*	*Rubus* sp.	Lower bush level *Lägre buskskikt*
Tall herbs *Höga örter*	Poace sp., *Filipendula ulmaria, Hypericum sp.*	Field level *Markskikt*
Intensively grazed pasture *Intensivt betad gräsmark*	Poace sp.	Field level *Markskikt*
Extensively grazed pasture *Extensivt betad gräsmark*	Poace sp.	Field level *Markskikt*
Farmland *Odlad åker*	Different crops *Olika grödor*	Field level *Markskikt*
Non-grazed grassland *Obetad gräsmark*	Poace sp	Field level *Markskikt*

Random plots

We sampled random plots and conducted vegetation descriptions (as described above) to compare these with the vegetation found in occupied territories. Two different methods were used to distribute the random plots. At the deciduous Ottenby Wood, we distributed one random plot at the forest edge. From this initial plot we made additional plots along an approximately 5 km long stretch of the forest border. The centre of each new plot lied at a distance of 200 m from the centre of the previous plot. This yielded 23 plots, covering a large proportion of the total forest edge. In the Alvar area in the northern part of the study area, 18 random plots were distributed using real territories as starting points. The location of random plots was sampled with 100 m distance from the centre of a real territory in N, E, W or S direction. The direction was chosen randomly. If a random plot (1) covered >50% of an existing territory, or (2) if it fell outside the study area, that plot was abandoned and a new direction was chosen. In one case all directions fell in either of these categories and a direction was then chosen anyway.

Changes in population size

We used two datasets to investigate trends in breeding population size: trapping numbers at Ottenby Bird Observatory (situated at the southern limit of the study area), and census numbers from a survey conducted in the same area in 1971–1975 (Aulén 1976). Trapping data originated from the standardized trapping scheme at the observatory (Hjort & Lindholm 1978), and we used the annual number of juvenile birds trapped 1976–2003 in the period July–September as a population size index. The number of trapped adult individuals was too small to analyse. A few juvenile birds trapped in late October, approximately one month after the last local birds

Table 2. Frequency of stable and unstable territories in 1999–2000.
Antalet stabila respektive flyktiga revir under åren 1999–2000.

	Forest edge *Skogskanten*	Alvar *Alvarmarken*	Total *Totalt*	Classification *Indelning*
Territory in both years *Revir båda åren*	9	6	15	Stable territory *Stabilt revir*
Territory one year, potential territory one year *Revir ett år, potentiellt revir ett år*	4	1	5	Stable territory *Stabilt revir*
Territory one year, no territory one year *Revir ett år, inget revir ett år*	6	9	15	Unstable territory *Flyktigt revir*
Potential territory one year *Potentiellt revir under ett år*	4	6	10	Unstable territory *Flyktigt revir*

Table 3. Mean vegetation score in forest edge territories (n=19), forest edge random plots (n=23), alvar territories (n=16) and alvar random plots (n=18).
Vegetation i medelrevir och slumpytor i skogsbryn och alvarmark.

	Forest edge *Skogsbryn*		Alvar *Alvar*	
	Territory *Revir*	Random plot *Slumpyta*	Territory *Revir*	Random plot *Slumpyta*
Tall deciduous trees (>3 m) *Höga lövträd (> 3 m)*	22.1 %	48.7 %	2.8 %	0.4 %
Low deciduous trees and shrubs (<3 m) *Låga lövträd och lövbuskage (< 3 m)*	7.4 %	1.0 %	4.9 %	0.8 %
Juniper bushes *Enbuskar*	1.1 %	0 %	4.8 %	5.3 %
Blackthorn bushes *Slånsnår*	2.8 %	0.1 %	5.3 %	1.2 %
Hawthorn trees *Hagtornsnår*	2.1 %	1.4 %	2.1 %	0.9 %
Shrubby Cinquefoil *Tok*	4.3 %	0.9 %	29.8 %	27.8 %
Wild roses *Vildros*	0.5 %	0%	0.8 %	0.6 %
Raspberries *Björnbär/hallon*	2.4 %	0.9 %	2.1 %	0.6 %
Rank herbs *Höga örter*	8.2 %	5.3 %	0.3 %	0.6 %
Intensively grazed pasture *Intensivt betad gräsmark*	0%	9.1 %	1.0 %	16.4 %
Extensively grazed pasture *Extensivt betad gräsmark*	19.0 %	15.9 %	33.1 %	29.7 %
Farmland *Odlad åker*	15.3 %	0%	12.2 %	18.3 %
Non pastured grassland *Obetad gräsmark*	17.4 %	1.5 %	1.9 %	0%
Else *Övrigt*	0.3 %	16.0 %	2.2 %	0%

Table 4. Mean vegetation structure in forest edge territories (n=19), forest edge random plots (n=23), Alvar territories (n=16) and Alvar random plots (n=18).
Vegetationsstruktur i medelrevir och slumpytor i skogsbryn och alvarmark.

	Forest edge *Skogsbryn*		Alvar *Alvar*	
	Territory *Revir*	Random plot *Slumpyta*	Territory *Revir*	Random plot *Slumpyta*
Tree level *Trädskikt*	22.1 %	48.7 %	2.8 %	0.4 %
Higher bush level *Högre busksikt*	10.6%	2.4%	11.9%	6.9%
Lower bush level *Lägre busksikt*	10.0 %	1.8 %	37.9 %	30.2 %
Field level *Markskikt*	59.8 %	48.7 %	48.4 %	65.0 %

had left the area, were excluded from the analysis as they were considered to be migrants from eastern populations.

The investigation in the 1970s (Aulén 1976) covered the same area as the present study, but with some slight differences in methodology. In the first two years, 1971–1972, the author walked along line transects, distributed in eight different sub-areas, to get a general knowledge about where the Barred Warblers occurred. In the later years, focus lied on the areas with breeding pairs, and less work was devoted to suboptimal areas with few or no Barred Warblers. This latter way of censusing is basically similar to the methods applied in 1999–2000.

Results

In total, 50 territories were located, 21 in 1999 and 29 in 2000 (Figure 1). An additional 15 potential territories were also assigned, 9 in 1999 and 6 in 2000. The temporal consistency of the territories varied (Table 2). The territories were found in two habitat types: (1) along the edge of deciduous forest, and (2) grazed Alvar with mixed trees and bushes. These habitats share some vegetation properties, and do blend into one another in some areas of Öland. We chose, however, to treat them separately in all analyses, to enable habitat-based inferences for management advice.

Deciduous forest edge

Along the edge of Ottenby Wood, the Barred Warbler territories were mainly found in two areas: on the north border of the forest and in the southwest corner (Figure 1). Nine territories were inhabited both census years. The vegetation (species) composition of occupied territories differed from random plots in many of the measured parameters (Table 3). Significant differences were found for four investigated parameters: occupied territories had less tall broad-leafed trees than random plots (22.1% compared to 48.7%; Mann-Whitney = 49.0, n = 42, $p < 0.001$); more of low trees and bushes (7.4% compared to 1.0%; Mann-Whitney = 54.5, n = 42, $p < 0.001$); more blackthorn bushes (2.8% compared to 0.1%; Mann-Whitney = 40.5, n = 42, $p < 0.001$); and a larger proportion of non-grazed grassland (17.4% compared to 1.5%; Mann-Whitney = 82.0, n = 42, $p < 0.001$).

Looking at the vegetation structure instead of the vegetation composition (Table 4), occupied territories were significantly more diversely structured, with richer levels of lower and higher bushes compared to random plots (lower bush level: Mann-Whitney = 41.5, n = 42, $p < 0.001$; higher bush level: Mann-Whitney = 38.0, n = 42, $p < 0.001$). Furthermore, there were less tall trees and more open areas (field level: Mann-Whitney = 76.5, n = 42, $p < 0.001$).

Alvar

In the Alvar area in the northern part of the study area, the 22 territories were aggregated in the more bushy parts, which predominated in the central part of this area (Figure 1). Six of the territories were stable between the two years (Table 2). Also in the Alvar habitat did the vegetation composition differ between occupied territories and random plots (Table 3). Significant differences were found for three investigated parameters: occupied territories had on average larger proportions of low trees and bushes (4.9% compared to 0.8%; Mann-Whitney = 39.5, n = 34, $p < 0.001$); more blackthorn bushes (5.3% compared to 1.2%; Mann-Whitney = 49.0, n = 34, $p = 0.001$); and more hawthorn bushes (2.1% compared

to 0.9%; Mann-Whitney = 76.0, n = 34, p < 0.012).

The only significant difference between random plots and territories, when looking at vegetation structure classes (Table 4), was that occupied territories had a more pronounced level of higher bushes (Mann-Whitney = 86.5, n = 34, p = 0.046). We measured the distances from the centre of all occupied territories, and random plots, to the nearest large deciduous trees (including also plots with distance=0). In random plots the mean distance was 127 m compared to 73 m in the territories (t = 1.751, d.f. = 32, p = 0.090).

Changes in population size and distribution

The number of trapped juvenile Barred Warblers in the trapping scheme at Ottenby Bird Observatory varied between 2–28 birds in different years (Figure 2), but showed no significant trend over time (Pearson, R=–0.297, n=28, p=0.125).

During the years 1971–1975 the breeding population in the Ottenby area varied between 17–33 territories annually (Aulén 1976), compared to 21–29 territories in our study. This suggests that there have been only minor changes in the size of the breeding population in the area. There have, however, been considerable changes in the geographical distribution of the territories within the study area (Figure 3). The numbers of territories in the Alvar area have increased (Pearson, R=0.900, n=6, p=0.014), while the number of territories in the forest edge habitat shows a weak tendency to have decreased (Pearson, R=–0.581, n=6, p=0.226).

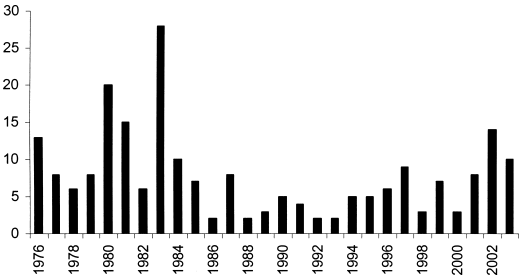

Figure 2. The annual number of trapped juvenile Barred Warblers *Sylvia nisoria* in the standardized trapping at Ottenby Bird Observatory in the period 1974–2003.
Antalet juvenila höksångare fångade i den standardiserade fångsten vid Ottenby Fågelstation åren 1974–2003.

Discussion

Habitat requirements

In this study, Barred Warblers were found in two kinds of habitat: forest edges with good mixture of vegetation elements of different heights, and shrubby Alvar areas with scattered stands of deciduous trees. These habitats were rather similar in vegetation structure, with rich bush levels, but differed in species composition. Both could be regarded as non-stable habitats, as they are succession states between forest and pasture. If left ungrazed, or unmanaged, they would likely loose their qualities as breeding sites for Barred Warblers when the vegetation structure changes to a dense cover of tall trees at the expense of low and high bushes. However, intensified grazing or clearings of bushes would also result in unsuitable habitats for Barred Warblers due to loss of low and tall bushes.

Comparison of territories and random plots showed that forest territories had a significantly more diverse spatial structure, with less tall trees, more developed bush vegetation, and the territories were more open at the field level. In the Alvar area, the differences in vegetation structure between territories and random plots were less pronounced; the only key difference was that territories had a larger proportion of high bushes. This finding could have been slightly biased, as Barred Warbler males prefer to sing from the top of a tall bush or tree, and that this position at the same time was used as the centre in the territory vegetation mapping.

Tall broad-leaf trees were often used by foraging Barred Warblers in both habitats, but in the Alvar area birds did not always have access to trees within the circular territory defined by us. Instead, birds were frequently seen flying large distance (up to 500m) from their territories to stands of trees for foraging, which also has been observed earlier by Aulén (1976) in territories away from the forest habitat. We measured the distance to closest stand of large broad-leaf trees in Alvar territories and random plots, and found the mean distance to be 73 m and 127 m, respectively. This difference tended to be statistically significant, but together with observational data, this suggests that the presence of trees is also important in the Alvar habitat.

Some particular vegetation elements were found to be typical for territories occupied by Barred Warblers. Both in the forest edge and Alvar habitats, low deciduous trees and blackthorn shrubs were especially important and in the Alvar habitat also presence of hawthorn shrubs. Only little systematic search for nests was done in this study, but

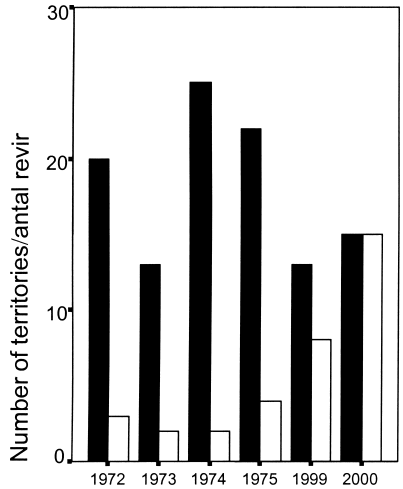

Figure 3. The number of Barred Warbler *Sylvia nisoria* territories in the 1970s (from Aulén 1976) compared to the censuses in 1999 and 2000. Territories found in the forest edge habitat are shown as filled bars and those found in the Alvar with open bars.
Antalet revir i skogskantshabitat och alvarhabitat på 1970-talet (från Aulén 1976) jämfört med inventeringarna 1999 och 2000. Skogsrevir är fyllda staplar och alvarsrevir är ofyllda staplar.

Hedenström & Åkesson (1991) have published data for 52 nests from the forest edge habitat of the same study area in 1984–1990. They found 18 nests in junipers, 14 in hawthorn, 11 in *Rubus* sp., four in *Potentilla fruticosa,* three in *Rosa* sp., and two nests in blackthorn bushes. Based on the difference between their data and that of Aulén (1976), who found nine nests in hawthorn and 21 nests in *Rubus* sp., it was suggested that nest site choice probably reflected availability rather than preference (Hedenström & Åkesson 1991).

Population trends

Using census data from the 1970s, when a similar study was performed in the same study area (Aulén 1976), we found no differences in the overall size of the breeding population at Ottenby. However, the distribution of territories within the study area had changed, with more territories now being found in the north part of the study area in the Alvar habitat. The increase of Barred Warblers in this habitat type is most likely an effect of changes in land use and grazing pressure. The investigated Alvar lies mainly outside the preserved area of the Ottenby Nature Reserve. In the 1980s and 1990s this area was not grazed, increasing the number of trees and bushes in the habitat. In 1998, the area started to be grazed again, but with a quite extensive grazing regime so that large parts of this area now hold varied and structurally diverse vegetation. It seems as these changes have been beneficial for the Barred Warblers.

It is also interesting to note the changes related to grazing at Klockarängen in the north-eastern corner of the study area. This was the area densest in Barred Warbler territories in 1984–1986. However, grazing stopped in the southern part of this area around 1990 and there were no Barred Warbler territories in this part in 1999–2000, whereas the grazed northern part still showed quite high densities of Barred Warblers.

In the forest habitat, we could not detect any large changes either in the number or distribution of territories. The forest edge areas harbouring Barred Warblers today are more or less the same as those in the 1970s. This stability is remarkable, and shows that the reserve management plan has been able to maintain the succession state of wood to pasture using an extensive grazing regime. Thus, it seems as an extensive grazing regime is optimal for creating the mixture of habitat elements which are important for the occurrence of Barred Warblers, both in the forest edge and the Alvar habitat. Grazing maintains openings at the field level and browsing shapes trees and bushes, selects for browsing-tolerant species and hampers colonisation of fast-growing tree species.

It should be noted that the Barred Warbler is comparatively hard to census due to its secretive behaviour on the breeding grounds. The territorial males sing only for a rather short period (Cramp 1992), and territories in peripheral, less densely populated areas could thus be overlooked. In the core areas, territories can occur side by side making it difficult to establish the exact number of pairs. The methodologies used in this study and the one of Aulén (1976) were comparable, both allocating more time to core areas. Therefore, the total population size in the study area might have been underestimated, but probably not much. The censuses conducted in the 1970s probably were more concentrated to the forest edge habitats, where most pairs were found at that time, which could have underestimated the numbers in the Alvar habitat slightly. We are confident, however, that the Alvar area nowadays holds a larger population of Barred Warblers than in the 1970s and the early 1980s, and that this increase reflects changes in vegetation parameters and grazing

pressures rather than differences in methodologies between studies.

The trapping data from Otteny Bird Observatory suggests a rather stable population. In fact, there has been no significant change in the number of juvenile birds trapped at the Bird Observatory from 1976 to present. However, the trapping index is likely to reflect the situation in a larger geographical area which, given the species distribution in Sweden and SE migratory direction, likely consists of the whole island of Öland. Unfortunately, there are no ringing recoveries as yet of these juvenile birds in the following breeding seasons.

Management advice

The two habitats used by Barred Warblers in this study have fairly large distribution on Öland and Gotland, the islands that also harbours most breeding Barred Warblers, which make the results of this study applicable for a larger area. Barred Warblers clearly have specific preferences regarding their breeding habitat. Both the Alvar and the forest edge territories exhibited a mixed spatial structure, with rich lower and higher bush-levels, compared to random plots. As a result preferred patches are varied, with dense bushes for nest sites, large broad-leafed trees for foraging, but yet still containing sunny areas kept open by moderate grazing. This mixture is not easy to maintain, and require grazing or possibly some kind of management.

In forest edges, creating and maintaining suitable breeding habitat for Barred Warblers is best done by safeguarding the existence of a gradient from tall trees to low bushes. In Alvar habitats, there is a need for concern not to clear the pasture too much. One has to leave groups of deciduous trees and also to save rich bush vegetation. Stands of young bush-like broad-leaf trees and bushes of blackthorn seem to be particularly important to save. For nest sites *Rubus, Crataegus* and *Juniperus* bushes are most valuable to preserve.

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Svensk sammanfattning

Höksångaren *Sylvia nisoria* är en sällsynt häckfågel i Sverige, med en uppskattad populationsstorlek på 260–350 par, varav merparten återfinns på Öland och Gotland (Svensson et al. 1999). På Öland har arten studerats vid ett par tillfällen (Aulen 1976, Pettersson 1976, Waldenström 1976, Hedenström & Åkesson 1991, Pettersson 1995), men trots detta är dess häckningsbiologi och biotopkrav dåligt kända. I föreliggande artikel har vi studerat höksångarens populationsutveckling i Ottenbyområdet genom att jämföra inventeringar gjorda 1971–1975 och 1999–2000, samt analyserat artens habitatskrav på södra Öland.

Material och metoder

Inventeringsytan omfattade området söder om Karl X mur i Ås socken på södra Öland, sammanlagt ca 1400 hektar. Området, som till stora delar utgörs av Ottenby naturreservat, består av en blandning av biotoper: betade strandängar, betesmark, alvarmark, ädellövskog och åkermark. Alla för höksångaren lämpliga biotoper inom inventeringsområdet (skogsbryn, buskrik betesmark, alvarmark) inventerades under häckningstiden åren 1999 och 2000. Sam-

manlagt lades 358 inventeringstimmar ner under perioden maj – juli. Samma område inventerades även åren 1971–1975 av Aulén (1976), samt har undersökts av personal från Ottenby Fågelstation vid olika tillfällen under 1980- och 1990-talen (t.ex. Hedenström & Åkesson 1991).

Häckningsindicier och biotopsbeskrivningar

Alla delar av undersökningsområdet besöktes minst tre gånger per år, och områden som hyste höksångare besöktes ytterligare 3–6 gånger. Det samlade inventeringsmaterialet delades upp efter styrkan på häckningsindicierna, enligt: (1) enstaka observation av revirhävdande hane, (2) två observationer av revirhävdande hane, (3) observation av hona eller par i lämplig miljö, (4) mer än 2 observationer av revirhävdande hane, (5) matning av kull eller nyligen flygg kull. Område med häckningsindicium 4 eller 5 bedömdes som ett säkert revir, medan ett område med kategori 1–3 bedömdes som ett potentiellt revir. I alla säkra revir (häckningsindicium 4 eller 5) och i ett antal slumpvis ”utplacerade revir” (se nedan) gjordes biotopbeskrivningar. Utgångspunkten för biotopbeskrivningen var den revirhävdande hanens sångplats (oftast toppen på en buske eller ett träd) och från denna klassades arealen inom en radie av 50 m med avseende på täckningsgrad av olika vegetation. Vegetationselementen och deras rumsliga struktur listas i Tabell 1. Bedömningarna av täckningsgraden var medelvärdet av två personers oberoende skattningar för varje yta.

Slumpvist utplacerade revir

För att erhålla jämförelsematerial slumpades ett antal revir ut i de områden som hyste höksångare. Dessa fördelades olika beroende på habitatstyp (alvarmark eller skogsbyn), men gemensamt var att de hade samma storlek som de riktiga reviren.

I alvarmarken slumpades revir ut med ett avstånd på 100 m från befintliga revir i antingen N, O, V eller S riktning utifrån det befintliga reviret. Riktningen togs ut slumpmässigt. Om ett revir låg i randen av habitatet, i utkanten av undersökningsområdet eller överlappade med mer än 50% till ett befintligt revir tog vi bort de alternativ som skulle hamna fel och riktningen slumpades i de kvarvarande riktningarna. Om ingen lämplig riktning fanns slumpades en riktning i alla fall (ett fall).

I skogsbrynet av Ottenby Lund slumpades ett första slumprevir ut, sedan placerades nya slumprevir ut vart 200:e meter längs kanten av skogen.

Populationsförändringar

Vi använde två olika källor för att utröna eventuella populationsförändringar hos höksångaren i området; fångstsiffror från Ottenby Fågelstation och äldre inventeringar av Ottenbyområdet (Aulén 1976). I den förstnämnda källan analyserade vi fångsten av juvenila höksångare i fågelstationens standardiserade höstfångst åren 1976–2003. Ett fåtal riktigt sena höstfåglar fångade i oktober borttogs från analyserna eftersom dessa fåglar sannolikt hade ett östligt ursprung. Antalet fångade adulter var för litet för att analysera.

Resultat

Totalt fann vi 50 säkra revir (21 st 1999, 29 st 2000) och 15 potentiella revir (9 st 1999, 6 st 2000, Figur 1). Av dessa bedömdes 20 som stabila revir, d.v.s. att de var besatta båda studieåren (Tabell 2). Huvudsakligen förekom höksångarna i två olika habitatstyper; buskrik alvarmark och i betade skogsbryn. Utifrån bevarandebiologiska aspekter valde vi att behandla dessa habitatstyper separat.

Skogsbryn

Höksångare påträffades framför allt i de norra och sydvästra delarna av Ottenby Lund, där skogen bildar utdragna skogsbryn ut i öppna områden (Figur 1). Vegetationen i bebodda revir skiljde sig från slumpytorna (Tabell 3). Reviren hade en lägre andel höga lövträd än slumpytorna (22.1% jämfört med 48.7%; Mann-Whitney = 49.0, n = 42, $p < 0.001$), mer låga träd och buskar (7.4% jämfört med 1.0%; Mann-Whitney = 54.5, n = 42, $p < 0.001$), mer björnsbärssnår (2.8% jämfört med 0.1%; Mann-Whitney = 40.5, n = 42, $p < 0.001$) och en genomsnittligt större andel av obetade öppna ytor (17.4% jämfört med 1.5%; Mann-Whitney = 82.0, n = 42, $p < 0.001$).

Om man grupperar vegetationen i strukturklasser (Tabell 4) hade reviren en större proportion av lägre och högre buskskikt (lågt buskskikt: Mann-Whitney = 41.5, n = 42, $p < 0.001$; högre buskskikt: Mann-Whitney = 38.0, n = 42, $p < 0.001$) och mer öppet fältskikt än slumpytorna (Mann-Whitney = 76.5, n = 42, $p < 0.001$).

Alvarmark

Alvarmarken i norra delen av undersökningsområdet höll totalt 22 revir, belägna mestadels i de centra-

la buskrika delarna (Figur 1). Sex av dessa var stabila mellan åren (Tabell 2). Reviren hade en högre andel låga träd och buskar (4.9% jämfört med 0.8%; Mann-Whitney = 39.5, n = 34, p < 0.001), mer björnbärssnår (5.3% jämfört med 1.2%; Mann-Whitney = 49.0, n = 34, p = 0.001) och mer hagtorn än slumpreviren (2.1% jämfört med 0.9%; Mann-Whitney = 76.0, n = 34, p < 0.012). Sammantaget hade reviren en större proportion högre buskskikt (Mann-Whitney = 86.5, n = 34, p = 0.046; Tabell 4). Vi mätte även avståndet från mitten av reviren/slumpytorna till närmsta högre lövträd (inklusive ytor med avstånd = 0). Reviren hade kortare avstånd till träd än slumpytorna (73 m jämfört med 127 m; t = 1.751, d.f. = 32, p = 0.090).

Antals- och utbredningsförändringar

Vid fågelstationen varierade antalet fångade juvenila höksångare mellan 2–28 olika år (Figur 2), men utan att uppvisa någon tydlig trend över tiden (Pearson, R=–0.297, n=28, p=0.125). Vid inventeringen 1971–1975 hittades 17–33 revir årligen jämfört med 21–29 revir 1999–2000. Även om antalet revir var oförändrat mellan inventeringarna hade fördelningen mellan olika habitatstyper ändrats (Figur 3). Antalet revir på alvarmarken har ökat (Pearson, R=0.900, n=6, p=0.014), medan antalet revir längs skogsbryn varit mer stabilt (Pearson, R=–0.581, n=6, p=0.226).

Diskussion

Höksångarreviren påträffades i två olika buskrika biotoper: välbevuxen alvarmark och utdragna skogsbryn som övergår i öppna marker. Båda dessa biotoper är successionstadier mellan öppna och slutna marker och är präglade av mänsklig påverkan. Ett för intensivt bete missgynnar uppkomst och bevarande av ett rikt buskskikt, medan frånvaro av bete ofta betyder att marken snabbt växer igen till skog.

Jämförelser mellan besatta revir och slumpytor visade att reviren i Ottenby Lunds skogsbryn var mer varierade i sin strukturella sammansättning. Även om skogen på de allra flesta håll övergick i betes- eller slåttermark, påträffades höksångarna företrädelsevis i områden med rikligt buskskikt och insprängda öppna ytor. Även i alvarmarken var reviren belägna i mer bebuskade områden. Ett utdraget skogsbryn eller en buskrik alvarmark är lika så till vida att där skapas en mosaik av olika vegetationselement, vilket höksångarna verkar föredra. Förutom förekomsten av olika typer av buskar, små träd och snår verkar förekomsten av höga lövträd viktigt. Höksångarna sågs ofta födosöka i äldre lövträd och sågs regelbundet flyga iväg långa sträckor (upp till 500 m) för att nå dessa. Detta var framför allt tydligt i alvarhabitatet, där också avståndet till närmsta grupp av större lövträd var kortare i de besatta reviren jämfört med slumpytorna.

Populationsförändringar

Auléns (1976) inventeringar åren 1971–1975 täckte i huvudsak samma yta som vår studie och metodiken kan anses som mer eller mindre likvärdig. Höksångarpopulationens storlek var likartad i de båda studierna, men en förändrad utbredning inom området var tydlig. Idag påträffas många fler höksångare i alvarmarken i norra delen av studieområdet. Enligt vad vi vet betades inte detta område under 1980- och 1990-talen vilket innebar att det sakta växte igen med en, tok och andra buskar och träd. 1998 startades ett extensivt bete kombinerat med en del röjningsarbeten. Det verkar som om dessa förändringar skapat en mycket god miljö för höksångare.

Ett annat område, Klockarängen i nordöstra delen av studieområdet, hade många par höksångare under 1980-talet, men efter det att betet delvis upphörde runt 1990 har området tappat flera revir. I den norra delen av Klockarängen som fortfarande betades fanns ett flertal revir kvar 1999–2000.

På fågelstationen beläget på sydspetsen av studieområdet varierade fångsten av juvenila höksångare mellan åren, men utan tydlig trend. Eftersom fångsten är standardiserad bör detta spegla en stabil population i upptagningsområdet, vilket i detta fall huvudsakligen bör omfatta Öland.

Skötselplaner

Vi rekommenderar att man i utformandet av skötselplaner för naturområden på Öland med betesmark, alvar och skogsbryn tar hänsyn till höksångarens preferenser. Från ett skogsparti bör övergången till betesmark vara gradvis och utdragen med ett rikt buskskikt. Ett extensivt bete som hindrar igenväxning rekommenderas. Vid buskrika alvarmarker bör särskild hänsyn tas till äldre och stora lövträd vilka förmodligen spelar stor roll för näringsintaget under häckningsfasen. Igenvuxna före detta betesmarker kan utsättas för en selektiv röjning av buskskiktet för att skapa en mer variationsrik sammansättning av busk- och trädskiktet.