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Population fluctuations and timing of spring migration of the Scandinavian Bluethroat *Luscinia svecica svecica* at Ottenby Bird Observatory, Sweden, 1955–2008

Beståndsvariationer och tidsförlopp för vårflyttningen hos den skandinaviska blåhaken Luscinia svecica svecica *vid Ottenby fågelstation, Sverige, 1955–2008*

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Abstract

In this study, 54 years (1955–2008) of consecutive trapping data from Ottenby Bird Observatory on the island of Öland, SE Sweden, was used to analyze the spring passage of the Scandinavian subspecies of the Bluethroat *Luscinia svecica svecica*. The aim was to investigate trends in the numbers of Bluethroat passing this site and to provide statistics related to the phenology of migration. Trapping of Bluethroats at Ottenby may be seen as an index of population numbers in the recruitment area, especially for the latest decades when trapping conditions have been standardized. The number of trapped individuals was stable both in the long and short term, but median spring passage has become significantly earlier over the study period. The spring migration of the species showed clear age and sex related differences in timing. Male Bluethroats preceded females with about three days, and adult birds preceded juveniles of both sexes. Finally, the local weather during the peak passage significantly affected the number of trapped individuals, with the largest number trapped in days with head winds from the northwest sector.

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Introduction

The Bluethroat *Luscinia svecica* is an enigmatic small songbird with a brightly coloured throat and a characteristic flute-like song. In Scandinavia, it is represented by the subspecies *L. s. svecica* (Mullarney et al. 1999). The species breed in birch (*Betula pubescens*) forests in the Scandinavian mountain range and above the treeline in willow (*Salix* spp.) shrubberies (Svensson et al. 1999). Census data from the Swedish part of the breeding range suggest a long-term population decline, of the order of 10–29% in the period 1977–2006 (Ottvall et al. 2008). However, during the latter part of the period (1997–2006) the decrease has levelled off, and the trend become more stable (Ottvall et al. 2008). Unlike most other long-distance migrants breeding in Scandinavia, the Bluethroat has a south-easterly migration route in autumn. There are very few ringing recoveries from passage or winter, but those at hand imply a migration to presumed winter grounds in Pakistan and India (Ellegren & Staav 1990, Cramp et al. 1988, Mullarney et al. 1999, Staav & Fransson 2007, Fransson & Hall-Karlsson 2008). Increased ringing in the breeding range is not expected to significantly increase the number of ring recoveries from migration or wintering sites. Another way of yielding data on the species migration pathways would be to use small logging devices, such as ‘light loggers’ that recently have been deployed in some passerine species (Bächler et al. 2010).

The stopover biology of Bluethroats in autumn has been studied in different Swedish localities. It seems that the species leaves the mountain range in August for stopover sites in the Swedish lowland, especially at coastal marshes and reeds. These sites are utilized for short stopovers, often less than a week. Adult Bluethroats are better than juveniles at putting on mass and also depart from stopover sites significantly earlier compared to juvenile birds (Lindström et al. 1985, Ellegren 1990a, Ellegren 1990b, Ellegren 1991).

In spring, Bluethroats pass eastern Sweden rapidly on the way to their breeding grounds (Pettersson 1993). Most ringing schemes at bird observatories in Sweden are operated mainly in autumn, and of the sites managed in spring, only a few trap Bluethroats in any significant numbers. Ottenby Bird Observatory in southeastern Sweden is one of these sites and Pettersson (1993) compiled descriptive data on the species' passage at the site until 1992. In the present study, we analyse all data from Ottenby bird Observatory in the years 1955–2008, a time series of 54 years.

Since the 1970s, the spring temperature in the northern hemisphere has increased (Both & Visser 2001, Raion 2008). The change towards a warmer climate in northern Europe has affected the timing of seasonal activities among both animals and plants (Walther et al. 2002). On an evolutionary timescale, migratory birds have evolved migration patterns to match peaks in food availability during the spring (Jonzén et al. 2006). A rapid change in climate can lead to a mismatch between arrival date and peak food availability, and can thereby affect migratory birds negatively and cause population declines. The generally earlier arrival of spring in Europe is thought to affect the arrival of migratory birds to their breeding grounds and has been the subject of several studies (Both & Visser 2001, Hüppop & Hüppop 2003, Stervander et al. 2005, Jonsén et al. 2006, Raione 2008). The main picture is that the spring arrival of birds is pushed forward to earlier dates. One of several effects that influence the climate in northern Europe is the North Atlantic Oscillation index (NAO) which has been used in many studies to test the impact of climate variability on spring arrival. The index describes the difference between the normalized sea-level preassure at the Azores and Iceland during winter and early spring. Negative values are associated with less precipitation and lower temperatures, and positive values with higher temperatures and more precipitation (Hurrell 1995, Ottersen et al. 2001). High positive values thereby indicate earlier arrival of spring in northen Europe. In the last decade studies have shown that the NAO affects the timing of spring migration in birds (Forchhammer et al. 2002, Hubalek 2003, Hüppop & Hüppop 2003, Stervander et al. 2005, Jonsén et al. 2006). Analysing data from Ottenby, Stervander et al. (2005) showed that the arrival date of Bluethroats, unlike many species wintering in West Africa or Europe, was not correlated with NAO. However, mean spring arrival was found to become progressively earlier during the study period, with on average 0.062 days/year.

The facts that the Bluethroat has a different migration direction compared to most Scandinavian long distance migrants, shows a long term population decrease on breeding sites (Ottvall et al. 2008) and inhabits a breeding habitat subject to changes due to climate conditions (Moen et al. 2004) warrant the need of studying population trends in this species. Here, we analyse trends both in abundance at spring migration and in median spring passage over more than 50 years of trapping data.

Material & Method

Study area, data and time series

Ottenby Bird Observatory is located at the southernmost point of Öland (56°12´N, 16°24´E), an island situated off the southeastern coast of Sweden. Trapping and ringing of birds have been carried out at Ottenby since 1946 and the spring trapping scheme has been standardized since 1979. The standardization includes daily trapping from 15 March until 15 June each year, each trapping day beginning 30 min before sunrise and ending at 11AM (Lindström et al. 2008). Birds are trapped with mist nets that are positioned at fixed places in the observatory garden, and with two stationary funnel traps of Helgoland-type (Stervander et al. 2005, Lindström et al. 2008). The number of nets used on a given day is dependent on the weather, where heavy winds or rain reduces the number operated. However, the Helgoland traps are always in use. When a bird is trapped and ringed, the sex and age is determined and its wing length, body mass and fat score are registered.

Ringing data from all individuals from 1946 through 2008 was extracted from the observatory database. We excluded the first 10 years in the period because they had insufficient coverage of the main Bluethroat passage period. Furthermore, 8 birds that belonged to the subspecies *L. s. cyanecula* – a vagrant to the area – were also omitted from the study which resulted in a total of 1922 birds available for analyses. As noted above, the standardized trapping scheme ends at 11AM. The ringers note the clock hour when each bird was ringed (i.e. not trapping hour), and we included all birds with a clock hour up to and including 12AM for analyzes of population trends, thereby excluding birds haphazardly trapped in the afternoons or during special cicumstances. In 1966 and 1967 the number of days with trapping was limited and the the trapping effort only reached 17% and 60%, respectively.

Statistical analyses were made in the statistical software SPSS v. 17.0, Statistica v. 8.0, Excel 2000 and R v. 2.10.0.

Trends in trapping numbers

The time series was divided into two: one comprising the total period 1955–2008, and one restricted time series covering the standardized period 1979–2008. Trends in the number of ringed birds at Ottenby during spring passage were then analysed with regression analyses, using year as predictor and the number of trapped birds as the dependent factor. Trapping numbers were log-transformed to achieve normality. No autocorrelation was found with a lag time up to 5 years. Where possible, analyses were done separately for adult and younger (born the previous summer) birds.

Median spring passage and differences between sex, age and size categories

Wilcoxon rank sum tests were used to analyse if the median spring passage of Bluethroats at Ottenby has changed over time. The median date of passage of the entire population was calculated separately for the three decades of standardized trapping (1979–1988, 1989–1998 and 1999–2008). To analyse age and sex-related differences in the phenology of migration from the whole time period (1955–2008), we used two-sample t-tests assuming unequal variance. For both analyses, we omitted 17 birds ringed in April and June. The spring passage of the species at Ottenby is very condensed in time, and the number of excluded individuals comprised 0.9 % of the total.

Finally, we tested predictors of the median spring passage with general linear models (GLMs). To perform the analysis, the date value was parameterized into Julian date, with 1 May as day 1 and the 31 May as day 31. The median spring passage was used as the dependent variable and we included sex, age, year and their two-ways interaction into a full model. Insignificant interactions and factors were eliminated stepwise to yield a final model.

Local weather and numbers of Bluethroats trapped

At Ottenby, daily diaries are written that sum the trappings, bird observations and other events of importance for the observatory. Weather data such as temperature (C°), wind direction, wind strength (m/s) and cloud cover (a scale from 1 to 8, where 8 is full overcast) from a local weather station are also noted. These weather data were collected and used to analyse if local weather had any impact on the number of Bluethroats trapped. The wind direction was described in sixteen different directions (N, NNE, NE, ENE, etc.), which we categorized into eight categories (N, NW, W, SW, S, SE, E and NE) combining the two closest directions, e.g. N and NNE became N. To achieve normal distribution of data, a log-transformation of trapping numbers was made. GLMs were developed with number of trapped Bluethroats as the dependent factor and temperature, wind strength, cloud cover, wind direction and the interaction between wind direction and wind strength as factors. Insignificant interactions and factors were taken away stepwise to yield a final model.

Results

Bluethroats were trapped each year in 1955–2008 (Figure 1), with a condensed passage mainly limited to May (Figure 2).

Population trends

The number of trapped Bluethroats varied over time and the analyses of trends in numbers trapped gave different results depending on which part of the time series that was analysed. Using the full time series, 1955–2008, the number of trapped birds increased significantly over time with 1.7% per year (Figure 3a; $F = 19.20$, d.f. = 51, $P < 0.001$). However, looking only at the standardized trapping period 1979–2008, there was no change in trapping numbers neither for the total number of birds (Figure 3a; $F = 0.40$, d.f. = 28, $P = 0.53$), nor for the numbers of trapped adults and young birds treated separately (Figure 3b; adult: $F = 0.17$, d.f. = 26, $P = 0.68$; younger birds: $F = 3.59$, d.f. = 27, $P = 0.07$). However, the negative trend for younger birds was close to statistically significant.

Spring passage

The median date of passage during three decades of standarized trapping was 15 May in 1979–1988, 18 May in 1989–1998 and 13 May in 1999–2008. There was a significant difference between the two first decades, 1979–1988 and 1989–1998 ($W = 124885$, $P < 0.001$), and also betwen the last two decades, 1989–1998 and 1999–2008 ($W = 204903$, $P < 0.001$).

The median date of passage showed significant differences between males and females (Table 1; d.f. = 1764, $T = -14.63$, $P < 0.001$) by ~3 days. The results also showed differences in time of passage between age categories (Table 1; Figure 4), where

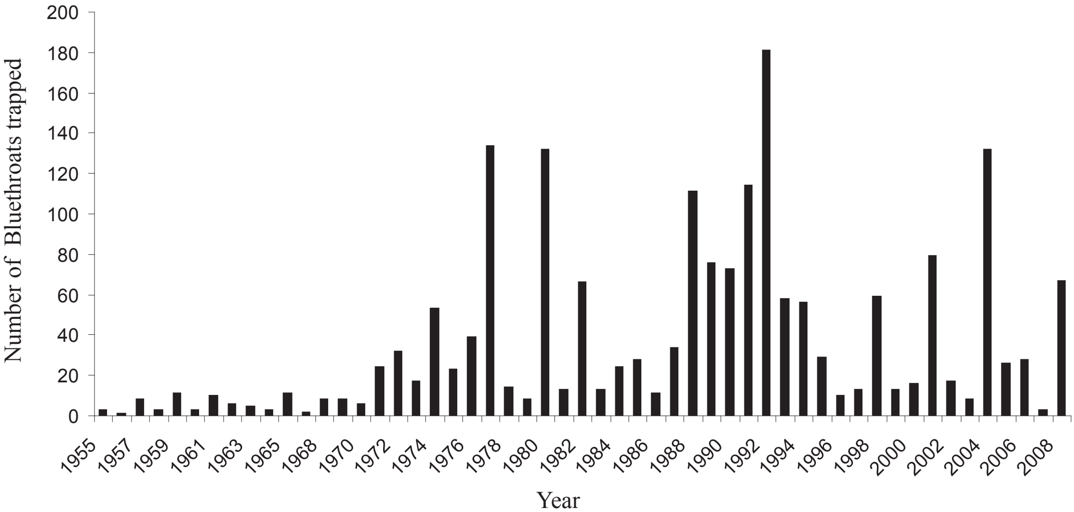

Figure 1. Number of Bluethroats trapped each year in 1955–2008.
Antal fångade blåhakar varje år under 1955–2008.

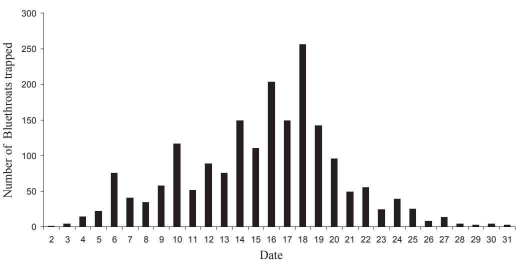

Figure 2. Number of Bluethroats trapped at each date in May in 1955–2008.
Antal fångade blåhakar varje datum i maj under 1955–2008.

adult males passed ~3 days before juvenile males (d.f.= 749, T = 8.13, $P < 0.001$) and female adults passed ~2 days earlier than juvenile females (d.f. = 668, T = 5.49, $P < 0.001$).

Analysis of predictors of the median date showed that passage was influenced by sex, year, the interaction sex*year, the interaction sex*age, and the interaction year*age (Table 2). However, age alone did not show any significant impact on spring arrival (Table 2).

Local weather and numbers of Bluethroats trapped

An analysis of the local weather data showed that wind direction was the factor affecting the number

Table 1. Median date of arrival of both sexes and their two age categories for the time period 1955–2008.
Median för ankomstdatum för båda könen och ålderskategorier för tidsperioden 1955–2008.

	Median date	St. dev
All birds	16 May	4.93
Juveniles	17 May	4.79
Adults	14 May	4.71
All males	15 May	4.95
Juvenile males	16 May	4.88
Adult males	13 May	4.59
All females	18 May	4.24
Juvenile females	18 May	4.16
Adult females	16 May	4.01

Table 2. Analysis of the predictors of median date of arrival.
Analys av variabler som påverkar datum för ankomst.

Predictors *Variabler*	d.f	F	P
Sex	2	15.55	0.011
Age	2	1.76	0.324
Year	32	2.80	0.002
Sex*Year	20	4.62	0.003
Sex*Age	2	10.48	0.002
Year*Age	24	3.59	0.010

Population trends

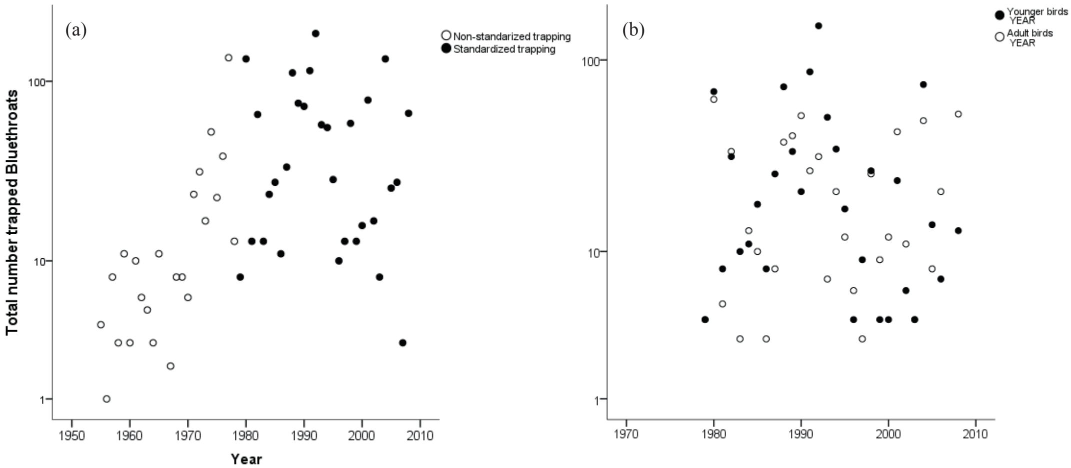

Figure 3. (a) Population trends for the full time series (1955–2008) and the standardized trapping (1979–2008). (b) Trends among adult and younger birds the standardized trapping.
(a) Populationstrender för hela tidsserien, 1955–2008 (°), samt den standardiserade fångsten, 1979–2008 (•). (b) Trender hos juvenila (•) och adulta (°) individer under den standardiserade fångsten.

Bluethroat passage

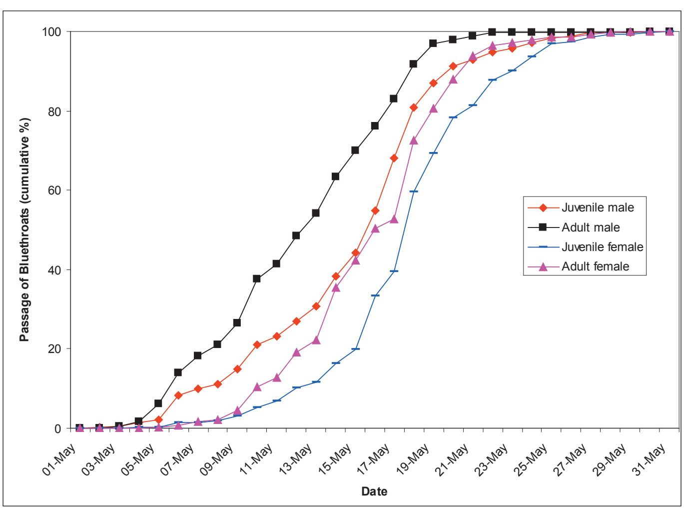

Figure 4. Cumulative passage of Bluethroats for each sex and age category that passes Ottenby in May during the period 1955–2008, e.g 50 % of the adult males have passed Ottenby before the 13 May.
Kumulativ passage av blåhake för varje köns och ålderskategori som passerar Ottenby i maj under tidsperioden 1955–2008, t.ex. 50 % av samtliga adulta hanar passerar Ottenby innan den 13 maj.

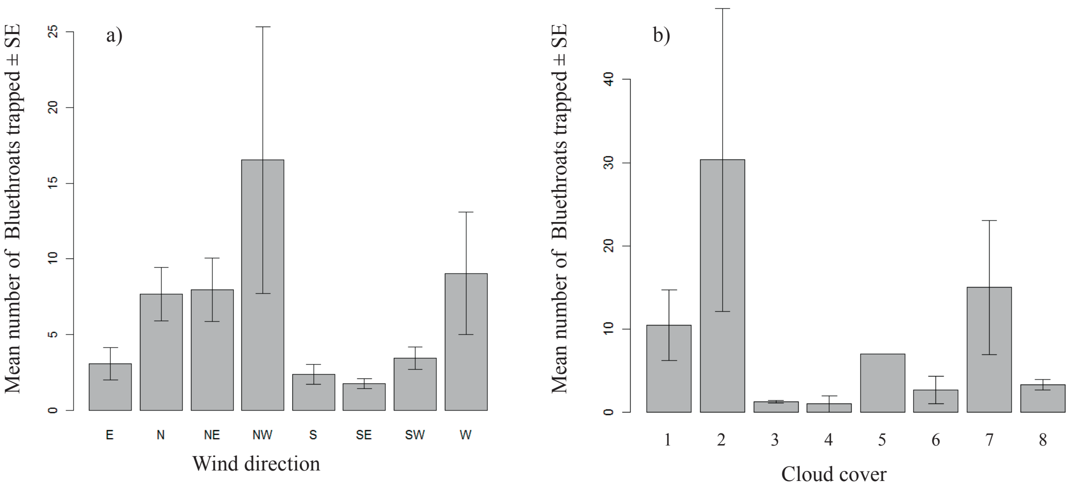

Figure 5. (a) Mean number of Bluethroats trapped between 1976–1995 under different wind directions and (b) different cloudiness on a scale 1–8, 1 describing a clear sky and 8 a sky 100 % cloud covered.
(a) Medelantal dagligen fångade blåhakar under olika vindförhållanden och (b) molnighet på en skala 1–8, där 1 beskriver en klar himmel och 8 en helt täckt himmel.

of birds trapped at Ottenby most strongly (Figure 5a; d.f. = 56, F = 5.45, P = 0.023). Cloud cover also affected the number of birds trapped (Figure 5b; d.f. = 7, F = 2.18, P = 0.05), however temperature (d.f.= 56, F= 0.005, P = 0.943) and wind strength (d.f. = 56, F = 0.48, P = 0.828) did not. In total, there were 28 days with cloud cover categories 1 or 2 and in which Bluethroats had been trapped. Sixteen of these days were categorized as days with winds from the north sector and 12 days with winds from the south sector. However, looking at the number of trapped birds, the vast majority of 'clear blue sky' birds were trapped with winds from the north (t-test; T = -3.30, d.f. = 22, P = 0.015).

Discussion

Trends in trapping numbers

The trapping scheme at Ottenby Bird Observatory is one of the longest uninterrupted time series on the abundance of migratory birds in Europe and has been used to study effects of climate variation on the phenology of migration (Pettersson 1993, Stervander et al. 2005, Jonzén et al. 2006). Here we used data gathered over 54 years (1955–2008) to study trends in trapping numbers and timing of spring passage of the Bluethroat. Within this period, the latter part from 1979 is characterized by a standardized trapping method, with nets and traps at fixed positions and a constant trapping effort. In the total time series (1955–2008), Bluethroat numbers increased significantly, whereas in the time series from the standardized period 1979–2008 it did not (Figure 3a). We cannot confidently tell whether the increase from the 1950s to today reflects an actual population size increase or not. Local microhabitat changes, such as fencing to keep grazing cattle and sheep outside the trapping area and an increased number of trees and bushes over time may have influenced trapping probabilities of staging birds. Restricting the dataset to only the standardized trapping period, there were no statistically significant trends in trapping numbers. This result is inconsistant with the findings by Ottvall et al. (2008) who used census data from Swedish surveys to estimate trends in the number of breeding birds in the country. They show that the Bluethroat population in the Swedish part of the Scandinavian mountain range has decreased in the long term period 1977–2006 with 10–29%, but has become more stable in the latter part of the period (1997–2006). Our data do however show a tendency for a negative trend in the number of trapped juvenile birds.

The Scandinavian mountain range is one of the least exploited habitats in Sweden, with commercial reindeer husbandry being the strongest anthropogenic disturbance. However, changing climate is a threat. For instance, Moen et al. (2004) have shown that the tree line limit can advance upward by 233–667 m over a 100-year time frame. An advancing tree line will likely result in loss of suitable breeding habitat (birch and willow shrubbery) for Bluethroats, thereby negatively affect the population size. A recent study by Van Bogaert et al. (2011) shows that reindeer husbandry has a much stronger impact on the tree line than previously assumed, with a significant negative correlation between tree establichment at the tree line and reindeer population density. As migration pathways and wintering areas are poorly known, it is at present not possible to say how changes in these areas could affect the Scandinavian population of the Bluethroat. Clearly, elucidating wintering areas and migration routes would be of great importance for a long-term conservation of the species.

Timing of spring passage

The Bluethroat has a remarkably short and condensed spring migration period at Ottenby. Normally, the majority of birds pass the site within 10 days. Despite the brevity of passage, there are clear differences between age and sex groups. Adult males pass first, followed, in turn, by younger males, adult females and last by younger females (Figure 4). The GLM analysis also showed significant effect of interactions between sex and year, and age and year, likely explained by variation between years in weather conditions affecting the timing of migration. Males generally pass Ottenby ~3 days before females (Table 1). This protandrous pattern is well known among migrating birds and other animal taxa (Rubolini et al. 2004, Tøttrup & Thorup 2008) and is consistent with the earlier study of Pettersson (1993) from Ottenby.

The fact that adults precede younger birds during migration is a common and widespread pattern among passerines (Stewart et al. 2002). The earlier accumulation of fat by adults at stopover sites, which is correlated with earlier departure (Ellegren 1991), could explain differences in time of arrival. However, differences could also depend on differential onset of migration from the wintering grounds.

Local weather and numbers of Bluethroats trapped at Ottenby

Both cloud cover and wind direction affected the numbers of trapped individuals (Figure 5). Northerly and westerly head winds during the migration period increased the number of caught individuals, likely as a consequence of increased costs of migration causing birds to be more prone to stopover. However, neither wind strength nor the interaction between wind strength and wind direction affected the numbers trapped.

Interestingly, cloud cover significantly affected trapping numbers in a bimodal pattern. Most birds were caught with more or less clear sky (cover 1 and 2) or at near complete overcast (cover 7). Complete overcast should be related to rainfall and low pressure weather systems likely to affect the propensity for stopover instead of continued migration. The ‘clear blue sky’ effect is less straightforward, but we hypothesize that this is related to wind direction in N and NW, i.e., rather an effect of head winds.

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References

Both, C. & Visser, M. E. 2001. Adjustment to climate change is constrained by arrival date in long-distance migrant bird. *Nature* 411: 296–298.

Bächler, E., Hahn, S., Schaub, M., Arlettaz, R., Jenni, L., Fox, J. W., Afanasuev, V. & Liechti, F. 2010. Year-round tracking of small trans-Saharan migrants using light-level geolocators. *PLOS ONE* 5: e9566.

Cramp, S., Brooks, D. J., Dunn, E., Gillmor, R., Hall-Craggs, J., Hollom, P. A. D., Nicholson, E. M., Ogilvie, M. A., Riselaar, C. S., Sellar, P. J., Simmons, K. E. L., Voous, K. H., Wallace, D. I. M. & Wilson, M. G. 1988. *Handbook of the Birds of Europe, the Middle East and North Africa. The birds of the Western Palearctic, Tyrant Flycatchers to Trushers*. Vol 5: 645–661.

Ellegren, H & Staav, R. 1990. Blåhakens *Luscinia s. svecica* flyttning – en återfyndsanalys av fåglar märkta i Sverige och Finland. *Vår fågelvärld* 49: 323–336.

Ellegren, H. 1990a. Autumn migration speed in Scandinavian Bluethroats *Luscinia s. svecica. Ringing & Migration* 11: 121–131.

Ellegren, H. 1990b. Timing of autumn migration in Bluethroats *Luscinia s. svecica* depends on timing of breeding. *Ornis Fennica* 67: 13–17.

Ellegren, H. 1991. Stopover ecology of autumn migrating Bluethroats *Luscinia s. svecica* in relation to age and sex. *Ornis Scandinavia* 22: 340–348.

Forchhammer, M. C., Post, E. & Stenseth, N. C. 2002. North Atlantic Oscillation timing of long- and short-distance migration. *Journal of Animal Ecology* 71: 1002–1014.

Fransson, T. & Hall-Karlsson, S. 2008. *Svensk ringmärkningsatlas*. Vol 3: 63–64.

Hubalek, Z. 2003. Spring migration of birds in relation to North Atlantic Oscillation. *Folia Zoologica* 52: 287–298.
Hurrell, J. W. 1995. Decadal trends in the North Atlantic Osciliiation: regional temperatures and percipitation. *Science* 269: 676–679.
Hüppop, O. & Hüppop, K. 2003. North Atlantic Oscillation and timing of spring migration in birds. *Proceedings of the Royal Society of London. Biological Sciences* 270: 233–240.
Jonzén, N., Lindén, A., Ergon, T., Knudsen, E., Vik, J. O., Rubolini, D., Piacentini, D., Brinch, C., Spina, F., Karlsson, L., Stervander, M., Andersson, A., Waldensröm, J., Lindström, Å., Bench, S. & Hasselquist, D. 1985. Höstflyttning hos unga blåhakar *Luscinia svecica. Vår Fågelvärld* 44: 197–206.
Lindström, Å., Andersson, A., Edman, A. & Waldenström, J. 2008. *Fågelräkning och ringmärkning vid Ottenby 2008*. Report to the Swedish environmental protection agency, within the project "Fågelräkning och ringmärkning vid Ottenby".
Moen, J., Aune, K., Edenius, L. & Angerbjörn, A. 2004. Potential effects of climate change on treeline position in the Swedish mountains. *Ecology and Society* 9(1), Article no. 16.
Mullarney, K., Svensson, L., Zetterström, D. & Grant, P. J. 1999. *Fågelguiden – Europas och Medelhavsområdets fåglar i fält*.
Ottersen, G., Planque, B., Belgrano, A., Post, E., Reid, P. C. & Stenseth, N. C. 2001. Ecological effects of the North Atlantic Oscillation. *Oecologia* 128: 1–14.
Ottvall, R., Edenius, L., Elmberg, H., Green, M., Holmqvist, N., Lindström, Å., Tjernberg, M. & Pärt, T. 2008. *Populationstrender för fågelarter som häckar i Sverige*. Naturvårdsverkets rapport pm 5813.
Pettersson, J. 1993. Blåhaken – Vårgäst på Öland i ökande antal. *Calidris* 22: 69–71.
Raion, K. 2008. *Climate change effects on avian migration*. PhD thesis. University of Turku.
Rubolini, D., Spina, F. & Saino, N. 2004. Protandry and sexual dimorphism in trans-Saharan migratory birds. *Behavioral Ecology* 15: 592–601.
Staav, R. & Fransson, T. 2007. *Nordens fåglar*. 4th edn. Prisma.
Stervander, M., Lindström, Å., Jonsén, N. & Andersson, A. 2005. Timing of spring migration in birds: long-term trends, North Atlantic Oscillation and the significance of different migration routes. *Journal of Avian Biology* 36: 210–221.
Stewart, R. L. M., Francis, C. M. & Massey, C. 2002. Age-related differential timing of spring migration within sexes in passerines. *Wilson Bulletin* 114: 264–271.
Svensson, S., Svensson, M. & Tjernberg, M. 1999. Svensk fågelatlas. *Vår fågelvärld, supplement* 31: 362–363.
Tøttrup, A. P. & Thorup, K. 2008. Sex-differentiated migration patterns, protandry and phenology in North European songbird populations. *Journal of Ornithology* 149: 161–167.
Van Bogaert, R., Haneca, K., Hoogesterger, J., Jonasson, V., De Dapper, M. & Callaghan T. V. 2011. A century of tree line changes in sub-artic Sweden shows local and regional variability and only a minor influence of 20th century climate warming. *Journal of Biogeography* 38: 907–921.
Walther, G-R., Post, E., Convey, P., Menzel, A., Parmesan, C., Beebee, T. J. C., Fromentin, J-M., Hoeg-Guldberg, O. & Bairlein, F. 2002. Ecological responses to recent climate change. *Nature* 416: 389–395.

Sammanfattning

I Skandinavien förekommer blåhaken i form av rasen *L. s. svecica*. Arten häckar i fjällbjörkskogar samt i tätvuxna videbestånd ovanför trädgränsen. Data från häckfågeltaxeringar visar att blåhaken har genomgått en långsiktig minskning med 10–29 % mellan 1977 och 2006, men att utveckling varit mer stabil från 1997 och framåt. Blåhaken är en av få svenska långdistansflyttare som flyttar i en sydostlig riktning under hösten. Även om antalet återfynd är få pekar dessa på troliga övervintringsområden i Pakistan och Indien.

Under våren passerar flyttande blåhakar östra Sverige på sin väg till häckningsområdena i fjällen. De flesta fågelstationer i Sverige har sin huvudsakliga fältperiod under hösten, och av de få som bedriver vårfångst är det endast ett fåtal som fångar några större antal blåhakar. I vår studie analyserar vi data från Ottenby fågelstation mellan 1955 och 2008, en tidsserie om totalt 54 år.

Sedan 1970-talet har temperaturen under våren ökat på det norra halvklotet. Utvecklingen mot ett varmare klimat i norra Europa har påverkat årstidsspecifika aktiviteter hos både växter och djur. På en evolutionär tidsskala har flyttfåglar anpassat sin ankomst till häckningsområdet till att överrensstämma med en god tillgång på föda. En snabb förändring i klimatet skulle kunna leda till att flyttfåglar förlägger tidpunkten för häckning fel i förhållande till tillgången på föda, och kan därmed orsaka populationsnedgångar. Flertalet studier har fokuserat på hur en generellt tidigare vår i Europa påverkar flyttfåglarna, och den sammantagna slutsatsen är att ankomsten blir allt tidigare. I de flesta studier har North Atlantic Oscillation index (NAO) använts för att korrelera ankomst av flyttfåglar med klimatvariabler. Genom att analysera fångstdata från Ottenby fågelstation kunde exempelvis Stervander m.fl. (2005) visa att ankomstdatum för blåhaken, i motsats till många andra arter som övervintrar i västra Afrika eller Europa, inte var korrelerat med NAO. Dock kunde man visa att ankomsten av blåhaken till Ottenby successivt tidigarelagts med i medel 0,062 dagar/år.

Det faktum att blåhaken har en annorlunda flyttriktning jämfört med de flesta Skandinaviska långdistansflyttarna, uppvisar en långsiktig minskning av populationen inom häckningsområden, samt häckar i en miljö som är under förändring p.g.a.

klimatet, gör det befogat med en ingående studie av långsiktiga trender inom arten. Här analyserar vi både trender i antal under våren samt trender i ankomstdatum över mer än 50 års fångstdata.

Studieområde och data

I denna studie använde vi ringmärkningsdata från blåhake från Ottenby fågelstation (56°12´N, 16°24´E) mellan åren 1955–2008. Vårfångsten vid Ottenby pågår mellan 15 mars och 15 juni. Fångsten påbörjas 30 min innan solens uppgång och avslutas 11:00. Ringmärkningsdata innan 1955 uteslöts från studien p.g.a. bristande täckning under den tid då arten flyttar. Efter att ha uteslutit 8 fåglar av rasen *L. s. cyanecula* (en sällsynt gäst) bestod våra data av 1922 ringmärkta individer. Under maj månad har fångstinsatsen vid Ottenby varit konstant under hela perioden 1955–2008 förutom under 1966 och 1967 då fångstinsatsen var 17% respektive 60%.

Resultat och diskussion

Blåhakar har fångats under varje år perioden 1955–2008 (Figur 1) vid Ottenby fågelstation och passerar huvudsakligen under maj månad (Figur 2). För att analysera eventuella trender i antal ringmärkta blåhakar vid använde vi oss av två olika tidsperioder: dels hela tidsserien 1955–2008 och dels tiden för standardiserad ringmärkning, 1979–2008. Våra resultat visar att blåhaken har ökat signifikant i antal sett över hela perioden 1955–2008, men inte under perioden 1979–2008 (Figur 3a). Vi kan inte utesluta att ökningen mellan 1955–2008 beror av förändringar i habitatet i fångsträdgården eller fångstansträngningen. Att vi inte fann någon trend under perioden 1979–2008 överrensstämmer inte med resultat av Ottvall m.fl. (2008) som kunde visa på en minskning i antal mellan 1977–2006 med 10–29%, men med en stabil utveckling under den senare delen av studietiden (1997–2006). Artens häckningsområde i den Skandinaviska fjällkedjan är en av människan minst påverkade områden i Sverige. Habitatet förmodas dock påverkas negativt av den pågående klimatförändringen. Under en hundraårsperiod kan trädgränsen komma att förflyttats uppåt med 233–667 m. Denna trend påverkar troligen blåhaken negativt då arealen av häckningsområdet minskar. Även renskötseln påverkar trädgränsen genom en negativ korrelation mellan trädföryngring och rentäthet. Då informationen om flyttvägar och övervintringskvarter är bristfällig är det svårt att analysera hur eventuella förändringar i dessa områden skulle kunna påverka den Skandinaviska populationen.

Normalt passerar majoriteten av blåhakar Ottenby under en kort men intensiv tiodagarsperiod. Trots den relativt korta perioden så finns det en tydlig skillnad i passage beroende på kön och ålder (Tabell 1; Figur 4). Vuxna individer anländer tidigare än yngre individer, vilket är vanligt förekommande bland tättingar och har föreslagits kunna bero av tidigare upplagring av fett av vuxna på rastplatser vilket är korrelerat med tidigare avfärd. En anan förklaring skulle kunna vara skillnader i avfärd från övervintringskvarteren. Att hanar passerar tidigare än honor är också vanligt förekommande bland fåglar.

Blåhaken uppvisar även en stor skillnad i mediandatum för ankomst till Ottenby under 1979–2008. Perioden delades upp i tre 10 års perioder och resultatet visar att ankomsten till Ottenby har tidigarelagts med 5 dagar under den senaste 10-årsperioden jämfört med föregående period (Tabell 1).

Vid Ottenby fågelstation förs dagbok över bl.a. vindriktning, temperatur och fångstantal. Genom att använda oss av dagboken kunde vi analysera inverkan av vindriktning, vindstyrka och molnighet på antalet fångade blåhakar. Både molnighet och vindriktning påverkar antalet individer som fångas vid Ottenby (Figur 5). Nord- och västliga motvindar ökar fångsten av blåhakar, antagligen som en effekt av ökad energiåtgång på grund av motvind under sträcket. Förvånande nog så påverkade vindstyrkan inte antalet fångade individer. Flest individer fångades antingen under väldigt låg molnighet (täckningsgrad 1 och 2) eller vid nästan total molnighet (täckningsgrad 7). Total molnighet är relaterat med nederbörd och lågtryck vilket troligtvis ökar fåglarnas benägenhet att rasta under sträcket.