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A common montane bird indicator for North Europe

Aleksi Lehikoinen[1], Martin Green[2], Magne Husby[3], John Atle Kålås[4] & Åke Lindström[2]

[1]Finnish Museum of Natural History. FI-00014 University of Helsinki, Finland.
[2]Department of Biology, Biodiversity Unit, Lund University, Ecology Building. SE-223 62 Lund, Sweden
[3]Nord-Trøndelag University College. Røstad, NO-7600 Levanger, Norway
[4]Norwegian Institute for Nature Research. P.O. Box 5685 Sluppen, NO-7485 Trondheim, Norway
[1] aleksi.lehikoinen@helsinki.fi

Abstract. Large-scale multi-species studies on population changes of montane or arctic species are scarce, not least because of logistic challenges. We recently presented a multi-national (Finland, Sweden and Norway) bird indicator for the Fennoscandian mountain range (Lehikoinen et al. 2014). An updated version is presented here. The indicator includes 14 common montane bird species collected at 291 different alpine survey plots, covering an area of 250 000 km2 and a distance of 1600 km in southwest-northeast direction. We briefly discuss the new results and discuss various practical and methodological aspects of this international cooperation. When fully developed the Fennoscandian monitoring system will include more than 400 montane survey plots, which will form a solid base for a robust bird indicator in this climate-sensitive montane region of northern Europe.

Introduction

Montane species and habitats are expected to be highly influenced by climate change the next century (Huntley et al. 2007, Gonzalez et al. 2010), with an increased risk of local species extinction (Sekercioglu et al. 2008). As far as birds are concerned, montane species have received relatively little attention compared to farmland and forest birds (Gregory et al. 2005, 2007). Recently, Chamberlain et al. (2012) called for ”long-term monitoring programmes across a relatively broad area (a minimum of an entire mountain range) that could act as a baseline to monitor altitudinal shifts in bird communities in response to climate change, and environmental change more broadly”.

The Fennoscandian mountain range (“the Scandes”) constitutes a very distinct and easily defined biogeographical region and it makes perfect sense to monitor it as one unit. However, like many other mountain ranges in Europe it stretches over several countries. This fact, together with the remoteness and often difficult terrain, poses some special challenges. For a long time, none of the national monitoring schemes of Norway, Sweden and Finland were even close to covering the birds of the Scandes to any representative degree, although some long-term monitoring series do exist from a few sites (Väisänen et al. 1998, Enemar et al. 2004, Svensson 2006, Byrkjedal & Kålås 2012, Svensson & Andersson 2013).

Since 2002 there have been nationwide bird monitoring schemes in all three countries, consisting of pre-defined routes placed in a grid over each country, making sure all relevant habitats are covered in a representative way. Accordingly, also the birds of the Scandes are well monitored. In a recent paper we calculated population trends for 14 common and typical montane bird species of the Scandes, by combining data from the generic nationwide monitoring schemes of Norway, Sweden, and Finland (Lehikoinen et al. 2014, see also Figure 1). The species trends were then combined into a single montane bird indicator (a multi-species trend; Gregory et al. 2005).

We here present an updated version of the indicator (adding two years), and discuss various aspects of our cooperative project.

Material and methods

We calculated trends for 2002–2014, a period with relevant data available from all three countries. The survey routes included in the analysis cover

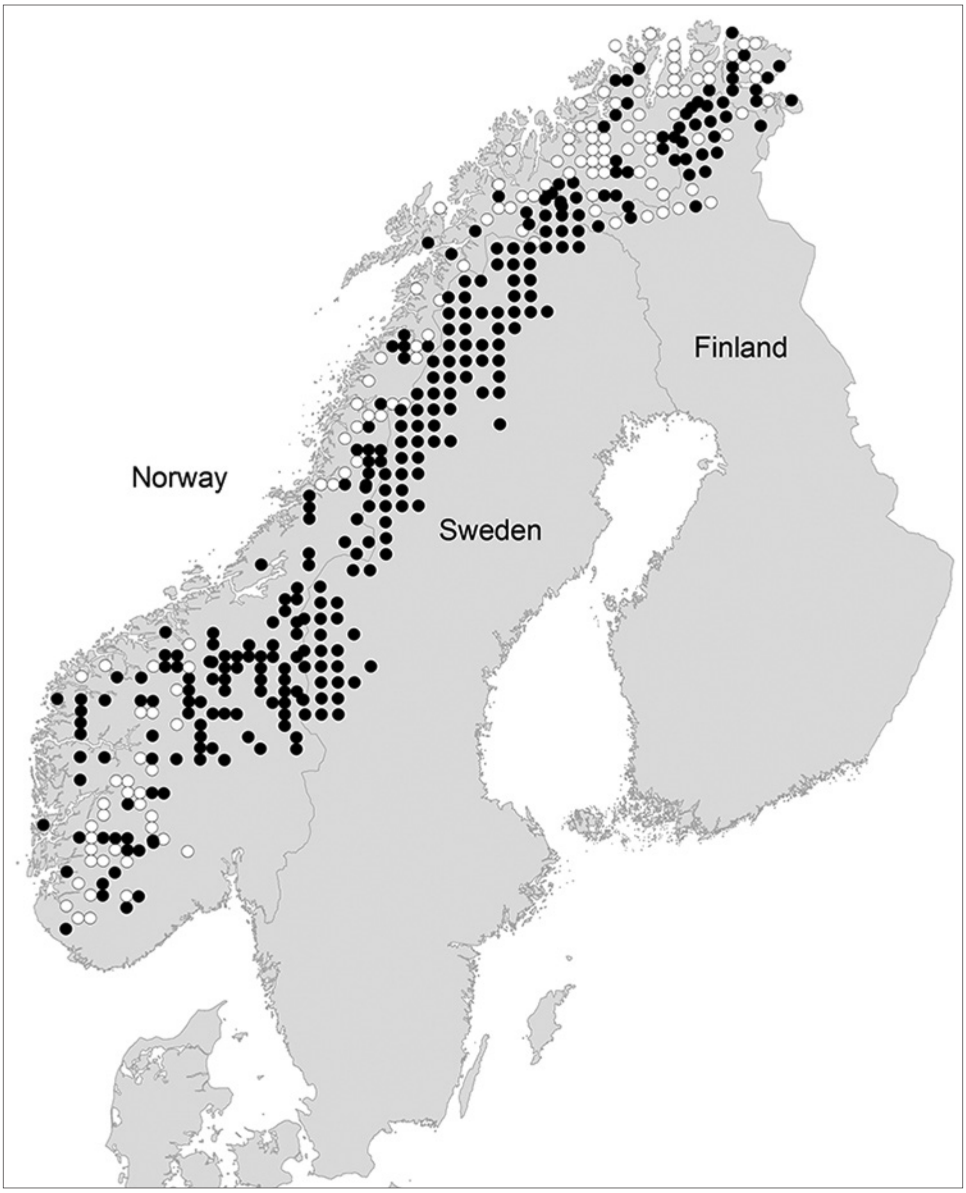

Figure 1. Map showing the 420 bird monitoring sites in the Fennoscandian mountain range. Black dots are sites sampled in at least two different years (2002–2014, n = 291). White dots indicate sites that have not yet been surveyed twice.

the full extent of the Scandes, an area of about 250 000 km^2, with 1600 km between the most distant routes (Figure 1). Although the highest peaks of the Scandes (<2500 m a.s.l.) are not very impressive from a European perspective, the high latitudes help to create two very distinct montane habitats; tundra and subalpine birch forest.

All survey routes included in our analysis are situated in tundra and/or subalpine birch forest. The tundra occurs above 1300 m a.s.l. in southern Norway and at gradually lower altitudes the further north in in Fennoscandia you go. In northernmost Norway the tundra reaches sea level. In most of the mountain range the tundra is gradually replaced by subalpine birch forest at lower altitudes (*Betula pubescens* ssp. *czerepanovii*). At still lower altitudes the birch forest is replaced by either spruce (*Picea*) or pine (*Pinus*) forest of the taiga zone (Kullman and Öberg 2009).

Given the distinct habitats and their distinct bird faunas (Husby and Kålås 2011, Ottosson et al. 2012), it was easy to designate both routes and species to represent alpine birds in the Scandes (Table 1).

Monitoring schemes and route selection

All data from Sweden originate from one single monitoring scheme for the entire period. The data from Norway and Finland originate from different

Table 1. Habitat classification (tundra or birch forest), migration strategy (R = resident, S = short-distance migrant, L = long-distance migrant), population trends and sample sizes (individuals counted: annual mean, min-max) of the common mountain bird species of Fennoscandia used in the analyses. Significant population trends are in bold.

Species	Scientific name	Habitat	Migration	Trend ± SE	N
Willow grouse	*Lagopus lagopus*	Birch	R	**-0.119 ± 0.026**	136, 73–202
Rock ptarmigan	*L. mutus*	Tundra	R	**-0.047 ± 0.013**	84, 40–211
Golden plover	*Pluvialis apricaria*	Tundra	S	-0.003 ± 0.008	942, 370–1652
Long-tailed skua	*Stercorarius longicaudus*	Tundra	L	0.014 ± 0.017	93, 15–177
Meadow pipit	*Anthus pratensis*	Tundra	S	**-0.017 ± 0.007**	1905, 802–3377
Bluethroat	*Luscinia svecica*	Birch	L	-0.026 ± 0.014	268, 137–437
Common redstart	*Phoenicurus phoenicurus*	Birch	L	0.014 ± 0.009	430, 172–734
Common wheatear	*Oenanthe oenanthe*	Tundra	L	-0.016 ± 0.012	374, 147–746
Redwing	*Turdus iliacus*	Birch	S	**-0.033 ± 0.008**	672, 249–1090
Willow warbler	*Phylloscopus trochilus*	Birch	L	**-0.035 ± 0.005**	3558, 2015–5036
Brambling	*Fringilla montifringilla*	Birch	S	**-0.034 ± 0.007**	1780, 969–2743
Common redpoll	*Carduelis flammea*	Birch	S	**-0.084 ± 0.014**	769, 218–1502
Lapland bunting	*Calcarius lapponicus*	Tundra	S	**-0.027 ± 0.011**	402, 143–678
Snow bunting	*Plectrophenax nivalis*	Tundra	S	**-0.042 ± 0.014**	70, 26–116

types of counts in 2002–2005, but from 2006 onwards the main bulk of data come from almost identical sampling schemes to that in Sweden. In all countries the counts are single visit censuses conducted mainly in June (late May – early July; for more details see Lehikoinen et al. 2014 and Figure 1). Only routes counted in at least two years were included in the analysis.

Finland: From 2006 onwards, data from 23 routes within a countrywide system of fixed line transect routes (6 km long) are included. There are also data from 2002–2014 from six line transects belonging to a separate monitoring scheme.

Sweden: The Swedish data stem from the so called Fixed routes (8 km long line transects) which are distributed systematically over Sweden. Of these 104 are montane routes and they all are included in the analysis.

Norway: From 2006 onwards the bulk of data come from 148 systematically distributed point count routes over Norway. For the period 2002–2009 there are additional annual data from 10 point-count survey routes from five different montane areas.

In all three countries, the areas of the Scandes are characterized by low human density, difficult terrain and many sites situated far from roads. Most surveyors of montane routes in the three countries are from more southern latitudes and paid for their surveys. In Norway and Sweden some remote routes are reached by helicopter.

Study species selection

We included 14 common and typical species, which had enough data to allow analyses in all three countries (Table 1). As the census networks grow in Finland and Norway, it will be possible to add more species in the future. Of the 14 species, seven are included for each of the two main habitats (tundra and birch forest).

Analyses

We used log-linear regression (program Trends & Indices for Monitoring data, TRIM, Pannekoek and van Strien 2004, www.ebcc.info/trim.html) to estimate annual bird abundances. We analysed each species including all data and using country as a covariate if possible.

We calculated the multi-species indicator by taking geometric mean of the annual species-specific indices (TRIM). Standard errors for geometric means were computed from the indices and standard errors of individual species (Gregory et al. 2005).

Results

Of the 14 species analysed for 2002–2014, nine species declined significantly, while none increased significantly (Table 1). The montane bird indicator decreased by about 20 % during 2002–2014 (Fig. 2a).

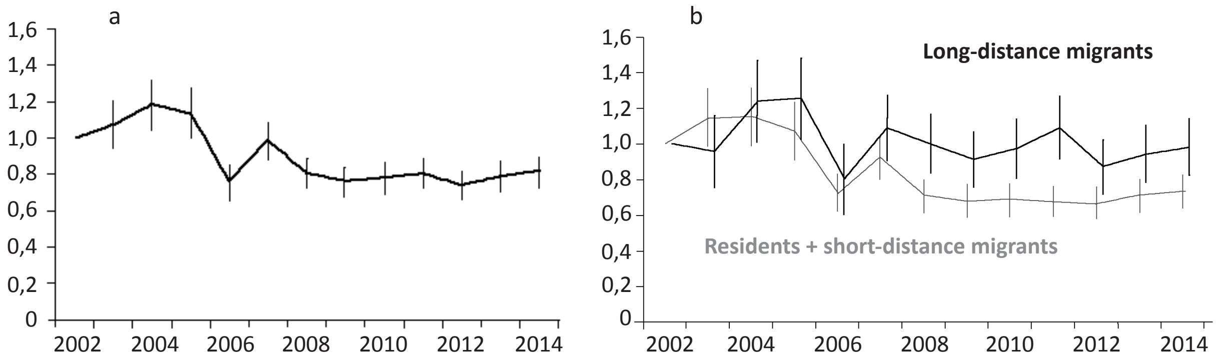

Figure 2. Geometric mean (bars indicating the 95% c.i.) of the abundance indices of 14 montane bird species (left) using combined data from Finland, Sweden and Norway and separated based on migration behaviour (right; long-distance migrants, n = 5 species, black line, and residents & short-distance migrants, n = 9, grey line).

The general decline of species in the multi-national data set concerned both tundra and birch forest species. The population development of long-distance migrants was tentatively less negative than that for short-distance migrants and residents (ANOVA, $F_{1,12} = 3.94$, $P = 0.07$, Fig. 2b).

Discussion

This update of the Fennoscandian montane indicator (Lehikoinen et al. 2014) stresses the recent bleak situation for many montane birds. A majority of the species included in our study declined significantly in numbers during 2002–2014. The declines were synchronous in all three countries (Lehikoinen et al. 2014) and occurred both in tundra and birch forest. One may therefore suspect that they were driven by the same large-scale phenomena.

It is well known that European long-distance migrants have declined more than species in other migratory groups (Sanderson et al. 2006; Gregory et al. 2007). In contrast, the population trends of the five long-distance migrants in our species pool were less negative than those of short-distance migrants and residents. It is therefore unlikely that the overall population declines are driven by problems in the tropical wintering and staging areas. Interestingly, the pattern is similar in European farmland species, where short-distance migrants have faced stronger declines than long-distance migrants in recent years (Voříšek et al. 2010).

In Lehikoinen et al. (2014) we listed a number of local factors that may have contributed to the declines. They include warmer and rainier summers (the beginning of the millennium was unusually warm and wet), uphill shifts of the tree-line, expanded distribution of insect pests, mismatch in food-web phenology, as well as changes in forest composition, grazing pressure, rodent abundance and hunting pressure. However, no firm conclusions could be drawn (for a more exhaustive discussion, see Lehikoinen et al. 2014). It should also be noted that periods of general population declines, followed by general increases, have occurred at least in the Swedish part of the Scandes during the last 50 years (Enemar et al. 2004, Svensson & Andersson 2013). Svensson & Andersson (2013) actually concluded that birds on the Swedish tundra in general showed positive population trends during the last 40 years.

Thirteen-year long time series are still somewhat short to draw strong ecological conclusions. At this stage, we therefore find it just as important that we actually can calculate a robust bird indicator for a whole mountain range, in this case the Scandes. There are several reasons why this is now possible.

Since the first generic bird monitoring schemes in all three countries were free-choice schemes, very few routes were located in the remote and often inaccessible mountains. In 1996, Sören Svensson started a new scheme in Sweden with pre-defined routes in a systematic grid, covering all of Sweden. Since the Swedish part of the Scandes make up about 14 % of the total land area of Sweden, accordingly, 14 % of the routes were located in the Scandes. The task was now to get people to count these remote routes. Some money was supplied by the Swedish Environmental Protection Agency, which made it possible to pay a few surveyors and their travel costs. A small number of montane routes could therefore be monitored every year. In 2003, another important step was taken when the regional county boards of Västerbotten and Dalarna, two of four counties with routes in the Scandes, decided to use the national scheme as their regional scheme, and helped recruiting and paying for surveyors. The other two counties soon joined, and in addition, priority was put on surveying the routes located in the Scandes. Since 2007, between 58 and 78 montane routes in Sweden (out of 104) were surveyed per year.

In 2006, Norway and Finland launched their new schemes. Both schemes are variants of the Swedish scheme. They both have a systematic grid of routes, although the methodological details have been somewhat adjusted. Although censuses of Finnish routes is based on voluntaries, the scheme has received annual funds from the Ministry of Environment. These funds are mainly used to support routes in the northern part of the country including montane routes.

The direct comparability of the sampling schemes between countries has greatly simplified our joint analysis. No geographical or habitat-related weighing was needed, since the countries and their major habitats are covered in a representative way. Nor was correction for national population sizes needed, since we could analyse all routes together, as if they were from one country. Another important factor for making the production of the indicator fairly simple was that we could build on the indicator concept outlined by Gregory et al. (2005), and used within the Pan-European Common Bird Monitoring Scheme (PECBMS) ever since. In addition, the very idea to make a montane indicator for the Scandes was first raised when some of us met at the PECBMS meeting in Mikulov, Czech Republic, in February 2012.

The fact that there is long tradition of cooperation between the Nordic countries at many different societal levels also facilitated our joint work. We have since produced joint trends for boreal and arctic-breeding waders (Lindström et al. submitted) and a study on Nordic mire birds is well under way.

In Finland and Norway all montane routes have not yet been surveyed twice and they are therefore not included in the trend analysis (the white dots in Fig. 1). When all routes have been surveyed twice, there will be 33 and 267 fixed montane routes in these countries, respectively. Together with the 104 routes in Sweden this will make a total of 404 Fennoscandian montane routes (420 when including the 6 + 10 routes from the additional schemes in Finland and Norway, respectively).

When the schemes are running full strength we will most certainly be able to add some more species to our indicator. These new species may be species that in Fennoscandia are exclusively found in the Scandes, such as Long-tailed Duck, Dotterel, Red-necked Phalarope and Ring Ouzel, or species that are typical for the Scandes although they also occur in other habitats, such as Rough-legged Buzzard, Merlin, Ringed Plover, Redshank, Dunlin and Cuckoo.

The Fennoscandian montane bird indicator gives basic information about population changes in one of the most extreme climatic environments of Europe (cf. Gregory et al. 2009), covering both tundra and birch forest. As such, this indicator can fill an important gap among the already existing continental-wide bird indicators for farmland, forest, and climate change (Gregory et al. 2005, 2007, 2009), and the many regional European bird indicators produced by the European Bird Census Council (www.ebcc.info). As far as we know, this may be the first large-scale indicator for alpine birds in the World, but we hope that similar indicators soon can be produced also for other montane regions of Europe and elsewhere. Maybe there is also room for a common European montane bird indicator.

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References

Byrkjedal, I. & Kålås, J. A. (2012). Censuses of breeding birds in a south Norwegian arctic-alpine habitat three decades apart show population declines in the most common species. Ornis Norvegica 35: 43–47.

Chamberlain, D., Arlettaz, R.L., Caprio, E., Maggini, R., Pedrini, P., Rolando, A. & Zbinden, N. (2012). The altitudinal frontier in avian climate impact research. Ibis 154: 205–209.

Gonzalez, P., Neilson, R.P., Lenihan, J.M., & Drapek, R.J. (2010). Global patterns in the vulnerability of ecosystems to vegetation shifts due to climate change. Global Ecol. Biogeogr. 19: 755–768.

Gregory R.D., van Strien A.J., Voříšek P., Gmelig Meyling A.W., Noble D.G., Foppen R.P.B. & Gibbons D.W. (2005). Developing indicators for European birds. Philos. Trans. R. Soc. B-Biol. Sci. 360: 269–288.

Gregory, R.D., Voříšek, P., Van Strien, A., Gmelig Meyling, A.W., Jiguet, F., Fornasari, L., Reif, J., Chylarecki, P. & Burfield, I.J. (2007). Population trends of widespread woodland birds in Europe. Ibis 149 (Suppl. 2): 78–97.

Gregory R.D., Willis S.G., Jiguet F., Voříšek P., Klvaňová A., van Strien, A., Huntley, B., Collingham, Y.C., Couvet, D. & Green, R.E. (2009). An Indicator of the Impact of Climatic Change on European Bird Populations. PLoS ONE 4(3): e4678.

Huntley B., Green R.E., Collingham Y.C. & Willis S.G. (2007). A climatic atlas of European breeding birds. Durham University, The RSPB and Lynx Edicions, Barcelona.

Husby, M. & Kålås, J. A. (2011). Terrestriske fuglearter som indikatorer for bærekraftig utvikling i Norge. Report no. 128, Høgskolen i Nord-Trøndelag. [In Norwegian].

Kullman, L. & Öberg, L. (2009). Post-Little Ice Age tree line rise and climate warming in the Swedish Scandes: a landscape ecological perspective. J. Ecol. 97: 415–429.

Lehikoinen, A., Green, M., Husby, M., Kålås, J. A. & Lindström, Å. (2014). Common montane birds are declining in North Europe. J. Avian Biol. 45: 3–14.

Lindström, Å., Green, M., Husby, M., Kålås, J. A. & Lehikoinen, A. Large-scale monitoring of waders on their boreal and arctic breeding grounds in northern Europe. — Ardea (in press).

Ottosson, U., Ottvall, R., Elmberg, J., Green, M., Gustafsson, R., Haas, F., Holmqvist, N., Lindström, Å., Nilsson, L., Svensson, M., Svensson, S. & Tjernberg, M. (2012). The birds in Sweden — numbers and occurrence. — SOF, Halmstad. [In Swedish]

Pannekoek, J. & van Strien A. (2004). *TRIM 3 Manual* (TRends & Indices for Monitoring data). — Statistics Netherlands, Amsterdam, Netherlands.

Sanderson, F. J., Donald, P. F., Pain, D. J., Burfield, I. J. & van Bommel, F. P. J. (2006). Long-term population declines in Afro-Palearctic migrant birds. — Biol. Conserv. 131: 93–105.

Sekercioglu, C. H., Schneider, S. H., Fay, J. P. & Loarie, S. R. (2008). Climate Change, Elevational Range Shifts, and Bird Extinctions. Conserv. Biol. 22: 140–150.

Svensson, S. 2006. Species composition and population fluctuations of alpine bird communities during 38 years in the Scandinavian mountain range. Ornis Svecica 16: 183–210.

Svensson, S. & Andersson, T. 2013. Population trends of birds in alpine habitats at Ammarnäs in southern Swedish Lapland 1972–2011. Ornis Svecica 23: 81–107.

Väisänen, R. A., Lammi, E. and Koskimies, P. 1998. Distribution, numbers and population changes of Finnish breeding birds. Otava, Helsinki, Finland, in Finnish with English summary

Voříšek, P., Jiguet, F., van Strien, A., Škorpilova, J., Klvanová, A. & Gregory, R. (2010). European trends in farmland birds. BOU Proceedings — Lowland Farmland Birds III. http://www.bou.org.uk/bouproc-net/lfb3/vorisek-etal.pdf

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