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Numbers of Horned Lark *Eremophila alpestris* are increasing at high alpine and arctic breeding sites in Norway

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Abstract. Strong declines in number of breeding Horned Larks *Eremophila alpestris* were reported from several Fennoscandian breeding grounds in the 1960s and 1970s. Counts from the species' high alpine breeding grounds at Hardangervidda, southern Norway in the early 1980s and the first couple of decades in the 2000s, and from its arctic breeding grounds in the Varanger region, northern Norway in the period 1996-2021, show a reversal of the trend. The increase in numbers is suggested to have resulted primarily from recovery of nonbreeding habitat after cessation of extensive building of embankments to prevent flooding in the German Wadden Sea area, which is the main wintering area of Fennoscandian Horned Larks.

Keywords: Breeding populations, mountain birds, population trends, winter habitat

INTRODUCTION

Population declines over the last decades have been reported for Horned Lark *Eremophila alpestris* at breeding grounds in Fennoscandia (Sweden: southern Lapland, Svensson 1990, 2006, Ottosen et al. 2012; northern Norway: Finnmark, Frantzen et al. 1991, Troms, Strann et al. 2004; Finland: Hildén 1987). In the mountains of southern Norway, no decline has been noted, except possibly in the Dovre area (Stueflotten 1994). On the contrary, line transect censuses at Hardangervidda indicated higher numbers in 2010 and 2011 compared to 1980 (Byrkjedal & Kålås 2012). However, due to specific habitat requirements and low breeding densities (Lien et al. 1970, 1974, Østbye & Framstad 1987), Horned Larks are difficult to monitor from censuses based on line-transects or mapping method applied to small areas.

During field work on other species of birds over a number of years in the Varanger area of northern Norway, and at Hardangervidda, southern Norway (Figure 1), we have recorded observations of Horned Larks in song flight or other situations indicating breeding territories, in our study areas. Our study areas were large and Horned Larks were reasonably evenly distributed but the number of territories is moderate. Yet, the number of seasons involved gives us useful information to evaluate trends in number of breeding Horned Larks, at Hardangervidda in the period 1979–2021 and at Varanger in the period 1996–2021.We here report the trends we have observed and discuss possible causes for changes.

MATERIALS AND METHODS

Hardangervidda

Survey data were obtained by IB in Steinbuheii, a north-facing slope, 7 km^2, 1170–1350 m asl. The area lies well above the treeline. *Juncus trifidus*/Lichen habitat is present on drier elevated patches of ground, in total making up 12.0% of the plant communities of the study area (a figure extracted from field data collected for Byrkjedal 1989). This is a chinofobic

Figure 1. Locations of the Hardangervidda and Varanger study areas.

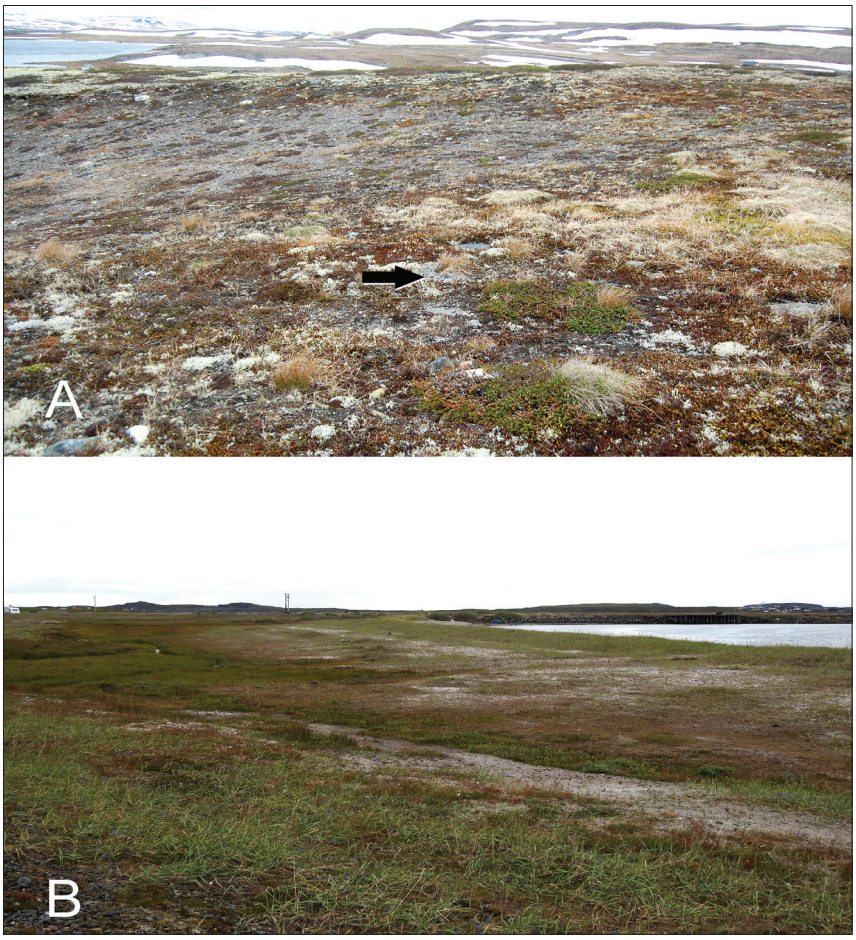

Figure 2. Breeding habitats of Horned Larks at (A) Hardangervidda (arrow points at a Horned Lark nest) and (B) Svartnes, Varanger.

plant community found on windswept hilltops where it gains a vegetation height of only a few centimetres, and it is primarily the breeding habitat (Figure 2A) used by Shore Larks at Hardangervidda (Østbye & Framstad 1987, IB pers. obs.). For a more detailed description of the study area and its habitat, see Byrkjedal (1989).

Horned Larks in song flight were systematically recorded during visits to the study area, as indicative of nesting territories, and were opportunistically corroborated by location of active nests and newly fledged young. In the years 1979–81 and 1984–85, extensive periods of field work were carried out on waders (Eurasian Golden Plover *Pluvialis apricaria* and Dotterel *Charadrius morinellus*), from early May to mid or late July, while in seven summers from 2004 to 2021 visits were primarily made to the study area of shorter duration in June, in connection with various field projects. An overview of field work periods is given in Appendix 1.

Horned Larks were not primarily a target species for the field projects, but the observations are thought to give representative information on the number of territories in the area, as the species sings frequently, is easy to detect in song flight, even over rather long distances, and song flight of one male often triggers neighbouring males to sing. In the 1980s, the study area was covered multiple times as field work was carried out almost daily and singing males of Horned Larks were recorded on maps. In the 2000s, the study area was walked so as to cover the whole area over consecutive days in a way that would allow location of singing males. Territories were not mapped, and numbers of males were recorded by descriptive notes, and special care was made to keep observations apart so as not to make multiple counts of the same singing males. Double-counting was not a problem because the male Horned Larks were well-spaced. Notes were made of males singing simultaneously.

Varanger

The study area at Svartnes–Smelror, Vardø (71˚ N, 31˚ E) is lowland tundra comprising 2 km^2. 65% consists of marsh and grass habitats partly covered by short willows while 35% are sandy shore habitats with a sparse vegetation of *Cladonia*-lichens, *Leymus arenarius*, various grasses (Poaceae), and *Juncus* sp. (Figure 2B), suitable for Horned Larks.

The study area was visited almost daily between 1

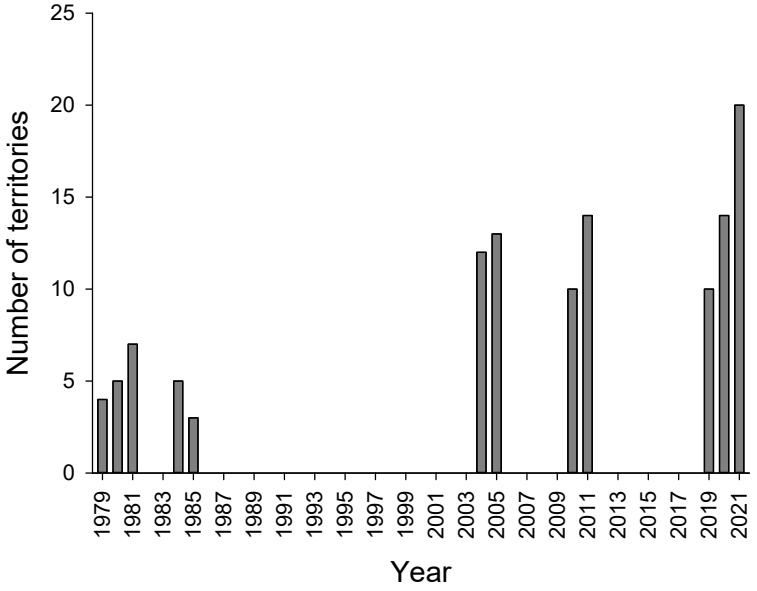

Figure 3. Number of territories at Steinbuheii, Hardangervidda in 12 years during the period of 1979–2021. In 2020 not whole area equally well covered.

June and 31 July in 1996–2021. In the beginning of June, a variable proportion of the ground was snow-covered (one to 20%), but after 15 June all snow had melted, and grass and willow bushes rapidly turned green.

Horned Larks are early breeders, so field work started immediately after 1 June, including mapping of singing males, warning individuals, nest-building females, food-collecting parents, and fledged broods. Males singing in territories not recorded before 25 June were ignored, since some failed breeders sometimes re-establish themselves. Potential bias from double-counting is low with only three birds belonging to this category.

RESULTS

In the Steinbuheii study area, Hardangervidda, the number of Horned Lark territories varied between 3 and 7 in the five summers during the period 1979–1985 that the species was censused, on average 4.8 (Figure 3). Nine years later, the number of territories during 7 years in the period 2004–2021 amounted to 10–20, on average 13.3. Based on the average number of territories, the change represents a 2.8 times increase. The difference between the two periods is statistically significant ($t = 5.181$, $df = 10$, $p < 0.001$). The number of territories corresponds to a breeding density of 0.4–1.0 pairs per km^2 in the first field period (1979–85) and

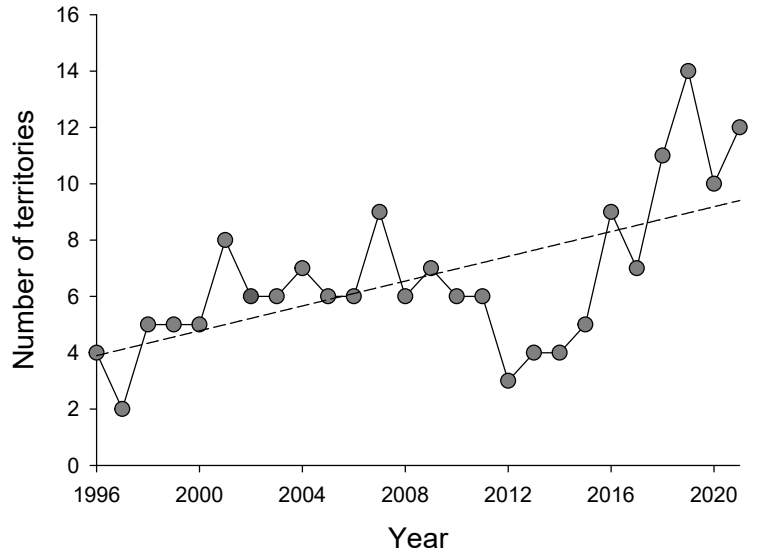

Figure 4. Number of territories at Svartnes–Smelror, Varanger, in the 25-year period of 1996–2020. Dotted line shows the linear regression.

1.4–2.9 pairs per km^2 in the second period (2004–21). Relating this to the area of the habitat strongly preferred by breeding Horned Larks at Hardangervidda, the Juncus trifidus/lichen community, which patchily covered totally 12% of the study area, the density of breeding pairs was 3.6–8.3 and 11.9–23.6 pairs per km^2 during the two periods.

At Svartnes, Varanger, the number of territories in the period 1996–2021 varied from 2 to 14 in the study area, and a linear regression of territories on year shows a statistically significant increase in spite of the variation between the years ($y = 0.2205x - 436.25$; $R^2 = 0.36$, $t = 3.699$, $df = 24$, $p = 0.001$; Figure 4). The increase was most marked in the years after 2015. The number of territories recorded corresponds to a breeding density of 1–7 pairs per km^2. Restricting the analyses to suitable Horned Lark habitats (35% of the total area) yields min.–max. breeding density of 2.9–20.0 pairs per km^2.

DISCUSSION

Our long-term survey data show that numbers of Horned Larks have increased over recent decades in both study areas, at Hardangervidda compared to the first half of the 1980s, and in Varanger at least since the mid 1990s. The patterns probably indicate a general positive population trend in South Norwegian mountains as well as on the arctic heaths of Finnmark, which differs from the situation reported from censused breeding grounds in central Swedish mountains (Svensson 1990, 2006, Ottosen et al. 2012) and from assessments made for northern Norway and Finland (Hildén 1987, Frantzen et al. 1991, Strann et al. 2004) but supports the trend reported by Byrkjedal & Kålås (2012). At Hardangervidda, far fewer field-days were spent each season in the 2000s than in 1979–85, which would be more likely to lead to underestimates in number of Horned Larks recorded.

Growth of the Horned Lark populations could be caused by changes in conditions on the breeding grounds as well as on non-breeding grounds.

At Hardangervidda, the ground layer vegetation has changed over the last two decades by a strong increase in cover of reindeer lichen (*Cladonia* spp., Strand et al. 2005, Byrkjedal & Kålås 2012). However, the increased abundance of lichen has not influenced the occurrence of bushes, herbs and grasses, which determine the general vegetation height and structure. Thus, the lichen coverage seems not to have increased the area of short vegetation preferred as nesting habitat by Horned Larks, and it is not apparent that lichen growth should have had any positive effect on Horned Lark breeding density. Besides, a corresponding expansion in cover of lichens was not seen at the Varanger breeding grounds.

Over the last decades, two granivorous species sympatric with Horned Larks have severely declined in numbers at Hardangervidda, namely Lapland Longspurs *Calcarius lapponicus* and Snow Buntings *Plectrophenax nivalis* (Byrkjedal & Kålås 2012, IB pers. obs; see also Lehikoinen et al. 2014 for the Scandinavian mountains). The diet of these two species overlaps heavily with that of Horned Larks early in the breeding season (Byrkjedal et al. manuscript), and Horned Larks may have benefited from release from interspecific competition with these species. However, the two species do not breed in the Varanger study area, although they frequent the area during spring migration.

Fennoscandian Horned Larks winter on the coasts of the North Sea, primarily on the Wadden Sea area, as shown by ringing recoveries (Svensson 1997, Dierschke 2001). To prevent flooding, huge embankment construction projects were undertaken along the Wadden Sea shorelines in the 1950s and 1960s (Dierschke & Bairlein 2002). Embankments caused dramatic changes of habitat, reducing the availability of halophytes, the seeds of which are a vital food source for Horned Larks in winter (Dierschke 2002), and a marked decline in number of wintering Horned Larks ensued. From late 1980s on, embankment construction has ceased, and subsequent habitat protection measures, including a strong reduction in grazing (Aumüller & Dierschke 2014), have led to an increase in salt marsh areas and a corresponding recovering of halophytic vegetation. A steady and strong increase in number of wintering Horned Larks followed in the 1990s (Dierschke & Bairlein 2002). Unfortunately, there was a hiatus in field work at Hardangervidda in the years when the Wadden Sea counts were performed, and the field work at Varanger began only in the middle of the Wadden Sea census period. Nevertheless, the improved winter conditions for Horned Larks in the Wadden Sea seem to offer the most likely explanation for the population increase of the species on the Norwegian breeding grounds from the 1990s on. Estimates of the total numbers of wintering Horned Larks within the Wadden Sea National Park of Lower Saxony, which embraces a significant part of the relevant nonbreeding habitat, have been discussed (Aumüller et al. 2016). We have not found any information on the trend in Horned Lark numbers in the Wadden Sea based on standardized counts since the counts ended there in 2000, but the numbers on Norwegian breeding grounds continue to look positive. Also in Sweden the species has recently been recorded again on breeding grounds, including Ammarnäs, where declines were first reported, and numbers have increased in winter in southern Sweden (Livbom & Corell 2021).

Partly due to scarcity of census data, the Horned Lark has been categorized with changes in conservation status over time by the Red Lists in Finland, Sweden, and Norway, with the most recent updates categorizing

the species in Finland as "critically endangered" (CR), in Sweden as "vulnerable" (VU) and in Norway as a species of "least concern" (LC) (Hyvärinen et al. 2019, SLU Artsdatabanken 2020, Stokke et al. 2021). For Finland and Sweden, the conservation status chiefly rests on the fact that the breeding populations in these two countries are judged to be small. More information from the species' breeding grounds, most of which are in remote and little visited areas, would be highly desirable.

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REFERENCES

Aumüller, R & Dierschke, J. 2014. Winterliche Singvogelgemeinschaften in Salzwiesen des schleswig-holsteinischen Wattenmeeres unter besonderer Berücksichtigung des Faktors Beweidung. Abhandlungen des Naturwissenschaftlichen Vereins zu Bremen 47: 211–222.

Aumüller, R., Weiner, C. N., Hill, R. & Krüger, T. 2016. Verbreitung und Bestand überwinternder Singvögel im Nationalpark Niedersächsisches Wattenmeer. Vogelkundliche Berichte aus Niedersachsen 44: 157–193.

Byrkjedal, I. 1989. Habitat use and resource overlap by breeding Golden Plovers and Dotterels (*Pluvialis apricaria*, *Charadrius morinellus*). Journal für Ornithologie 130: 197–206.

Byrkjedal. I., Fjeldheim, V.B., Halvorsen, L.S. & Lislevand, T. Manuscript. Food of three sympatric granivorous passerine species in Norwegian high mountains during the early breeding season.

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.

Dierschke, J. 2001. Herkunft, Zugwege und Populationsgrösse in Europa überwinternder Ohrenlerchen (*Eremophila alpestris*), Schneeammern (*Plectrophenax nivalis*) und Berghänflinge (*Carduelis flavirostris*). Vogelwarte 41: 31–43.

Dierschke, J. 2002. Food preferences of Shorelarks *Eremophila alpestris*, Snow Buntings *Plectrophenax nivalis* and Twites *Carduelis flavirostris* wintering in the Wadden Sea. Bird Study 49: 263–269.

Dierschke, J. & Barlein, F. 2002. Why did granivorous passerines wintering in the Wadden salt marshes decline? Ardea 90: 471–477.

Frantzen, B., Dransfeld, H., Hunsdal, O., Skakuj, M., Kauhanen, H., & Laine, T. 1991. Fugleatlas for Finnmark. Fylkesmannen i Finnmark, Norway.

Hyvärinen, E., Juslén, A., Kemppainen, E., Uddström, A. & Liukko, U.-M. (eds.). 2019. The 2019 Red List of Finnish Species. Ympäristöministeriö & Suomen ympäristökeskus. Helsinki, Finland. 704 pp.

Järvinen, O. & Väisänen, R.A. 1978. Habitat distribution and conservation of land bird populations in northern Norway. Holarctic Ecology 1: 351–361.

Lehikoinen, A., Green, M., Husby, M., Kålås, J.A., & Lindström, Å. 2014. Common montane birds are declining in northern Europe. Journal of Avian Biology 45: 3–14.

Lien, L., Østbye, E., Hagen, A., Klemetsen, A., Skar, H.-J. 1970. Quantitative bird surveys in high mountain habitats, Finse, South Norway, 1967–68. Nytt Magasin for Zoologi 18: 245–251.

Lien, L., Østbye, E., Hogstad, O., Haande, K.M., Haande, P.S., Hagen, A., Skar, H.-J., Skartveit, A. & Svalastog, D. 1974. Bird surveys in the high mountain habitats of Finse and Stigstuv, Hardangervidda, South Norway, 1967-1972. Norwegian Journal of Zoology 22: 1–14.

Livbom, A. & Corell, M. 2021. Fågelrapport 2020. Vår Fågelvärld, Suppl. 61: 65-195.

Ottosen, U., Ottvall, R., Elmberg, J. Green, M., Gustafsson, R., Haas, F., Holmqvist, N., Lindström, Nilsson, L., Svensson, S. & Tjernberg, M. 2012. Fåglarna i Sverige – antal och förekomst. SOF, Halmstad, Sweden.

SLU Artdatabanken. 2020. Rödlistade arter i Sverige 2020. SLU, Uppsala, Sweden. 242 pp.

Stokke, B.G., Dale, S., Jacobsen, K.-O., Lislevand, T., Solvang, R. & Strøm, H. 2021. Fugler: Vurdering av fjellerke *Eremophila alpestris* for Norge. Rødlista for arter 2021. Artsdatabanken, Trondheim, Norway. https://www.artsdatabanken.no/lister/rodlisteforarter/2021/27806.

Strand, O., Bevanger, K. & Falldorf, T. 2005. Reinens bruk av Hardangervidda – sluttrapport fra Rv-7-prosjektet. NINA Rapport 131,

Strann, K.-B. & Bakken, V. 2004. Hekkefuglatlas for Troms. Norsk institutt for naturforskning, Tromsø ISBN: 82–426–1435–0.

Stueflotten, S. 1994. Fjellerke *Eremophila alpestris*. Pp. 318–319 in Gjershaug, J.O., Thingstad, P.G., Eldøy, S. & Byrkjeland, S. (eds.) Norsk fugleatlas. Norsk ornitologisk forening, Klæbu.

Svensson, S. 1990. An alarming decline of the Shore Lark *Eremophila alpestris* in Sweden. Pp. 5–11 in Haftorn, S. (ed.) Proceedings of the sixth Nordic Congress of Ornithology 1987. Norsk ornitologisk forening, Trondheim.

Svensson, S. 1997. The wintering area of Shore Larks *Eremophila alpestris* breeding in Swedish Lapland. Ornis Svecica 7: 169–173.

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.

Østbye, E. & Framstad, E. 1987. Spurvefuglenes habitatbruk i høyfjellet. Viltrapport 43: 104–110.

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Appendix 1. Periods of daily field work in Steinbuheii, Hardangervidda during which observations of Horned Larks were recorded

Year	Number of days	Time periods
1979	28	25 May–3 June; 12–17 June; 11–24 July
1980	31	18–20 May, 27-29 May; 9–13 June; 7–23 July
1981	48	11–12 May; 18–25 May; 5–17 June; 27 June–22 July
1984	37	25–29 May; 12–21 June; 9–20 July
1985	13	12–19 June; 28 June–2 July; 24–25 July
2004	4	7–10 June
2005	4	28 June–1 July
2010	6	10–13 June; 8–9 July
2011	7	10–16 June
2019	9	30 May–2 June; 29 June–3 July
2020	4	14–17 July
2021	5	27–31 May