Environmental influences and population ecology of a semi-domesticated reindeer herd in Finnish Lapland

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Introduction

Relative importance of density-dependent and density-independent factors on reproduction, winter mortality, and population growth of semi-domesticated reindeer were studied in the area of the Käsivarsi Herding Association, North-West Finnish Lapland, during 1960-2000 (Fig. 1). Reindeer data were extracted from official reindeer statistics (Fig. 2) and annual reports of the herding association (including description of winter conditions), and meteorological data from the Kilpisjärvi weather station of the Finnish Meteorological Institute. Annual variation in the population characteristics was related to snow and weather variables known to affect food availability. We also studied correlations between local weather and NAO (the North Atlantic Oscillation) and AO (Arctic Oscillation) in December-March, and the direct impact of NAO and AO on population characteristics.

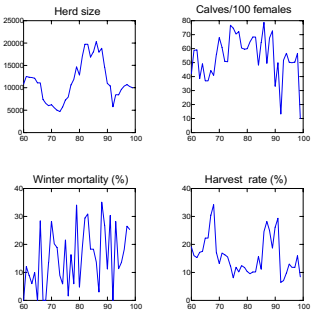

Fig. 2. Population characteristics in Käsivarsi in 1960–2000.

According to the reindeer herders' report, lichen ranges were heavily grazed already in the late 1950's. The mean lichen biomass decreased between 1978 and 1991 by about 40 %.

Results

Winter density did not affect reproduction or the growth rate, whilst mortality slightly increased with density and calendar year. In crosscorrelation analysis, winter mortality was positively related to winter density with a time lag of 3-7 years.

Reproduction correlated negatively with precipitation, the snow depth sum, frequency of heavy winds (compacting the snow), and the time of snow melt (affecting availability of green forage) (Fig. 3). In ANOVA estimated by GLM, the snow depth sum and icing conditions in early winter explained a total of 54 % of the annual variation in reproduction (Fig. 4).

Most of the relevant snow and winter weather variables correlated significantly with AO, but only a few of them with NAO.

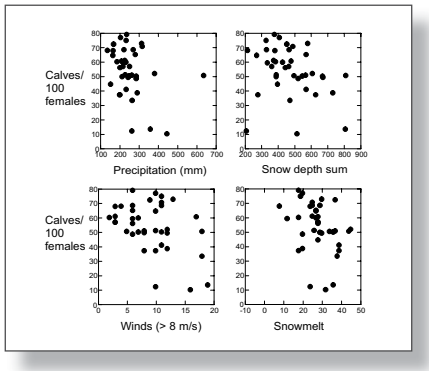

Fig. 3. Correlations between selected winter weather variables in Dec–Mar and reproduction of reindeer in next summer in Käsivarsi 1960–2000.

We did not find any correlation between winter conditions and mortality, whilst mortality was positively associated with AO with a time lag of 1 year (Fig. 5). Reproduction was related to AO with time lags of 3-7 years (Fig 6). This can be explained by the fact that females which have lost their calves or have not become pregnant as a result of bad winters have recovered and have a high reproduction capacity; cohort effect may be involved also.

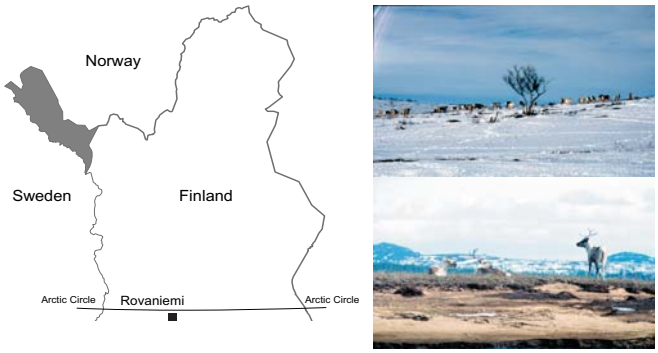

Fig. 1. The study area (dark) is located mainly in alpine and subalpine zones. Photos by Päivi Salminen and Ilpo Kojola.

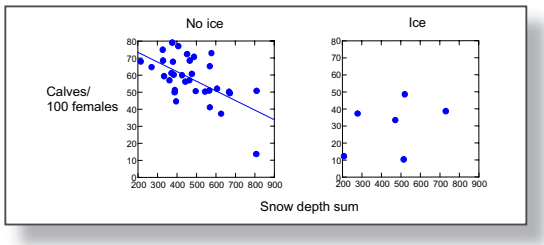

Fig. 4. The relationships between the snow depth sum and reproduction separately for "normal" winters and winters with severe icing.

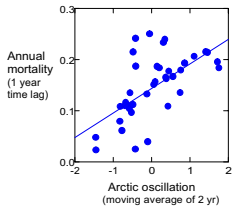

Fig. 5. The relationships between Arctic Oscillation and mortality of reindeer in Käsivarsi 1960–2000.

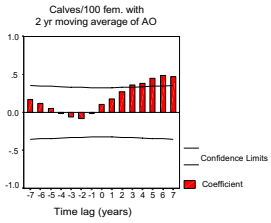

Fig. 6. Crosscorrelations between Arctic Oscillation and reproduction of reindeer 1960–2000.

Conclusion

In comparison to density, winter weather has an overwhelming impact on reproduction and mortality, which emphasizes the importance of distinguishing between absolute and relative food resources. In other words, density dependences are masked by climatic variability and are difficult to find especially due to time lags of various length (both in reindeer herd and range condition). The period 1975-1988 was characterized by exceptionally favourable winter conditions, which led to an inevitable increase in animal numbers without any clear immediate negative effects, but resultant detorioration of range could be attributable, together with difficult snow conditions, to later population crash.

Local weather affecting food availability was associated with AO, which is a measure depicting large-scale climatic variation/change.

Similar trends in the number of semi-domesticated reindeer have been reported over a wide area in northern Fennoscandia, suggesting that also the reasons behind have been the same.

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