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Spatial and Temporal point process models for estimation of brown bear population size

An attempt to separate the measures of density and search effort

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Abstract

Monitoring of the population of brown bears is important for its management and preservation. The primary aim is to estimate the size of the population, distribution and trends within the population. The size is currently estimated by using Capture-Recapture (CR) models for closed populations.

In this thesis we propose a different model which has its roots in the Spatially Explicit Capture-Recapture models which make use of spatial information in data. The model consists of a spatial point process model for the activity centres of bears and a temporal point process model for the detection times of each bear. A measure of search effort is obtained through the temporal point process. The search effort is used to ensure the identifiability of the measure of density. The model is fit with a Bayesian approach using Markov Chain Monte Carlo sampling.

Results of a simulation study show that the proposed model works well for estimation of the parameters of density and search effort. An application to real data collected in the county of Västerbotten during autumn 2019 yields a more narrow 95% credible interval of the population size than the 95% confidence interval obtained by using the current CR models. In addition, spatially varying estimates of density, which are corrected for the spatial variation in search effort, are produced.

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