

Seasonal demographic trends and spatial dispersion of closely monitored populations

Chiara Mazzetta¹, Byron Morgan¹ and Tim Coulson²

¹ Institute of Mathematics and Statistics, University of Kent, UK

² Division of Biology, Imperial College, UK

In this work we consider populations of wild animals that are closely monitored over time, by being recaptured or simply re-sighted on multiple occasions within a year, until they are finally recovered or lost to follow up. Recapture data are integrated with recovery data to estimate the age and time structure of key demographic parameters such as survival and productivity rates. Rather than considering annual trends we consider the seasonal variability of survival at different ages, which is related to environmental effects, and the seasonal variability of nuisance parameters, such as recapture and recovery rates, which reflects among other things some aspects of the study design. Re-sighting data of a different group of individuals, within the same population, are used to estimate the geographical dispersal over a discrete set of locations in the study area. These two independent data sets of re-sightings and recaptures/recoveries are then integrated into a non-linear and non-normal state-space model so as to estimate simultaneously spatial and temporal dynamics. Parameters are estimated with MCMC methods within a fully Bayesian approach. As an example we consider the Soay sheep population on the uninhabited island of Hirta, Scotland, that has been closely monitored over the last 20 years. This species is particularly interesting as it represents the most prehistoric form of domestic sheep and it has remained virtually unchanged for thousands of years. Our aim is to investigate with this model the potential for density-dependent dispersal and to see whether the well known periodic population crashes for this species influence the sheep's use of the island territory.