

Abstract

In this thesis, I investigate the application of various statistical methods towards analysing GPS tracking data collected using GPS collars placed on large mammals in Kruger National Park, South Africa. Animal movement tracking is a rapidly advancing area of ecological research and large amount of data is being collected, with short sampling intervals between successive locations. A statistical challenge is to determine appropriate methods that capture most properties of the data is lacking despite the obvious importance of such information to understanding animal movement. The aim of this study was to investigate appropriate alternative models and compare them with the existing approaches in the literature for analysing GPS tracking data and establish appropriate statistical approaches for interpreting large scale mega-herbivore movements patterns. The focus was on which methods are the most appropriate for the linear metrics (step length and movement speed) and circular metrics (turn angles) for these animals and the comparison of the movement patterns across herds with covariate. A four parameter family of stable distributions was found to better describe the animal movement linear metrics as it captured both skewness and heavy tail properties of the data. The stable model performed favourably better than normal, Student's t and skewed Student's t models in an ARMA-GARCH modelling set-up. The flexibility of the stable distribution was further demonstrated in a regression model and compared with the heavy tailed t regression model. We also explore the application circular linear regression model in analysing animal turn angle data with covariate. A regression model assuming Von Mises distributed turn angles was shown to fit the data well and further areas of model development highlighted. A couple of methods for testing the uniformity hypothesis of turn angles are presented. Finally, we model the linear metrics assuming the error terms are stable distributed and the turn angles assuming the error terms are von Mises distributed are recommended for analysing animal movement data with covariate.