

The Royal Statistical Society - General Applications Section

Wednesday 21st June, 2pm-5.30pm at the RSS (tea at 3.45pm)

Statistics in Ecology

Byron Morgan, (NCSE, University of Kent)

"An Overview of Statistical Ecology"

Statisticians have been working on a wide range of interesting and challenging problems arising in ecology for many years. The talk will start with a general review of this work, which provides the context for the research of the National Centre for Statistical Ecology (NCSE); the NCSE is supported by a 5-year grant from the EPSRC, and is distributed between the universities of Cambridge, Kent and St. Andrews. The talk will outline the research taking place in the NCSE, and conclude by focusing on the particular issues of model-identification and parameter redundancy, which arise both when one is trying to estimate population size and the survival rates of wild animals.

Ruth King (University of St. Andrews)

"Recent Approaches to Analysing Complex Ecological Data"

Computationally intensive methods are becoming increasingly popular within statistical ecology for analysing complex data. We concentrate on the use of Bayesian methods, with particular reference to the issues of the incorporation of covariate information to describe heterogeneity (with possible missing covariate values) and model discrimination. Real examples will be considered to illustrate these methods, followed by a discussion of the increased understanding of the systems obtained through our analysis.

William Browne (University of Nottingham)

"Random effect modelling of great tit nesting behaviour"

Statistical modelling of observational wild animal data typically focuses on population-level variables, for example population size. In this talk we consider fitting random effect models to observation level data where in our problem observations are nesting attempts of Great tits. The dataset used is a subset from a larger dataset from Wytham Woods in Oxfordshire and consists of 34 years of breeding attempts. We look at models that aim to partition both the variability of several breeding attempt responses (clutch size, nestling mass, lay date, bird success and parental survival) and the correlation between pairs of responses into genetic and environmental influences. The models are fitted using MCMC methods and the sparsity of the data structures pose some interesting methodological and practical problems which we will discuss.

(Joint work with R.A. Pettifor, R.H. McCleery and B.C. Sheldon)

Takis Besbeas (University of Kent)

"Classical methods for modelling wildlife population dynamics"

Systematic declines in wild animal populations are common in recent years and conservation plans are urgently needed to protect them from extinction. We discuss classical methods for joint inference from multiple sources of data to provide more reliable estimates than those obtained from a single source of information. The methods are based on a state-space model for the population size data with a joint likelihood connecting the various types of observations. We describe how the methods can be fitted using the Kalman filter and we illustrate the approach using models for the British grey seal population.

(Joint work with B Morgan, L Thomas and J Harwood)

Len Thomas (University of St. Andrews)

"Bayesian methods for modelling wildlife population Dynamics"

This talk is a companion to the previous one. We describe how such models can be specified within a Bayesian framework, and fitted using Bayesian Monte-Carlo methods, in particular Monte-Carlo particle filtering (also called sequential importance sampling). We discuss the strengths and weaknesses of particle filtering for this application, relative to other fitting methods.

(Joint work with K. B. Newman, C. Fernandez, S. T. Buckland and J. Harwood)

Title: New developments in statistical ecology

Key-words: Bayesian methods; Capture-recapture; Changing environments; Diffusion models; Ecology; Evolution; Hierarchical models; Metacommunities; Markov processes; Movement; Nonparametric methods; Semiparametric regression; Spatial processes; Splines.

Organizers:

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Motivation:

The IBC2008 will take place at a time of unprecedented concern with regard to climate change, and its effects on flora and fauna throughout the world. It is essential that biometricians address associated vital issues relating to animal abundance, movement and reproduction. These vitally important issues motivate this proposal for an invited paper session on *New Developments in Statistical Ecology*.

This proposal is by the three co-Directors of the *National Centre for Statistical Ecology* (NCSE – see <http://www.ncse.org.uk/>). The NCSE was established in October 2005, with funding from the *Engineering and Physical Sciences Research Council*, as a Centre of international repute for the development and application of novel statistical methods in population ecology, integrating the partner Universities' research programmes and activities in statistical ecology. The *International Conference in Statistical Ecology* in 2008 will be hosted by NCSE, and take place in St. Andrews. Our intention, in proposing this invited paper session, is to bring together three outstanding young researchers in the general area of statistical ecology, all at work in different countries. They all have links with the NCSE, and two have worked in the NCSE as post-doctoral researchers; the discussant is an Associated Member of the NCSE. If accepted, the session would be chaired by the proposers. Some idea of the work currently being done by the suggested invited speakers can be obtained from the sample of papers referenced below. A common characteristic is the development of new methodology, and its application to substantive real problems and data, in ecology. The methodological approaches include both Classical and Bayesian inference.

References:

Blackwell, P. G. (2003) 'Bayesian Inference for Markov Processes with Diffusion and Discrete Components'. *Biometrika*, **90**, 613-627.

Dorazio, R.M. and **J.A. Royle**. 2005. Estimating size and composition of biological communities by modeling species occurrence. *Journal of the American Statistical Association*, **100**, 389-398.

Gimenez O., C. Crainiceanu, C. Barbraud, S. Jenouvrier and B.J.T. Morgan. (2006). Semiparametric regression in capture-recapture modelling. *Biometrics*. **62**, 691-698.

Morales J.M. and T.A. Carlo. (2006). The effects of plant distribution and frugivore density on the scale and shape of dispersal kernels. *Ecology*, **87**: 1489-1496.

SPEAKERS:

Dr. Olivier Gimenez : **Nonparametric Methods in Ecology and Evolution**

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Dr. Juan M. Morales: **The Way They Move: Towards a General Framework for Understanding Animal Movement in Changing Environments**

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Dr. J. Andy Royle: **Hierarchical Models for Inference in Metacommunity Systems**

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DISCUSSANT:

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International Statistical Ecology Conference



University of St Andrews, 9-11 July 2008

Invited speakers

- [Ken Burnham](#), Assistant Unit Leader, Colorado Cooperative Fish and Wildlife Research Unit
- [James Clark](#), Blomquist professor of the environmental sciences and biology, Duke University
- [Anne Chao](#), National Tsing Hua University, Taiwan
- [Jim Nichols](#), Wildlife Biologist, USGS, Patuxent Wildlife Research Center, USA
- [Shirley Pledger](#), Reader in Biometrics, University of Victoria Wellington, New Zealand
- [Carl Schwarz](#), Simon Fraser University, Canada
- [Roger Pradel](#), Biometry and population biology team leader, Center for Evolutionary and Functional Ecology, Montpellier, France

Topics

Papers in any of the following areas are especially welcome:

- mark-recapture methods,
- distance sampling methods,
- other abundance estimation techniques,
- monitoring of biodiversity,
- survey design and analysis for estimating population trends,
- modelling of spatial trends in animal density,
- integrated population modelling,
- stochastic population dynamics modelling,
- stochastic multippecies modelling,
- stochastic modelling of animal movement.

Further details from: <http://www.creem.st-and.ac.uk/isec2008/>