UNIVERSIDADE DE ÉVORA

Seminar Series

(EMMA-WEST/CIMA-U.E.)

June 13th, 2014, 14h30-18h00

Anfiteatro 4 (Colégio Luís António Verney, U.Évora)

Program

14h30-15h15 **Quantifying environmental impacts for marine renewables: Modelling spatially explicit change** by **Monique L. Mackenzie**, Centre for Research into Ecological and Environmental Modelling (CREEM), University of St Andrews, Scotland.

15h15-16h00 **How to plan the experimental design in carcass removal trials to estimate bird and bat fatalities at wind energy facilities?** by **Regina Bispo**, Instituto Superior de Psicologia Aplicada (ISPA), Instituto Universitário de Ciências Psicológicas, Sociais e da Vida, Lisbon, Portugal.

16h00-16h20 **Coffee Break**

16h20-17h05 **A chat over LATTE: using statistical tools to understand the effect of sonar use on marine mammals** by **Tiago A. Marques**. Centre for Research into Ecological and Environmental Modelling (CREEM) University of St Andrews, Scotland

17h05-17h50 **A Generalized Estimating Equations Approach to Capture-Recapture Closed Population Models** by **Md. Abdus Salam Akanda**, Research Center in Mathematics and Applications, DMAT, University of Évora, Portugal and Department of Statistics, Biostatistics and Informatics, University of Dhaka, Bangladesh.

14h30-15h15

Quantifying environmental impacts for marine renewables: Modelling spatially explicit change

Monique L. Mackenzie

Centre for Research into Ecological and Environmental Modelling (CREEM)
University of St Andrews, Scotland

Installation of near-shore and off-shore marine renewables (e.g. wave/tidal turbines and off-shore wind farms) in UK waters requires baseline and post-impact monitoring of key wildlife populations that use the potentially licenced area(s). The baseline period serves to characterise the abundance and distribution of key species before any renewable energy-related equipment is installed, while the post-impact monitoring period serves as a comparison for the baseline results after any equipment is in place and/or in operation. A statistical modelling approach is often adopted for this pre/post-impact comparison in order to quantify any impact-related effects while accounting for environmental covariates which also influence animal abundance and distribution, yet are unrelated to the installation.

The demands of environmental impact assessment modelling methods are often complex and typically include: spatially adaptive one-dimensional smoothing methods for the environmental covariates and spatially adaptive two-dimensional smoothing methods for the spatial element; the latter of which needs to accommodate both local (e.g. impact related effects) and far-reaching surface features (via a mix of local and global smoothing). Additionally, some sites have complex topography (e.g. islands and coastlines) and so the two dimensional element often requires a sensible distance metric (to underpin the smoother) which reflects the geodesic distance travelled between points for the animals. These smooth terms (and any associated impact-related terms) must also be fitted inside a framework which permits residual auto-correlation, since the patterns along the transect lines are never fully explained by the covariates available for modelling.

I will present recently developed smoothing methods (Complex Region Spatial Smoother (CReSS) and the spatially adaptive local smoothing algorithm (SALSA)) which have been used for this purpose inside a Generalized Estimating Equation (GEE) framework. These methods will be illustrated for one of the world's largest off-shore wind farms (Horns Rev, Denmark) and now also form part of a new R package, MRSea.

15h15-16h00

How to plan the experimental design in carcass removal trials to estimate bird and bat fatalities at wind energy facilities?

Regina Bispo

Instituto Superior de Psicologia Aplicada (ISPA)
Instituto Universitário de Ciências Psicológicas, Sociais e da Vida, Lisbon, Portugal

Carcass removal is known to be an important source of unreliability in bird and bat mortality estimation. To quantify removal, wind farm monitoring plans include removal trials. Typically, in these trials a certain number of carcasses is randomly placed in the study area to record time until removal. In conventional trials, researchers tend to use the greatest practicable sample size of carcasses, with groups of carcasses eventually too big being placed simultaneously under the turbines. To assess removal times, carcasses are then checked in many cases on a daily basis, until the majority is removed by scavengers or decay. However, little is known about the optimal experimental design needed to minimize the estimates uncertainty and, hence, improve fatality estimation. Additionally, the optimization of the experimental procedures is important because human and financial resources may be scarce.

To address this topic we have conducted a simulation study to assess removal bias varying the trial conditions. The simulation exercise was conducted using the R Environment for Statistical Computing. We conclude formulating some recommendations regarding carcass removal experimental designs.

16h20-17h05

A chat over LATTE: using statistical tools to understand the effect of sonar use on marine mammals

Tiago A. Marques

Centre for Research into Ecological and Environmental Modelling (CREEM)
University of St Andrews, Scotland

In this talk I will describe project LATTE, which has been my day job for over 3 years now. The objectives of LATTE were to understand the effect of sonar use on marine mammals using Blainville's beaked whales (*Mesoplodon densirostris*) at AUTEC as a case study. To do so an interdisciplinary team of researchers involving biologists, statisticians and acousticians used data at multiple spatial and temporal scales, including (1) acoustic data collected at AUTEC, a US navy instrumented range I the Bahamas, (2) DTAG data, which provides small duration but high resolution temporal data on whale movement and (3) satellite tag data, providing low spatial and time resolution data on whale movement but over longer time periods than DTAGs.

I will present a dose response curve representing the probability of behavior disturbance as a function of sonar level. Further I will describe a number of intermediate steps required to model animal movement in 3 dimensions as part of an agent based model to assess the effect of sonar on beaked whales. These will include a model for depth over time (i.e. a model for depth profiles) based on hidden Markov models and extensions and a model for georreferencing (i.e. to locate in absolute terms in the earth frame) DTAG data via state space models implemented through a Kalman Filter.

While some of the names used above might be frightening and I promise to show some equations to keep statisticians happy, I would invite biologists/ecologists to attend this talk as the focus will be on the intuitive concepts behind the methods as well as on some of the results obtained so far and the problems (i.e. solutions in the making) that lay ahead.

17h05-17h50

A Generalized Estimating Equations Approach to Capture-Recapture Closed Population Models

Md. Abdus Salam Akanda

Research Center in Mathematics and Applications, DMAT
University of Évora, Portugal and
Department of Statistics, Biostatistics and Informatics
University of Dhaka, Bangladesh

Wildlife population parameters, such as capture or detection probabilities, and density or population size, can be estimated from capture-recapture data. These estimates are of particular interest to ecologists and biologists who rely on accurate inferences for management and conservation of the population of interest. However, there are many challenges to researchers for making accurate inferences on population parameters. For instance, capture-recapture data can be considered as binary longitudinal observations since repeated measurements are collected on the same individuals across successive points in times, and these observations are often correlated over time. If these correlations are not taken into account when estimating capture probabilities, then parameter estimates will be biased, possibly producing misleading results. Also, an estimator of population size is generally biased under the presence of heterogeneity in capture probabilities. The use of covariates (or auxiliary variables), when available, has been proposed as an alternative way to cope with the problem of heterogeneous capture probabilities. In this work, we are interested in tackling these two main problems, (i) when capture probabilities are dependent among capture occasions in closed population capture-recapture models, and (ii) when capture probabilities are heterogeneous among individuals. Hence, the capture-recapture literature can be improved, if we could propose an approach to jointly account for these problems. In summary, we propose: (i) a generalized estimating equations (GEE) approach to model possible effects in capture-recapture closed population studies due to correlation over time and individual heterogeneity; (ii) the corresponding estimating equations for each closed population capture-recapture model; (iii) a comprehensive analysis on various real capture-recapture data sets using classical, GEE and generalized linear mixed models (GLMM); (iv) an evaluation of the effect of accounting for correlation structures on capture-recapture model selection based on the `Quasi-likelihood Information model selection Criterion (QIC)'; (v) a comparison of the performance of population size estimators using GEE and GLMM approaches in the analysis of capture-recapture data. The performance of these approaches is evaluated by Monte Carlo (MC) simulation studies resembling real capture-recapture data. The proposed GEE approach provides a useful inference procedure for estimating population parameters, particularly when a large proportion of individuals are captured. For a low capture proportion, it is difficult to obtain reliable estimates for all approaches, but the GEE approach outperforms the other methods. Simulation results show that quasi-likelihood GEE provide lower standard error than partial likelihood based on generalized linear modelling (GLM) and GLMM approaches. The estimated population sizes vary on the nature of the existing correlation among capture occasions.

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