



Newsletter

April 2011

New funding and new members for NCSE

An exciting expansion in NCSE activities is taking place, following new funding of over £1m from EPSRC and NERC. New members are the Universities of Bath, Bristol, Exeter, Glasgow and Sheffield, together with the Centre for Ecology and Hydrology. We also have several Project Partners – organisations which are not eligible for the research council funding awarded, but who are contributing resources of their own to NCSE: Biomathematics and Statistics Scotland (BioSS); the Centre for Environment, Fisheries and Aquaculture Science (Cefas); Marine Scotland Science (MSS); and the Game and Wildlife Conservation Trust (GWCT). Of the founding members of NCSE, the statistical ecology groups at Kent and St Andrews are continuing to thrive. Following departure of first Steve Brooks and then Bobby Gramacy from Cambridge, they no longer have a statistical ecology group, and



Left to right: Byron Morgan, Professor Dame Julia Goodfellow, Professor Lord Robert May and Steve Buckland at the opening of ISEC 2010 © Spencer Scott

are therefore no longer a member.

The new funding, which is for a five-year period from October 2010, is primarily for postdocs at Bath, Kent, Sheffield and St Andrews, and for four PhD studentships. We hope to use the studentship funding to

lever matching funding from other sources, giving us up to eight students part-funded from the award. These students can be registered at any of the seven universities who are members of NCSE. There is also funding to allow travel among NCSE members, and to conferences.

New NCSE members

We welcome the new NCSE members. The senior researchers at Bath are Simon Wood and Nicole Augustin. Both were formerly in the statistical ecology group at St Andrews, and Simon taught a training workshop at the NCSE summer meeting in 2009. At Bristol, Bill Browne is based in the School of Clinical Veterinary Sciences, but his publications reflect his interest in applying statistics to a wide range of disciplines. At Exeter, Stuart Townley brings expertise in mathematical ecology, while Dave Hodgson is a quantitative

ecologist. At Glasgow, Marian Scott and Adrian Bowman have extensive experience of applying statistics to environmental problems, while Dan Haydon is a quantitative modeller of ecological and epidemiological processes. At Sheffield, Paul Blackwell has already been actively participating in NCSE activities as an associate member for a few years. His interests in statistical ecology include modelling animal movement, and modelling biodiversity. At CEH, the senior researchers are Steve Freeman and Ron Smith. Steve has been

part of NCSE since its inception, while Ron's involvement is more recent. He is well known for his work in environmental statistics. Peter Henrys, who worked as a summer student in the statistical group at St Andrews a few years ago, recently joined CEH. Those staff at Project Partners who are actively involved in NCSE activities are David Elston, Mark Brewer and Adam Butler (BioSS), Jon Barry (Cefas), Nicholas Aebischer (GWCT), and Rob Fryer (MSS), who has been part of NCSE from the start.

Special points of interest:

- NCSE funding renewed
- NCSE membership extended
- PhD opportunities within NCSE
- Updates on recent work in NCSE
- 2010 Conference reports
- ISEC 2012
- PhDs awarded to NCSE students

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Chiara Mazzetta

It is with great regret that NCSE learned of the death of Chiara Mazzetta from melanoma on 1st November 2010. Chiara had been a vital part of the NCSE, contributing significantly to its work as a research student and as a post-doc. She will be sadly missed by all her colleagues.

Chiara started her career at Rome University "La Sapienza", studying for a degree in Scienze Statistiche ed Economiche. Here she chose a final year dissertation in the field of Bayesian analysis. After completing her degree she moved to Milan, where she worked for five years as a statistician at the European Institute of Oncology. In 2003, Chiara moved to the Statistical Laboratory at Cambridge University to study for a PhD in applied statistics under the supervision of Steve Brooks and Steve Freeman. Here

Chiara focused on the study of MCMC methods and their application to ecology, becoming interested in particular in a Bayesian approach to estimating temporal trends in population ecology and the evolution over time of both abundance indices and key demographic parameters when described with nonlinear and non-normal state space models. In 2006, Chiara moved to the University of Kent, where she continued her work as a Research Associate with Byron Morgan, before transferring to the University of Warwick as a Research Fellow in 2008. At Kent she developed innovative Bayesian methods for modelling Soay sheep data, in collaboration with Tim Coulson of Imperial College.

She leaves behind her husband Giovanni and their son Alessandro.



Chiara and Alessandro 2010
© G. S. Lomoriello

Capture recapture

The British and Irish Region of the *International Biometric Society* held a half-day meeting on Capture recapture at Rothamsted Research Station in November 2010. It was preceded by an *Introduction to methods of capture recapture and their application*, by Rachel McCrea and Byron Morgan. Full details are to be found at: <http://bir.biometricsociety.org/events/agm10>.

In order, the speakers were:

- Byron Morgan: *Of mice and men: recent developments in capture-recapture models*
- Gerta R ucker: *Boosting qualifies capture-recapture methods for estimating the comprehensiveness of literature searches for systematic reviews.*
- Dankmar B hning: *Capture-recapture inference under structured heterogeneity*

- Ruth King: *Bayesian capture-recapture analyses using a state-space framework*
Bill Browne provided the invited Discussion.

Both Ruth and Byron commented on the usefulness of new state-space model formulations for methods of capture-recapture.

At Kent, recent research in the general area has involved Dan Brown, Diana Cole and Rachel McCrea, all of whom are/were supported by NCSE grants. In his PhD work, Dan has shown how thin plate splines can be used to interpolate temperature maps, to provide local weather information for incorporation in models for wild animal survival; this work involved collaboration with David Thomson (Hong Kong) and Ian Jolliffe (Exeter). In addition, also in collaboration with Ian, he has investigated the

“NCSE contributes to IBC British and Irish Region meeting.”

lasso for covariate selection, and shown how one can perform conditional analysis of recovery data without the limiting assumption of constant reporting probability. In separate research, Rachel has shown how ring- recovery data obtained from marking animals of unknown age can be analysed using mixture models, removing the restrictive assumption that all adult animals have the same survival probabilities. Both Dan and Rachel teamed up with Diana, to check which of the different models considered were full rank and which were parameter redundant.

International Statistical Ecology Conference 2012

ISEC 2012 is being held from 3rd to 6th July 2012 at the Sundvolden Hotel, Krokkleiva, which is about 40 minutes drive from Norway's capital city, Oslo.

Plenary speakers have been confirmed as follows:

- [Nils Chr. Stenseth](#), University of Oslo: *Opening remarks*
- [Steinar Engen](#), Norwegian University of Science and Technology: *Stochastic age-structured modelling; dynamics, genetics*

ics and estimation

- [Rachel Fewster](#), University of Auckland: *Genetics in statistical ecology*
- [Joanna Mills Flemming](#), Dalhousie University: *The Ocean Tracking Network: visualization tools and novel analyses for acoustic tracking data*
- [Otso Ovaskainen](#), University of Helsinki: *The analysis of spatial data: individual movements and species and community models*
- [Andr  Punt](#), University of Washington:

Estimating precautionary thresholds for US west coast fisheries

- [Andy Royle](#), Patuxent Wildlife Research Centre: *Incorporating auxiliary spatial information in capture-recapture models*
- [Len Thomas](#), University of St. Andrews: *The future of statistical ecology*

Further information on paper submission and registration for this conference will be available at <http://www.cees.uio.no/news/2010/isec2012.html> in due course.



The way animals move: working towards a general framework

Ruth King

Recent developments in animal tracking technology have permitted the collection of detailed data on the movement paths of individuals from many species, providing time-series data of the location of an individual (typically with observation error) over a given period of time – see Figure 1. However, methods for the analysis of these data have not developed at a similar pace. This EPSRC-funded collaborative project at St Andrews involving Brett McClintock, Len Thomas, Jason Matthiopoulos and Ruth King, with Visiting Researcher Juan Morales (Universidad Nacional del Comahue, Argentina) has the aim of providing a general framework for analysing telemetry data within a discrete-time and continuous-space framework.

Complex movement paths are conceived as a series of movement strategies among which animals transition (at each discrete time point) through time. A suite of possible models has been developed that allows different behavioural states including migratory/directed, dispersal/exploratory and foraging/area-restricted movement. Each behavioural state has an associated underlying movement model, representing the given movement behaviour, where the parameters are to be estimated. For example, for directed movement to a particular location (representing migration or movement to feeding/breeding areas) there may be an expected movement direction

(towards a given focal point) with some associated variability. Such models can be extended to allow, for example, the strength of attraction to the given focal point to be a function of the distance to the focal point. Similar models are developed for other behavioural states, such as an exploratory state. Using this “tool-box” of model components, multi-state movement models may be custom-built for a wide variety of species applications. The proposed models are fitted using a Bayesian data augmentation approach (to impute the behavioural state and location of an individual at each discrete time point).

The methods are applied to the telemetry data of a grey seal (*Halichoerus grypus*) in collaboration with Bernie McConnell (Sea Mammal Research Unit, University of St Andrews) – see Figure 1. The seal clearly transitions between directed movement to distinct locations corresponding to haul-out and foraging sites. Figure 2 provides posterior (point) estimates of the location of the individual at each discrete time point and corresponding behaviour (directed movement to one of three distinct locations) and an exploratory state. Within this analysis, we assume that there are three focal points, but with the location of these focal points unknown *a priori*, and so determine the locations of these centres from the telemetry data. See McClintock *et al* (2012) in submission for further details.



Grey seal (*Halichoerus grypus*)
© Paddy Pomeroy, University of St Andrews

Current work in this area, in collaboration with Lorenzo Milazzo (University of St Andrews), involves developing a user-friendly R package for fitting these behavioural models. In addition, these methods are being applied to different datasets and extended, for example, addressing the issue of an unknown number of focal points.

“For recent papers by members of NCSE, go to <http://www.ncse.org.uk/publications.aspx>.”

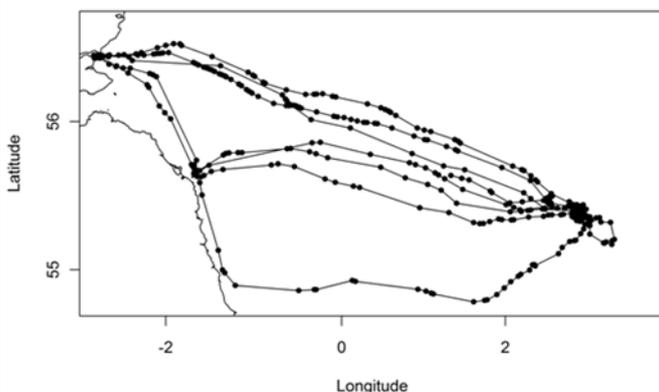


Fig. 1: Observed locations for a grey seal as it travelled clockwise through a foraging area in the North Sea and haul-out sites on the eastern coast of Great Britain

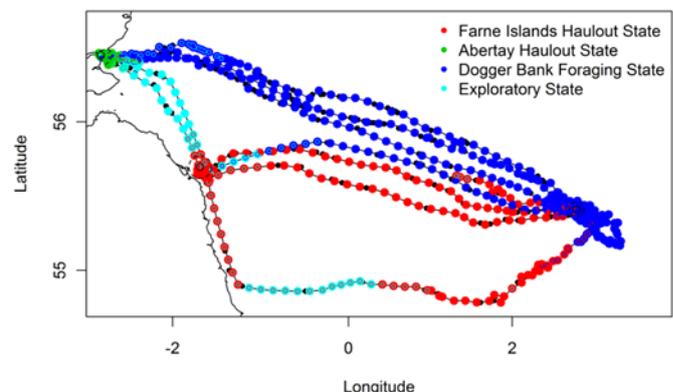


Fig. 2: Posterior predicted locations, movement behaviour states, and coordinates of three centres of attraction (corresponding to Farne Islands, Abertay haulout sites and Dogger Bank foraging site) with additional exploratory state





International Biometric Conference 2010

The 2010 IBC was held in Florianopolis, Brazil from 5-10 December and offered a perfect opportunity to escape the cold winter weather in the UK. The NCSE was well represented at the conference by both staff and students. The conference contained a number of interesting invited and contributed ecological statistics sessions as well as other diverse sessions for general biometricians. Steve Buckland and Rachel McCrea were two of the invited speakers in the session 'Statistical ecology and conservation', organised and chaired by Byron Morgan, who also chaired the JABES showcase session. Following his talk 'Multispecies inte-

grated population model for the study of synchrony in demographic parameters', José Lahoz-Monfort, a PhD student of the NCSE based at the University of Kent, was awarded the prize for Best Student Presentation. As well as the scientific sessions, delegates were able to attend one of a variety of excursions, which included trekking, boat trips and historical tours. The location provided outstanding perspectives on a wide range of wildlife of interest to all who attended. The conference social calendar culminated with the conference party which was held in a beach resort hotel and included Samba dancing demonstrations.



White-throated hummingbird (Leucochloris albicollis) © Byron Morgan

PhD projects available at NCSE

NCSE is looking to recruit well-qualified and innovative research students, to start PhD study at any date between April 2011 and March 2012. Funding is available for a limited number of students. This funding is open to international students. Students from the European Union will be fully funded, while funding for non-EU students will include full stipend and partial fees (UK£3400 per year for 2010/11, leaving UK£8000 per year to be found from other sources). The stipend will be paid for a period of 3.5 years, and will be enhanced relative to the standard UK research council stipend by UK£3000 per year. Thus for 2010/11, the enhanced stipend will be UK£16,590 for the year.

There are currently around 35 research students in NCSE.

Each available project falls within one or more of the following six research themes:

1. *Biodiversity monitoring methodologies*
2. *Spatial and spatio-temporal models for ecological communities*
3. *Parameter redundancy, model diagnosis and model averaging in ecological models*
4. *New statistics methodology*
5. *Stochastic models for population dynamics*
6. *Movement models to exploit large tracking databases*

Projects and their supervisors are listed on the NCSE website, together with information about making an application (<http://www.ncse.org.uk/newsItem.aspx?ni=301>). Students are also encouraged to approach

“NCSE seeks highly motivated students for PhD studentships”

NCSE with their own suggestions for projects. If the proposed work fits well with the aims of NCSE, and an NCSE supervisor with relevant expertise can be identified, applications will be considered alongside applications for the other projects. Again, further information about making an application can be found on the website.

Questions should be directed to one of the NCSE Co-Directors, Steve Buckland (steve@st-and.ac.uk) or Byron Morgan (B.J.T.Morgan@kent.ac.uk).

NCSE welcomes Prof. Paul Blackwell

Paul's first degree was in mathematics, including a strong statistical component and an early introduction to the Bayesian approach. He has a long-standing interest in ecological applications of probability and statistics; he spent a year working for the Forestry Commission Statistics and Computing Section, followed by a PhD on the stochastic modelling of social and territorial behaviour.

Since then, Paul has worked in the School of Mathematics and Statistics at the University of Sheffield. His particular interests within statistical ecology include territory modelling and mapping, animal movement and radio-tracking, and coral reef ecosystems and associated issues in remote sens-

ing. He is also interested in the quantification of biodiversity, in cellular automata and spatial models generally, as well as modelling and simulation in ecology more widely. He has worked extensively on other statistical applications, for example the dating of ice cores and the construction of calibration curves for radiocarbon dating.

Methodologically, Paul's main interest is Bayesian inference for stochastic models, including tessellations, point processes, diffusions and Markov chains, all motivated by the kinds of problems described above. In practice this often involves computer-intensive methods such as Markov Chain Monte Carlo. He is also interested in the issues of visualisation and interpretation



Prof. Paul Blackwell, University of Sheffield

that arise with such complex models.



ISEC 2010



The success of the first International Statistical Ecology Conference that was held in the University of St. Andrews in 2008 was repeated when the conference moved to the University of Kent in July 2010. The full scientific programme is to be found at http://www.creem.st-and.ac.uk/ocs/files/SP_web.pdf. The conference was opened by Professor Dame Julia Goodfellow, Vice-chancellor of the University, and Professor Lord Robert May gave the opening address. There were invited talks by Carmen Fernandez, Richard Barker, Darryl MacKenzie, Nigel Yoccoz, Jeff Laake and Trond Reitan. The 98 contributed talks were arranged into sessions on:

- Abundance estimation,
- Movement and dispersal,
- Biodiversity,
- Spatially-explicit capture-recapture,
- Distance sampling,
- Occupancy models,
- Mark-recapture,
- Wildlife and management,
- Spatial modelling,
- Fisheries,

- Disease and individual modelling,
- Mixture modelling,
- Combining information,
- Biodiversity and movement, and
- Temporal trends.

Prizes were awarded by the Conference's Scientific Committee for the best student talks and the best poster contributions. The worthy winners were as follows.

Student Talks:

1. José Lahoz-Monfort
2. Guru Guillera-Arroita
3. Lindsay Scott-Hayward

Student Posters:

1. Jessica Ford
Equal 2nd Wendell Challenger
- Equal 2nd Joyce Yuan

Before the conference dinner, delegates were entertained by a display of Morris Dancing by the local troupe Oyster Morris, and Jeremy Greenwood, the former Director of the BTO, gave a very entertaining after-dinner speech.

A new venture for 2010 was the introduc-

Participants and presenters at ISEC 2010 © Spencer Scott

tion of pre-conference workshops, and four of these were run, each of which was very well received.

- Spatially explicit capture–recapture with R delivered by Murray Efford and David Borchers;
- Modelling Patterns and Dynamics of Species Occurrence Workshop delivered by Darryl MacKenzie;
- AD Model Builder delivered by Mark Maunder and Anders Nielsen;
- Open-population capture-recapture and stopover duration models; recent advances including age-structure and heterogeneity delivered by Shirley Pledger, Eleni Matechou and Murray Efford.

The only complaint received from the participants was that the weather had been too hot! The glorious summer sun was enjoyed on the Wednesday afternoon outings, to Oare Marshes, to Stodmarsh Nature reserve, on tours around the historic city of Canterbury, and to Dover Castle.



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Objectives of NCSE

NCSE was set up in October 2005 as a joint venture between the Universities of Kent, Cambridge and St Andrews, with funding from the EPSRC. Its original objectives were:

- To be 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.
- To develop novel statistical methodology for the analysis of complex data sets arising in ecology and to apply these methods to a broad collection of topical and important data sets.
- To train PhD and postdoctoral researchers to work as statistical ecologists.
- To develop a computer software system to enable ecologists to use cutting edge statistical methodology on their own data.
- To train end-users in the use of methodology and accompanying software developed by NCSE.
- To build upon and create new collaborations with relevant stakeholders.
- To develop and deliver a programme of workshops and conferences.

In 2010, NCSE was expanded to include the Universities of Bath, Bristol, Exeter, Glasgow and Sheffield, together with the Centre for Ecology and Hydrology, and the University of Cambridge dropped out, following departure of staff. This expansion was achieved with the aid of a new five-year joint EPSRC/NERC grant. Four further organisations are Project Partners: Biomathematics and Statistics Scotland; the Centre for Environment, Fisheries and Aquaculture Science; the Game and Wildlife Conservation Trust; and Marine Scotland.

NCSE is steadily broadening its areas of research expertise and activities. Active areas of research include:

- modelling population dynamics,
- animal movement models,
- metapopulation models,
- community models,
- distance sampling,
- mark-recapture,
- biodiversity monitoring,
- random effects models in ecology,
- modelling ecological point process data,
- parameter redundancy in ecological models.



Congratulations!

The following NCSE students successfully completed their PhDs in 2010:

- Teresa Frost with a thesis entitled Stochastic modelling and analysis of wildfowl: *Anatidae* monitoring data from the Wetland bird survey;
- Daniel Brown with a thesis entitled Climate modelling for animal survival;
- Eleni Matechou with a thesis entitled Applications and extensions of capture-recapture stop-over models;
- Toby Reynolds with a thesis entitled Bayesian modelling of integrated data and its application to seabird populations.

We wish them every success in their future careers.