NCSE

National Centre for Statistical Ecology

Newsletter

NCSE congratulates . . .

- Rachel McCrea, University of Kent, who received the Young Biometrician Award 2011 of the British and Irish Region of the International Biometric Society and the Fisher Memorial Trust for her paper 'Multistate Mark-Recapture Model Selection Using Score Tests' (with Byron Morgan, 2011, Biometrics, **67**, 234-241).

- Gurutzeta Guillera-Arroita, University of Kent, who received an Honourable mention in the Young Biometrician Award 2011 for her paper 'Species occupancy modelling for detection data collected along a transect' (with Byron Morgan, Martin Ridout and Matthew Linkie, 2011, Journal of Agricultural, Biological and Environmental Statistics, **16**, 301-317).

- Andrew Knell, University of Essex, who successfully completed his PhD (Identifying Behavioural Changes In Movement Path Data).

- Heather Burgess, University of Exeter, who successfully completed her PhD (Integral Projection Models and Analysis of patch dynamics of the reef-building coral Montastraea annularis).

- José Lahoz-Montfort and Gurutzeta Guillera-Arroita, University of Kent, who received a best poster prize at the 25th International Congress of Conservation Biology in Auckland, 5-9 December, 2011.

- Tore Schweder, University of Oslo, who was awarded the Sverdrup Award by the Norwegian Statistical Association for being an outstanding representative of statistics in Norway.

Rachel McCrea receives the Young Biometrician Award 2011 from John Hinde, Regional President of the International Biometric Society © Byron Morgan

Special points of interest:

- NCSE celebrates the successes of its members

- Meet the NCSE Post Doctoral Research Associates (PDRAs)

- Tales of an NCSE rat-catcher!

- Forthcoming meetings and conferences: Statistics in Sport, Integrated Population Modelling, International Statistical Ecology Conference 2012, 26th International Biometric Society Conference

- Personal development opportunities for PhD students and PDRAs

Inside this issue:

Forthcoming meetings

NCSE members are planning forthcoming meetings of the British and Irish Region of the International Biometric Society.

The annual Summer Meeting has the topical subject of 'Statistics in Sport'. It is arranged by Rachel McCrea and is being held in association with the Centre for Sports Studies, University of Kent. It will be held at Medway Park. Date: Wednesday, 20th June, 2012.

A meeting on 'Integrated Population Modelling' has been organised by Diana Cole, Janine Illian, Rachel McCrea and Mathew Smith (Microsoft). It will take place in Charles Darwin House in London. This is a joint meeting of the Environmental Statistics Section of the Royal Statistical Society, the British and Irish Region of the International Biometric Society and the Computational Ecology Special Interest Group of the British Ecological Society. Date: Monday, 24th September, 2012.

Further information can be found at http://bir.biometricsociety.org/events

Meet the NCSE PDRA . . . at Kent

Rachel McCrea completed a mathematics degree in 2003 and moved to the University of Kent to join the taught MSc in Statistics course. Her research project during this programme involved analysing data collected by the British Trust for Ornithology and this initiated her interest in statistical ecology research. Rachel studied for a PhD in Statistics under the supervision of Byron Morgan at the University of Kent and Jean-Dominique Lebreton at CNRS, Montpellier. The PhD developed multi-state integrated population models which combined the analysis of capture-recapture and census data.

After her PhD, Rachel completed 2 years of postdoctoral research within the NCSE and in October 2010 was appointed as the new

Post Doctoral Research Associate (PDRA) of the NCSE at the University of Kent. Because of the complexity of the models she dealt with in her previous research, model fitting and discrimination were non-trivial. Thus, being immersed in this area of complex ecological modelling inspired her interest in simple and effective model selection procedures which can be used even on complex models. She has developed model selection for multi-site mark-recapture models using score tests and for this paper she was awarded the Young Biometrician Award 2011 by the British and Irish Region Biometric Society and the Fisher Memorial Trust.

Jointly with Byron Morgan, Rachel is finalising a book 'Analysis of capture-recapture

Rachel McCrae
© Rachel McCrae

data' which seeks to collate the modern developments in this research field. Rachel has a wide variety of both statistical and ecological collaborators and enjoys the challenge that statistical ecology provides.

Meet the NCSE PDRA . . . at Bath

Before obtaining her PhD at the University of Bath, Natalya Pya worked in an academic environment for a number of years and has extensive experience in both research and teaching. The main focus of her PhD work was in developing shape preserving smoothing within generalized additive models (GAM). The proposed framework for GAM with a mixture of shape restricted and unconstrained smooth terms has been implemented in an R package, scam. Before her PhD, Natalya obtained the Candidate of Physical and Mathematical Sciences Degree from the Institute for Mathematics, Almaty, Kazakhstan.

In addition to her interest in the theoretical

background to statistical modelling, she is very interested in the application of methodology to practical applications. A major part of this is the opportunity to collaborate with researchers both within statistics and from other disciplines. She is working on applications of the methods developed to the study of tree height-diameter relationship in forest research, constrained dose-response curves in environmental epidemiology and 'stock-recruit' modelling in fisheries studies. Natalya is now in the statistical ecology group at Bath. Her particular research interests include parameter estimation and inference for nonlinear ecological dynamic systems and the comparative study of various approaches to stochastic

Natalya Pya
© Natalya Pya

dynamic modelling on different ecological data.

Meet the NCSE PDRA . . . at St Andrews

Yuan Yuan (Joyce) has a first degree in mathematics, and a master's degree in Actuarial Science, during which she developed her interest in statistics. She then continued studying statistics in the Centre for Research into Ecological and Environmental Modelling at the University of St Andrews. Her PhD involved abundance estimation of the anglerfish stock occupying the northern European shelf. In her

PhD she focussed on the application of statistical modelling to different types of wildlife survey data, including bottom-trawl survey data, distance sampling data and mark-recapture survey data. Her research interests lie in mixed-effects models, abundance estimation with random effects, and spatial models for zero-inflated count data. She is also interested in measuring the spatial structure of biodiversity.

Yuan Yuan
© Yuan Yuan

International Statistical Ecology Conference (ISEC) 2012

ISEC 2012 will take place from 3rd to 6th July 2012 at the Sundvolden Hotel in Krokkleiva, Norway, just 40 minutes outside Oslo.

The conference will convene experts from around the world to present and discuss issues of interest to ecological statisticians and biologists. Pre-conference workshops will take place from 30 June to 3 July.

The conference programme will include invited talks from:

- Steinar Engen, Norwegian University of Science and Technology: Stochastic age-structured modelling; dynamics, genetics 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.
- André 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.

In addition to a wide range of session topics for contributed talks, including mark-recapture methods, distance sampling methods, abundance estimation techniques, monitoring of biodiversity, study design, integrated population modelling, stochastic population dynamics modelling, stochastic multispecies modelling, and stochastic modelling of animal movement, there will be two special sessions with invited talks:

- Statistical approaches to paleobiological questions, chaired by Lee Hsiang Liow;
- The development and use of statistical methodology in fisheries research, chaired by Mark Maunder.

Four workshops in ecological statistics will run immediately prior to the conference, at either the conference venue or at Finse Alpine Research Center. The workshops are primarily open to conference participants.

'King's View' near Sundvolden Hotel
© Sundvolden Hotel

- 30 June – 1 July: AD Model Builder, led by Mark Maunder, Hans Skaug and Anders Nielsen
- 2 July: Hierarchical modelling and R-package 'unmarked', led by Andy Royle and Richard Chandler, USGS Patuxent Wildlife Research Center
- 2-3 July: Population genetics for statisticians, led by Rachel Fewster and Arnaud Le Rouzic
- 3 July: Model selection, led by Nils Lid Hjort, University of Oslo

Further details on the conference are available at http://www.cees.uio.no/isec2012/.

NCSE contributes to 26th International Biometric Society Conference

Members of NCSE will take part in the invited paper session *Statistical Ecology*, to be held at the 26th International Biometric Society Conference in Kobe, Japan, in August, 2012.

Speakers and titles are:

- Simon Bonner, University of Kentucky, USA: Mark-recapture of whalesharks with multiple, natural marks
- Janine Illian, University of St Andrews:

Complex spatial and spatio-temporal point process modelling with application in ecology

- Martin Ridout, University of Kent: Effect of early-life covariates on meerkat longevity

The discussant will be Rachel Fewster, and the session will be chaired by the organiser, Byron Morgan.

"NCSE members from the USA, UK and New Zealand join forces to deliver invited paper session."

Inaugural meeting of the Computational Ecology Special Interest Group

The inaugural joint meeting of the Computational Ecology Special Interest Group of the British Ecological Society and the British and Irish Region of the International Biometric Society was jointly organised by David Murrell of University College London

and Byron Morgan. It was held in Charles Darwin House, London on the 9th November, 2011. The topic, Advances in the analysis of animal movement, drew a large audience. Roland Langrock started the meeting with an excellent introductory talk entitled

'A non-exhaustive overview of animal movement models'. He was followed by Ruth King, with the talk, 'A tale of two case studies', and Paul Blackwell spoke on 'Modelling animal movement in continuous time'.

Where did you get that rat? Genetic sourcing of invasive pests
Rachel Fewster, University of Auckland, New Zealand — International Member of NCSE

Over the past few years I've been taking the occasional break from my usual statistical endeavours, and trying my hand at rat-catching. New Zealand's ecosystems evolved in the complete absence of land mammals, so the human introduction of rats, stoats, cats, and other four-legged disasters has had a devastating impact on the native fauna and flora. Sanctuary islands that can be kept pest-free offer the only hope for many species of birds and reptiles that are found nowhere else in the world. The key problem for conservation managers is to ensure that these islands remain pest-free. Rats and stoats are athletic swimmers and resourceful hitchhikers, and it might take only one pregnant female to ruin decades of conservation work. During 2011, rat and stoat invasions occurred on two of NZ's flagship sanctuaries: Ulva Island and Kapiti Island. The cost to the taxpayer is typically tens of thousands of dollars per rat, or hundreds of thousands of dollars per stoat.

Our interest is in using genetic evidence to uncover swimming patterns of rats and stoats, and to determine the source of individuals that turn up out of the blue on protected islands. Being the leader of a sparsely-funded research project back in 2004, I first-of-all set out to catch my own data. Much as I love the great outdoors, the realities of fieldwork have instilled in me great enthusiasm for my desk job. We were focusing on the Norway rat (*Rattus norvegicus*) and ship rat (*Rattus rattus*),

but quickly discovered a new species: the Fieldwork rat (*Rattus catchus ifyoucanus*). While island locals complained of plague-like proportions of rats, our 12-hour field-work days often turned up only one or two catches. Clearly, we were out-smarted.

Fortunately, rats are not too popular in New Zealand, and we soon made lots of friends, including a number of government agencies and community groups whose professional rat-catching skills far surpassed our own. Rat DNA samples began pouring in. I would get phone calls: "Meet me on Princes Street in half an hour for a dead rat", whereupon I would be presented with a dripping package of formerly-frozen rodent: great for DNA preservation but something of a challenge to slip through the reception fortress of the biology department hosting the nearest freezers. It became commonplace to see visitors traipsing through the statistics department with parcels of rat tails. My head of department has recently commandeered a box of twelve mummified rats for use as gifts should the occasion arise.

Statistically, the wily creatures obliged us by offering strong signals from simple statistical analyses. Isolated islands quickly develop their own genetic signatures in terms of allele frequencies, and basic scatter-plots can reveal much genetic structure. Sampling uncertainty, missing data, genotyping error, and genetic anomalies pose a few extra challenges, some of which are

Norway Rat © Rachel Fewster

easily accommodated while others are still unresolved. Figures 1 and 2 show results from two islands (Broken Islands and Kaikoura Island) that are each about 300m away from a much larger island (Main Island: Great Barrier/Aotea). Each point corresponds to one ship rat, and the two coordinates measure the rat's fit to the two featured populations. In the case of the Broken Islands, the source populations are easily distinguishable. Reinvaders after an eradication attempt were readily sourced to the nearby mainland, and found not to be survivors of the eradication. For Kaikoura Island, which has a lot of boat traffic, the populations are less distinguishable. The overlap between the pre-eradication Kaikoura population and the Main Island suggests that Kaikoura was not greatly isolated before the eradication. It is hard to give a conclusive source for post-eradication samples, but there is strong evidence for at least some survivors.
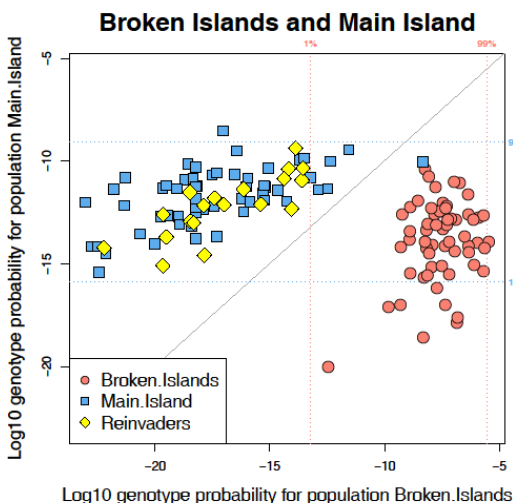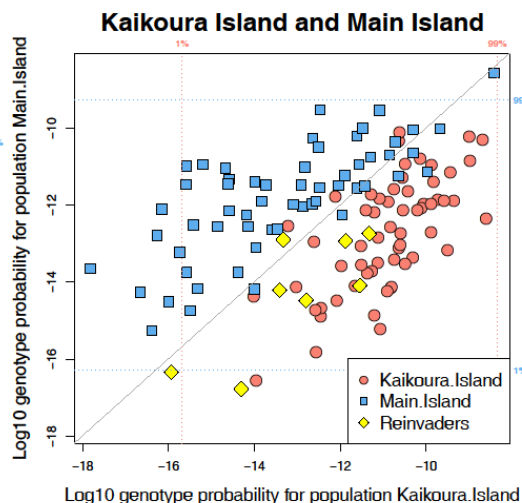
The charts bear out subsequent events. The Broken Islands have remained rat-free after the invasion shown was dealt with, but the burgeoning population on Kaikoura could not be controlled, and Kaikoura is again rat-infested.

Rachel Fewster, Steven Miller, and James Russell are the original members of the Rodent Invasion Project

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

Figure 1

Figure 2

NCSE research updates US regulators

Steve Buckland contributed to a workshop in December 2011 to update US regulators and survey groups on recent developments in the UK in surveying sea mammals and birds that may be impacted by the construction of large offshore wind farms. The workshop took place at the British Consulate in Boston, and was organised by HiDef. HiDef have developed high-resolution video to allow surveys to be conducted from aircraft that fly much higher than is possible with visual surveys, so that disturbance is minimized, and so that surveys can be conducted from aircraft that are safely above the blades of the wind turbines. The St Andrews group of NCSE has been actively involved in developing the methods used, which have now largely replaced visual aerial surveys of seabirds in the UK. Given the rapid technological developments, such methods are likely to replace many – perhaps most – visual aerial surveys of wildlife (terrestrial as well as marine) in the coming years.

Aerial survey for sea ducks, Horns Rev offshore wind farm, Jutland © Ib Krag Petersen, NERI, Denmark

New video-conferenced seminar series for NCSE PhD students and PDRAs

A new NCSE seminar series has been started for PhD students and PDRAs. The first meeting was held in December 2011 and a talk 'One type of data, many applications' was given by Rachel McCrea at the University of Kent. The format of these meetings will be varied depending on what the host institution would like to present. Some ideas include a standard seminar talk, a paper discussion, or even tutorials on specialist topics. The meetings are video-conferenced and five centres connected in for the December talk. If you currently do not receive the e-mails relating to these meetings and would like to get involved please e-mail Rachel - R.S.McCrea@kent.ac.uk.

"Personal development opportunities for NCSE PhD students and PDRAs"

CREEM workshops delivered in Florida, USA

CREEM organised a workshop on Recent Developments in Cetacean Survey Methods at the 19th Biennial Conference on the Biology of Marine Mammals in Tampa, Florida, in November 2011. The workshop attracted 80 participants, who listened to presentations by Len Thomas (CREEM), Hans Skaug (University of Bergen), Steve Buckland (CREEM), David Borchers (CREEM) and Jay Barlow (Scripps Institution of Oceanography) on recent and current methodological developments and participated in useful panel discussion on the methods. The presentations and a summary of the discussion will soon be available on the CREEM website.

After the Biennial Conference, some members of CREEM (Steve, Len, Danielle Harris and Cornelia Oedekoven) stayed on in Tampa to teach a training workshop on distance sampling to around 25 participants.

19TH BIENNIAL CONFERENCE ON THE BIOLOGY OF MARINE MAMMALS TAMPA, FLORIDA NOVEMBER 27 - DECEMBER 2, 2011

NCSE Summer meeting 2011

The NCSE Summer meeting 2011 was held on the beautiful campus of the University of Bath, 11th-15th July. The meeting programme and talk abstracts can be found on the NCSE website.

In addition to the programme of scientific talks, Lorenzo Milazzo gave a half-day training workshop on 'Statistical Computing. An introduction to concepts, techniques and tools for algorithm design'. Simon Wood gave a one-day training workshop on 'Semi-parametric GLMs with mgcv: beyond GAMs', and Janine Illian gave a half-day training workshop on 'Spatial modelling with INLA'. The meeting dinner was held in the Pump Room, and excursions included the Bath skyline walk and the Roman Baths.

Pulteney Bridge, Bath © Janine Illian

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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.

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Snippets!

Movements:

Farewell to Brett McClintock, who left CREEM to join the National Marine Mammal Laboratory (NMML) in Seattle. Brett now becomes an International Member of NCSE, along with several NMML colleagues (Paul Conn, Devin Johnson, Jeff Laake and Jay Ver Hoef.)

Farewell to Dr Svetlana Tishkovskaya, who has taken a job as Lecturer in Health Statistics at the University of Central Lancashire. She joins a group of statisticians in the School of Health there who provide methodological support to a range of health-related projects based in the school and university. Svetlana had been an NCSE-funded PDRA at the University of Sheffield, working on

animal movement, with Paul Blackwell; she hopes to continue to have some involvement in that research area.

Phil Harrison returned to St Andrews in 2011, to develop models that quantify changes in biodiversity due to climate change. Phil completed his PhD at CREEM in 2005, before joining the metapopulation research group at the University of Helsinki.

Welcome to:

PhD students Emily Dennis and Chen Yu (Kent); Ben Swallow and Hannah Worthington (St Andrews).

PDRAs Roland Langrock, Grant Hopcraft and Antony Overstall (St Andrews); Mu Niu (Sheffield).