UNIVERSITY OF EXETER

Centre for Ecology and Conservation

CORNWALL CAMPUS

Annual Report 2011

Introduction



Welcome to the 2011 Annual Report for the Centre for Ecology and Conservation, and it is a pleasure to state that it has been another stellar year for the Centre. We recruited our largest undergraduate intake to date with 135 new Level 1 students joining us this year. This occurred on the back of increased tariff for all degrees, plus we have added new programmes (BSc Animal Behaviour and Environmental Science) that will come online in 2012. This will allow us to offer students even more excellent choices, and further build our reputation as a premier destination to study whole organismal biology.

We were also joined by 65 MSc students in 2011, spread across three programmes (including our new MSc Applied Ecology), and by a large group of new MRes and PhD students. Our MSc programmes in particular continue to be high quality offerings that recruit well and provide students with the training they need to find quality employment once they leave the University, but we have been able to increase the employability of all our students across the board thanks to the drive and dedication of CEC staff and increasing investment in the Careers Service. Our total student population across all years now stands at 358, a very healthy state-of-affairs, representing a phenomenal increase from our initial intake in 2004.

As well as welcoming new students, we also saw the arrival of four new academic staff this year when we were joined by Dr Sarah Hodge, Dr Britt Koskella (a NERC Fellow), Professor Mike Boots and Professor Angus Buckling. This outstanding group expand our expertise in behaviour, disease and evolution even further, and added to the new appointments in the Environment and Sustainability Institute, greatly enhance the Bioscience presence on the Cornwall Campus. We also saw four members of CEC staff leave us in 2011, Professor Matthew Evans and Dr Trish Moore, Nicole Westbury Harris, and Paul Wilkinson, and while it was sad to see colleagues move on, we thank them all for their work and wish them well in their new ventures. To cover this loss and to provide students with an even better learning experience, while further strengthening key research areas within the CEC, we will continue to recruit new staff in 2012. We were pleased to be joined by Verity Reed, our new Aviary Technician, as part of our continued drive for excellence.

In terms of research, the CEC continues to perform exceptionally well. As show-cased elsewhere in the report, Professor Nina Wedell was made a Royal Society Wolfson Merit Award Holder this year. This is an extremely prestigious recognition of her research excellence. The Centre as a whole generated new research income of around £2 million in a tough economic environment, with numerous new projects funded over the last 12 months. There were some outstanding research outputs this year too, with a number of papers in the top scientific journals like *Nature*, *Science*, *Current Biology* and *Ecology Letters*. This year also saw the graduation of five PhD students, and our ability to recruit and train excellent young researchers bodes well for the future. Several staff were promoted during 2011 in recognition of their excellent performances. Dr Nick Royle was promoted to Senior Lecturer and Professor Stuart Bearhop was promoted to a Chair in Animal Ecology, while Professor Brendan Godley was promoted to a Chair in Conservation Science.

A huge thanks to all staff and students, your outstanding efforts continue to make the Centre for Ecology and Conservation a great place to work and study, and with continued application our growth and improvement will be sustained in 2012 and beyond.

Professor David Hosken – Centre Director
University of Exeter, Cornwall Campus

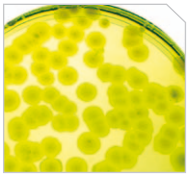
Research highlights

Decline in species shows climate change warnings not exaggerated

The study covered a wide range of species in all types of habitat across the globe.

One in 10 species could face extinction by the year 2100 if current climate change impacts continue. This is the result of work by **Ilya Maclean** and **Rob Wilson** examining studies on the effects of recent climate change on plant and animal species and comparing this with predictions of future declines. This work featured in the *Independent* and *The Times*. (Published in *Proceedings of the National Academy of Sciences USA*.)

Bacteria and their virus parasites co-evolve



The *Pseudomonas fluorescens* bacterium.

While bacteria and the viruses which parasitise them have been shown to co-evolve in test-tubes, it was unknown whether the same was true in nature. Work by **Angus Buckling** has shown that there is co-evolution in nature, but the pattern of co-evolution is very different from patterns found in laboratory studies. Rather than show arms-race dynamics, specific virus genotypes specialise on specific bacterial genotypes generating fluctuating selection dynamics. (Published in *Science*.)

Opposites may attract but they aren't better parents

A zebra finch.

A study by **Sasha Dall** and **Nick Royle** has revealed that couples with similar personalities make much better parents than those with different dispositions – at least in the world of zebra finches. The research found birds expressing strong personality traits, such as aggressive behaviour or a willingness to explore, did a much better job of raising young if they had a like-minded partner. (Published in *Animal Behaviour*.)

Epic journeys of turtles revealed

A leatherback turtle.

Research from the marine group, including **Matthew Witt**, **Annette Broderick** and **Brendan Godley**, enjoyed widespread media coverage including featuring on BBC News and in the *Guardian*. The work revealed the epic ocean-spanning journeys of the gigantic leatherback turtle in the South Atlantic for the first time thanks to groundbreaking research using satellite tracking. The five-year study has shed new light on the little-known migration behaviour of these animals by following their movement from the world's largest breeding colony in Gabon, Central Africa, as they returned to feeding grounds across the South Atlantic. (Published in *Proceedings of the Royal Society B*.)

Research reveals how butterflies copy their neighbours to fool birds

Heliconius numata (top) and co-mimic *Melinaea mneme* (bottom).

The mystery of how butterfly wing-patterns evolve to mimic neighbouring species and enable butterflies to avoid being eaten by birds has been solved by a team of scientists including **Richard ffrench-Constant** in collaboration with CNRS (Muséum National d'Histoire Naturelle, Paris). The work shows how chromosomes evolve to keep co-adapted genes together, eventually forming super-genes that help butterflies avoid bird predation. (Published in *Nature*.)

'Heat-proof' eggs help turtles cope with hot beaches

Green turtle hatchling.

Sea turtles face an uncertain future as a warming climate threatens to reduce their reproductive viability. However, new research by **Sam Weber**, **Jon Blount** and **Annette Broderick** shows that some turtles are naturally heat-tolerant. This means they may be more robust to temperature changes than previously thought. This work was covered by ITV Westcountry and BBC Radio Devon, and in an article in *NERC Planet Earth*: Heat-proof eggs help turtles cope with hot beaches. (Published in *Proceedings of the Royal Society B*.)

Ants' ecosystem role is key

A common red ant.

A study by **Frank van Veen** has revealed that ants have a big impact on their local environment as a result of their activity as 'ecosystem engineers' and predators. The study found that ants have positive or negative effects on their local environment depending on their density. (Published in *Journal of Animal Ecology*.)

Is chivalry the norm for insects?

Field crickets.

The long-standing consensus of why insects stick together after mating has been turned on its head. The study by **Rolando Rodríguez Muñoz** and **Tom Tregenza** shows that, contrary to previous thinking, females benefit from this arrangement just as much as males. They found that even if their life is threatened, male crickets let their partners flee first into protective tunnels. This work was reported in *The New York Times*, *Scientific American*, *The Huffington Post* and *Chicago Sun-Times*. (Published in *Current Biology*.)

Student Societies

BeeSoc started at the beginning of 2011 due to student interest in the recent decline in bee numbers and the introduction of new pests and diseases to the local honey bee populations. Although in its infancy, BeeSoc has over 60 members and has secured over £2,000 of funding from FXU and the Exeter Annual Fund, the majority of which is being spent on setting up four new hives over the coming spring. Working with a local bee keeper who uses "bee friendly" techniques has given us a unique insight into the world of bee keeping. Successful events over the last year include: an Introduction to Bee Keeping course; free screenings of bee-related films such as "Last of the Honey Bee"; and attending West Cornwall Bee Keeping Association meetings (WCBKA). Over the coming months we are planning practical bee keeping sessions, wild flower planting and bumble bee nest making.

The Bioscience Student Employability Committee (BSEC) is a student-led committee to showcase relevant employability opportunities to the Bioscience student body. This is the second year that the committee has been running, with notable achievements in its first year including a successful Bioscience Careers Fair that hosted speakers from the BBC Natural History Unit, Acorn Ecology Ltd and Cornwall Council Environmental Service. Over 200 students attended this evening event and feedback was very positive.


Bioblitz event.

Off the back of this success, BSEC has received both support and recognition from academic and welfare staff. Other departments have also taken note and encouraged their students to set up similar employability committees – BSEC has begun to make students think about employability as well as their degrees!

This academic year, BSEC expanded its committee and the number of events it hosts. A weekly seminar series (Student Employability Seminars) has been introduced, providing students with talks from relevant speakers who provide useful information based on student guidelines. Speakers have included people from Newquay Zoo, the National Trust and BRinK; with future speakers from the RSPCA, Erasmus and the BBC.

Future careers fairs are planned with the aim of providing presentations from notable employers as well as stands from local relevant companies, charities and university employability services. At least some of these will be a collaboration between BSEC and the newly formed Geography Employability Committee (GEC), creating a College of Life and Environmental Sciences Careers Fair.

BSEC is currently putting into action continuity plans so knowledge and skills can be handed on to new members each year. The aim is to continue showcasing relevant employability opportunities and to provide work experience, and hopefully paid internships, by developing employer-student relations.

This committee has already brought benefit to the student body in its infancy, and we look forward to watching it develop and increase its impacts over the coming years.

EcoSoc is the Ecological Society for the Cornwall Campus. We have over 300 members who come along to varied events, including conservation work, mammal and moth trapping, guest speakers, weekends away, fundraising quizzes and river cruises to name but a few. The aim of the society is to get people out and about in Cornwall, learning about the natural world and working with the local community in a sustainable way. We help out with events run by organisations based in Cornwall, like basking shark watching with Cornwall Wildlife Trust and green woodworking with the National Trust.

People and Planet is a national student-led movement which specialises in protecting the environment, defending human rights and putting an end to world poverty. Over the past year People and Planet Tremough has set up and run a number of campaigns and projects concerning both ethical and environmental issues, these include the promotion of sustainable transport, specifically cycling; raising awareness about unsustainable fishing methods; encouraging students to ask where their student fees are being invested and the sustainability extravaganza that was Sustainability Week. Our main aim is to bring environmental and ethical issues to the forefront of people's attention, and to facilitate the realisation that a small change in the way you live, or the products you buy, can have globally positive effects.

Movement patterns of the serotine bat

Research and Knowledge Transfer Case Study in conjunction with FERA

Rabies is a serious viral disease that can cause death from brain inflammation if not treated appropriately. The common serotine bat is widespread in continental Europe where it is the main reservoir for rabies virus EBLV1. In the UK this bat is restricted to the south of England, but so far live EBLV1 has not been found in the British Isles.

Why is this and if rabies were to infect these bats, how fast would it spread in the UK and how far? At present we do not know the answers to these critical questions, but this research project, conducted by PhD student **Caroline Moussy** and supervised by **Professors David Hosken** and **Stuart Bearhop** (CEC) in conjunction with Drs James Aegerter and Graham Smith (FERA), aims to shed light on these and other questions of concern for this bat species.

The Centre for Ecology and Conservation has co-operated with the Food and Environment Research Agency (FERA) on a number of projects over the last few years, and last year the University of Exeter and FERA signed a Memorandum of Understanding to promote research and knowledge exchange. This bat project is one that involves the combined expertise of the CEC and FERA to address a blue skies question that has direct consequences for a real world problem. The project is entering its third year and will not only inform FERA and Government rabies policy, but will also provide vital information on one of the most charismatic but mysterious members of the UK's mammal fauna.

Students celebrate partnerships with Cornish businesses

In September MSc students at the Centre for Ecology and Conservation held a conference to celebrate how they can work together with local businesses to further our understanding of Cornwall's flora and fauna.

MSc students studying at the CEC spend five months conducting a research project, which is an integral part of their training. Last year, 19 students chose to conduct their research project alongside local Cornish businesses. This not only benefits the businesses, who gain the expertise of a postgraduate student in tackling a particular issue, but also provides the student with valuable experience of working with an active conservation organisation.

To celebrate these partnerships, the ESF Convergence fund sponsored a conference in September in which the students presented the results of their projects to an audience of students, staff and representatives from local organisations. Talks ranged from studies of ponds and plants on the Lizard Peninsula, in collaboration with Natural England, to research into how baby lobsters react to predators, in collaboration with the National Lobster Hatchery.

University of Exeter student Lucie Buckland gave a talk on her work monitoring the distribution of whales, dolphins and porpoises around the Cornish coast using technology developed by Chelonia Ltd in Penzance. She said,
"Having the opportunity to work with real conservationists in Cornwall was fantastic and the assistance I was given by Cornwall Wildlife Trust made such a difference to my understanding and progress. Hopefully my project will assist future work in this area."

Funding Awarded during 2011

The Centre for Ecology and Conservation enjoyed many funding successes during 2011. Funders ranged from UK government bodies to the EU, and we also secured funding from a number of important scientific societies. Funders include, the Engineering and Physical Sciences Research Council (EPSRC), the European Commission, the European Regional Development Fund, the European Science Foundation, the Overseas Territories Environment Programme (OTEP), the Food and Environment Research Agency (FERA), the National Environment Research Council (NERC), The Association for the Study of Animal Behaviour, The Genetics Society, The Marine Conservation Society, The Royal Society and The Society for Endocrinology. Awards were made to Professor Stuart Bearhop, Dr Annette Broderick, Professor Angus Buckling, Professor Matthew Evans, Dr David Hodgson, Professor David Hosken, Dr Clarissa House, Professor Allen Moore, Dr Nick Royle, Professor Nina Wedell, Dr Rob Wilson and Dr Andy Young. Awards were for blue-skies and applied research, and even included a project for student training within an applied, external project on badger-population controls and tuberculosis.

Particular highlights include: a project spearheaded by Stuart Bearhop in conjunction with FERA to investigate the use of stable isotope techniques as a tool for regulating the trade of tortoises; a OTEP award to Annette Broderick and Brendan Godley to investigate the conservation status of marine turtles on Ascension Island; a Royal Society award to Clarissa House to investigate evolutionary trade-offs between beetle sexual characters; a large NERC funded project headed by Nick Royle, with Allen Moore, to investigate aspects of parental care; and Dave Hodgson's project to investigate the properties of species invasions that has been funded by the EPSRC. Thanks to all our funders and congratulations to all awardees.



Awards and prizes

CEC featured prominently in the recent University of Exeter Impact Awards:

Outstanding Regional Impact category – winner
Brendan Godley and **Matthew Witt** (with colleagues from EMPS) "Uncharted waters: leading the world in marine renewable energy"

Through contributions to the development of Wave Hub, an offshore test facility for wave devices, and, in partnership with Cornwall Council, supporting development for peripheral regions of Europe, academics are dismantling the technical barriers to commercial success. Their expertise has created a unique commissioning site in Falmouth already attracting worldwide interest, bolstering the global competitiveness of SW-based companies, and potentially accelerating the route to market for the technologies.

Student Impact category – winner
Tim van Berkel and **Martin Holland** "The Heart of Borneo Project: conservation, sustainability and community empowerment"

In 2010 students Martin Holland and Tim van Berkel organised and led an 18-strong expedition to Borneo to document the flora and fauna of Bukit Batikap Nature Reserve, one of the most remote, biodiverse and threatened rainforests on earth. The quality of the scientific research and pioneering use of interactive communications, through which exciting discoveries were shared in real time with a worldwide audience, brought numerous awards, extensive media coverage, and the accolade of 'Expedition of the Year'.

The expedition's work continues through the Heart of Borneo Project, a UK charity focusing on the processes that regulate biodiversity, and empowering local communities to achieve sustainability and conserve biodiversity in their fragile environment.

The following students were awarded prizes at our Graduation ceremony in July:

Undergraduate:

Dean's Commendations – **Alice Fitch, Michael Hawkes, Ben Jackson**

School Commendations – **Lucie Brown, Naomi Gregory, Leonora Harbord, Rachel Kehoe, Amy Lewis, Heather Parris, Finn Raven, Odette Wills, Emma Wood, Martin Yeo**

Oxford University Press Award – **Chloe Amoo, Anna Harrison**

Society of Biology Award – **Michael Hawkes**

ZSL Charles Darwin Award – **Ben Jackson**

Postgraduate:

Dean's Commendations for exceptional performance – **Lynda Donaldson, Alex Ferguson, Aoife Parsons, Faye Thompson, Anne Winters**

Dean's Commendations for outstanding contribution – **Phil Bradshaw, Val Brookes**

Best Overall Mark and Best Project Mark – **Lynda Donaldson** (MSc Conservation and Biodiversity)

Best Overall Mark and Best Project Mark – **Anne Winters** (MSc Evolutionary and Behavioural Ecology)

Congratulations to the following CEC students who were awarded PhDs in 2011:

Xavier Harrison. Thesis title: Causes and Consequences of Variation in Dispersal Strategy in an Arctic Migrant

Josie Orledge. Thesis title: Consequences of Trade-Offs during Growth and Development in Pheasants (*Phasianus colchicus*)

Kate Plummer. Thesis title: The Effects of Over-winter Dietary Provisioning on Health and Productivity of Garden Birds

Peter Richardson. Thesis title: Managing Marine Turtles: a Study of Marine Turtle Conservation Science and Policy

Melanie Smee. Thesis title: Population Ecology and Genetics of the Marsh Fritillary Butterfly *Euphydryas aurinia*

Professor Nina Wedell,
a Royal Society Wolfson Research Award winner

Professor Nina Wedell of the Centre for Ecology and Conservation has been honoured by a Royal Society Wolfson Research Merit Award. These prestigious awards are recognition of research excellence and are awarded to a small number of recipients across all the sciences every year. Professor Wedell, an evolutionary biologist who works on "selfish genes", joined the CEC in 2004. She says she was "enormously flattered to receive this prominent award and have my research excellence acknowledged by the Royal Society". It is a great credit to Professor Wedell and her work that this honour was bestowed upon her, and Nina's outstanding achievement again shows the quality of research being conducted at the CEC and on the Cornwall Campus. In addition to supporting Professor Wedell's research, the CEC has also benefited from The Royal Society's support for the Research Fellows Drs Jon Blount, Mike Cant, John Hunt and Andy Russell over the last year.

Stuart Bearhop Inaugural Professorial Lecture

CEC enjoyed many successes during 2011, and one of the most enjoyable was the Centre's first Inaugural Professorial Lecture presented by Professor Stuart Bearhop.

Stuart is an ecologist who specialises in using stable isotopes to understand the diet and migration patterns of animals, particularly birds. His lecture was attended by 200 interested students, staff, members of the public, collaborators and his family. Highlights of the lecture included the presentation of his latest *Science* paper on the nutritional benefits of tool use by New Caledonian Crows and Stuart's acknowledgements to his closest family for the support they have provided over the years. Professor Mark Goodwin, Dean of CLES, provided the vote of thanks and the entire crowd was then treated to an aperitif and some very amusing videos from Stuart's international collaborators who could not attend the presentation. Staff from the CEC along with Stuart's family then attended a dinner in Falmouth to cap-off a most memorable and auspicious event. Congratulations Stuart and thanks to everyone who made this a celebration for the whole Centre for Ecology and Conservation.

Sample CEC publications from 2011

Alfaro-Shigueto J, **J Mangel**, F Bernedo, P Dutton, J Seminoff, **B Godley**. (2011). Small scale fisheries of Peru: a major sink for marine turtles in the Pacific. *Journal of Applied Ecology*, *48*, 1432-1440.

Bonneaud C, SL Balenger, **AF Russell**, J Zhang, GE Hill, SV Edwards. (2011). Rapid evolution of disease resistance is accompanied by functional changes in gene expression in a wild bird. *Proceedings of the National Academy of Sciences USA, 108*, 7866-7871.

Bretman A, **R Rodríguez-Muñoz**, C Walling, J Slate, **T Tregenza**. (2011). Fine-scale population structure, inbreeding risk and avoidance in a wild insect population. *Molecular Ecology, 20*, 3045-3055.

Cant MA. (2011).The role of threats in animal cooperation. *Proceedings of the Royal Society B, 278*, 170-178.

Mares R, **AJ Young**, DL Levesque, N Harrison, TH Clutton-Brock. (2011). Responses to intruder scents in the cooperatively breeding meerkat: sex and social status differences and temporal variation. *Behavioural Ecology, 22*, 594-600.

Joron M, L Frezal, RT Jones, NL Chamberlain, SF Lee, CR Haag, A Whibley, M Becuwe, SW Baxter, L Ferguson, PA Wilkinson, C Salazar, C Davidson, R Clark, MA Quail, H Beasley, R Glithero, C Lloyd, S Sims, MC Jones, J Rogers, CD Jiggins, **RH ffrench-Constant**. (2011). Chromosomal rearrangements maintain a polymorphic supergene controlling butterfly mimicry. *Nature, 477*, 203-206.

Gómez P, **A Buckling**. (2011). Bacteria-phage antagonistic co-evolution in soil. *Science, 332*, 106-109.

Harrison XA, **J Blount**, **R Inger**, **S Bearhop**. (2011). Carry-over effects as drivers of fitness differences in animals. *Journal of Animal Ecology, 80*, 4-18.

Henri DC, **FJ Van Veen**. (2011). Body Size, Life History and the Structure of Host-Parasitoid Networks. *Advances in Ecological Research, 45*, 135-180.

Hodge SJ, MB Bell, **MA Cant**. (2011). Reproductive competition and the evolution of extreme birth synchrony in a cooperative mammal. *Biology Letters, 7*, 54-56.

Hosken DJ, **CM House**. (2011). Sexual selection. *Current Biology, 21*, R62-R65.

House CM, BH Bleakley, CA Walling, TA Price, CE Stamper, **AJ Moore** (2011). The influence of maternal effects on indirect benefits associated with polyandry. *Proceedings of the Royal Society B, 278*, 1177-1182.

Kight C, J Swaddle. (2011). How and why environmental noise impacts animals: an integrative, mechanistic review. *Ecology Letters*, *14*, 1052-1061.

Lewis Z, **N Wedell**, **J Hunt**. (2011). Evidence for strong intralocus sexual conflict in the Indian meal moth, *Plodia interpunctella*. *Evolution, 65*, 2085-2097.

Maclean I, **RJ Wilson.** (2011). Recent ecological responses to climate change support predictions of high extinction risk *Proceedings of the National Academy of Sciences USA, 108*, 12337-12342.

McNamara JM, **SRX Dall**. (2011). The evolution of unconditional strategies via the "multiplier effect". *Ecology Letters, 14*, 237-243.

Rodríguez-Muñoz R, A Bretman, **T Tregenza**. (2011), Guarding males protect females from predation in a wild insect. *Current Biology*, *21*, 1716-1719.

Sanders D, **FJF van Veen**. (2011). Ecosystem engineering and predation: the multi-trophic impact of two ant species. *Journal of Animal Ecology, 80*, 569-576.

Schuett W, **SRX Dall**, **NJ Royle**. (2011). Pairs of zebra finches with similar "personalities" make better parents. *Animal Behaviour, 81*, 609-618.

Stott I, S Townley, **D Hodgson.** (2011). A framework for studying transient dynamics of population projection matrix models. *Ecology Letters, 14*, 959-970.

Weber S, **J Blount**, **BJ Godley**, **MJ Witt**, **AC Broderick.** (2011). Rate of egg maturation in marine turtles exhibits 'universal temperature dependence'. *Journal of Animal Ecology*, *80*, 1034-1041.

Witt MJ, EA Bonguno, **AC Broderick**, MS Coyne, A Formia, A Gibudi, GA Mounguengui Mounguengui, C Moussounda, M NSafou, S Nougessono, RJ Parnell, G-P Sounguet, S Verhage, **BJ Godley**. (2011). Tracking leatherback turtles from the world's largest rookery: assessing threats across the South Atlantic. *Proceedings of the Royal Society B, 278*, 2338-2347.

Zhang QG, **A Buckling**. (2011). Antagonistic co-evolution limits population persistence of a virus in a thermally deteriorating environment. *Ecology Letters*, *14*, 282-288.

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