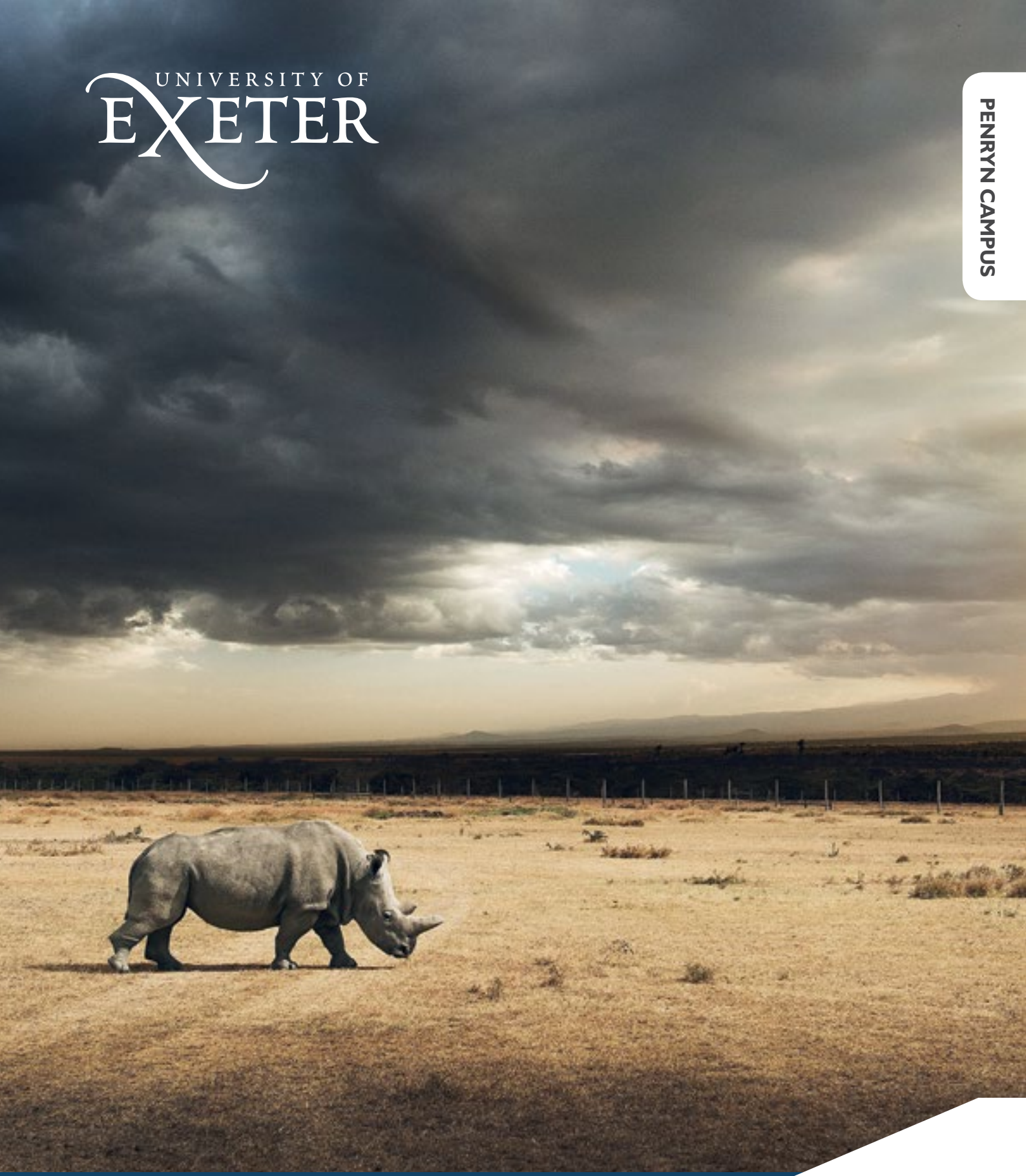

UNIVERSITY OF EXETER

PENRYN CAMPUS

Centre for Ecology and Conservation

Annual Report 2016

Welcome

Still growing in size and reputation

The year 2016 was again one in which the staff and students of the Centre for Ecology and Conservation (**CEC**) celebrated a long list of achievements in research, teaching and community engagement. Together with our colleagues from the Centre for Geography, Environment and Society (**CGES**) and those in the Environment and Sustainability Institute (**ESI**) and European Centre for Environment and Human Health (**ECEHH**) we continue to make the Penryn Campus a globally known locus for world-leading research and teaching with an environmental focus. We have, of course, begun to outgrow our facilities so construction of a large two building extension to the Science and Engineering Research Support Facility (**SERSF**) building was commenced at the end of 2016. In year, we also celebrated the opening of a range of new campus facilities including a new Sports Facility, a Nursery and an extensive Study Suite for Exeter MSc students.

We are a research-intensive unit but we are nothing without our 750 students. Their tremendous commitment towards a co-development of the culture of learning and personal development in the CEC was recognized by our nomination and shortlisting in the Exeter Students' Guild Awards this year. We were winner of the "Best Research Community" with several staff being shortlisted for other awards. These accolades are as much about the character of our students as the quality of their academic mentors. We are now being celebrated across the University for the magnitude of publishing of student research that occurs across undergraduate, masters and doctoral programmes. The broader activities of our student body also continue to impress as they undertake an ever-wider range of extracurricular societies which are so important to the life of the campus and the employability of our graduates (see section on **Student Societies**).

A major ambition of the University is to continue to grow in research. Our research portfolio continues to go from strength to strength, with £9.5million in new grants in 2016, taking our current grant holdings to over £21million. Funders included Research Councils (BBSRC, ERC, ESRC, NERC), Bertarelli Foundation, CB Dennis Trust, Darwin Initiative, the Defence Science and Technology Laboratory (DSTL), Defra, the European Union, Genetics Society, Leverhulme Trust, Marine Conservation Society, Natural England, the Royal Society, Rufford Foundation, Scottish Natural Heritage, Wellcome Foundation, Wildlife Conservation Society and the Wissenschaftskolleg zu Berlin. For more detailed examples see **Funding Awards**. We also continue to publish well, often in the most prestigious journals in our respective fields; examples of recent publications are featured in the **Research Highlights** and **Selected Publications** sections later in this report.

In the year of the Brexit referendum we continue to celebrate our international nature in both of our student body and staff at all levels. We are proud of our diversity, it strengthens us as a department and a university. Indeed, the 2016 round for the EU funded Marie Skłodowska-Curie Individual Fellowship awards saw a record breaking 8 successful bids. This means that 8 of the best postdoctoral fellows from across the EU will be funded to come and work with us here in Cornwall, expanding our international reach and reputation. This international standing was further attested by the successful hosting of the world's largest behavioural ecology congress at Exeter organised by **Dr Sasha Dall** and a large committee of CEC staff and students during the Presidency of **Prof Nina Wedell**. It was a tremendous success with >1100 participants from across the globe, with **Prof Richard Dawkins** giving the opening plenary address (see photo).

In addition to the many plenary addresses and guest lectures our staff have delivered around the world, we also have a very strong record of liaising with local schools (see **Science in the Community**). This sees exemplary engagement from our students of all levels. Further, this year also saw us reaching out to the wider community at the Royal Cornwall Show, our now annual "Science in the Square" event during Falmouth Week and our third "Science of Christmas" at the Royal Cornwall Polytechnic Society. A large cadre of staff paraded in gowns as part of the 800 year celebrations of the founding Penryn and we hosted a mini Science festival in the town hall. Two of our student endeavours are pass-remarkable in this regard. January saw the launch of ***#FieldCourseFortnight*** a multi-media (blogs, videos, instagram, twitter and facebook) extravaganza allowing international audiences to follow along with our final-year students during their exciting and immersive capstone field courses to the Bahamas, Borneo, Kenya, South Africa and Tenerife. Others are being planned for Alaska, Galapagos, Iceland and India. Another exemplary student endeavour is ***Naturewatch***, a high-quality, wildlife-focussed television programme shared freely on the internet (www.facebook.com/naturewatchcornwall).

As I look forward to my third full year as Director of the CEC, I am still extremely proud to be working with, and for, such a vibrant and industrious group of staff and students. The personal achievements of many of our number have been recognised by a number of promotions and prestigious awards this year (see **Selected Highlights**). The year 2017 will, no doubt, see ever more success.

Professor Brendan Godley
Director, Centre for Ecology and Conservation
Head of Discipline, CLES Cornwall

Research Highlights

Individual variation in social learning

Recent years have seen an explosion in research on animals' abilities to learn from one another. This 'social learning' has been documented in numerous species of fish, insects, birds and mammals. Meerkats, for example, learn what food is good to eat from older conspecifics. An article by **Dr Alex Mesoudi**, Lei Chang, **Sasha Dall** and **Alex Thornton** argued that while knowing whether social learning is present in a species is valuable, researchers often neglect individual variation in social learning *within* species and groups of animals. They review evidence that within groups, some individuals copy frequently, and others seldom copy. There is also variation in the ways individuals copy, such as from whom they learn. They suggest several potential explanations for this individual variation, including underlying genetic variation, developmental cues such as maternal stress, and, at least in humans, cultural variation in social learning. (Published in ***Trends in Ecology and Evolution***)

Reproductive competition triggers mass eviction in cooperative banded mongooses

Animal societies often feature high levels of cooperation, but also conspicuous levels of conflict. Within-group conflict can manifest in eviction, where individuals are forcibly expelled from their social group, but little is known about what triggers eviction. Banded mongooses live in highly cooperative family groups but occasionally erupt into violence, resulting in the mass eviction of multiple individuals. Using data from our 16-year study of banded mongooses in Uganda, we found that reproductive competition is the main trigger for these mass evictions. Females are more likely to be evicted when there are many breeding females in the group, and males are more likely to be evicted alongside females when there are many breeding males. Our results show that reproductive competition can destabilise cooperative groups, and that the consequences of resolving within-group conflict resonate through groups and populations to affect population structure. (Published in ***Proceedings of the Royal Society B***)

Defensive insect symbiont leads to cascading extinctions and community collapse

Animals often engage in mutualistic associations with microorganisms that protect them from predation, parasitism or pathogen infection. Sanders et al. demonstrate how an association between an aphid and the symbiont *Hamiltonella defensa*, that protects the aphid against its natural enemy, has community wide effects in insect food webs. Introducing the bacterial symbiont into one aphid species led to its escape from its natural enemy with knock-on effects on other species in the food web. This triggered an extinction cascade and finally the collapse of the community. The study shows that defensive symbionts can cause extinction cascades and therefore play a significant role in the stability of consumer-herbivore communities in the field. (Published in ***Ecology Letters***)

A major gene controls mimicry and crypsis in butterflies and moths

Dr. Andrea Dowling

The effect of natural selection on the patterns of butterfly and moth wings has created captivating examples of diversity and evolution. The wings of Lepidoptera are covered with unique scale cells within which pigmentation is laid down in order to form colours and patterns. However, the genetic mechanisms underlying how this occurs are not well understood. In this paper, a combined approach using both population genetics and gene expression studies honed in on the gene cortex as a major switch in wing pattern formation in the mimetic *Heliconius* butterflies. This gene belongs to a family of conserved cell-cycle regulators; as such its likely role is in scale cell development, affecting how and when they become pigmented. In parallel, it was discovered that a mutation in cortex was responsible for the appearance of black peppered moths during the industrial revolution. Industrial melanism camouflaged the moths from birds against the soot-covered trees. These results indicate that one gene could control melanism in Lepidoptera and go towards explaining mimicry in butterflies and industrial melanism in moths. This finding represents a major step forward in elucidating the evolution of, and mechanisms behind, wing colour and pattern regulation in Lepidoptera.
(Published in ***Nature***)

Deformed wing virus is a recent global epidemic in honeybees driven by Varroa mites

By pollinating crops and wildflowers, managed honeybees and wild pollinators are key for maintaining both food security and biodiversity. Many pollinators have experienced often drastic declines over the last decades, and anthropogenic factors, such as habitat degradation, pollution and the global movement of species have contributed to these declines. Using genetic and phylogenetic tools, we were able to show that a key pollinator disease, Deformed Wing Virus, is undergoing a global epidemic in honeybees and wild bumblebees, driven by the man-made movement of European populations of honeybees. This re-emergence was in turn fuelled by the emergence of a novel vector, the ectoparasitic Varroa mite, which is native to East Asian honeybees. Our work demonstrates the risks of man-made global movement of live animals and plants for disease emergence and highlights the need for conserving sustainable and diverse pollinator populations globally.
(Published in ***Science***)

Do mutually beneficial partnerships really exist in nature?

Dr. Regan Early

Invasive alien species (IAS) threaten human livelihoods and biodiversity globally. Increasing globalisation facilitates IAS arrival, and environmental changes, including climate change, facilitate IAS establishment. Here, we provide the first global, spatial analysis of the terrestrial threat from IAS in light of 21st century globalisation and environmental change and evaluate national capacities to prevent and manage species invasions. We find that one-sixth of the global land surface is highly vulnerable to invasion, including substantial areas in developing economies and biodiversity hotspots. The dominant invasion vectors differ between high-income countries (imports, particularly of plants and pets) and low-income countries (air travel). Uniting data on the causes of introduction and establishment can improve early-warning and eradication schemes. Most countries have limited capacity to act against invasions. In particular, we reveal a clear need for proactive invasion strategies in areas with high poverty levels, high biodiversity, and low historical levels of invasion.
(Published in ***Nature Communications***)

Insecticide resistance mediated by an exon skipping event

Alternative splicing, the process by which exons (gene coding regions) are included or excluded from a final messenger RNA, enables a single gene to code for multiple proteins. In insects, alternative splicing has important functional consequences including sex determination, immune recognition and neural development. Furthermore, most important insect receptors that are targets of synthetic insecticides exploit alternative splicing to produce a diversity of mRNA transcripts. In this study, we demonstrated that deregulation of alternative splicing in the global crop pest, *Tuta absoluta*, can lead to the evolution of resistance to the biopesticide spinosad. We showed that skipping of two mutually exclusive exons in the target-site of this insecticide confers resistance. Our results demonstrate that the intrinsic capacity of insect receptors to generate transcript diversity via alternative splicing can be readily exploited during the evolution of resistance and identified exon skipping as a novel molecular mechanism conferring insecticide resistance.
(Published in ***Molecular Ecology***)

The coping strategies of plants to continually changing environments

How organisms respond to ever-changing environments may be more variable than previously thought. To date, one 'coping' strategy has been suggested to dominate in nature. The demographic buffering hypothesis states that organisms should buffer their most influential vital rates (survival, growth and reproduction) against environmental variation. However, research led by **Dr Jenni McDonald** and **Prof Dave Hodgson** found that widespread evidence for demographic buffering can be artefactual, resulting from natural relationships between the mean and variance of vital rates. The team applied appropriate corrections to 141 wild plant populations and found a range of demographic strategies. Some plants buffered their most important vital rates. Whereas, for others it seems that it may be beneficial for their most important vital rates to have high variability. These patterns were also linked to their evolutionary history suggesting that clades of plants are prone to similar strategies. (Published in ***Nature Ecology and Evolution***)

Research Highlights

Lessons from the grapevine: identifying climate change impacts and adaptive strategies

Dr. Jonathan Mosedale

The cultivation of grapevines for winemaking is an indicator of historic and contemporary climate change, illustrated by the vineyards that flourished across England during medieval times. Today, UK vineyards are again seeing rapid growth and projected to benefit from climate change, as higher temperatures permit more reliable yields. Viticulture remains a risky business, exemplified by the destruction caused by this year's late frost, and climate change will affect seasonal patterns and extreme events. Working with vineyards, we have identified weather events and conditions affecting harvests, from growing season temperatures to the timing of frosts and conditions at flowering. We also identified grapevine phenology and exploitation of microclimatic niches as mediating the effects of climate. By applying models capturing the effects of topography and other factors, we developed high resolution maps describing climatic risks, illustrating the importance of site selection for the long-term success of the industry. (Published in ***Global Change Biology***)

Addressing uncertainty in marine resource management; combining community engagement and tracking technology to characterise human behaviour

Globally, small-scale fisheries make an important contribution to many local and national economies due to their essential role in food security, employment, and poverty alleviation. Unfortunately, the availability of detailed spatial information to support management decisions related to local livelihoods, conservation, and resource sustainability is often poor. A study by **Dr Kristian Metcalfe, Dr Matthew Witt, Dr Rachel Turner & Prof Brendan Godley** in collaboration with colleagues in the Republic of Congo demonstrated how a multidisciplinary approach that involved combining community engagement and Global Positioning System (GPS) devices at a national scale can rapidly provide fine-scale information on the behavioural dynamics of fishers, as well as the location, size and attributes of important fishing grounds upon which communities are dependent; thereby ensuring that future management decisions will better reflect stakeholder priorities and account for actual patterns of resource use (Published in ***Conservation Letters***).

CASE STUDY

Mass seasonal bioflows of high-flying insect migrants

Migrating animals have an impact on ecosystems directly via influxes of predators, prey, and competitors, and indirectly by vectoring nutrients, energy, and pathogens. These aerial flows of organisms, material and energy influence and couple local ecosystems into 'meta-ecosystems'. Such 'bioflows' can be difficult to assess for aerial migrants in particular, because of the long migration distances involved and their inaccessibility to visual observation. In this study, we combined aerial sampling and special-purpose radar to obtain, for the first time, a comprehensive and long-term overview of aerial insect migration above one ecological region (southern UK), by quantifying high-flying insect migration intensity, direction and biomass flux over a 10-year period. We show that ~3.5 trillion insects (3200 tons of biomass) migrate above the region annually. These flows are not randomly directed in the billions of larger insects (including beneficial hoverflies, ladybirds and lacewings), as they exploit seasonally beneficial tailwinds to travel northwards in the spring and southwards in the autumn. Large seasonal differences in the southward versus northward transfer of biomass occur in some years, although flows were balanced over the 10-year period. Our long-term study revealing a major transport process through this relatively small area of the Earth will form the basis for future studies of the contribution of insect migrants to meta-community functioning in the face of the impacts of global environmental change. (Published in ***Science***) **Gao Hu**, *Ka S. Lim, Nir Horvitz, Suzanne J. Clark, Don R. Reynolds, Nir Sapir,* **Jason W. Chapman**

Student Societies

EcoSoc

EcoSoc has had another fantastic year! We've been extremely busy running many events for our keen members to get involved with, working with external partners such as the National Trust, ERCCIS and local land owners, and helping conservation efforts of British wildlife. To introduce our members to different practical skills beneficial for a career in ecology, we have been running regular mammal trapping, moth trapping and bird ringing sessions where members can get hands on experience in surveying for local wildlife. Other events have included ID sessions, spider and bee walks and seal spotting trips. This year has brought the launch of new initiatives also, particularly our biological recording workshops in association with ERCCIS to encourage people to get outside and look for wildlife! Alongside this, we have launched a species of the month awareness campaign to bring to people's attention the plight of some of local and international species and show them what they can do about it. As well as conservation awareness, we are getting involved practically by running scrub clearance days with the National Trust, amphibian surveys and habitat management at Woodland Valley Farm to assist with the reintroduction of the first beavers back into Cornwall! One of our biggest events of this year was our first ever residential field trip to Lundy Island which was an amazing experience for committee and members alike who enjoyed exploring the island and finding many interesting species, some of which cannot be found anywhere else in the UK! Another major project of this year is the ongoing construction of the EcoSoc pond in the old allotments. This project is still in early stages but we hope to get as many members involved as possible in its design and building so it can be enjoyed by all on campus!

Our collaboration project with Wild Doc Soc 'Naturewatch' is continuing its success now in its second series with three new charismatic presenters. The reach of Naturewatch is growing rapidly and has had thousands of views and shared all over the world! Our other collaboration project 'BioBlitz' was also a great success even if the weather was atrocious! Students and public still turned out to come and find as many species on campus as possible in 24 hours and collected and grand total of over 200! We already have a lot more planned for the coming year so hope to continue our success!

BeeSoc

BeeSoc is a small society dedicated to raising awareness of bee conservation amongst students and the local community. We have hosted a walk around campus to educate members on how to identify some of the bee species found around Cornwall, as well as a visit to the research apiaries to give students a taste of beekeeping before the spring. Matt, our local beekeeper, ran a very popular beeswax candle making session as well as assisting us with collecting the first batch of honey from our hives on campus which sold out from the FXU office in only a couple of days. In 2017 we're running our beekeeping lectures and practical sessions, and have a talk lined up on rare bee species in Cornwall.

Wildlife Documentary Society

It's been a busy year for the Wild Doc Soc, kicking off the year in September with a Freshers BBQ on the beach bringing together both new and old members to share their enthusiasm about wildlife media. With Planet Earth II finally coming to our screens we used this opportunity to screen episodes, complete with snacks as always! It wasn't all fun and games however, we also used our film nights to raise big wildlife issues showing the likes of Racing Extinction, Before the Flood and Blood Lions. These screenings allowed us to highlight how wildlife film making can be used to illustrate current, and often unknown, concerns. We were also lucky enough to welcome Michaela Strachan to speak to our members about her successful television career. During this week we raised funds for the Borneo Orangutan Survival Foundation, with our 'bug night' social, chances of winning signed raffle prizes and even the opportunity to meet Michaela helping. For the first time ever we branched into tutorials giving photography workshops to allow our members to develop and hone their own skills, with the exciting opportunity to showcase their talents in March in the form of one of our collaborative projects, Wild Film Fest. With this and many more exciting projects lined up this term make sure to like our Facebook page, and check out our YouTube and Snapchat to keep up to date with all things Wild Doc Soc!

Bioscience Student Employability Committee

Following on from the Bioscience Employability Committee's (BSEC) excellent push last year, we have continued to provide networking and employability opportunities to students in an exciting and interactive way. With a great attendance from the student body, from all years and disciplines, we hope that the work BSEC carries out is invaluable to students and the faculty. We have been proud to host inspiring local guest speakers, for example Jaclyn Pearson from the Isles of Scilly Seabird Recovery Project, as well as national speakers like the Vincent Wildlife Trust from Herefordshire. In addition to our successful annual seminar series, we have had great success with providing training opportunities. In particular, the Marine Mammal Training Course organised on Penryn Campus and run by British Divers Marine Life Rescue attracted over 70 students! We are currently collaborating with the Geography Student Employability Committee (GSEC) to organise the annual Centre for Ecology and Conservation's careers fair, in which we hope to host over 50 stalls from external organisations and graduate programs. This event will provide fantastic opportunities and advice to current students spanning all years, including potential graduate employment.

We continue to improve gender equality and ensure CLES Cornwall is a safe, inclusive environment for everyone

This year has seen many changes in how we view gender equality, with the introduction of a new Equality Challenge Unit, Athena SWAN Charter and a University-wide move towards intersectionality and inclusivity.

CLES Cornwall will be reapplying for the Silver Award in November 2017, focusing beyond just academic staff to ensure that all who work within the department are represented and supported. 2017 will also see the launch of the new Cornwall Inclusivity Group, who will work in partnership with the Athena Swan Working Group to bring about positive impact for our staff and students – making the campus a more inclusive place to study and work.

In June 2016, we welcomed **Sophie Sinclair-Brown** as Penryn Campus' new Equality and Diversity Officer – a role that will involve her in our work with Athena SWAN and with the wider equality efforts on campus.

Alumni Business Wins Sustainability Award

CEC graduate Tim van Berkel (MSc Conservation and Biodiversity, 2009) set up The Cornish Seaweed Company in 2012 with fellow Exeter graduate Caroline Warwick-Evans. This year it was recognised for its commitment to sustainable production and conservation at the Cornwall Sustainability Awards with the award for 'Best Contribution Toward Creating a Sustainable Food Economy'. The Company provides sustainability harvested, edible seaweed from local sources to stores all around the UK. This is a fantastic achievement, highlighting Tim and Caroline's important work and reaffirms the importance of seaweed in sustainable food production.

www.facebook.com/CornishSeaweed **@CornishSeaweed**

Funding Awards

The Centre for Ecology and Conservation enjoyed an incredibly successful year for research funding, with academics securing awards totalling £9.5m. Successes came from a broad range of funders including the Biotechnology and Biological Sciences Research Council (BBSRC); the Defence Science and Technology Laboratory (DSTL); the Department for Food, Environment and Rural Affairs (DEFRA); the European Commission; the Leverhulme Trust; Natural England; the Natural Environment Research Council (NERC); the Royal Society; the Wellcome Trust and the Wildlife Conservation Society (WCS).

There were 48 awards in total, including a number of prestigious fellowships. Here are just a few highlights. Alex Hayward was awarded a **BBSRC** David Philips Fellowship (*Architects of Genomic Change: The Evolutionary Dynamics of Transposable Elements*); Ben Longdon won a **Wellcome** Sir Henry Dale Fellowship (*The Evolutionary and Mechanistic Basis of Virus Host Shifts*) and **Royal Society** University Research Fellowships went to Shakti Lamba (*Testing evolutionary theories of human cooperation in the real world*) and Karl Wotton (*The environmental and genetic basis of migration in the marmalade hoverfly*). **European Research Council** Grants were awarded to Gabriel Yvon Durocher (*Ecological and Evolutionary Constraints on the Temperature Dependence of the Carbon Cycle*), Edze Westra (*The evolutionary ecology of bacterial immune mechanisms) and Alastair Wilson (Evolutionary genetics of guppy sex chromosomes – led by Deborah Charlesworth at the University of Edinburgh*). Robbie McDonald and Dave Hodgson received funding from the **Animal and Plant Health Agency** to investigate transmission and control of bovine TB in badgers and Matthew Witt and Brendan Godley secured funds from **WCS** for work on *Transforming marine resource governance in the Republic of the Union of Myanmar*. **BBSRC** funds went to Edze Westra (*Identifying Factors that drive CRISPR-CAS dependant phage resistance in Bacteria*) and significant **NERC** awards were made to Jon Blount and Mike Cant (*Oxidative shielding and the cost of reproduction*), Angus Buckling and Richard Ffrench-Constant (*Reciprocal interaction between microbial evolution and community structure in soil*) and (*Diversity, Disturbance & Invasion: Experimental microcosms to illuminate ecological theory - joint NERC/US National Science Foundation award*) and Andrew Robertson (NERC KE fellowship - *Facilitating knowledge exchange to manage Bovine Tuberculosis at the regional level*). **Royal Society Global Challenges Research Funds** went to Angus Buckling (*Bacteria–virus coevolution during a human phage prophylaxis trial*) and **DEFRA Darwin** awards were made to Brendan Godley, Matthew Witt and Rachel Turner (*Transforming marine resource management in the Republic of Congo*) and Annette Broderick and Brendan Godley (*Improving Marine Biodiversity and Livelihood of coastal communities in Principe*).

Science with the Community

Schools Outreach

During 2016, CEC researchers, staff and student ambassadors were involved with numerous outreach events across Cornwall and beyond. We reached over 2000 students through partnerships with 28 schools and colleges in Cornwall. We were also delighted to have presence at large events such as the Cornwall Careers Show and the Royal Cornwall Show, where the University had a stand for the second year, talking about our research, and running hands-on science activities. For the second time we ran a Bioscience strand of the Exeter Progression Scheme, a programme designed for Year 12 students to develop their knowledge and passion for a subject. 40 students from Devon and Cornwall took part in seven practical lab and field sessions, all led by academics and students from the Centre, including a trip to Gyllyngvase beach. We have already met with our 42 students for 2017 at the Progression Conference in Exeter, where we ran an Evolution Game with them to get them in the mood!

Science in the Square

In August, our fifth annual Science in the Square event invited visitors to discover the answers to some strange scientific questions! The free family event, which is held as part of Falmouth Week, featured talks on What if there was no moon? What if dinosaurs still existed? And What if there were no bees? Visitors were also able to explore seven interactive zones, giving them the chance to learn more about nature by taking part in activities such as examining animal skulls, holding live snakes and studying creatures under the microscope. This event once again had its highest attendance yet. A huge thank you to all of our staff and students who helped to make this happen. Falmouth Town Council has our spot booked in Falmouth Week for the foreseeable future!

Science of Christmas

This was our third year of Science of Christmas and it was, once again, a festive success. Tickets were booked out in record time, and we even had the BBC in attendance! Two of our students, Naomi Appleby and Jenna Proctor, delivered a talk on 'Why are bees important to Christmas?'; Dr Shane Fudge talked about how to choose Christmas presents; Ben Makin (PhD student) talked about the importance of friendship at Christmas in the animal kingdom, and led the audience in a singalong; Dr Ben Raymond - 'Gift-giving in the biological world'; Dr Lena Bayer-Wilfert explained why Rudolph has a red nose (complete with glitter-sneeze demonstrations). Two of our most popular talks were by Dr Katy Sheen, who managed to prove Santa Claus' existence (and attract media attention in the process!) and Dr Kev Hughes, who described how we could power Santa's sleigh using reindeer poo! Thank you and well done to all involved.

Students As Change Agents

Students As Change Agents is a scheme that allows students to play an active part in improving their student experience. Penryn Campus was particularly engaged with the scheme, with successful projects including: a Discussion Seminar Club; Dyslexia Group and upgraded Natural Selection Podcast.

Wild Film Fest

In February 2016, we welcomed the second annual Wild Film Fest. This 3-day event was packed full of exhibits and screenings of the best films that people around the world had submitted to our Wild Film Fest competition, as well as a number of talks including BBC editor and producer Mark Fletcher. We had a fantastic turnout, with members of the public, CEC staff and students attending the event to enjoy the wonderful wildlife and nature documentaries on show.

More information about our outreach activities can be found at: http://lifesciences.exeter.ac.uk/outreach/cornwall/

Awards and Prizes

Prize Winners

See also Selected Highlights for accolades to **Prof Nina Wedell, Prof Edze Westa** and **Laura Kelley**

Exeter Students Guild Teaching Awards
This awards ceremony formally recognises outstanding teaching and support at the University.

Best Research Community- *Biosciences (Penryn)*

Best Supervisor (taught) runner up- *Dr Chris Lowe*

Best Employability support runner up- *Celine Gamble*

Innovative Teaching runner up- *Dr Andy Pye*

FXU Awards

Our students were very successful at the 2016 Falmouth and Exeter Students' Union awards as follows:

Student Led Project or Campaign of the Year - *NatureWatch*

Innovative Project of the Year - *NatureWatch*

Outstanding Contribution to the Student Experience - *Sam Green & Daisy Gates (BSEC)*

Most Significant Contribution to the Community through Volunteering - *Rebekah Trehern*

Outstanding Society Committee Member - *Hermione Bloomfield-Smith*

Graduation Awards

Congratulations to the following CEC students who were awarded PhDs in 2016:

Rochishnu Dutta – Divergence and reproductive isolation in the Bushcricket *Mecopoda elongata*

Charlie Ellis – Reproductive and molecular ecology of the European lobster: implications for Conservation Management

Julian Evans – Group-foraging and information transfer in European shags *Phalacrocorax aristotelis*

David Fisher – Social networks and individual behaviour variation in wild crickets

Nicole Goodey – Ecological patterns in plant defence chemistry and herbivore responses in natural populations of *Brassica oleracea*

Martin Grunnill – Inapparent and vertically transmitted infections in two host-virus systems

Sarah Lane – The role of cuticular hydrocarbons in determining male reproductive success

Sean Meaden – The tri-trophic interaction of plants, pathogenic bacteria and bacteriophages

Stephen Pikesley – Multiple approaches and novel techniques to study the spatial ecology of marine vertebrates

Kimberley Stokes – Ecology of marine turtles under climate change

Lindsey Walker – The evolution and regulation of cooperation in the wild

Sheridan Willis – Sexual conflict and sexual selection in the Indian meal moth *Plodia interpunctella*

Graduation Awards

Prizes were awarded to the following students:

Undergraduate

Dean's Commendations**:**
Susan Hills
Hannah Jenkin

Centre for Ecology and Conservation Commendations:
Peter Coles
Peter Cooper
Elsa Domoney
Emma Dwan
Daisy Gates
Samuel Green
Lilian Hurst
Eleanor Jackson
Molly Meadows
Eleanor Opsal
Joshua Parry
Elisabeth Quirin
Jessica Rudd
Meike Simms
Alexandra Szczurek
Rebekah Trehern
Gara Trujillo-Ferreres
Ethan Wriggleswort

Oxford University Press:
Hannah O'Sullivan

ZSL Charles Darwin Award:
Emma Holden

Postgraduate

Prizes/Dean's commendations
Dean's Commendations for exceptional performance (70% + Distinction in all MSc modules):
MSc Conservation and Biodiversity 2015/16:
Hazel Akester
Rebecca Austin
David Bartholomew
Gabriella Church
Zoe Deakin
Amber Nichols

MSc Evolutionary and Behavioural Ecology 2015/16:
Jake Burton

Centre for Ecology and Conservation Commendations:
MSc Applied Ecology 2015/16:
Harrison Coles - *Best Overall Mark*
Harrison Coles - *Best Research Project Module Mark*
Lisbeth Morrison - *Best Research Project Report Mark*

MSc Conservation and Biodiversity 2015/16:
Gabriella Church - *Best Overall Mark*
Rebecca Austin / Rebekah Butler - *Best Research Project Module Mark*
Alice Brown - *Best Research Project Report Mark*

MSc Evolutionary and Behavioural Ecology 2015/16:
Jake Burton - *Best Overall Mark*
Arianna Dalzero - *Best Research Project Module Mark*
Doreen Cabrera - *Best Research Project Report Mark*

School's Commendation for Triumph in Adversity:
Rachel Nichols

Selected Highlights

Heineken Young Scientists Award

Dr Edze Westra received the 2016 Heineken Young Scientists Award for Biochemistry and Biophysics for his cross-disciplinary study of CRISPR-Cas, a natural adaptive immune system in bacteria. His research combines structural, biochemical, biophysical, evolutionary and ecological aspects, all of which are usually pursued within separate subdisciplines. He has published or co-published many highly cited articles in prestigious journals such as Science and Nature. In addition to an EU Marie Curie fellowship, he received major stipends from the UK's Natural Environment Research Council, the Biotechnology and Biological Sciences Research Council, the Wellcome Trust, and the European Research Council. His enthusiasm is infectious and inspired the majority of his students to pursue a career in science. He is also a passionate ambassador for science with the general public.

Professor Nina Wedell

Prof Nina Wedell gave the 2016 Savigear lecture at the University of Sheffield on her work on selfish genetic elements and sexual selection. The Annual Savigear Lectures were set up by the Department of Animal and Plant Sciences Athena SWAN committee with the aim to increase the visibility of women biologists and inspire the next generation of researchers, and so invite prominent female researchers to speak. The lecture is named after Margaret Savigear who received her BSc in 1939 and was awarded an MSc from the APS in 1949 when it was rare for women to be encouraged to pursue postgraduate education. Her pursuit of a postgraduate degree was unusual at the time and supported by the then head of department, Leonard ES Eastham.

Laura Kelley

In December 2016 **Dr Laura Kelly** was honoured to receive the Christopher Barnard Award for Outstanding Contributions by a New Investigator from the Association for the Study of Animal Behaviour (ASAB). She received a contribution to her research funds and the privilege of giving a plenary talk at the society's Easter conference, which was targeted towards postgraduate students. Her talk about her research marked the ten-year anniversary of her attending her first ASAB conference as a new PhD student. Laura was also interviewed for a podcast about women in science by two Penryn postgraduates whose conference attendance was funded by a grant from the CLES Women in STEMM network.

World's largest behavioural ecology conference comes to Exeter

This year we also hosted the World's largest behavioural ecology congress at Exeter organised by **Dr Sasha Dall** and CEC colleagues and presided over by **Prof Nina Wedell**. It was a tremendous success with more than 1100 participants from across the globe. The University of Exeter hosted global research leaders in the field of behavioural ecology through the International Society for Behavioural Ecology (ISBE) for the conference between July 28 and August 3. The biennial conference, was opened by Prof Richard Dawkins, and brought together academics in the fields of animal behaviour, ecology and evolution. It featured talks by world-renowned scientists with plenary speakers including: Naomi Pierce; Rosemary Grant; Malte Andersson, Madeleine Beekman, Tim Clutton-Brock, Hopi Hoekstra, Trevor Price. It was the first time in more than 20 years that the ISBE congress was held in the UK, and Exeter was the perfect place to host it, having the largest concentration of behavioural ecologists in Europe, possibly even the world.

Congratulations!

This past year saw a number of key promotions: **Dr Ilya Maclean** became Senior Lecturer, **Dr Andy Young** was made Associate Professor, and **Dr Alistair Wilson** was promoted to Professor.

Selected CEC Publications from 2016

Bass C, Jones CM (2016) Mosquitoes boost body armour to resist insecticide attack. ***Proceedings of the National Academy of Sciences*** doi: 10.1073/pnas.1610992113

Beirne C, Waring L, **McDonald RA**, Delahay R, **Young AJ** (2016) Age-related declines in immune response in a wild mammal are unrelated to immune cell telomere length. ***Proceedings of the Royal Society B*** doi: 10.1098/rspb.2015.2949

Benton CH, Delahay RJ, **Robertson A**, **McDonald RA**, **Wilson AJ**, Burke TA, **Hodgson D** (2016) Blood thicker than water: kinship, disease prevalence and group size drive divergent patterns of infection risk in a social mammal. ***Proceedings of the Royal Society B*** doi: 10.1098/rspb.2016.0798.

Berger M, Puinean AM, **Randall E, Zimmer CT**, Silva, WM, Bielza P, Field LM, Hughes D, Mellor I, Hassani-Pak K, Siqueira, HAA, Williamson MS, **Bass C** (2016) Insecticide resistance mediated by an exon skipping event. ***Molecular Ecology*** doi: 10.1111/mec.13882

Bicknell AWJ, **Godley BJ**, Sheehan E. V., **Votier SC**, **& Witt, MJ** (2016) Camera technology in monitoring marine biodiversity and human impact. ***Frontiers in Ecology and the Environment*** doi:10.1002/fee.1322

Bush ER, Short RE, Milner-Gulland EJ, Lennox K, Samoilys M, **Hill N** (2016) Mosquito net use in an Artisanal East African fishery, ***Conservation Letters*** doi: 10.1111/conl.12286

Campbell AL, Levitan DR, **Hosken DJ**, Lewis C (2016) Ocean acidification changes the male fitness landscape. ***Scientific Reports*** doi: 10.1038/srep31250

Chabas H, van Houte S, Høyland-Kroghsbo NM, **Buckling A**, **Westra ER** (2016) Immigration of susceptible hosts triggers the evolution of alternative parasite defence strategies. ***Proceedings of the Royal Society B*** doi: 10.1098/rspb.2016.0721

Cox DTC, **Inger R**, Hancock S, **Anderson K**, **Gaston**, **KJ** (2016) Movement of feeder-using songbirds: the influence of urban feature. ***Scientific Reports*** doi: 10.1038/srep37669

De Gasperin O, **Duarte A**, **Troscianko J**, Kilner RM (2016) Fitness costs associated with building and maintaining the burying beetle's carrion nest. ***Scientific Reports*** doi: 10.1038/srep35293

Early R, Bradley BA, Dukes JS, Lawler JJ, Olden JD, Blumenthal DM, Gonzalez P, Grosholz ED, Ibañez I, Miller LP, Sorte CJB, Tatem AJ (2016) Global threats from invasive alien species in the twenty-first century and national response capacities. ***Nature Communications*** doi:10.1038/ncomms12485

Ellis E, Richerson PJ, **Mesoudi A**, Svenning J-C, Odling-Smee J, Burnside WR (2016) Evolving the human niche. ***Proceedings of the National Academy of Sciences*** doi: 10.1073/pnas.1609425113

Ffrench-Constant R, **Somers-Yeates R**, **Bennie J**, **Hodgson D**, McGregor P, Spalding S (2016) Artificial lighting advances tree bud burst across the UK. P***roceedings of the Royal Society B*** doi: 10.1098/rspb.2016.0813

Gianuca D, Phillips RA, **Townley S**, **Votier SC** (2016) Global patterns of sex- and age-specific variation in seabird bycatch. ***Biological Conservation*** doi: 10.1016/j.biocon.2016.11.028

Gomez P, Paterson S, De Meester L, Liu X, Lenzi L, **Sharma MD**, McElroy K, **Buckling A** (2016) Local adaptation of a bacterium is as important as its presence in structuring a natural microbial community. ***Nature Communications*** doi: 10.1038/ncomms12453

Greggor AL, **McIvor GE**, Clayton NS, **Thornton A** (2016) Contagious risk taking: social information and context influence wild jackdaws' responses to novelty and risk. ***Scientific Reports*** doi: 10.1038/srep27764

Hawkes M, **Gamble C**, **Turner E**, **Carey M**, **Wedell N**, **Hosken DJ** (2016) Intralocus sexual conflict and insecticide resistance. ***Proceedings of the Royal Society B*** doi: 10.1098/rspb.2016.1429

Hinsley A, **Nuno A**, Ridout M, St John F, Roberts D (2016) Estimating the extent of CITES non-compliance amongst traders and end-consumers; lessons from the global orchid trade. ***Conservation Letters*** doi: 10.1111/conl.12316

Hopwood PE, Head ML, **Jordan EJ**, Carter MJ, **Davey E**, Moore AJ, **Royle NJ** (2016) Selection on an antagonistic behavioral trait can drive rapid genital coevolution in the burying beetle, *Nicrophorus vespilloides*. ***Evolution*** doi: 10.1111/evo.12938

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Ioannou CC, **Dall SRX** (2016) Individuals that are consistent in risk-taking benefit during collective foraging. ***Scientific Reports*** doi: 10.1038/srep33991

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Lintott PR, **Richardson SM**, **Hosken DJ**, Fensome SA, Mathews F (2016) Ecological impact assessments fail to reduce risk of bat casualties at wind farms. ***Current Biology*** doi: 10.1016/j.cub.2016.10.003

Lynch PA, **Boots M** (2016) Using evolution to generate sustainable malaria control with spatial repellents. ***eLife*** doi: 10.7554/eLife.15416

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