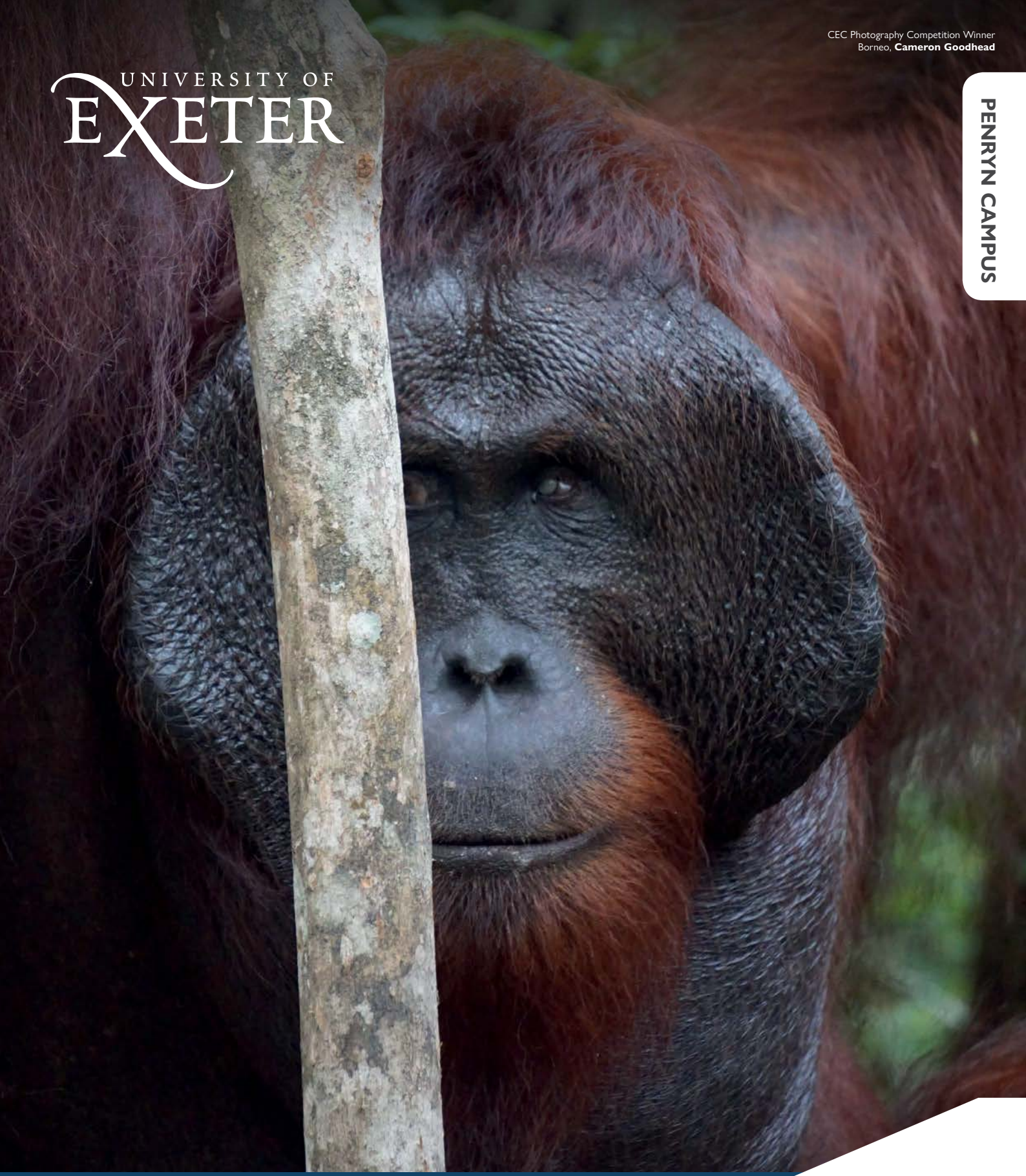


CEC Photography Competition Winner
Borneo, **Cameron Goodhead**

UNIVERSITY OF EXETER

PENRYN CAMPUS

Centre for Ecology and Conservation

Annual Report 2018

Welcome

Still growing in size and reputation

And so another year comes to an end, and I find a few seconds to reflect on what has been a very intense, and very successful, year for the Centre for Ecology and Conservation. This marks the first twelve months of my Directorship of the Centre. I took on this role because I'm incredibly proud of the great research and education delivered by the CEC, and because I want all staff and students in our Centre to understand their own value. My priorities are collaboration, dynamism and happiness… and I'm confident that these features will yield even better research and education in the future.

The Centre for Ecology and Conservation is now home to 78 permanent academic staff, 105 early career researchers funded by research grants, over 150 postgraduate research students, 147 MSc and MSci students, and 629 undergraduate students. It's amazing to think about the massive growth that we have enjoyed over nearly 15 years. This growth is surely a sign of excellence.

Excellence feeds success, and we've enjoyed plenty of success in 2018. Our researchers exceeded all targets for research grant applications, funding success, peer-reviewed publications and research impact. Several of these research highlights are described in this annual report…my only regret is that we don't have space here to describe more of them. We've made discoveries and shared knowledge about social learning in birds, threats to marine ecosystems, colour vision in racehorses, disease dynamics in wild animals, responses of natural systems to global environmental change… the list goes on. A great capstone to the year was for a team of Marine Conservation Biologists, including our own Professor Brendan Godley, to win the overall prize for Scientific Impact of Research funded by the Natural Environment Research Council, for their work on plastics in our oceans.

2018 has also been a great year for education successes. We recruit a very high proportion of the UK's best A-level students (rivalling Bristol and Oxford for national market share in Biosciences). Our numbers of international students are increasing, particularly on our Masters programmes. The University of Exeter maintains gold standards in the Teaching Excellence Framework, indeed we have now achieved GOLD at the subject level for Biosciences. In the National Student Survey, our students rate us very highly for the enthusiasm and quality of our education.

In 2018, Dr Andy Pye, one of our specialist Education and Scholarship lecturers, was awarded a National Teaching Fellowship from the Higher Education Academy. This is a huge accolade and we are very proud of Andy.

The Centre for Ecology and Conservation is more than just research and education. It is also about people. In 2018 we retained our SILVER Athena SWAN award, which acknowledges our efforts to improve opportunities for women in science. Inclusivity is high on our agenda, and we have rolled out several initiatives to ensure that ALL members of the Centre have a voice, share similar opportunities for development and career progression, and share opportunities to maintain a healthy balance between work and life. The Centre is also about resources, and we are just about to colonise a new building, named "Stella Turk" after a renowned Cornish conservation scientist. This move involves 230 members of the centre, and is the culmination of several months of planning and consultation. I sincerely hope that the move brings members of the Centre closer together, not just physically but also collaboratively.

We continue to deliver outreach events for the people of Cornwall. Our annual events, including Science in the Square, the Science of Christmas and the Christmas Conservation Lecture, continue to engage and amaze the children of Falmouth and beyond. This year, a media circus erupted around our Science of Christmas talks, with attention from newspapers, radio and television for our presentations on the native ranges of species we find on our Christmas dinner plates, and on how Rudolph's red nose couldn't be seen by his colour-blind sleigh-mates.

And on that Christmassy theme, I will sign off and let you read about our research and education case studies. I'm proud to have been Director of the CEC in 2018. I'm looking forward to further adventures in 2019.

Professor Dave Hodgson
Director, Centre for Ecology and Conservation
Head of Department, CLES Cornwall

Research Highlights

Study reveals why older women are less healthy than older men

Scientists have long wondered why older women are less healthy than older men, given that men at any given age are more likely to die than women (a puzzle known as the "male-female, health-survival paradox"). A potential answer can be found in "intralocus sexual conflict" – where the genes that benefit one sex harm the other. The study used mathematical models and experimental data on flies to show that such genes can easily spread if they take effect after female reproduction stops. After females reach menopause, they no longer reproduce which means selection on females is greatly weakened. So, after that point, any genes that improve late-life male fitness will accumulate, even if they harm female fitness. The experimental data on flies (Drosophila) supported the findings of the mathematical models, as genes that were better at late-life male reproduction tended to be worse for females. Published by Dr Ruth Archer, Dr Mario Recker, Eoin Duffy and Professor David Hosken in *Nature Communications*.

Angry birds: Size of jackdaw mobs depends on who calls warning

Credit: Victoria Lee

New research from the **Cornish Jackdaw Project** – a long term study of behaviour of Jackdaws in Cornwall – has found that Jackdaws recognise each other's voices and respond in greater numbers to warnings from familiar birds than strangers. The birds produce a harsh "scolding call" when they spot a predator, calling fellow jackdaws to mob the intruder and drive it away. Research has discovered that each bird has a unique call, and the size of the mob depends on which bird calls the warning. The study involved playing recordings of individual calls and found that the largest mobs assembled when birds heard the cry of a member of their own colony. They also found a positive feedback loop – if birds joining a mob made alarm calls of their own, this in turn caused more birds to join in, magnifying the size of the mob. "Joining a mobbing event can be dangerous, as it involves approaching a predator, so it makes sense for individuals to be selective in whom they join," said **Dr Alex Thornton**. These results show that jackdaws use the ability to discriminate between each other's voices when deciding whether to join in potentially risky collective activities. Published by Dr Richard Woods, Dr Michael Kings, Dr Guillam McIvor and Dr Alex Thornton in *Scientific Reports*. For more information about the Cornish Jackdaw Project visit www.wildcognitionresearch.com or follow them on twitter @CornishJackdaws

Micro plastics found in all sea turtle species

Tests on more than 100 sea turtles – spanning three oceans and all seven species – have revealed micro plastics in the guts of every single turtle studied. These tests took place within study sites in North Carolina, USA (Atlantic), Northern Cyprus (Mediterranean) and Queensland, Australia (Pacific). Necropsies were carried out on the turtles from these study sites after they died either by stranding or bycatch (accidental catching in fishing). Synthetic particles were found in all of the turtles, the most common being fibres, which can potentially come from sources including clothing, tyres, cigarette filters and maritime equipment such as ropes and fishing nets. In total, more than 800 synthetic particles were found in the 102 turtles studied – but researchers only tested part of each animal's gut – so the total number of particles is estimated to be about 20 times higher. The turtles with the most synthetic particles were in the Mediterranean – thought to have higher rates of contamination than the Atlantic or Pacific – but this study's sample sizes and methodology did not allow for detailed geographical comparisons. Researchers do not currently understand how synthetic particles are ingested by turtles, but the likely sources are polluted seawater and sediments, and ingestion. Published by Dr Emily Duncan, Professor Annette Broderick, Dr Wayne Fuller, Lucy Omeyer, Dr Robin Snape and Professor Brendan Godley in *Global Change Biology*.

Burly bird gets the worm

Can the pecking order of garden birds be determined by their size and weight? In a study at bird feeders, researchers from the University of Exeter and the British Trust for Ornithology (BTO) found larger species like house sparrows and greenfinches monopolised the best food and spent longer feeding than smaller birds. Meanwhile, smaller birds such as blue tits and coal tits had to feed quickly and were left with lower-quality food. The researchers say the findings have "important implications" for using bird feeders as a conservation method. The researchers watched birds at feeders placed at woodland edges and hedgerows on the Penryn Campus. Dominance ranks for each species were measured by recording any interaction between two individuals that resulted in one retreating from the food source. In these cases, the bird that stayed was classified as the "winner" (the more dominant). Though the results do not show the ten species in exact order of weight, there is a strong correlation between weight and dominance. The two heaviest birds (based on average weight) were rated most dominant – house sparrow (27.3g) and greenfinch (27.7g) – while the two lightest – blue tit (10.9g) and coal tit (9.1g) – were bottom of the list. Published by Megan Francis, Dr Kate Plummer, Bethany Lythgoe, Catriona Macallan, Dr Thomas Currie and Professor Jonathan Blount in the journal PLOS ONE.

Study confirms truth behind 'Darwin's moth'

Scientists have revisited – and confirmed – one of the most famous textbook examples of evolution in action. Olivia Walton and Professor Martin Stevens have shown that, to the vision of birds, pale peppered moths (Biston betularia), are indeed more camouflaged against lichen-covered trees than dark moths – making pale moths less likely to be eaten by birds in unpolluted woodland and giving them an evolutionary advantage. Remarkably this is the first study that has tested how well camouflaged the moths were to the vision of their key predators – birds – and how their camouflage directly influenced survival in natural environments. Using digital image analysis to simulate bird vision and field experiments in British woodland, they compared how easily birds can see pale and darker moths, and ultimately determine their predation risk. "Through a bird's eyes, the pale peppered moths more closely match lichen-covered bark, whereas darker individuals more closely match plain bark," said first author Olivia Walton. "Crucially, this translates into a strong survival advantage; the lighter moths are much less likely to be seen by wild birds when on lichen-covered backgrounds, in comparison to dark moths." The research was funded by the Biotechnology and Biological Sciences Research Council (BBSRC). Published by Olivia Walton and Professor Martin Stevens in *Communications Biology*.

Bird bacteria study reveals evolutionary arms race

Credit: Geoff Hill, Auburn University

A study of a songbird and a bacterium that infects it has revealed how species in conflict evolve in response to each other. Research indicates North American house finches developed greater resistance to a bacterial pathogen *(Mycoplasma gallisepticum)* thereby pushing the pathogen to become more virulent. This process – known as "host-pathogen coevolution" – is believed to play a key role in evolution, but until now evidence for it has been scarce. In this study Dr Camille Bonneaud, Dr Mathieu Giraudeau and Luc Tardy show how a pathogen can shape evolution in a vertebrate and how this has consequences for the pathogen. The research, supported by universities in Alabama (Auburn University) and Arizona (Arizona State University), was made possible by differences in finch populations in these two US states. House finches in Arizona have not been exposed to *Mycoplasma gallisepticum*, while those in Alabama have been exposed to it for over 20 years. Researchers found that exposure to the pathogen led to eye swelling in birds from both states, but that resistant Alabama birds were three times less likely to show symptoms that would lead to death in the wild. Similarly, the pathogen evolved to become better able to infect and transmit as the birds became more resistant. These findings have wider implications on our knowledge of diseases that affect humans and can contribute to further understanding of how pathogens evolve in response to treatment. Published by Dr Camille Bonneaud, Dr Mathieu Giraudeau and Luc Tardy in *Current Biology*.

Climate-threatened animals unable to relocate

Many of the European mammals whose habitat is being destroyed by climate change are not able to find new places to live elsewhere. 30 of the 62 mammal species' in a University of Exeter study will have their habitat substantially affected by climate change, but don't have the traits that could allow them to colonise a new habitat somewhere else in Europe. These included at-risk species such as the wolverine (classified as "vulnerable" in Europe). The researchers studied two sets of characteristics to see how well each species could relocate to the places where climate will be suitable in the future. One important characteristic was whether the animals are "generalists" that can live in many kinds of habitats and eat a wide variety of foods. The other important characteristic was the animal's reproductive strategy – species that breed young and have many offspring have a better chance of establishing themselves in a new area. However, the complexities of climate change mean that some species – even those that could move relatively long distances – will struggle to move because possible new habitats are just too far from current ones. Published by Lisbeth Morrison, Dr Regan Early and Professor Martin Stevens in *Diversity and Distributions*.

Thousands of turtles netted off South America

A recent study has shown tens of thousands of sea turtles are caught each year by small-scale fishers off South America's Pacific coast. Surveys at 43 harbours in Ecuador, Peru and Chile reveal that gillnet fisheries catch more than 46,000 sea turtles per year, with more than 16,000 killed in the process. And the true numbers are likely to be higher, as not all ports in each country were surveyed. Bycatch – the accidental capture of non-targeted species- is a major threat to marine life including sea turtles. Turtles living in the study area include leatherbacks (critically endangered in the east Pacific) and hawksbills (critically endangered worldwide). Further goals from this research includes actively working with fishers in this region to develop and implement solutions for bycatch which are sustainable for these small-scale fishing communities. The study, supported by the UK government's Darwin Initiative, was designed to fill data gaps and identify priority areas for future conservation work. Published by Dr Joanna Alfaro-Shigueto, Dr Jeffrey Mangel, Dr Phil Doherty and Professor Brendan Godley in *Fisheries Research*

Research Highlights

Asian hornet nests found by radio-tracking

Credit: Dr Peter Kennedy

Electronic radio tags could be used to track invasive Asian hornets and stop them colonising the UK and killing honeybees, new research shows. Asian hornets are the latest threat to Britain's honeybees, which – like many pollinators – are suffering due to factors including habitat loss, parasites and pesticides. Adult Asian hornets "hawk" at beehives, meaning that they hover outside to grab bees, before dismembering them and taking them back to their nest to feed to larvae. Dr Peter Kennedy and Scott Ford from University of Exeter's Penryn Campus, among co-authors from France, attached tiny tags to Asian hornets, then used a tracking device to follow them to their nests; the first time this has been achieved. They tested the technique in southern France and Jersey – where Asian hornets are well established – and the tags led researchers to five previously undiscovered nests. "It is vital to find the nests early in the season to prevent the hornet spreading, as later in the year hundreds of new queens emerge and disperse from each nest, each with the potential to make new nests," said Professor Juliet Osborne, a co-author on the study. The work was funded as part of DEFRA's efforts to prepare for future outbreaks of the Asian hornet in the UK. Published by Dr Peter Kennedy, Scott Ford and Professor Juliet Osborne in *Communications Biology*.

Night-time lighting changes how species interact

Credit: Dr Dirk Sanders

Recent NERC funded research has shown that night-time lighting from streetlights and other sources has complex and unexpected effects on communities of plants and animals. Previous studies have shown that artificial lighting affects a wide variety of individual species, including many moths and bats. But little has been known about how the feeding links between different species – known as food webs – are changed by artificial light. By studying communities of plants, aphids and parasitoid wasps in the UK, University of Exeter scientists found that the effects of night-time lighting changed depending on the brightness of the light. At low levels of lighting, equivalent to sky-glow from a nearby town or light further away from street lights, the parasitoid wasps had a hunting advantage that meant they killed twice as many aphids. But with brighter lighting, these wasps became distracted and flew away from the aphids. With much of the world – including 88% of Europe – now subject to some level of artificial night-time lighting, the researchers say it could be having a "widespread impact" on the way many different species interact. Published by Dr Dirk Sanders, Rachel Kehoe, Dave Cruse, Dr Frank Van Veen, and Professor Kevin Gaston in *Current Biology*.

Large-group living boosts magpie intelligence

Can growing up in a large social group makes Australian magpies more intelligent? Using four tasks, that ranged from memory testing to self-control, Dr Alex Thornton and scientists from University of Western Australia tested intelligence in 14 wild groups of Australian magpies. They found wild Australian magpies from larger groups showed elevated cognitive performance and found these more intelligent females produced more offspring. Thus, showing that individuals living in larger groups could be linked to increased reproductive success. Furthermore, the process of repeated testing of juveniles at different ages showed that the link between group size and intelligence emerged in early life. This exciting research suggests that the demands of living in complex social groups may play a role in the evolution of intelligence. Published by Professor Alex Thornton in *Nature*.

Mongooses inherit behaviour from role models rather than parents

Credit: Dr Harry Marshall

Young mongooses learn lifelong habits from role models rather than inheriting them from genetic parents, new research shows. Banded mongooses live in social groups where pups are consistently cared for one-to-one by a single adult known as an "escort" – not their mother or father. Therefore, they develop niche diets and, by studying these, research has showed pups inherit the behaviour of their escort, rather than parents. The findings offer a fascinating insight into one of the great puzzles of evolution – how diversity persists rather than disappearing with passing generations. The findings help explain how diverse behaviour persists in nature. There are arguments that variation should disappear where multiple individuals learn from one. But the new research on mongooses shows that where individuals learn from their own personal teacher, cultural inheritance can work to maintain diversity. Published by Catherine Sheppard, Dr Harry Marshall, Dr Richard Inger, Professor Robbie McDonald and Professor Michael Cant in *Current Biology*.

Stunning footage shows how drones can boost turtle conservation

Drones are changing the face of turtle research and conservation; a new study shows. By providing new ways to track turtles over large areas and in hard-to-reach locations, the drones have quickly become a key resource for scientists. The research, led by the University of Exeter, also says stunning drone footage can boost public interest and involvement in turtle conservation. Satellite systems and aircraft originally transformed turtle conservation, but drones offer cheaper and often better ways to gather information. Not only does drone footage offer further insights into turtle behaviour and movements at sea, it also gives new avenues for anti-poaching efforts. However, the paper warns that, despite the benefits, drones cannot fully replace ground work and surveys. And it says more research is required to understand if and how turtles perceive drones during flight, and whether this has an impact on them. Published by Dr Alan Rees, Professor Annette Broderick, Dr Jeffery Mangel, Dominic Tilley, Miguel Varela and Professor Brendan Godley in *Endangered Species Research*.

CASE STUDY

Research into equine vision leads to a rethink on fence and hurdle design

The colours deployed on hurdles and fences on British racecourses may be set to change following cutting-edge research led by Dr Sarah Paul and Professor Martin Stevens at the University of Exeter into the way that horses perceive colour. In 2017 the British Horseracing Authority (BHA) and Racing Foundation commissioned – and provided funding support for – research into equine vision. The opportunity for this project was identified by preliminary work on horse vision and horse sports by the Exeter team, in collaboration with the BHA.

The aim of the study was to improve obstacle visibility for horses, therefore reducing the risk of falls and injuries for both horses and their jockeys. Presently, the colour used on hurdle frames and fence take-off boards and guard-rails is orange, based on human vision. However, horses have reduced colour vision compared to humans, and only differentiate objects in a palette of blues and yellows. The new research shows that other colours could be more effective in offering visibility to horses.

The research phase of the project included testing the visibility of orange markers and other potential colours at 11 racecourses, and then testing the behavioural responses of horses to more prominent colours in a training environment. As a result of the research, a recommendation has been approved by the sport's Racecourse Committee that a phased trial should be carried out using fluorescent yellow for all hurdles, and guard-rails and take-off boards on fences. These colours have been predicted to maximise visibility under a wide range of conditions for both humans and horses.

It has now been agreed that the next phase of the project should see a more extensive trial take place at training grounds in order to build up a significant dataset before rolling the trial out to a live racing environment.

The faller rate in British racing has reduced by 29% since 2004 as a result of ongoing investment in racecourse safety, and constant enhancements in racehorse care and training standards. Consequently, the results of this research and the ongoing trials will now be shared with other racing jurisdictions and equine organisations. The Exeter researchers are currently finishing a related project commissioned by British Eventing on the visibility of fences in cross country equine events

Professor Martin Stevens, Chair in Sensory and Evolutionary Ecology for the University of Exeter, said: "Understanding how animals see the world, and using cutting-edge tools to investigate this, has a valuable role to play in guiding the safety and welfare of animals and humans in a variety of contexts. This project demonstrates how modern science can look to have widespread positive implications in human society and our interactions with animals."

A paper based on these findings has been submitted for publication and will be released in 2019.


What a human sees


What a horse sees


What a human sees


What a horse sees

Student Societies

EcoSoc

EcoSoc has had a fantastic year! We've been trying harder than ever to achieve an NUS award, having been nominated for many years in a row. To achieve this, as well as carrying out our regular events (such as mammal trapping, moth trapping and bird walks, to name but a few), we've also been trying out new events! These include a natural history specimen workshop, a residential trip to Snowdonia, and collaborations with organisations such as the Prickle Project and the Elysium Project! We've also been fundraising for wildlife conservation charities, and have raised £115 for the Bat Conservation Trust.

EcoSoc

MarineWatch

This was MarineWatch's first term as a society, and it's been an incredibly successful one for us. This term we have trained many of our members to become MARINElife certified marine mammal and seabird surveyors. From this we then ran multiple wildlife cruises into Falmouth Bay, and managed to see hundreds of dolphins which we then recorded and submitted this data to a national database. We have completed a plastic trawl in collaboration with a Beach Clean and used the results in large scale analyses. Furthermore, we hosted a guest lecture from Exeter alumna Lizzie Daly and began creating and selling our own merchandise. We also ran our first charity raffle, raising £274 – which meant we raised up to a phenomenal £1447.32 for our adopted charity MARINElife this term!


Marine Watch on an ID training course with MARINElife

Wildlife Documentary Society

WildDocSoc have had a really busy first term, starting off with our Fresher's BBQ and Planet Earth 2 film night, which had over 120 participants. Our film nights have continued to be successful throughout the term, with screenings including Virunga, Mission Galapagos and a live screening of Dynasties. We participated in the campus's sustainability week, hosting a successful screening of 'Drowning in Plastic', where we, as a society, committed to providing our members with only plastic-free snacks for the remainder of the year. Amongst this we've run bi-weekly film workshops, assisted in the film-making of a project at Looe Pool and ran charity bake sales and film nights for charities such as the 'Cameron Bespolka Trust' and a mangrove restoration project in the Galapagos Islands. In the past few weeks, we also held our first guest speaker event of the year, where Nick Baker participated in meet & greets with students before giving a talk on 'Being a Naturalist'. Next term we hope to continue with such events.


Wild Doc Soc Committee

Wild Film Fest

Athena SWAN Penryn Campus

In 2018, Inclusivity has been prioritised as one of the three main strategic pillars of our department (alongside Research and Education).

Our work encompasses equality and wellbeing for all of our staff and students. We strive to ensure that everyone is treated without prejudice, and we lobby for improvements to working conditions and benefits for all. We were proud to renew our Athena Swan silver award in 2018. This is not an accolade… it is an affirmation that our efforts help people of all kinds and from all backgrounds feel equally respected in our department, and enjoy equality of opportunity. The award does not make us complacent, though: unconscious bias is difficult to stamp out. The prioritisation of Inclusivity activities means that all staff and students in the Centre for Ecology and Conservation have a voice and are agents of change. Staff workshops, improved social activities, better employment benefits for parents, improved gender equality of recruitment and career-progression procedures…these are all successes in the CEC. In 2019 we will prioritise staff wellbeing and the intersection of equality with gender, race, religion and socioeconomic background. We have become more inclusive, but we would like to be MOST inclusive.

Funding Awards 2018

2018 was an incredibly successful year for CEC research funding, with our staff securing over £10 million!

Funders included the Bertarelli Foundation, Biotechnology and Biological Sciences Research Council (BBSRC), British Academy, British Eventing, Carter Centre, Cornwall Area of Outstanding Natural Beauty (AONB) Unit, Darwin Initiative, Department for Environment, Food and Rural Affairs (DEFRA), Deutsche Forschungsgemeinschaft (DFG), European Commission, European Maritime and Fisheries Fund (EMFF), European Regional Development Fund (ERDF), Leverhulme Trust, Met Office, Natural England, Natural Environment Research Council (NERC), QinetiQ Ltd, Royal Society, The Halpin Trust, The Rufford Foundation, The Waterloo Foundation, University of Pretoria, and Zoological Society of London.

Awards were made to Professor Christopher Bass, Professor Jonathan Blount, Dr Camille Bonneaud, Dr Neeltje Boogert, Professor Annette Broderick, Professor Angus Buckling, Professor Michael Cant, Dr Jason Chapman, Dr Thomas Currie, Dr Regan Early, Professor Jeremy Field, Professor Kevin Gaston, Professor Brendan Godley, Dr Elze Hesse, Dr Kimberley Hockings, Professor David Hodgson, Professor David Hosken, Dr Christopher Kaiser-Bunbury, Dr Laura Kelley, Dr Christopher Lowe, Dr Ilya Maclean, Professor Robbie McDonald, Dr Kristian Metcalfe, Professor Juliet Osborne, Dr Ben Raymond, Professor Martin Stevens, Professor Tom Tregenza, Dr Frank Van Veen, Dr Stephen Votier, Dr Edze Westra, Dr Matthew Witt, Dr Karl Wotton, and Professor Gabriel Yvon-Durocher.

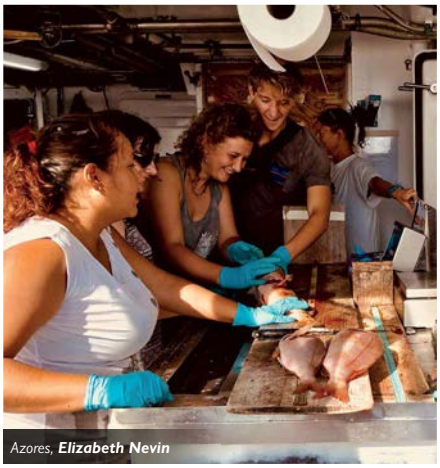
Funding highlights include: an Environmental Growth for Business fund awarded to Kevin Gaston and supported by the European Regional Development Fund (ERDF); European Research Council projects lead by Professor Thomas Currie, Professor Jeremy Field and Dr Edze Westra; a NERC award to Professor Michael Cant to investigate the ecology and evolution of intergroup conflict in animal societies; a NERC award to Professor Angus Buckling for the study "Determining casual links between interaction type and network structures"; a European maritime and Fisheries Fund (EMFF) for Dr Matthew Witt's study on shark catch and release survivability, and loads more.

It was an incredible year, and we thank all staff for your efforts.

Field Course Fortnight

At the Centre for Ecology and Conservation BSc finalists and MSc students embark on a field course in their final year, to learn about natural systems in the real world. These trips take them to some of the most biodiverse regions on the planet, where they have the opportunity to see first-hand the conflict of humans and wildlife living side by side. On these trips, long lasting friendships are forged, and life changing experiences occur. These trips allow the students to receive research-inspired teaching and first-class education to provide them with invaluable skills to help them progress in the future.

Alaska, **Charles Jennings**



Azores, **Elizabeth Nevin**

I found the research projects on my field course to be fascinating. Having the opportunity to study a diverse range of fauna, from crickets to elephants out in the field was truly a highlight of my time at Exeter

Matthew Wall, South Africa Field Course

Trekking through rainforests with local guides and experienced lecturers really put everything I'd leant in a lecture theatre into perspective. I saw wildlife I'd only ever dreamt of seeing and I made great friends too!

Sophie Corrigan, Costa Rica Field Course

This year we saw the introduction of two new field courses; Yukon/Alaska and the Galapagos. These field courses joined the existing list of countries our students travelled to during field course fortnight which includes The Bahamas, Borneo, Costa Rica, Kenya and Tenerife.

Kluane Lake Research Station - Yukon, **Charles Jennings**

Our field trip to Costa Rica was one of the highlights of my time at Penryn, showcasing the country's incredible diversity of habitats and species. Having the opportunity to learn hands-on from our enthusiastic lecturers and in-country partners made for a thoroughly engaging trip, and one I'll not be forgetting soon!

Ben Porter, Costa Rica Field Course

Yukon, **Emily Gilford**

Field course fortnight is a social media campaign where students and staff document their experiences via different social media outputs using the hashtag #fieldcoursefortnight to show the world what our students get up to.

When everyone returned, the final awards ceremony celebrated the social media efforts of students and staff during the campaign and also their contribution to their field course!

Costa Rica, **Victoria Hoare**

IFRA director David Kay (left) and IFRA instructor Kevin Tong

*A special mention to **Marie Nute**, a current Animal Behaviour student, who has worked with International Fire and Rescue Association (IFRA) to provide an astonishing 26 helmets, tunics, flash hoods and pairs of gloves, trousers and boots to the San Cristobal fire department in the Galapagos Islands. Whilst planning towards her final year field trip to the Galapagos this January, she discovered from a previous trip that the firefighters in San Cristobal wore only t-shirts and jeans to tackle blazes. After contacting friends within the London Fire Brigade, she was able to help contribute this generous donation.*


Science with the Community

Schools Outreach

During 2018, CEC researchers, staff and student ambassadors were once again involved with various outreach events across Cornwall. We reached over 4,000 students through partnerships with over 20 schools and colleges in Cornwall. We ran discover days where schools engaged with our academics and PhD students at interactive sessions. We also ran our first fish dissection practical with a local school which was a great success and we hope to continue with more in 2019. We were also delighted to have presence at the Royal Cornwall Show again, where the University talked about our research, and ran hands-on science activities with microscopes and space surviving water bears! For the fourth 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. We have also started to develop a project with a local college and surrounding primary schools to work on a 'How Science Works conference' which is to be held in November.

Science in the Square

For our 7th annual Science in the Square event 'Weird Science' was the theme, during which nearly 3,000 visitors attended for the free family event held as part of Falmouth Week in August. This event invited every one of all ages to come and have their scientific questions answered through a series of engaging talks. Our expert scientists gave talks on 'Weird waves from Space', the 'Wonderful World of Weird and Wobbly Jellyfish', with one talk even showing live insects under a microscope for everyone to see. The event also gave visitors the chance to explore our seven interactive zones, where they could learn about the creatures you might find in a rock pool, what an elephant skull looks like, or how to hold live insects! We also had the addition of 'Martha' the meerkat this year, who paired with 'Brenda' the turtle, and was very popular with everyone. Thank you to all the speakers, staff and students who worked extremely hard to make sure the event was a huge success! We look forward to next year, where we might have a new interactive zone in store.

Science of Christmas

This was the fifth year of running our Science of Christmas family friendly event, which aims to uncover some of the mysteries behind Christmas! It was a festive success and the whole audience (children and adults too!) were engaged throughout. Prof Brendan Godley acted as the compere and as always kept everyone in the Christmas spirit with some great singalongs. Our Head of Department, Prof Dave Hodgson, delivered a talk on 'A Christmas Dinner; A Truly Global Feast', which has since made it into the papers and Dave even got an interview from Jeremy Vine of Radio 2! Prof Martin Stevens and Masters by Research student Maria Watson asked the question 'Why can't Rudolph find his carrots' and explained that none of the other reindeers could actually see Rudolph's shiny nose as they can't see the colour red. The night finished with the Energy Policy Group performing a very amusing sketch on 'Is Santa naughty or nice?' which had everyone laughing and was a great way to end the evening. We had a fantastic turnout and thank you to all our amazing speakers for inspiring all generations about the science behind Christmas, without giving away any of the magic.

Students as Change Agents

Students as Change Agents is a scheme that allows students to play an active part in improving their student experience, and for the wider student community. Students registered through the scheme receive support and training to effect each change, and are able to develop and demonstrate experience in leadership, teamwork and project management. This year we saw projects such as Sci-Fest a science communication festival, and GeogSoc guest speaker talks where we heard from survival expert John Hudson. We had previous projects funded by the scheme run successfully for yet another year, such as BioBlitz and Life Magazine.

Wild Film Fest

Wild Film Fest returned for the 4th year running in March 2018, showcasing the best student wildlife photography and films from across the nation. Judged by the prestigious panel of industry experts including university lecturers, Gillian Burke and Ian McCarthy; our winners and the shortlisted were of the highest standard with a particular focus on important conservation issues. Organised and hosted by a dedicated team of students, the evening was a great success held in the iconic and historic Poly Theatre. Blending artistic and scientific disciplines, this was a wonderful example of science communication at its finest, and a great end to Wild Doc Soc's Science Communication festival, 'Sci-Fest'.

Generation Wild

Generation Wild is a student-led volunteering project that delivers weekly environmental outreach sessions for local primary schools and extracurricular children's groups. From rock pool rambles and evening bug hunts, to designing sustainable homes and herptile handling, 2018 has been an incredible year for us! Over the course of 2018 we have had the pleasure of working with over 500 children across Cornwall, thanks in part to our brand new partnership with Cornwall Wildlife Trust. Generation Wild took home not one, but two awards from the FXU awards ceremony for Student-Led project of the year, and most outstanding SLVP committee member. We've had so much positive feedback from the local community, it's really heartening to see young people so enthusiastic about getting back out into nature, and the positive impacts that environmental education can have on the local community. With exciting developments in the pipeline, including another large scale Girl Guide event, 2019 is set to be another fantastic year!

More information about our outreach activities can be found at:

lifesciences.exeter.ac.uk/outreach/cornwall

Awards and Prizes

Prize Winners

See also Selected Highlights for accolades to **Dr Andrew Pye and Professor Brendan Godley.**

Elected as British Ecological Society's Vice President – *Professor Dave Hodgson*

British Ecological Society, Founders Prize 2018 – *Professor Gabriel Yvon-Durocher*

The FXU and Students' Guild Teaching Awards

Best Subject Cornwall – *Renewable Energy (Penryn)*

Most Outstanding Student Led Volunteering Project Committee Members – *Jenny Lawrie (Generation Wild)*

Most Outstanding Society Event or Project – *Survivalist and broadcaster John Hudson's talk (presented by Geogsoc)*

Graduation Awards

Congratulations to the following CEC students who were awarded PhDs in 2018:

Philip James Bradshaw – Investigating Variation in the Life-History Strategy of Marine Turtles

Ana Rita Caldas Patricio – Ecology of the Green Sea Turtle *(Chelonia mydas L)* in a Changing World

Lewis Campbell – An Investigation into the Impacts of an Emerging Viral Pathogen on Wild UK Populations of European Common Frog *(Rana temporaria)*

Sarah Louise Crowley – Ecological Politics and Practices in Introduced Species Management

Lynda Donaldson – Conservation and Ecology of Wetland Birds in Africa

Beatrice Catherine Downing – Disruption and Disease: How does Population Management affect Disease Risk in Wild Bird Population?

Dimas Gianuca Neto – Influence of Climate and Fisheries on the Demography of Giant Petrels

Cecily Erica Diana Goodwin – Hazel Dormouse Ecology and Conservation in Woodlands

Daniel Padfield – Scaling the Effects of Warming on Metabolism from Organisms to Ecosystems

Robin Huw Somers-Yeates – Impacts of Artificial Night-time Light on Moths and their Food Plants

Andrea Soriano Redondo – Reintroduction Ecology of the Eurasian Crane *(Grus grus)*

Peter Robert Stilwell – The Ecology and Evolution of Diversity and Cooperation in Bacterial Public-goods

George Julius Fraser Swan – Understanding Conservation Conflicts Surrounding Predation and Game Shooting Interests

Stephen John White – The Evolutionary Genetics of Behavioural Variation: Multivariate Perspectives on Personality in the Trinidadian Guppy

Emmanuelle Sophie Briolat – The Form and Function of Warning Signals in Lepidoptera, with a Special Focus on Burnet Moths *(Zygaenidae)*

David John Pascall – The Diversity and Distribution of Multihost Viruses in Bumblebees

Emma Mary Wood – Causes and Fitness Consequences of Telomere Dynamics in a Wild Social Bird

Graduation Awards

Prizes were awarded to the following students:

Undergraduate

Dean's Commendations:
Jack Barton
Katherine Bickerton
Joseph Mine
Joseph Minus
Ben Porter
Charlotte Rankin
Henry Slesser
Abigail Thompson

Dean's Commendations Stage 4:
Megan Francis
Francesco Garzon
Lucy Hadingham
Ana Drago

Centre for Ecology and Conservation Commendations:
Katherine Westerberg
Lucy Wells
Abi Gwynn
Gemma Haggar
Jenny Lawrie
Ben Porter
Will Hawkes
Teddy Walliker
Matt Wall
Robbie Phillips
Sophia Fraser
Gabi Oliver
Alyssa Lowry
Megan Francis

Top Project Mark:
Meaghan Castledine

Oxford University Press – Most Improved Student Award:
Matthew Kyle-Henney

Royal Society of Biology Award for Top Overall Marks:
Ben Porter
Highest Overall AWCM:
Ben Porter

Postgraduate

Centre for Ecology and Conservation Commendations:
MSc Applied Ecology 2017/18:
Best Overall Mark –
Sarah Binnie
Best Research Project Mark –
Nafee Alothygi and Sarah Binnie

MSc Conservation and Biodiversity 2017/18:
Best Overall Mark –
Christopher French
Best Research Project Mark –
Haley Dolton

MSc Evolutionary and Behavioural Ecology 2017/18:
Best Overall Mark – Richard Turner
Best Research Project Mark –
Richard Turner

MSc Conservation Science and Policy 2017/18:
Best Overall Mark –
Valerio Donfrancesco
Best Research Project Mark –
Valerio Donfrancesco

School's Commendation for Exceptional Academic Achievement:
Christopher French
Rosie Bailey-Clark
Sarah Binnie
Nicholas Davey
Lucy Haskell
Lucie Machin
Charlotte Marshall

School's commendation for Outstanding Contribution to Student Experience:
Jax Kennan
Jenna Govier

Selected Highlights

All-female crew sailed the Pacific on plastics research mission

An all-female crew including sailors, scientists and film-makers crossed the North Pacific earlier this year to study and raise awareness of plastic pollution. The eXXpedition team set off on 23rd June 2018 on a five-week trip across the North Pacific Gyre – better known as the Great Pacific Garbage Patch because of the plastic that gathers there – from Hawaii to Seattle. Their efforts focussed on micro plastics and links to environmental and human health. The team, led by British skipper and ocean advocate Emily Penn, included University of Exeter, Centre for Ecology and Conservation's **Dr Emily Duncan** as the Head of Science (Leg 1). **Dr Emily Duncan** is one of many Exeter researchers working as part of Exeter Marine (#ExeterMarine), which aims to bring together experts from numerous fields. The rest of the eXXpedition voyage team was a diverse and international group of 24 women made up of a wide variety of professions ranging from artists to psychologists, and novice, as well as experienced, sailors. During the expedition, the crew sailed the Sea Dragon, a 72ft scientific exploration vessel (owned by Pangaea Exploration), from Oahu, Hawaii to Vancouver, British Columbia and then from Vancouver to Seattle.

Photo: Steve Greenwood

Congratulations!

This past year saw the recruitment of:
Dr Stineke Van Houte as an Associate Research Fellow
Dr Diego Barneche as a Senior Lecturer
Dr Kristian Metcalfe as Lecturer
And a number of key promotions:
To Professor: Jon Blount
To Associate Professor: Alex Thornton and Thomas Currie
To Senior Lecturer: Regan Early

Scientists secure prestigious awards for global impact of micro plastics research

Scientists from the University of Exeter, the University of Plymouth and Plymouth Marine Laboratory won the Societal Impact category and overall prize in the Natural Environment Research Council's (NERC) 2018 Impact Awards. The accolades recognised their efforts to bring the causes and effects of plastic pollution, and in particular micro plastics, to the attention of policy makers, industry and the general public globally. In an excellent example of collaborative research, the three institutes brought together a wealth of expertise, experience and the facilities to investigate the global challenge of micro plastics in the ocean. The winning team included: **Professor Brendan Godley**, Professor Tamara Galloway, and Dr Ceri Lewis, from the University of Exeter; Professor Richard Thompson OBE at the University of Plymouth; and Dr Penelope Lindeque and Dr Matt Cole from Plymouth Marine Laboratory. The NERC-funded research by the team has directly influenced policy in the UK and, consequently, the world. This includes the subsequent UK's ban on microbeads in cosmetics, which came into force in January 2018, while members of the team have also advised on influential TV documentaries such as Blue Planet II and Drowning in Plastic.

National Teaching Fellowship awarded to Dr Andrew Pye

Congratulations to **Dr Andrew Pye** who received the prestigious National Teaching Fellowship from the Higher Education Academy. The award was given in recognition of his innovative and enthusiastic teaching and his devotion to outstanding student experience and wellbeing. **Dr Andrew Pye**, a Senior Lecturer in Biosciences based at the University of Exeter's Penryn Campus in Cornwall, received the Fellowship for his long-standing work supporting the staff and students through academic tutoring and peer support. His nomination for an 'Outstanding Contribution to Student Wellbeing', made by students, described him as "the driving force behind the peer mentor scheme", adding "there are few academics recognised as providing as much support and help to students through initiatives they have devised as Andy". **Dr Andrew Pye** also facilitates networking events and led the Penryn Campus HEA accredited Learning and Teaching in Higher Education Programme (LTHE) for three years and he now facilitates the Postgraduate Certificate in Academic Practice (PCAP). Andrew frequently presents his work at national and international conferences and workshops. He contributed to the HEA National Report 'Mapping Student-Led Peer Learning in the UK' in 2014 and was on the Board of Directors of the Peer Led Team Learning International Society (PLTLIS) from 2013-2016. **Dr Andrew Pye** said: "I am delighted to have received this national recognition for my teaching. Recognising and rewarding learning and teaching for all staff is critical if we are to meet the challenges facing the sector and deliver high quality education."

Dr Andrew Pye was joined by 52 other academics nationwide to receive the fellowships from Advance HE, announced on Thursday 30th August 2018.


Credit: Benjamin Hintz

Selected CEC Publications from 2018

Archer, C. R., **Recker, M.**, **Duffy, E.**, & **Hosken, D. J.** (2018). Intralocus sexual conflict can resolve the male-female health-survival paradox. *Nature Communications*, *9*(1), 5048.

Bartlett, L. J., **Wilfert, L.**, & **Boots, M.** (2018). A genotypic trade-off between constitutive resistance to viral infection and host growth rate. *Evolution*, *72*(12), 2749–2757.

Bauer, S., Shamoun-Baranes, J., Nilsson, C., Farnsworth, A., Kelly, J. F., Reynolds, D. R., … Horton, K. G. & **Chapman, J.** (2018). The grand challenges of migration ecology that radar aeroecology can help answer. *Ecography*.

Benton, C. H., **Delahay, R. J.**, Smith, F. A. P., Robertson, A., **McDonald, R. A.**, **Young, A. J.**, … **Hodgson, D.** (2018). Inbreeding intensifies sex-and age-dependent disease in a wild mammal. *Journal of Animal Ecology*, *87*(6), 1500–1511.

Bestion, E., García-Carreras, B., **Schaum, C.**, Pawar, S., & **Yvon-Durocher, G.** (2018). Metabolic traits predict the effects of warming on phytoplankton competition. *Ecology Letters*, *21*(5), 655–664.

Bonneaud, C., **Giraudeau, M.**, **Tardy, L.**, Staley, M., Hill, G. E., & McGraw, K. J. (2018). Rapid antagonistic coevolution in an emerging pathogen and its vertebrate host. *Current Biology*, *28*(18), 2978–2983.

Boogert, N. J., Lachlan, R. F., Spencer, K. A., Templeton, C. N., & Farine, D. R. (2018). Stress hormones, social associations and song learning in zebra finches. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *373*(1756), 20170290.

Briolat, E. S., Zagrobelny, M., Olsen, C. E., **Blount, J. D.**, & **Stevens, M.** (2019). No evidence of quantitative signal honesty across species of aposematic burnet moths (Lepidoptera: Zygaenidae). *Journal of Evolutionary Biology*, *32*(1), 31–48.

Castledine, M., **Buckling, A.**, & **Padfield, D.** (2018). A shared coevolutionary history does not alter the outcome of coalescence in experimental populations of *Pseudomonas fluorescens*. *Journal of Evolutionary Biology*.

Chan, I. Z. W., **Stevens, M.**, & Todd, P. A. (2018). PATGEOM: A Software Package for the Analysis of Animal Patterns. *Methods in Ecology and Evolution*.

Colchero, F., Jones, O. R., Conde, D. A., **Hodgson, D.**, ... **Delahay R. J.**, … **McDonald, J.**, … & Bouwhuis, S. (2018). The diversity of population responses to environmental change. *Ecology Letters*.

Connallon, T., Olito, C., Dutoit, L., Papoli, H., Ruzicka, F., & **Yong, L.** (2018). Local adaptation and the evolution of inversions on sex chromosomes and autosomes. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *373*(1757), 20170423.

Cornetti, L., Hilfiker, D., Lemoine, M., & **Tschirren, B.** (2018). Small-scale spatial variation in infection risk shapes the evolution of a Borrelia resistance gene in wild rodents. *Molecular Ecology*, *27*(17), 3515–3524.

Correa-Cano, M. E., **Goettsch, B.**, **Duffy, J. P.**, **Bennie, J.**, **Inger, R.**, & **Gaston, K.** J. (2018). Erosion of natural darkness in the geographic ranges of cacti. *Scientific Reports*, *8*(1), 4347.

Cox, D. T. C., & **Gaston, K. J.** (2018). Human–nature interactions and the consequences and drivers of provisioning wildlife. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *373*(1745), 20170092.

Cox, D. T. C., Hudson, H. L., **Plummer, K. E.**, Siriwardena, G. M., **Anderson, K.**, Hancock, S., … **Gaston, K. J.** (2018). Covariation in urban birds providing cultural services or disservices and people. *Journal of Applied Ecology*.

Dällenbach, L. J., Glauser, A., Lim, K. S., **Chapman, J. W.**, & Menz, M. H. M. (2018). Higher flight activity in the offspring of migrants compared to residents in a migratory insect. *Proc. R. Soc. B*, *285*(1881), 20172829.

Dell'Aglio, D. D., **Troscianko, J.**, McMillan, W. O., **Stevens, M.**, & Jiggins, C. D. (2018). The appearance of mimetic Heliconius butterflies to predators and conspecifics. *Evolution*, *72*(10), 2156–2166.

Duncan, E. M., **Broderick, A. C.**, **Fuller, W. J.**, Galloway, T. S., Godfrey, M. H., Hamann, M., … **Omeyer, L. C. M.**, Santillo, D., **Snape, R. T. E.**, & **Godley, B. J.** (2018). Microplastic ingestion ubiquitous in marine turtles. *Global Change Biology*.

Field, J., **Accleton, C.**, & Foster, W. A. (2018). Crozier's effect and the acceptance of intraspecific brood parasites. *Current Biology*, *28*(20), 3267–3272.

García, F. C., **Bestion, E.**, Warfield, R., & **Yvon-Durocher, G.** (2018). Changes in temperature alter the relationship between biodiversity and ecosystem functioning. *Proceedings of the National Academy of Sciences*, *115*(43), 10989–10994.

García-Carreras, B., Sal, S., **Padfield, D.**, Kontopoulos, D.-G., **Bestion, E.**, **Schaum, C.-E.**, **Yvon-Durocher, G.**, & Pawar, S. (2018). Role of carbon allocation efficiency in the temperature dependence of autotroph growth rates. *Proceedings of the National Academy of Sciences*, *115*(31), E7361–E7368.

Gaston, K. J., **Cox, D. T. C.**, Canavelli, S. B., García, D., Hughes, B., Maas, B., … & **Inger, R.** (2018). Population Abundance and Ecosystem Service Provision: The Case of Birds. *BioScience*, *68*(4), 264–272.

Gaston, K. J., Soga, M., **Duffy, J. P.**, **Garrett, J. K.**, Gaston, S., & **Cox, D. T. C.** (2018). Personalised Ecology. *Trends in Ecology & Evolution*.

Gates, D. E., Valletta, J. J., **Bonneaud, C.**, & Recker, M. (2018). Quantitative host resistance drives the evolution of increased virulence in an emerging pathogen. *Journal of Evolutionary Biology*, *31*(11), 1704–1714.

Goodwin, C. E. D., Suggitt, A. J., **Bennie, J.**, **Silk, M. J.**, **Duffy, J. P.**, Al-Fulaij, N., … **Hodgson, D.J.**, & **McDonald, R. A.** (2018). Climate, landscape, habitat, and woodland management associations with hazel dormouse *Muscardinus avellanarius* population status. *Mammal Review*, *48*(3), 209–223.

Greggor, A. L., **McIvor, G. E.**, Clayton, N. S., & **Thornton, A.** (2018). Wild jackdaws are wary of objects that violate expectations of animacy. *Royal Society Open Science*, *5*(10), 181070.

Guerrero, A. M., Bennet, N. J., Wilson, K. A., Carter, N., Gill, D., Mills, M., … & **Nuno, A.** (2018). Achieving the promise of integration in social-ecological research: a review and prospectus. *Ecology and Society*, *23*(3).

Gwinner, H., **Capilla-Lasheras, P.**, Cooper, C., & Helm, B. (2018). 'Green incubation": avian offspring benefit from aromatic nest herbs through improved parental incubation behaviour.' *Proc. R. Soc. B*, *285*(1880), 20180376.

Heathcote, R. J. P., **Darden, S. K.**, **Troscianko, J.**, Lawson, M. R. M., Brown, A. M., Laker, P. R., … **Croft, D. P.** (2018). Dynamic eye colour as an honest signal of aggression. *Current Biology*, *28*(11), R652–R653.

Hinsley, A., Keane, A., St. John, F. A. V, Ibbett, H., & **Nuno, A.** (2018). Asking sensitive questions using the Unmatched Count Technique: Applications and guidelines for conservation. *Methods in Ecology and Evolution*.

Kennedy, P. J., **Ford, S. M.**, Poidatz, J., Thiéry, D., & **Osborne, J. L.** (2018). Searching for nests of the invasive Asian hornet (Vespa velutina) using radio-telemetry. *Communications Biology*, *1*(1), 88.

Landsberger, M., Gandon, S., **Meaden, S.**, **Rollie, C.**, **Chevallereau, A.**, **Chabas, H.**, **Buckling, A.**, **Westra, E.**, & **van Houte, S.** (2018). Anti-CRISPR phages cooperate to overcome CRISPR-Cas immunity. *Cell*, *174*(4), 908–916.

Manjon, C., Troczka, B. J., Zaworra, M., **Beadle, K.**, **Randall, E.**, … **Singh, K.**, **Zimmer, C.**, ... **Bass, C.**, & Nauen, R. (2018). Unravelling the molecular determinants of bee sensitivity to neonicotinoid insecticides. *Current Biology*, *28*(7), 1137–1143.

Mesoudi, A., & **Thornton, A.** (2018). What is cumulative cultural evolution? *Proceedings of the Royal Society B: Biological Sciences*, *285*(1880), 20180712.

Metcalfe, K., Bréheret, N., Chauvet, E., Collins, T., Curran, B. K., Parnell, R. J., …**Turner, R.**, **Witt, M.**, & **Godley, B. J.** (2018). Using satellite AIS to improve our understanding of shipping and fill gaps in ocean observation data to support marine spatial planning. *Journal of Applied Ecology*, *55*(4), 1834–1845.

Narasimha, S., Nagornov, K. O., Menin, L., Mucciolo, A., … **Stevens, M.**, & Vijendravarma, R. K. (2019). Drosophila melanogaster cloak their eggs with pheromones, which prevents cannibalism. *PLoS Biology*, *17*(1), e2006012.

Niu, Y., Sun, H., & **Stevens, M.** (2018). Plant camouflage: ecology, evolution, and implications. *Trends in Ecology & Evolution*.

O'Brien, S., Hesse, E., Luján, A., **Hodgson, D. J.**, Gardner, A., & **Buckling, A.** (2018). No effect of intraspecific relatedness on public goods cooperation in a complex community. *Evolution*, *72*(5), 1165–1173.

Padfield, D., **Buckling, A.**, Warfield, R., **Lowe, C.**, & **Yvon-Durocher, G.** (2018). Linking phytoplankton community metabolism to the individual size distribution. *Ecology Letters*.

Parathian, H. E., Frazão-Moreira, A., & **Hockings, K. J.** (2018). Environmental psychology must better integrate local cultural and sociodemographic context to inform conservation. *Conservation Letters*, *11*(4), e12590.

Patrício, A. R., **Varela, M. R.**, Barbosa, C., **Broderick, A. C.**, Catry, P., **Hawkes, L. A.**, … **Godley, B. J.** (2018). Climate change resilience of a globally important sea turtle nesting population. *Global Change Biology*.

Paul, S. C., **Stevens, M.**, **Burton, J.**, Pell, J. K., Birkett, M. A., & **Blount, J. D.** (2018). Invasive Egg Predators and Food Availability Interactively Affect Maternal Investment in Egg Chemical Defense. *Frontiers in Ecology and Evolution*, *6*, 4.

Perkins, D. M., Perna, A., Adrian, R., Cermeño, P., Gaedke, U., Huete-Ortega, M., … **Yvon-Durocher, G.** (2019). Energetic equivalence underpins the size structure of tree and phytoplankton communities. *Nature Communications*, *10*(1), 255.

Phillips, B. B., **Shaw, R. F.**, **Holland, M. J.**, Fry, E. L., Bardgett, R. D., Bullock, J. M., & **Osborne, J. L.** (2018). Drought reduces floral resources for pollinators. *Global Change Biology*.

Pincheira-Donoso, D., & **Hodgson, D. J.** (2018). No evidence that extinction risk increases in the largest and smallest vertebrates. *Proceedings of the National Academy of Sciences*, 201804633.

Pursey, E., **Sünderhauf, D.**, Gaze, W. H., Westra, E. R., & **van Houte, S.** (2018). CRISPR-Cas antimicrobials: Challenges and future prospects. *PLoS Pathogens*, *14*(6), e1006990.

Roberts, K. E., Hadfield, J. D., **Sharma, M. D.**, & **Longdon, B.** (2018). Changes in temperature alter the potential outcomes of virus host shifts. *PLoS Pathogens*, *14*(10), e1007185.

Sanders, D., **Kehoe, R.**, Cruse, D., **van Veen, F. J. F.**, & **Gaston, K. J.** (2018). Low levels of artificial light at night strengthen top-down control in insect food web. *Current Biology*, *28*(15), 2474–2478.

Sanders, D., Thébault, E., **Kehoe, R.**, & **van Veen, F. J. F.** (2018). Trophic redundancy reduces vulnerability to extinction cascades. *Proceedings of the National Academy of Sciences*, *115*(10), 2419–2424.

Schaum, C.-E., **Buckling, A.**, Smirnoff, N., Studholme, D. J., & **Yvon-Durocher, G.** (2018). Environmental fluctuations accelerate molecular evolution of thermal tolerance in a marine diatom. *Nature Communications*, *9*.

Sheppard, C. E., **Inger, R.**, **McDonald, R. A.**, **Barker, S.**, Jackson, A. L., **Thompson, F. J.**, **Vitikainen, E.**, **Cant, M. A.**, & **Marshall, H. H.** (2018). Intragroup competition predicts individual foraging specialisation in a group-living mammal. *Ecology Letters*, *21*(5), 665–673.

Sierocinski, P., **Bayer, F.**, **Yvon-Durocher, G.**, **Burdon, M.**, Großkopf, T., Alston, M., … **Buckling, A.** (2018). Biodiversity–function relationships in methanogenic communities. *Molecular Ecology*, *27*(22), 4641–4651.

Silk, M. J., Finn, K. R., Porter, M. A., & Pinter-Wollman, N. (2018). Can Multilayer Networks Advance Animal Behavior Research? *Trends in Ecology & Evolution*, *33*(6), 376–378.

Suggitt, A. J., **Wilson, R. J.**, Isaac, N. J. B., Beale, C. M., Auffret, A. G., August, T., **Bennie, J.**, … **Hopkins, J.**, … **Maclean, I. M. D.** (2018). Extinction risk from climate change is reduced by microclimatic buffering. *Nature Climate Change*, *8*(8), 713.

Troscianko, J., Skelhorn, J., & **Stevens, M.** (2018). Camouflage strategies interfere differently with observer search images. *Proceedings of the Royal Society B: Biological Sciences*.

Varela, M. R., **Patrício, A. R.**, **Anderson, K.**, **Broderick, A. C.**, DeBell, L., **Hawkes, L. A.**, **Tilley, D.**, **Snape, R.**, Westoby, M. J., & **Godley, B. J.** (2018). Assessing climate change associated sea-level rise impacts on sea turtle nesting beaches using drones, photogrammetry and a novel GPS system. *Global Change Biology*.

Verd, B., Clark, E., **Wotton, K. R.**, Janssens, H., **Jiménez-Guri, E.**, Crombach, A., & Jaeger, J. (2018). A damped oscillator imposes temporal order on posterior gap gene expression in Drosophila. *PLoS Biology*, *16*(2), e2003174.

Zimmer, C., Garrood, W., **Singh, K.**, **Randall, E.**, Lueke, B., Gutbrod, O., Matthiesen, S., Kohler, M., Nauen, R., Davies, T. and Bass, C. (2018). Neofunctionalization of Duplicated P450 Genes Drives the Evolution of Insecticide Resistance in the Brown Planthopper. Current Biology, 28(2), pp.268-274.e5.

Galápagos Islands, David Matheson (www.david matheson.co.uk)

Peruvian Amazon, Jalal Khan

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