

# Bristol Zoological Society

## TECHNOLOGY AND INNOVATION FOR CONSERVATION



8<sup>th</sup> Annual Symposium – 17<sup>th</sup> February 2016



**Bristol Zoological Society**  
Saving Wildlife Together

The world's human population is growing, and wild habitats are shrinking at unprecedented rates. Humans and wild animals are moving ever closer together. In Madagascar 80% of all remaining forests are now within just one km of a non-forest edge, which makes them increasingly vulnerable. More and more species are moving up the ladder of extinction risk into one of the so-called 'threatened' categories of the IUCN Red List. Many wild populations now need intense management to survive. The need for captive reserve populations of the most threatened species is greater than ever before and good, scientifically managed zoos have an important role to play in this. At Bristol Zoo and the Wild Place Project, we not only participate in numerous cooperative breeding programmes for endangered species such as those for aye-ayes, okapi or Asiatic lions but also contribute our expertise in animal husbandry and veterinary care to conservation programmes in different parts of the world.

But this is not where the story ends. The mission of BZS is *to save wildlife, through conservation action and engaging people with the natural world*. Over half a million guests visit our two sites every year, a huge potential for our annual conservation campaigns to inspire positive behaviour change towards wildlife-friendly actions. In addition to the core operation of our zoos, we are running the equivalent of a medium-sized school, teaching animal and conservation-based classes to more than 40,000 children of all ages each year. We are also a small university, with more than 300 Higher Education students studying in our new Institute of Conservation Science and Learning at Bristol Zoo. To run our degree courses, we employ a whole team of Lecturers in Conservation Science, each of them specialised in a different research field relevant to wildlife conservation. Our scientific output is in every way comparable to that of a university department. At the very heart of our conservation mission, we operate the equivalent of a small international NGO, carrying out community-based field conservation programmes in developing countries around the world and here in the UK. To achieve the greatest impact we run our conservation projects in partnership with the very best local and international NGOs, other like-minded zoos, government agencies, international bodies and corporates. We are an active member of the International Union for Conservation of Nature, with several of our staff serving on different taxonomic and functional specialist groups.



Dr Christoph Schwitzer  
Director of Conservation

# Technology and Innovation for Conservation

17<sup>th</sup> February 2016

09:30 - 10:00

***Arrival and coffee***

10:00 - 10:10 Christoph Schwitzer Welcome from Director of Conservation, BZS

10:10 – 10:50 Peter Barham Non-invasive technologies for individual recognition

10:50 – 11:20 Richard Sherley Right place, wrong time: a broad-scale ecological trap revealed through metapopulation level tracking of juvenile African penguins

11:20 – 11:50 Mark Steer Opportunities and risks of lab-grown food: what should a conservationist think?

11:50 – 12:20 Chris Chuck Could oily yeast be used as a novel source of fuels, chemicals and food?

12:20 – 12:30 Discussion

12:30 - 13:30

***Lunch***

## **Symposium session 2**

13:30 – 14:00 Natasha De Vere Using DNA metabarcoding to understand the favourite flowers of honeybees and wild pollinators

14:00 – 14:30 Marc Holderied Acoustics and conservation - current research between Bristol Zoo and the University of Bristol

14:30 – 15:00 Alex Piel Sounds on the Savanna: remote acoustic monitoring for the study of wild primates

15:00 - 15:30

***Tea***

## **Symposium session 3**

15:30 - 16:00 Serge Wich Conservation drones to monitor wildlife and its habitat

16:00 - 16:30 David Bird Applications of drones in nature conservation

16:30 - 17:00 Grainne McCabe Panel discussion and summing up

17:00 – 18:30 ***Reception*** ***Conservation Education Centre***

## **Bristol Zoological Society Conservation Science Team**

### **Dr Bryan Carroll – CEO Bristol Zoological Society**



Dr Bryan Carroll joined Bristol Zoo in August 1995, having come from the Jersey Wildlife Preservation Trust (now Durrell Wildlife Conservation Trust) where he was Curator of Mammals at Jersey Zoo. This background in an establishment that pioneered the idea of the zoo as a conservation organisation has enabled the development of Bristol Zoo's conservation and scientific programmes.

Bryan is a member of the Council of the European Association of Zoos and Aquaria (EAZA) as well as being a member of the EAZA EEP Committee (which oversees all European co-operatively managed species programmes) and the EAZA Conservation Committee. Bryan is also a member of the IUCN's Primate Specialist Group, Bat Specialist Group and the Conservation Breeding Specialist Group. He became Director of Bristol Zoo Gardens in September 2010 and is CEO of the Bristol Zoological Society.

### **Dr Christoph Schwitzer – Director of Conservation**



A biologist by training, Dr Christoph Schwitzer received his PhD in Zoology from the University of Cologne, Germany, for his work on the nutritional ecology of lemurs. He worked as part of the primatological research group at Cologne Zoo for several years and also coordinated the European Endangered Species Programme for Ruffed lemurs. In 2003 he took on the position of Programme Coordinator for the European Association for the Study and Conservation of Lemurs (AEECL) in northwest Madagascar, where he directed a field research and conservation programme that has led to the creation of a national park. Since August 2006, Christoph has been Head of Research at Bristol Zoo Gardens, and was promoted to Director of Conservation in 2014. He is the Vice President for Capital Care of the International Primatological Society, the Executive Secretary of AEECL and sits on the Steering Committee of the IUCN SSC Primate Specialist Group as the Red List Authority Coordinator, Vice Chair for Madagascar and editor of *Lemur News*.

## **Neil Maddison - Head of Conservation Programmes**



Neil Maddison gained his first degree in Zoology at the University of Bristol and went on to work for several conservation charities before joining the Bristol, Clifton and West of England Zoological Society in 1997, initially as Development Manager. His experience in field conservation has led him to focus on working with communities to develop sustainable solutions to wildlife conservation, looking for practical ways to support disadvantaged people in their development. This often leads to an examination of the ‘business case’ for conservation, and finding new sources of revenue for local communities. Neil obtained his MBA from the University of the West of England, with a specialisation in pro-poor ecotourism. He is a Trustee of Ape Action Africa, an NGO working to address the commercial bushmeat trade in Africa and was previously a Trustee of the Hawk and Owl Trust. He is also currently a member of the IUCN Conservation Specialist Breeding Group and is leading the review process on the IUCN Guidelines for Managing Confiscated Species.

## **Dr Grainne McCabe – Head of Conservation Science**



Dr Gráinne McCabe heads up the conservation science and research team at the Bristol Zoological Society. She leads the Society’s growing team of Conservation Science Lecturers and is developing and implementing a proactive research strategy and programme. She is also involved with managing and developing research aspects of the Society’s vital conservation projects overseas in collaboration with the Head of Conservation Programmes.

Gráinne received her MA from the University of Calgary, Canada, in Primatology. She gained her PhD in Biological Anthropology from the University of Texas at San Antonio, for her study on the reproductive ecology of the Sanje mangabey in Tanzania. She has spent many years working in the field on primate conservation in Tanzania, specialising in primate behaviour and ecology. Gráinne’s research focuses on how local ecology, such as the availability of nutritious food, influences reproduction in wild monkeys to gain a better understanding of the factors impacting reproductive success.

### **Dr Sue Dow – Lecturer in Conservation Science**



Dr Sue Dow trained as a Zoologist at the University of Oxford and carried out a PhD at the University of Exeter on foraging and learning in pigeons. She carried out research at Bristol University on the biomechanics of bird flight in the zoology department and investigations into tendon injuries and humane treatments for horses in the anatomy department.

Sue worked part time at London Zoo setting up environmental enrichment projects before joining Bristol Zoo Gardens in 1992. She worked with construction projects but was also co-ordinator of research projects undertaken at the zoo. She has been increasingly involved with research projects and now works as a Lecturer in Conservation Science, teaching on courses carried out at Bristol Zoo and supervises undergraduate and post graduate students. Her research interests include a longitudinal study into the social dynamics of Bristol Zoo's group of gorillas but she maintains her interest in bird and bug behaviour and biomechanics.

### **Dr Amanda Webber – Lecturer in Conservation Science**



After working in West Africa, Amanda spent six months in Costa Rica collecting behavioural data on mantled howler monkeys. An MSc in Primate Conservation at Oxford Brookes University followed which led to a PhD in human-wildlife interactions, specifically the actual and perceived risk of crop damage by primates and other large vertebrates in Uganda.

Amanda taught and supervised undergraduates and MSc students at Oxford Brookes and the University of Bristol before joining BZS in 2013. She is a Lecturer in Conservation Science contributes to the various courses taught at Bristol Zoo. Her main research interests are human-wildlife interactions, perceptions of 'pest' species, and animals more generally, and wildlife conservation.

## **Dr Alison Cotton – Lecturer in Conservation Science**



Alison's interest in animal behaviour and conservation became apparent in her Bachelor degree studies in her home country of New Zealand. She then spent a few years travelling in Central and South America and Indonesia, volunteering at rescue and rehabilitation centres and gaining insights into global conservation and wildlife issues. On returning to New Zealand she worked with the Department of Conservation, investigating the efficacy deterring dogs from killing kiwis. In 2008 she moved to England for her MSc at Oxford University where a love of evolutionary research was born. A Masters by Research and PhD at UCL followed, studying the evolution of sexually selected traits in stalk-eyed flies, in both the laboratory and the rainforests of Malaysia.

Alison joined the BZS Research team in 2014, teaching on the UWE undergraduate courses taught at the zoo and supervising BSc and MSc students. Her main interests include sexual selection and genetics, animal behaviour, welfare and enrichment. She also assists with primate Red List assessments, edits the journal *Lemur News* and organises university day visits and monthly conservation lectures.

## **Osiris Doumbe – Lecturer in Conservation Science**



Osiris obtained his MSc in Tropical Ecology from the University of Antilles and Guyana, Guadeloupe, French Indies. He studied the feeding ecology of freshwater crustaceans, supervised by Dr Dominique Monti. After that, he assisted a PhD student at Affenberg Salem, Germany, for four months studying the behaviour of female barbary macaques living semi-freely. The following year, he studied Primate Biology, Behaviour and Conservation at Roehampton University, London, UK. For this MRes, Osiris studied the nesting ecology of Nigeria-Cameroon chimpanzees in a small fragmented mountainous forest of north-western Cameroon. He later created and led the Ellioti Project, a regional project to map the distribution of chimpanzees and the diversity of monkeys in this same area. Osiris is now a Lecturer in Conservation Science as a maternity cover at Bristol Zoological Society

## **Dr Tim Bray – Lecturer in Conservation Science**



Tim specialises in using molecular genetic approaches to answer questions in conservation, ecology, and the distribution of biological diversity. He has worked with a variety of ecological and evolutionary systems across several geographical regions. His work encompasses a wide range of spatial and temporal scales as well as considering the genetic data in the context of environmental variables.

Subsequent to an MSc in Ecology (Bangor) his PhD project considered genetic introgression in a minority cattle breed (Cardiff). He has since continued to work largely with mammalian populations in Africa and Arabia. As well as the more well-known groups, such as grey wolves and pipistrelle bats, his work has touched on the more obscure; including jirds, spiny mice, and the solitary Cape dune mole-rat. Most recently his work has touched on the incredible diversity of South-east Asian beetle communities, looking into species delimitation and phylogenomics.

## **Dr Torsten Wronski – Lecturer in Conservation Science**



Torsten obtained his MSc and PhD from the University of Hamburg, Germany, in Behavioral Ecology. He has managed several research projects on African ungulates, has been responsible for off-shore monitoring of harbor porpoises in the North Sea and studies of terrestrial gastropods in the Albertine Rift Valley and on Bioko Island. After his postdoctoral fellowship, he moved to Saudi Arabia to head the Field Conservation department at King Khalid Wildlife Research Centre. Working with the Zoological Society of London, he was involved in the management of several protected areas and advised the Saudi Wildlife Authority on wildlife reintroduction and conservation management. Following this he worked for the University of Rwanda and at Northwest A&F University, China, implementing research projects on rangeland degradation and its effects on biodiversity. He is a member of the IUCN Wildlife Health and Antelope Specialist Groups.



## **Jen Nightingale - UK Conservation Officer**



Jen Nightingale gained a degree in Zoology from the University of Bristol, a Masters in Wildlife Management and Conservation from Reading University and is a full member of the Institute of Ecological and Environmental Management. With extensive experience in the aquarium industry, from Vancouver Aquarium and European Sealife Centres, she became Curator of the Aquarium at Bristol Zoo Gardens in 1997 where she focused on a programme of extensive modernisation of exhibits, off show breeding facilities, infrastructure and educational themes.

During this time Jen also played a major role in two successful water vole reintroductions and extended this to establish the position of UK Conservation Officer at the zoo. Within this current role Jen focuses on the conservation of UK species both *in-* and *ex-situ* and project manages the South West Crayfish Project, the largest white-clawed crayfish initiative in the UK. This project has established 8 ark sites for this species, is developing a captive breeding programme at the zoo and an extensive communication outreach initiative. Jen is on the Steering Committee of the BIAZA native species focus group. She is also studying part-time for her PhD.

## **Katie Major – Conservation Campaign Manager**



Katie's interest in animal behaviour and wildlife conservation first developed during her BSc Psychology degree at Plymouth University. She completed an MSc in Primate Conservation at Oxford Brookes University and has conducted research examining the behaviour and welfare of various captive species in both zoos and aquariums, including fish and lemurs and has also spent eight months living in remote forests of the Philippines working with the Agta, an indigenous hunter-gatherer population. During this fieldwork she examined the knowledge and perceptions the Agta had of the national park they lived in and their relationship with the wildlife around them, as well as working as a field assistant collecting genealogical information and behavioural data. Katie joined BZS in spring 2015 and is responsible for coordinating and managing behaviour-change campaigns at Bristol Zoo Gardens.

## About the speakers



**Prof Peter Barham**  
**Department of Physics,**  
**University of Bristol**

Peter Barham is Professor Emeritus in the School of Physics at Bristol University UK, honorary Professor of Molecular Gastronomy in the Life Sciences faculty of the University of Copenhagen and honorary Research Associate at the Animal Demography Unit in Zoology at the University of Cape Town. He has been involved with conservation based research into African penguins for more than 15 years.



**Dr David Bird**

**Principal Lecturer – Environmental Biology  
University of the West of England**

Dave Bird studied zoology as an undergraduate at Reading University, completed a PhD at Murdoch University in Western Australia and currently lectures at the University of the West of England, Bristol. His research has mainly involved the biochemistry and ecology of fish in estuaries and in tropical environments. As a lecturer in eco-physiology and conservation, he has had a long involvement with undergraduate fieldwork in the UK and has helped develop field trips to Tenerife, Cuba and Madagascar. His interest in the scientific application of drones developed from his experience with photography. He is one of the Directors of Skyview Ecology Ltd, a company that explores the potential of using aerial imagery for ecology and conservation.



**Dr Chris Chuck**

**Department of Chemical Engineering  
University of Bath**

Christopher Chuck attended the University of York obtaining an MChem before moving to the University of Bath to complete his PhD. Chris was awarded a Whorrod Research Fellowship in 2011, to work on the interface between Biology, Chemistry and Engineering. Chris is currently a lecturer in Chemical Engineering and in his research he works toward producing a microbial biorefinery that remediates environmental wastes while producing biofuels and bioproducts.



## **Dr Natasha De Vere**

### **National Botanic Garden of Wales**

Natasha de Vere is Head of Science at the National Botanic Garden of Wales and a Senior Lecturer at the Institute of Biological, Environmental and Rural Sciences at Aberystwyth University and has been responsible for the science programme at the Garden for the last eight years. During this time she led the team that made Wales the first nation in the world to DNA barcode its native flora. She has gone on to work on a wide variety of projects, both nationally and internationally, that use DNA barcoding. These range from monitoring pollen for hayfever sufferers to fighting wildlife crime.

A key focus of Natasha's research is using DNA metabarcoding to understand foraging preferences of both wild pollinators and honeybees and aims to develop conservation solutions that help to address pollinator declines. Natasha is passionate about public engagement with science and regularly presents her research on television and radio. A particular passion is using art-science projects to engage and develop a wide audience with scientific ideas.



## **Dr Marc Holderied**

### **Senior Lecturer in Biology**

### **University of Bristol**

Marc completed his PhD at the University of Erlangen where he implemented 3D acoustic tracking of animals in the field. After spending time at the universities of Maryland and Erlangen he came to the School of Biological Sciences at the University of Bristol in 2008.

Marc is a sensory ecologist whose research focus is on innovative next-generation bioacoustics starting from establishing the exciting new fields of acoustic camouflage, and bio-inspired robotics navigation to developing acoustic methods for wildlife conservation. His current research team, the BASE-lab, consists of 14 post graduate research students and two postdoctoral researchers.



**Dr Alex Piel**

**Lecturer in Animal Behaviour  
Liverpool John Moores University**

Alex is a lecturer in Animal Behaviour, focusing on primate behaviour and ecology. He has conducted fieldwork in both East and West Africa, focusing on primate adaptations to a highly seasonal, open and dry habitat. His current research centres on primate community ecology in the miombo woodlands of western Tanzania, where he co-directs the Ugalla Primate Project. Specifically, he is interested in the consequences to sociality and communication for animals that live at remarkably low population densities and that exhibit vast home ranges.



**Dr Mark Steer**

**Lecturer in Behavioural Ecology  
University of the West of England**

Mark is a practical conservation biologist who works closely with other practitioners to answer questions of direct importance to conservation organisations, industrial stakeholders and volunteer organisations. His interests lie in the conservation and restoration of ecological processes both in the UK and, more recently, Madagascar.

Mark leads a new MSc in Advanced Wildlife Conservation in Practice as well as teaching on a number of undergraduate degrees. His main interests are in techniques for survey and monitoring at the landscape scale, ecological impacts of species reintroductions and impacts of new technologies on land use.



**Dr Richard Sherley**

**Postdoctoral Research Associate, Bristol Zoological Society/  
Environment and Sustainability Institute, Exeter University**

Richard gained a PhD from the University of Bristol in 2010 for research on the conservation and ecology of two seabird species on Robben Island, South Africa. He carried out postdoctoral research at the University of Cape Town, before joining BZS in 2015. His interests focus on conservation biology and population ecology.

Richard studies seabirds to understand the impact of anthropogenic and environmental change in marine ecosystems. More broadly, he is interested in how the conditions that animals experience during development may influence later fitness, how to consider life-history strategies in conservation and how technology can assist our understanding of animal behaviour and population ecology to create tangible conservation benefits.



**Prof Serge Wich**

**Natural Sciences and Psychology  
Liverpool John Moores University**

Serge Wich started his biology study at the University of Amsterdam and obtained his PhD in 2002 at Utrecht University. After a postdoctoral post at Utrecht University he joined Great Ape Trust of Iowa in 2005 until in 2009 he joined the Sumatran Orangutan Conservation Program and the University of Zurich. He joined Liverpool John Moores University as a professor in primate biology in 2012. In 2014 he joined the UvA as an honorary professor for the conservation of the great apes. His research focuses on primate behavioral ecology, tropical rainforest ecology and conservation of primates and their habitats. Together with Dr Lian Pin Koh he founded the non-profit ConservationDrones.org and uses drones for conservation applications.

# Abstracts

## **Non-invasive technologies for individual identification**

**Peter Barham**

There are many reasons why we might want to be able to identify individual animals: to monitor breeding success over many years, to estimate survival rates; to measure mate fidelity and so on. The traditional method has been to mark the animals in some way (e.g. ringing birds, cutting notches in scutes on crocodiles, etc.). While these methods are generally successful, they have a lot of drawbacks not the least of which is the need to capture the animal in the first place and the uncertainty in reading the band numbers and the risk of natural damage altering the marks you have made.

In this talk I will discuss alternative methods that we have applied to African penguins and outline some of the interesting results we have been able to uncover which otherwise would probably not have been possible.

# Right place, wrong time: a broad-scale ecological trap revealed through metapopulation level tracking of juvenile African penguins

**Richard Sherley**

Human-mediated pressures are rapidly degrading marine habitats worldwide. Where habitat worsens but animals continue to use historical relationships between environmental cues and habitat quality, they may fall into ecological traps. Many long-lived marine vertebrates refine their navigation and foraging skills over many years; thus inexperienced juveniles may be particularly vulnerable to selecting habitat that lowers fitness. Dispersal influences the population dynamics of many marine vertebrates, so effective conservation requires understanding of how immature animals use their environment. However, few studies have tracked juvenile animals in the ocean at a metapopulation scale.

We used satellite transmitters (PTTs) to track the postnatal dispersal of 54 fledgling African penguins *Spheniscus demersus* from eight colonies spanning the species' breeding range. We assessed whether their behaviour enabled them to access high quality foraging habitat in light of widespread changes in the marine ecosystems of South Africa and Namibia. Our results suggest dispersal targeted productive areas (high chlorophyll-*a* concentration) within a particular thermal range (SST 14.5–17.5°C), normally associated with high forage fish availability. However, environmental change and localised overfishing have driven ecological regime shifts in the Benguela Upwelling ecosystem, inducing mismatches between productivity and forage fish availability in some areas. As a consequence, fledglings from Namibia and western South Africa now forage in degraded habitats with a poor prognosis for their survival.

Management that reduces pressure on scarce forage fish resources, such as spatially-explicit fisheries management, may be required to ensure the sustainability of this marine ecosystem. More broadly, our results have identified an ecological trap operating at an ecosystem-wide scale and highlight the importance of considering the initial dispersal of marine vertebrates in conservation planning.



# **Opportunities and risks of lab-grown food: what should a conservationist think?**

**Mark Steer**

A rising world population and human consumption levels are putting ever-increasing pressures on our food production systems and the environment. The ability to produce more food while mitigating impacts on the natural world is one of the big challenges of the modern age. The relatively low production efficiency and high environmental impacts of livestock production are leading some companies to explore ways of growing meat and other animal products in the lab. What if they succeed?

This talk will explore the environmental opportunities and risks that these new technologies represent, and pose the question of how can we best plan for a future of cellular agriculture.

# **Could oily yeast be used as a novel source of fuels, chemicals and food?**

**Chris Chuck**

In this talk I will lay out the need for alternative sources of edible oils such as palm oil, and delve further into the many traits that micro-organisms need to be able to provide a sustainable alternative. I will conclude on what the latest developments in industry are and how close we are to a fully renewable alternative.

# Using DNA metabarcoding to understand the favourite flowers of honeybees and wild pollinators

**Natasha De Vere**

There is considerable concern worldwide about declines in both wild pollinators and honeybees due to habitat loss, agricultural intensification, pests and disease and climate change. Understanding the reasons for these declines and providing conservation guidance requires detailed information on the habitat requirements and foraging preferences of pollinating insects. DNA metabarcoding of pollen collected by insects provides a powerful method for tracking floral visitation. Pollen can be retrieved from the bodies of insects, or from pollen loads or honey from honeybees. DNA is extracted, amplified using DNA barcode markers and then sequenced using the Illumina MiSeq platform. Key to ability to identify unknown DNA samples is a comprehensive DNA barcode reference library. We have DNA barcoded all of the native flowering plants of the UK (1479 species) along with non-native, horticultural and agricultural plants likely to be important for pollinators.

I will present three case studies that illustrate the use of pollen DNA metabarcoding. 1: Honey samples have been collected from hives situated within the National Botanic Garden of Wales. The vegetation of the botanic garden has been mapped so that honeybee foraging can be shown in a spatially explicit way. 2: Honey samples have been collected from beekeepers throughout the UK to investigate the floral range of honeybees in different geographic areas. 3: Hoverflies in the genus *Eristalis* have been sampled from four grasslands of varying plant species diversity. Floral constancy will be compared across individuals, species and sites.

# **Acoustics and conservation - current research between Bristol Zoo and the University of Bristol**

## **Marc Holderied**

The School of Biological Sciences at the University of Bristol and the Bristol Zoological Society have a long record of collaborations on conservation research. My Behavioural Acoustics and Sensory Ecology (BASE) lab has conducted research with the BZS for over seven years including the projects of 5 PhD and 7 MSc students with field work conducted in South Africa and Madagascar. Many of these projects have had a strong quantitative acoustics approach. I will present these projects and their specific technological approaches, and show some emerging acoustic technologies that we hope to use in the future.

# **Sounds on the Savanna: Remote acoustic monitoring for the study of wild primates**

**Alex Piel**

Remote sensing of wildlife presence and behaviour has widespread applications for conservation, from censusing animal populations to monitoring land cover change, often as a result of human activity. Recent developments in camera trapping, satellite imagery, and unmanned aerial vehicles have propelled this approach forward, but it is not just the visibility of animals that has improved.

Remote acoustic monitoring can provide continuous data on the presence, distribution, and movement of conspicuous and cryptic species alike. Moreover, whilst historically passive acoustic monitoring (PAM) stored data in-house and required labour-intensive checks of recording units, some systems offer real-time transmission and on-board processing, expanding the uses of this technology, whilst minimising maintenance. In my talk, I will review different ways to remotely monitor wildlife acoustically, and describe examples from the primates, especially in western Tanzania.

# **Conservation drones to monitor wildlife and its habitat**

## **Serge Wich**

Land-cover change and hunting are leading to major declines in tropical biodiversity. The fast changes occurring in the tropics place an urgent need on rapid and affordable techniques to monitor wildlife and its habitats. Recently the use of drones in conservation has increased markedly. Drones allow for the acquisition of very-high resolution imagery in a flexible low-cost system. A variety of sensors can be used to obtain images that can be used to determine the distribution and density of animals and allow for land-cover mapping and change detection.

In this talk I will describe some recent examples of how drones have been applied to conservation. These will include the counting of orang utan and chimpanzee nests to determine their distribution and density, automatic detection of species, land-cover classification and change monitoring, and some thoughts on the future of technology and conservation.

# **Applications of drones in nature conservation**

## **David Bird**

Unmanned Aerial Vehicles (UAVs), better known as drones, are becoming increasingly important scientific tools. Drones are packed with sophisticated technology that allows them to fly autonomously over pre-defined areas. With the help of advanced software, they can generate maps and monitor habitats over time, provide rapid assessments of plant and animal populations and assist with the conservation of vulnerable species and ecosystems, especially where access is difficult or dangerous.

As instrumentation becomes smaller and light enough to be carried by drones, it is now possible to use LIDAR and multispectral cameras, in addition to conventional photography, to collect information and imagery that is more detailed and less expensive than can be obtained using satellites.

# Poster Abstracts



## ***Ex-situ* conservation of the pancake tortoise (*Malacochersus tornieri*) - novel DNA markers for the genetic characterisation of captive breeding populations.**

Joel Allainguillaume<sup>1</sup>, G. McCabe<sup>2</sup>, T. Skelton<sup>2</sup>, A. Croxford<sup>3</sup>, D. Kerhoas<sup>2</sup>, T. Bray<sup>2</sup>, A. Campbell<sup>1</sup>, Z. McLean<sup>1</sup> and J. Rodrigues Santos<sup>1</sup>

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3. Plant Research Centre, University of Adelaide, Australia 5005

The pancake tortoise (*Malacochersus tornieri*), an East African species, has experienced major population declines due to heavy exploitation for the exotic pet trade. Populations are also threatened by agricultural practices and livestock grazing. The pancake tortoise is classified as Vulnerable on the IUCN Red List and listed on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The species is now the subject of a coordinated breeding programme within the UK and other European zoos with several young pancake tortoises having been hatched successfully in Bristol Zoo's incubators.

Examining the genetics of a captive population is necessary to be able to better manage their breeding program. At present, many pancake tortoises in captivity are animals confiscated at customs and thus information regarding their geographical origin as well as the level of genetic diversity or relatedness between individuals is missing. In order to conserve this species effectively we need to identify molecular markers specific to the species. A molecular study conducted in a collaborative project between Bristol Zoo Gardens and the University of the West of England (UWE) has confirmed that good quality DNA samples can be collected using buccal swabs thus facilitating a wider collection from many individuals in captivity. Diagnostic markers including 23 mitochondrial DNA variants (which are maternally inherited) and 400 nuclear microsatellites markers have been identified. These can now be used in pedigree analysis for the selection of the best individuals in the breeding of pancake tortoises.

**Key words:** *Malacochersus tornieri*, DNA markers, mitochondrial DNA variants, pancake tortoise

# Camera trapping to inform jaguar and associated biodiversity conservation across increasing human-use landscapes in Colombia

**Valeria Boron**

Durrell Institute of Conservation and Ecology, University of Kent, Canterbury CT2 8SE

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Habitat loss is considered the main threat to biodiversity worldwide, and especially for large carnivores like jaguars (*Panthera onca*), due to their slow reproduction rate and large area requirements. Information on neotropical species in unprotected areas is scarce and baseline data for conservation and management are needed, especially in ever increasing oil-palm (*Elaeis guineensis*) landscapes. Camera trapping was used (50 stations, 1.7 – 2.3 km apart, 120 survey-days) across an agricultural area with oil-palm plantations in the Magdalena river valley of Colombia with the following objectives: compile species inventories across different habitat types, estimate jaguar density through classical and spatially explicit capture-recapture models, and investigate jaguar habitat use.

Nineteen mammal species were recorded, of which only three were in oil palm areas. Twelve individual jaguars were recorded (143 independent capture events) with a resulting density of 2.9 – 4.9 jaguars/100 km<sup>2</sup>, depending on the analysis used. Jaguars were strongly associated with wetland habitats. Results indicate that, for mammals including jaguars survival across human dominated landscapes, it is vital to maintain natural and wetland habitat through land-use planning. The use of camera traps was effective for collecting data on jaguar population size, habitat use, and even provided unexpected insights into jaguar reproductive biology. Finally, camera trapping proved to be a powerful tool for engagement with all administrative levels (local, regional and national).

**Key words:** *Panthera onca*, camera trapping, habitat use, jaguars

# Investigating the effects of spatial management of South African fisheries on African penguins *Spheniscus demersus* in the Western Cape of South Africa

Jennifer L. Grigg<sup>1</sup>, Richard B. Sherley<sup>2</sup>, Antje Steinfurth<sup>3,4</sup>, Kate Campbell<sup>4,5</sup>, Katrin Ludynia<sup>4,6</sup>, Azwianewi B. Makhado<sup>7</sup>, Leisha Upfold<sup>7</sup>, Johan Visagie<sup>8</sup>, Robert J.M. Crawford<sup>4,5,7</sup>

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The African penguin (*Spheniscus demersus*) population has decreased by over 90% since 1900 and, in South Africa, within the last decade has decreased by around 10% per year since 2004. Reduced access to food has influenced breeding success and survival of African penguins and driven the current decline. Shifts in prey availability away from South Africa's west coast have resulted in a mismatch between the locations of the penguin breeding colonies and their prey. However, it remains unclear whether commercial fisheries affect the penguins by competing for food and over what spatial scale this occurs. Poor sardine availability, potentially exacerbated by a regional concentration of fishing effort, may also be affecting the penguin population. As the population decline continues, it becomes increasingly important to understand the penguin-fishery competition and implement appropriate spatial management. Since 2008 experimental small-scale closures to purse-seine fishing have been alternated around four main breeding colonies off the west and south coasts of South Africa.

In this study, we investigated whether these fishing closures can positively influence penguin fitness. This will provide information to determine whether introducing permanent fishing closures around colonies will be an effective conservation intervention. We compared indicators of African penguin breeding success as measured by chick growth and chick condition as well as foraging parameters, collected during periods both when fishing was allowed around the colonies and when it was excluded. We tested the hypothesis that the presence of a fishing closure will result in decreased penguin foraging effort and increased breeding success, as a result of an increased abundance of local fish availability.

Since 2008 measurements of chick growth and chick condition have been made at Robben Island and Dassen Island. Foraging parameters (foraging trip duration, foraging path length, maximum distance from colony) were measured using GPS-TD loggers. Measurements of growth from 866 African penguin chicks, 9436 measures of chick condition, and foraging parameters from 347 foraging trips were analysed and contributed to the study. While fishing closures were in place African penguins at Robben Island decreased their foraging effort, and chick condition increased significantly. However, there was no difference in chick growth. In contrast, at Dassen Island, the closures provided no benefit to foraging or penguin breeding output. Overall these results suggest that small scale fishing closures can benefit African penguins, but would not be sufficient to offset current population declines on their own. Further research is required to determine whether small-scale closures in conjunction with other spatial management systems would be effective in mitigating the effect of changing environmental conditions for African penguins.

**Keywords:**

*Spheniscus demersus*, African penguin, breeding success, foraging effort, seabird-fisheries interactions, spatial management of fisheries,

# Acoustic survey of habitat preference of the Sambirano mouse lemur, *Microcebus sambiranensis*, with a description of its vocal repertoire

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Acoustic loud calls in cryptic, nocturnal primates are vital to carry a variety of information to other members of the population. The acoustic traits of these calls are an effective vocal fingerprint to discriminate between sibling species for taxonomic discrimination. Despite this potential, the vocal behaviour of nocturnal primates has been poorly studied and there have only been a handful of studies on the species-specific vocal repertoires of nocturnal primates. This study addresses this issue by compiling a vocal repertoire for the Endangered Sambirano mouse lemur, *Microcebus sambiranensis*, an as yet unstudied nocturnal primate of the Anabohazo Forest, north-western Madagascar.

Vocalisations from radio-collared individuals were recorded using handheld recorders over a three month period. An acoustic survey was used to reveal the nocturnal patterns of calling activity and differences of use within four forest habitat types of *M. sambiranensis* within the study site. Five call types were identified for this species and their acoustic properties were compared to similar calls of two other mouse lemur species; *M. murinus* and *M. rufus*. We found that there are significant differences in the vocal repertoire of the three species, with one call type, the whistle, having considerably different acoustic properties when compared across species. The acoustic survey revealed that *M. sambiranensis* individuals have a preference for secondary forest, riparian forest and forest edge habitats compared to primary forest. Future research is needed to clarify the reason for these vocal differences and whether mouse lemur acoustic communication is shaped by phylogenetic constraints or environmental stressors.

**Key words:** *Microcebus sambiranensis*; acoustic survey, vocal repertoire, habitat preference, lemurs



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