

Percy FitzPatrick Institute of African Ornithology

DST/NRF CENTRE OF EXCELLENCE

UNIVERSITY OF CAPE TOWN



ANNUAL REPORT

2012

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FRONT COVER: **Bar-tailed Godwit** *Limosa lapponia* (Photo: Peter Ryan)

OPPOSITE: **Grey Heron** *Ardea cinerea* (Photo: Peter Ryan)

PUBLICATION LAYOUT AND TYPESETTING BY HILARY BUCHANAN



Director's Report



Acting Director of the Fitz, A/Prof. Peter Ryan. (Photo: John Graham)

2012 was a watershed year for the Fitztute; a year spent holding our collective breaths. And unfortunately it did not end happily. The year started normally enough. January and February were the usual whirl of activity as the CB class of 2011 rushed to complete their research projects, and we welcomed the new class of 2012. But in March we learned that our Director, Phil Hockey, had been diagnosed with cancer. His prognosis was good, but he would be absent from the office periodically as he underwent an intensive course of chemo- and radiotherapy. And so we took a deep breath, and waited.

Things progressed normally enough through winter. Phil's tumour shrunk away; the oncologists were amazed by his progress. But by spring it was clear that all was not well. Phil reacted badly to a new round of treatment, and it was less clear what would happen next. Still, for most of us it was only at the end of year party, kindly hosted by Hilary and Ross Buchanan, when we realised that Phil was not coming back. He put a brave face on it, giving a short speech where he reiterated the findings of the Centre of Excellence (CoE) review that showed the Fitztute was being more productive than ever in terms of numbers of students and the quality and quantity of our research publications.

Collective shock set in. We got the chance to say goodbye before Phil finally died on 24 January 2013, but the Fitz was left drifting rudderless. It's fair to say that institutional momentum carried us through the latter part of 2012 and into 2013. Existing projects continued, new projects were initiated, and we continued to produce large numbers of quality publications and students. 2012 saw the publication of 87 papers in peer-reviewed journals by the CoE, of which more than one third were in journals with impacts factors greater than 3.5. The Fitz was home to 13 postdocs and 47 students, the highest totals of each, and 3 PhD, 1 MSc and 12 conservation biology MSc students graduated. Rowen van Eeden deserves a special mention for receiving the Purcell Memorial Prize for the best dissertation in zoology at UCT for his MSc thesis on African Penguin foraging ecology.

But new leadership was required. In mid-January 2013 I was asked by the Dean to stand as Acting Director. After consulting with the other academic staff, I accepted the position on condition that the University move as swiftly as possible to appoint a new Director. Unfortunately the post was only advertised three months after Phil's death, and the response was muted to say the least. In June the selection committee decided to re-advertise, and with the closing date for applications only at the end of September, we are unlikely to have a new Director much before March 2014.

Phil's death sees a major change in the Fitz. I have been involved with the institute since I was a schoolboy in the late 1970s. And throughout most of that time the Fitz core academic staff was Siegfried, Crowe and Hockey. I joined the staff in 1993, on a Zoology Department post created to run the conservation biology MSc programme. After Roy's retirement, Morné du Plessis was appointed Director, and a few years later the institute was recognized as a national Centre of Excellence. This substantially increased our resource base, and we grew further through associations with researchers at institutions throughout South Africa and in Europe and North America. It also provided sufficient momentum to finally fill the Pola Pasvolsky Chair of Conservation Biology, and

Graeme Cumming joined the academic staff.

When Morné left to lead WWF-SA, Phil Hockey moved into the hotseat, making way for Arjun Amar to become the first new academic appointment other than at Director level in more than 30 years. Sadly, around this time, ill-health saw Tim Crowe's involvement in the institute start to wane. Phil's death and Tim's retirement in 2013 sees the end of the old triumvirate of Siegfried, Crowe and Hockey. It also sees the union of Zoology and Botany into a new, mega-department of Biological Sciences. How will the Fitztitute move forward?

I see two paths ahead. The high road sees the appointment of a new, dynamic Director who builds on the solid foundation left by his predecessor, and Tim Crowe's post is filled by a young, promising researcher who adds cutting edge skills to the academic pool. The Centre of Excellence (CoE) funding, recently renewed for a further five years, carries the new team through their honeymoon period, leaving them ready to gain a further extension in CoE support and to compete for international research funds. The low road sees the effective loss of Tim Crowe's post, despite the University's undertaking to maintain current staffing throughout the duration of CoE funding. If, as is planned, I move laterally into Tim's position, the future of the Conservation Biology MSc programme is placed in jeopardy, which in turn threatens a further extension of CoE funding in five years. Ornithological research will continue at UCT, but the momentum gained through the CoE since 2005 will have been lost.

The leadership transition at the Fitz occurs at a time when the Science Faculty is being asked to shave its budget by 6%. This challenge is being met by a freeze on posts, resulting in the loss of numerous positions within Biological Sciences through retirements in 2013. The chances of following the high road thus appear to be remote unless we can find external funding to maintain the academic staff complement. Worryingly, this crisis seems likely to recur at the end of 2014, when Chris Tobler, who has been central to the smooth running of the Fitz since 1990, retires. The Department of Biological Sciences also is deemed to have too many support staff, and so one of the new Director's first battles will be to argue for the need to maintain Chris's post.

Unfortunately the cost-cutting measures being undertaken by the University appear to be largely independent of any cost-benefit analysis. The conservation biology MSc programme generates more than R2 million each year in subsidy income for the University; is it really worth placing this at risk for the sake of a lecturer position that costs less than one quarter of this? It is also naive to expect the Fitz to continue to generate more than R7 million in subsidy income annually if the staff complement shrinks. The Fitz is more productive than it has ever been, both in terms of the quality and quantity of publications, and the number of students graduating, but we cannot continue at this rate with a reduced staff complement. Currently we have 43 postgraduate students being supervised by three staff members, which is too many to provide an adequate level of supervision. Even once a new Director is appointed, we are likely to see a decrease in outputs, simply because of limited capacity. A similar pull back happened in the 1990s, following the cessation of the Co-operative Scientific Programmes funding, which saw the loss of several research positions at the Fitz.

Peter Ryan, Acting Director, July 2013

New Fitz CoE Board Members:



Mr Tasso Leventis



Dr Hanneline Smit-Robinson

Philip Anthony Richard Hockey (1956-2013)



Phil Hockey, the fourth Director of the University of Cape Town's Percy FitzPatrick Institute of African Ornithology, died on 24 January 2013 after a year-long battle with cancer. His career was intimately linked with the Fitztitute, where he studied African Oystercatchers *Haematopus moquini* for his PhD from 1979 to 1983, and remained ever since. He took over as Director in 2008, continuing a period of growth linked to the Institute's recognition as a national centre of research excellence. During his career, Phil contributed to our understanding of the role of birds in inter-tidal ecology and the factors underpinning migration distance. In birding circles, he is perhaps best known as the lead editor of the seventh edition of *Roberts' Birds of Southern Africa* (John Voelcker Bird Book Fund, 2005), which saw Roberts being transformed into a handbook that made accessible the wealth of scientific information on southern African birds.

Born in Bournemouth on 8 March 1956, Phil grew up in rural Gloucestershire. He had a passion for natural history from an early age, collecting fossils, butterflies and reptiles, but his main passion was for birds, with Chew Valley his local patch. Phil's father encouraged his obsession, driving him all over the country to look for new birds, and spending long hours during winter in freezing hides overlooking the Severn Estuary while Phil searched for rare geese. Phil gained a scholarship to Monkton Combe School, Bath, where he completed A-levels in Maths and Science. He then spent a year teaching at Moffat School, Shropshire, before completing his BSc Hons in Ecological Science at Edinburgh University. He subsequently published some of his undergraduate work on wintering Common Pochards *Aythya ferina* in *Scottish Birds* (1983).

Phil first came to South Africa in 1976 as an assistant to Ron Summers studying the breeding biology of White-fronted Plovers *Charadrius marginatus* at Langebaan Lagoon. Enjoying the Cape's easy-going lifestyle and pleasant climate, he and his then wife Carole moved to South Africa in 1979 to study African Oystercatchers. They spent their first couple of years based in the Bob Rand House on Marcus Island, where Phil made several significant contributions to rocky shore ecology (*South African Journal of Science*, 1983). He identified the key role oystercatchers play in structuring inter-tidal communities by removing grazing limpets (*Ardea*, 1984), and together with his first PhD student, Alison Bosman, he demonstrated how enhanced productivity on island rocky shores was linked to runoff from seabird breeding colonies (*Marine Ecology Progress Series*, 1986).

Even in those early years, Phil demonstrated his versatility as a scientist. I was able to appreciate his skills first hand in 1985 during the Fitztitute's 25th Anniversary Expedition to Chile, where Phil, Alison Bosman and I worked on various shorebird projects. The five-week trip resulted in no fewer than six papers, including one that explained polymorphism and cryptic mimesis in a limpet due to predation by cinclodes (*Veliger* 1987). He extended the lessons learned from oystercatcher predation to manage human exploitation of rocky shore communities (*Environmental Conservation*, 1985; *Oikos*, 1986), and demonstrated an early awareness of the potential impacts of human disturbance, initiating a study on the impacts of disturbance on African Penguins *Spheniscus demersus* (*South African Journal of Wildlife Research*, 1981). He also appreciated the need for solid baseline data, and was involved in setting up the guidelines for the first southern African bird atlas. His first book was the *Atlas of the Birds of the Southwestern Cape* (Cape Bird Club, 1989).

After taking up a teaching position at the Fitztitute in 1986, Phil's main research thrust remained the foraging ecology of coastal shorebirds. He led research teams to tropical Africa and islands in the Indian Ocean, South America, the Canary Islands and the Middle East. His seminal paper on wader migration (*American Naturalist*, 1992) literally turned upside down the way we perceive the factors underpinning long-distance migration in shorebirds. He showed that, contrary to conventional wisdom, migrant shorebird densities are highest at the southern limits of their migratory ranges, and was able to

explain this elegantly in terms of a latitudinal gradient in food production during the austral summer. He was soon recognised as the authority on African waders and in 1995 he published the monograph *Waders of Southern Africa* (Struik Winchester).

Phil combined his interests in conservation and shorebirds in the 1990s, when he launched a highly successful public outreach programme that used African Oystercatchers as a flagship for coastal conservation. In part, this led to the banning of off-road vehicles on South African beaches, a measure that remains in force today and that has done as much to conserve inshore fish populations from shore-based angling as it has coastal birds. His beloved African Oystercatchers are now more numerous than they have been in the last 50 years, although this has as much to do with the invasion of the southern African coast by the mussel *Mytilus galloprovincialis* (a species first discovered in the region by Phil) as it does with his active conservation initiatives.

As is often the case in countries with a relatively small research community, Phil published on a wide range of topics and birds. Waders were his first love, but together with his students he also worked on gulls, terns, penguins, gannets, raptors, rails, bustards, cranes, gamebirds, ducks, larks and warblers. This gave Phil an extraordinary breadth of knowledge, which made him a natural choice to lead the revision of *Roberts' Birds* as a fully-referenced handbook. The resultant five-year project tested even Phil's legendary work ethic, and brought his otherwise prolific publication record to a near standstill.

In recent years, Phil became involved in addressing the impacts of climate change on birds. His initial work pointed out the folly of invoking climate change to explain recent bird range changes, because most such changes result from other factors such as habitat alteration (Ostrich, 2009; *Diversity and Distributions*, 2011). Frustrated by the lack of empirical evidence on the impacts of climate change on bird populations, he initiated the 'hot birds' programme to investigate how birds in hot, arid environments are likely to be impacted by hotter climates. It is extremely unfortunate that he was unable to carry this project through to full fruition.

During his academic career, Phil graduated more than fifty PhD and MSc students and supervised eight Post-doctoral Fellows. Among his better known students are Morné du Plessis (World Wide Fund for Nature), Olivier Langrand (Island Conservation) and Ross Wanless (BirdLife). He published more than 120 scientific papers, 150 semi-popular articles, ten books and numerous book chapters, including the family account for oystercatchers in the *Handbook of*

the Birds of the World.

Phil retained his enthusiasm for birding throughout his life. He was chairman of the southern African rare birds committee for many years, and was always happy to discuss birds with all and sundry. Together with Ian Sinclair and Warwick Tarboton, he wrote the best-selling regional field guide *Sasol Birds of Southern Africa*, currently in its fourth edition, as well as numerous other popular books on birds. As a wonderful raconteur and public speaker, he was forever being asked to speak on birds. Indeed, he was passionate about the need to disseminate the science of birds, and their conservation, to a wide audience. These contributions were recognised by the Southern African Network for Coastal and Oceanic Research who named him 'Marine and Coastal Communicator of the Year' in 2000 and he was awarded the Stevenson-Hamilton Medal for contributions to the public awareness of science by the Zoological Society of Southern Africa in 2008.

Yet despite birds being his first love, Phil was far from one-dimensional. He excelled at sports, especially tennis, which he played for Edinburgh University's First Six and competed in the youth competition at Wimbledon. In Cape Town, he was a fierce competitor on the squash courts, defeating much younger opponents with a blend of power and accuracy. He loved solving problems, and was a member of Mensa. Many a birder enjoyed the crosswords and other puzzles he put together for the Christmas editions of *Africa Birds and Birding*. He also had an earthy sense of humour, and frequently wrote humorous articles for birders. He remained down to earth and approachable even as Director of the Fitz, often coming to work in shorts and bare feet. He was always up for a party, where he entertained people with his remarkable repertoire of ditties and doggerel, irrespective of the volume of alcohol he consumed.

As was typical of the man, Phil refused to have any form of memorial ceremony, leaving instructions for a party instead. The number of people who turned up from all over the world is testament to the many people from diverse walks of life touched by his enthusiasm and energy. Yet it is Phil's intellect, insight and leadership that will be missed most. As renowned intertidal ecologist George Branch reminisced "When I really wanted to chew over some serious scientific issue, Phil was always top of my list because of his incisive, lateral thinking and breadth of knowledge". Our condolences go to his wife, Samantha, family in the UK, and his extended family at the Fitz.

Peter G. Ryan

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Staff, Students and Associates

GRADUATES

PhD

UCT: Viviane Barquete Costa; Grant Joseph, Mduduzi Ndlovu (Dec 2012)

MSc

UCT: Rowen van Eeden (Dec 2012)

Conservation Biology MSc

Nikki Best, Emily Cressey, Lauren de Vos, Jeremy Goss, Masumi Gudka, Hlengiwe Mbatha, Jenneca McCarter, Christine Moore, Maurice Schutgens, Lovelater Sebele, Darlington Tuagben, Dan Wright (June 2012) Edward Rice (Dec 2012)

BSc Hons

UCT: Beth Mackay, Jenni Roberts

Pretoria: Bianca Viviers

NEW STUDENTS

Post-doctoral Fellows

Alta de Vos and Kristi Maciejewski (Graeme Cumming); Tom Flower and Martha Nelson-Flower (Phil Hockey)

PhD

Julia Baum (Graeme Cumming), Alistair McInnes (Peter Ryan and Lorien Pichegru) Margaux Rat (Phil Hockey and Rita Covas), Chevonne Reynolds (Graeme Cumming), Dominic Rollinson (Peter Ryan), Tanja van der Ven (Phil Hockey).

Dominic Henry upgraded his MSc to PhD (Graeme Cumming)

MSc

Philna Botha (Tim Cook), Ben Dille (Peter Ryan), John Heydinger (Graeme Cumming), Corlia Meyer (Tim Cook), Dane Paijmans, (Phil Hockey), John Pallett (Peter Ryan), Gareth Tate (Arjun Amar), Otto Whitehead (Peter Ryan), Blair Zoghby (Phil Hockey)

Conservation Biology MSc

Fifteen students began the CB MSc in January 2012, see p. 8 for a listing.

Externally registered:

PhD

Sabrina Engesser (Zurich), James Westrip (Edinburgh), Elizabeth Wiley (Western Australia)

MSc

Lara Broom (Porto), Maxine Whitfield (Pretoria)

Staff

* Denotes permanent member of the UCT staff establishment.

Director

Prof. Phil Hockey, PhD (Cape Town)*

Academic and Research Staff

Prof. Tim Crowe, PhD (Cape Town)*

Prof. Graeme Cumming, PhD (Oxford)*

Assoc. Prof. Peter Ryan, PhD (Cape Town)*

Dr Arjun Amar (PhD (Aberdeen))*

Honorary Professor

Prof. David Cumming, PhD (Rhodes)

External CoE Team Members

Prof. Paulette Bloomer, PhD (Pretoria) – Univ. Pretoria

Asst Prof. Rauri Bowie, PhD (Cape Town) – UC, Berkeley

Assoc. Prof. Andrew McKechnie, PhD (Natal) – Univ. Pretoria

Dr Pierre Pistorius, PHD (Pretoria) – NMMU

Honorary Research Associates

Dr Phoebe Barnard, PhD (Uppsala)

Dr David Grémillet, PhD (Kiel)

Dr Mandy Ridley, PhD (Cambridge)

Dr Rob Simmons, PhD (Wits)

Dr Ross Wanless, PhD (Cape Town)

Research Associates

Dr Rita Covas, PhD (Cape Town)

Dr Richard Dean, PhD (Cape Town)

Dr Andrew Jenkins, PhD (Cape Town)

Dr. Grant Joseph, PhD (Cape Town)

Dr Martim Melo, PhD (Edinburgh)

Michael Mills, MSc (Cape Town)

Dr Antoni Milewski, PhD (Murdoch)

Prof. Sue Milton, PhD (Cape Town)

Dr Lizanne Roxburgh, PhD (Ben Gurion)

Dr Claire Spottiswoode, PhD (Cambridge)

Anthony van Zyl, MSc (Cape Town)

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Manager, DST/NRF Centre of Excellence

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Principal Technical Officer

Chris Tobler*

Administrative Assistant

Hilary Buchanan* BA, HDipLib (UCT)

Senior Secretary, DST/NRF Centre of Excellence

Tania Jansen

Departmental/Accounts Assistant

Anthea Links*

Library Staff

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Webmaster

Melissa Stander

Research Assistants

Jessie Berndt Cassie Carstens Samantha Harebottle

Alistair Fyfe Vera Liebau Kate Meares

Christine Moore Greg Mutumi David Nkosi

Tristan Sandwith Barend Visser

Students

Post-doctoral fellows

Dr Steve Boyes, PhD (KwaZulu-Natal)
 Dr Maelle Connan, PhD (P&M Curie), Jan-Aug
 Dr Timotheé Cook, PhD (La Rochelle)
 Dr Susan Cunningham, PhD (Massey)
 Dr Alta de Vos, PhD (Cape Town), Aug-Dec
 Dr Tom Flower, PhD (Cambridge)
 Dr Alan Lee, PhD (Manchester), Dec
 Dr Kristine Maciejewski, PhD (NMMU), Nov-Dec
 Dr Rowan Martin, PhD (Sheffield)
 Dr Ralf Mullers, PhD (Groningen)
 Dr Martha Nelson-Flower, PhD (Cape Town)
 Dr Graeme Oatley PhD (Cape Town)
 Dr Lorient Pichgru PhD (Strasbourg)
 Dr Tim Reid, PhD (Tasmania)

Doctoral

Viviane Barquete Costa, MSc (Furd, Rio Grande)
 Julia Baum, MSc (KIT, Germany)
 Owen Davies, BSc (Hons) (Cape Town)
 Dominic Henry, BSc (Hons) (Cape Town)
 Potiphar Kaliba, MSc (Cape Town)
 Sonja Krüger, MSc (KwaZulu-Natal)
 Tshifhiwa Mandiwana Neudani, MSc (Cape Town)
 Mduduzi Ndlovu, BSc (Hons) (NUST, Zimbabwe)
 Alistair McInnes, MSc (KwaZulu-Natal)
 Lisa Nupen, MSc (Cape Town)
 Sharon Okanga, MSc (Nairobi)
 Margaux Rat, MSc (Claude Bernard Lyon)
 Chevonne Reynolds, MSc (Wits)
 Dominic Rollinson, MSc (KwaZulu-Natal)
 Jessica Shaw, MSc (Cape Town)
 Alex Thompson, BSc (Hons) (Cambridge)
 Tanja van de Ven, MSc (NMMU)

MSc by dissertation

Philna Botha, BSc (Hons) (Stellenbosch)
 Mia Cerfonteyn, BSc (Hons) (Stellenbosch)
 Ben Dilley, BSc (Hons) (UCT)
 Lisle Gwynn, BSc (Hons) (Plymouth)
 John Heydinger, BSc (Hons) (Cape Town)
 Corlia Meyer, BSc (Hons) (Stellenbosch)
 Dane Paijmans, BSc (Hons) (UKZN)
 John Pallett, BSc (Hons) Wits
 Gareth Tate, BSc (Hons) (Cape Town)
 Rowen van Eeden, BSc (Hons) (Cape Town)
 Bianca Viviers, BSc (Hons) Pretoria
 Otto Whitehead, BSc (Hons) (Cape Town)
 Blair Zoghby, BSc (Hons) (Wits)

Masters in Conservation Biology 2012/13

Daniël Cloete, BSc (Hons) (NMMU)
 Lea Cohen, BA (Hons) (California)
 Kimon de Greef, BSc (Hons) (Cape Town)
 Katherine Forsythe, BSc (Hons) (New South Wales)
 Jessica Greenston, BA (Hons) (Michigan)
 Craig Harding, BSc (Hons) (Western Ontario)
 Wade Lane, BSc (Hons) (Cape Town)
 Vera Liebau, BSc (Hons) (Cape Town)
 Christine Madden, BSc (Hons) (Cape Town)
 Jayaneesh Namah, BSc (Hons) (Mauritius)
 Heinz Ortmann, BSc (Hons) (Stellenbosch)
 Louise Palframan, BSc (Hons) (Cape Town)
 Koebräa Peters, BSc (Hons) (Cape Town)

Kirsten Retief, BSc (Hons) (Cape Town)
 Carolyn Sanguinetti, BSc (Hons) (Kent)

Masters in Conservation Biology 2011/12

Nikki Best, BSc (Hons) (Long Island)
 Emily Cressey, BSc (Hons) (Bristol)
 Lauren de Vos, BSc (Hons) (Cape Town)
 Jeremy Goss, BSc (Hons) (Cape Town)
 Hlengiwe Mbatha, BSc (Hons) (Wits)
 Jenneca McCarter, BSc (Hons) (Arkansas)
 Christine Moore, BSc (Hons) (Western Ontario)
 Edward Rice, BSc (Hons) (KwaZulu-Natal)
 Maurice Schutgens, BSc (Hons) (Nottingham)
 Lovelater Sebele, BSc (Hons) (NUST, Zimbabwe)
 Darlington Tuagben, BSc (Hons) (Kwame Nkrumah)
 Dan Wright, BSc (Hons) (North Carolina)

Masters in Conservation Biology 2010/11

Masumi Gudka

BSc Honours

Beth McKay Jenni Roberts

Externally registered students

Doctoral

Sabrina Engesser – Zurich
 David Humphries – Maquarie
 Matthieu Paquet – Montpellier
 Ben Smit – Pretoria
 Martin Stervander – Lund
 James Westrip – Edinburgh
 Eizabeth Wiley – Western Australia

MSc by dissertation

Lara Broom – U.Porto
 David Green – NMMU
 Asefa Mitiku – Pretoria
 Gavin Rishworth – NMMU
 Maxine Whitfield – Pretoria

BSc Honours

Bianca Viviers - Pretoria

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 Dr Marilet Sienaert (Director, Research Office, UCT)
 Dr Ntabiseng Taole (NRF)
 Prof. Danie Visser (DVC Research, UCT, Chairperson)

Systematics: the foundation of Evolutionary and Conservation Biology

Studies of the relationships among organisms are essential to characterize biodiversity and to understand the processes that generate it. The fields of taxonomy, phylogenetics and biogeography now are united through studies that combine data from DNA, anatomy, behaviour and ecology. Studies conducted under this broad framework at the Fitz tackle questions that range across a range of temporal and spatial scales, from local dispersal and hybridisation to the origin of Africa's birds.

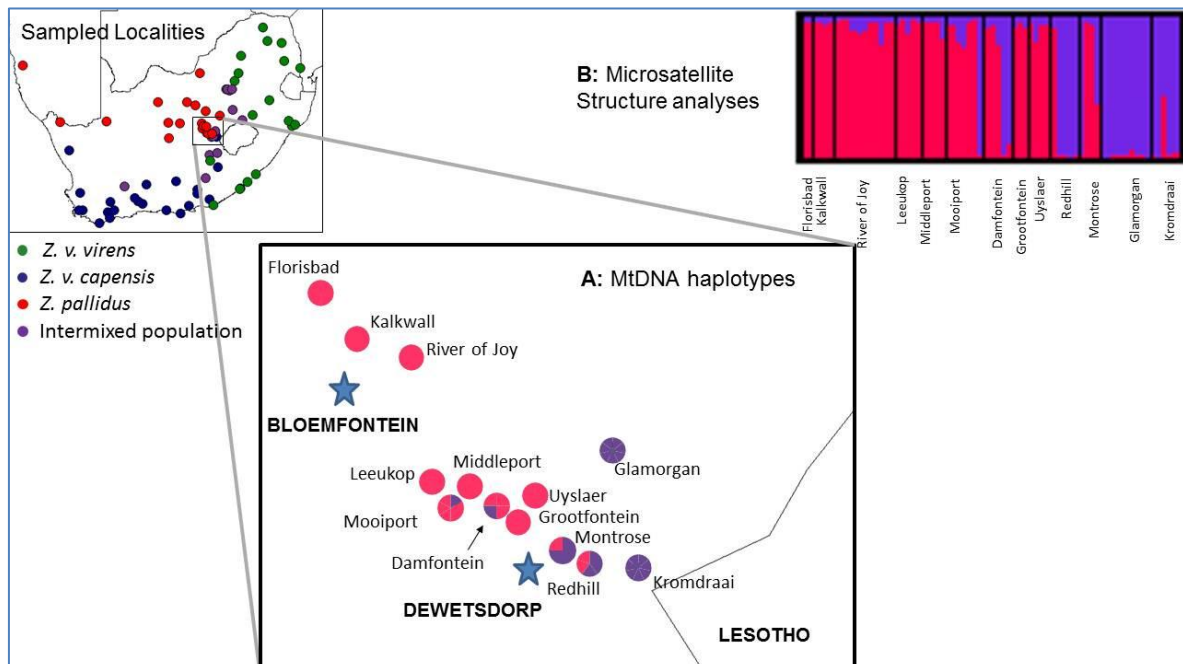
Population-level variation: white-eyes...

The Cape White-eye *Zosterops virens* complex occurs in three plumage forms that meet and potentially interbreed at various points in the Free State. Post-doctoral fellow Graeme Oatley extended his PhD research by exploring an area of contact between the Orange River White-eye *Z. pallidus* and the grey-bellied form of the Cape White-eye *Z. virens capensis*. Assisted by Dawie de Swardt from the National Museum in Bloemfontein, he collected specimens from north of Bloemfontein to near the Lesotho border at Dewetsdorp. This transect across the contact zone between the two species contained some individuals of intermediate plumage colouration, and preliminary vocal analyses

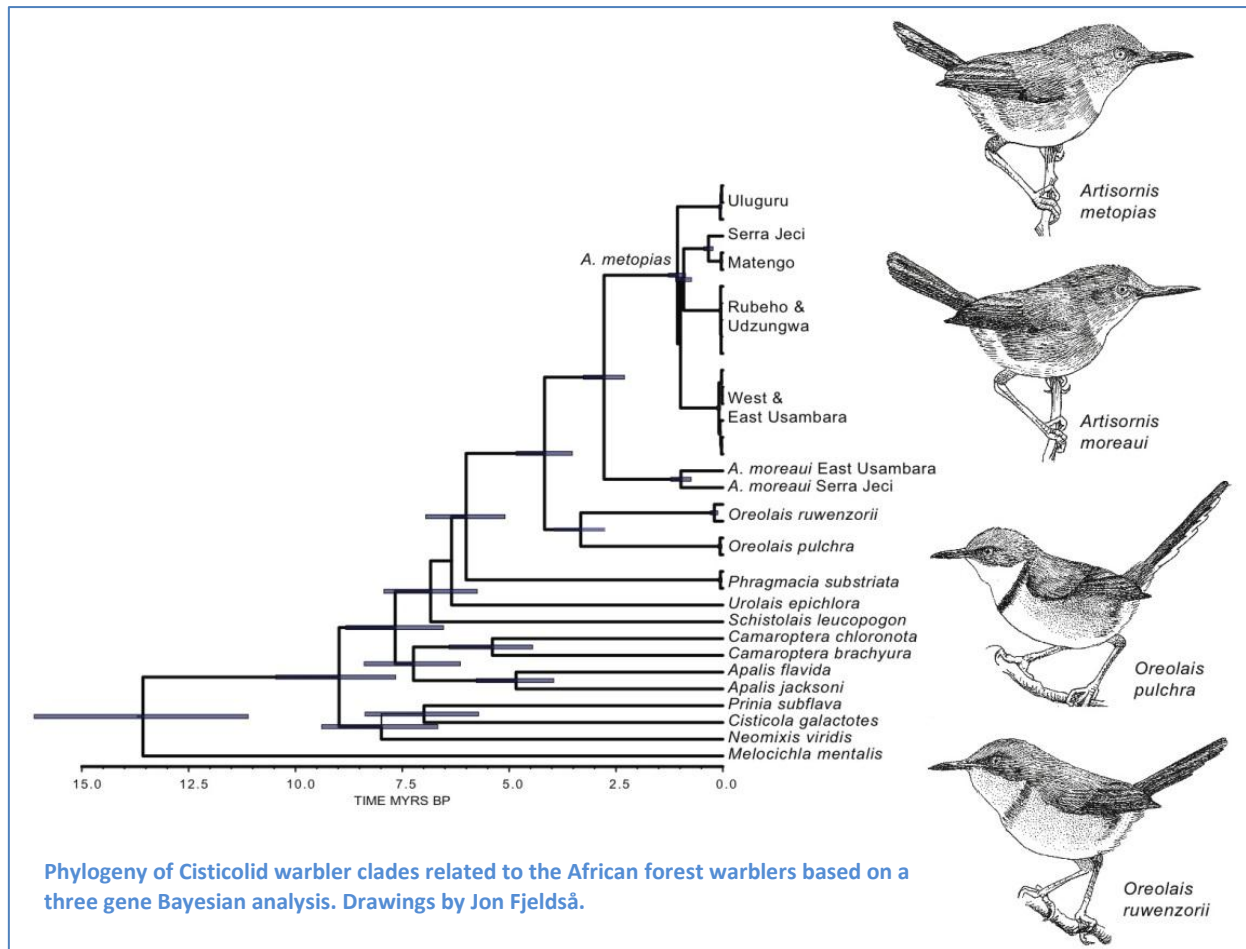
suggest that their calls and song also are intermediate. DNA for one mitochondrial gene, four nuclear introns and 10 microsatellite markers confirmed the hybrid origin of some individuals that had mixed microsatellite and nuclear markers. Molecular dating analyses suggest that the two species diverged 750-800,000 years ago. In the next year we hope to apply next-generation sequencing techniques to this interesting study to better understand the extent of introgression across the genome.

Larks...

Bianca Viviers will register in 2013 in the Department of Genetics at Pretoria University, to investigate speciation and selection in the Karoo



All three plumage forms of white-eyes found in South Africa meet and potentially interbreed in the Free State. Recent efforts have focused on collecting samples along a transect from Bloemfontein to the Lesotho border. Populations on either end of this transect were composed of pure parental populations (i.e. *Z. pallidus* [red] or *Z. v. capensis* [purple]) whereas intermediate populations consisted of both parental forms or individuals of intermediate plumage colouration and genetic composition occur in between.



lark *Calendulauda albescens* complex. Her study will extend research conducted at the Fitz in the 1990s, which resulted in the recognition of Barlow's Lark *C. barlowi* as a new species. However, this initial study only sampled one mitochondrial gene. Bianca will contrast this with several nuclear DNA markers, and extract high quality DNA for RAD sequencing, a technique that samples vast numbers of genes to identify loci under selection. It is hoped that this approach will allow her to find the genes coding for the seemingly adaptive plumage traits exhibited by populations, allowing them to closely match soil colour and vegetation density (reflected in the amount of plumage streaking). In addition, low coverage genome sequencing or exome sequencing is planned to study more of the coding regions of the DNA.

And seabirds

PhD student Lisa Nupen is writing up her study of the conservation genetics of three species of threatened seabirds endemic to the Benguela Ecosystem: African Penguins *Spheniscus demersus*, Cape Gannets *Morus capensis* and Cape

Cormorants *Phalacrocorax capensis*. She describes the evolutionary emergence of her study species in the Benguela, and their relatedness to congeners, assesses gene-flow among breeding regions and breeding colonies along the coasts of Namibia and South Africa, and goes on to investigate the genetic considerations of a proposed captive breeding programme for African Penguins. Her estimates of gene-flow among regions and colonies of African Penguins, Cape Gannets and Cape Cormorants contradict ringing data which suggest there are high levels of philopatry in at least Cape Gannets and African Penguins. Based on mitochondrial sequence data and microsatellites, these species seem to respond to geographic changes in their environment through juvenile dispersal to non-natal colonies. They also exhibit some behavioural plasticity (e.g. prey switching and changed foraging ranges), but this adaptability in the face of environmental change can only buffer their populations up to a certain threshold. The marked population declines across the ranges of all three focal species indicate that, despite

having evolved in an inherently variable ecosystem, these species are struggling to cope with the threats that they currently face.

Above the species level: the radiation of cisticolas...

Owen Davies is nearing the completion of his PhD research using morphological, behavioural and molecular data to re-assess Lynes' seminal work on the radiation of cisticolas using modern cladistic techniques. A phylogenetic reconstruction on morphology, plumage and behavioural data supports some of Lynes' groupings, but their relative positions differ from those suggested in the 1930s. Owen visited the Natural History Museum of Sweden, Stockholm, to learn how to recover DNA sequences from museum specimens. Toe-pad samples from the British Natural History Museum at Tring in the UK were successfully sequenced even though some of the specimens were over 100 years old. Owen has repeated techniques that he learned in Stockholm using the laboratory facilities at UCT and successfully extracted DNA from specimens obtained from local museums, creating opportunities for similar analyses in South Africa. Preliminary analyses of these molecular data indicate that much of our current understanding of the structure of the genus may be inadequate.

And shags

The *Phalacrocoracidae* are a taxonomically challenging group and a robust phylogeny based on comprehensive molecular sampling has yet to be published. PhD student Lisa Nupen and post-doctoral fellow Tim Cook have expanded the current phylogeny by adding two species of African microcormorants *Microcarbo* and three sub-Antarctic shag taxa.

Systematics of rare species with highly disjunct populations

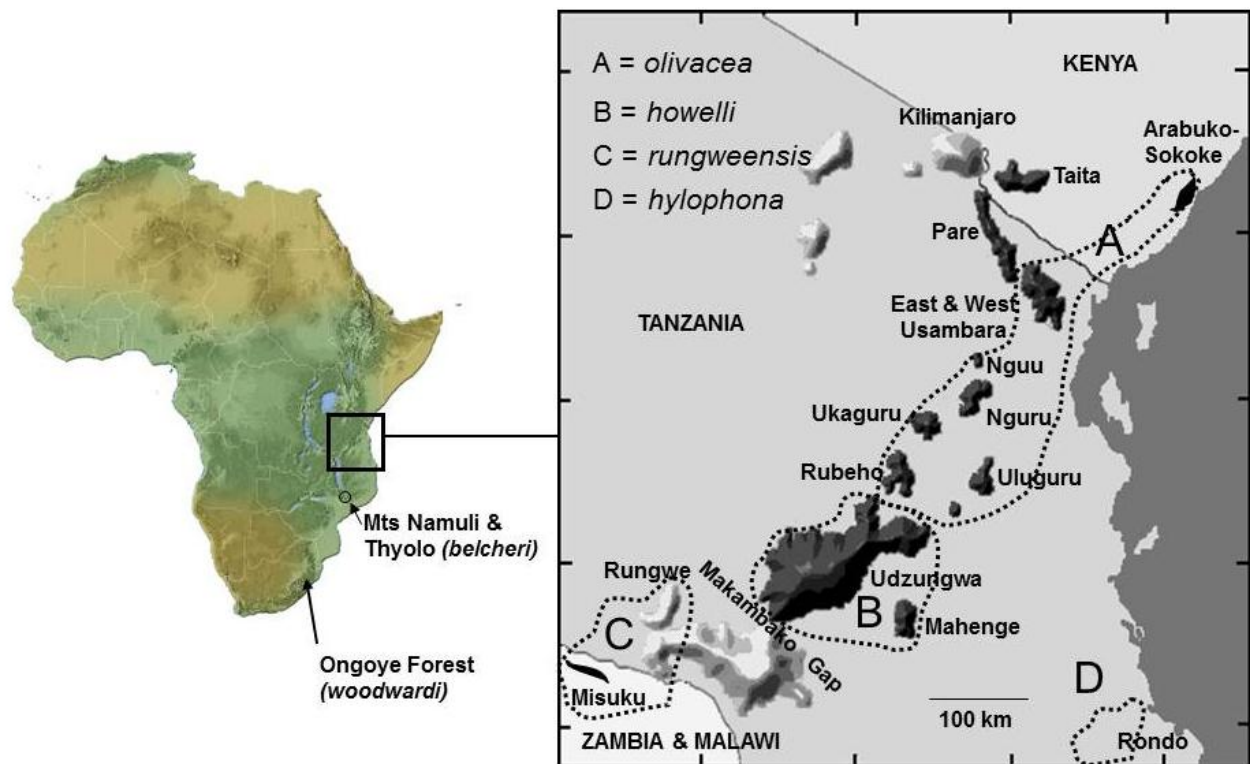
The Eastern Arc mountains and adjacent Afromontane forest 'islands' support a wide range of endemic birds, some of which have very small, fragmented ranges. One of the most enigmatic of these is the Long-billed Forest Warbler *Artisornis moreaui*, which has two small populations 950 km apart in the West Usambara Mountains, northern Tanzania, and Serra Jeci, Mozambique. This disjunct distribution cannot be explained by competitive replacement by the Red-capped Forest Warbler *A. metopias*, because



Levaiant's Cisticola *Cisticola tinniens*: one of the species Lynes struggled to place in his groupings of cisticolas. (Photo: Peter Ryan)

molecular data suggest that the two species have co-existed at both localities for hundreds of thousands of years. Our seven-gene dataset (three mitochondrial genes, four nuclear introns) confirms the two as sister species, related to other cisticolid warblers with 10 tail feathers. They are most closely linked to the two Oreolais warblers (formerly placed in *Apalis*) and, more distantly, the Namaqua Warbler *Phragmacia substriata*, endemic to the Karoo of South Africa and southern Namibia. This provides a further link between the monotypic warblers of the southwest arid zone and the tropical forest taxa, following the recent discovery that the closest relative of the Cinnamon-breasted Warbler *Euryptila subcinnamomea* is the localised Eastern Arc endemic, Winifred's Warbler *Scepomycter winifredae*.

The Green Barbet *Stactolaema olivacea* is another East African species with a highly isolated outlying population (*woodwardi*) confined to the Ongoye Forest in KwaZulu-Natal, 2,000 km from the closest East African population on Mount Namuli, Mozambique. Six subspecies are recognised on morphological grounds, occurring in small, isolated populations that are at risk from habitat loss. Genetic sequences, obtained from fresh material and museum skins, suggest that *woodwardi* is more closely related to the dark-headed *belcheri* on Mount Namuli, than to the other yellow-eared



Map of Africa depicting the distribution of the Green Barbet (*Stactolaema olivacea*). Birds only occur in montane forest except for the individuals from Rondo Plateau and Arabuko-Sokoke, which are coastal forests. Black areas represent the mountains belonging to the Eastern Arc, the mountains in light gray represent younger mountains mostly of volcanic origin.

taxon (*hylophona*) restricted to the Rondo Plateau, southeastern Tanzania, although all three taxa exhibit low levels of mitochondrial sequence divergence making it difficult to resolve relationships. The sister clade to *woodwardi-belcheri-hylophona* comprises two subclades: i) lowland (Arabuko-Sokoke Forest, Kenya) and montane populations of the northern Eastern Arc Mountains of Tanzania (West Usambara Mts), and ii) the rest of the Eastern Arc and southern volcanic highlands of Tanzania, as well as the Misuku Hills in Malawi. These two clades do not correspond to existing taxon boundaries, with nominate *olivacea* straddling both clades, and the black-headed *howelli* intermixed with *olivacea* and *rungweensis*. Sequence divergence is small (1-2% in cytochrome b) among all taxa, suggesting that they achieved their present distribution through recent fragmentation, with subsequent morphological divergence taking place quickly in small, isolated populations.

Highlights:

- Tshifhiwa Mandiwana submitted her PhD and has several papers on the phylogenetics and vocalizations of francolins and spurfowls under review.
- Lisa Nupen presented her results on African Penguin population genetic connectivity, and

Owen Davies presented his results on the radiation of cisticolas, at the tenth conference of the Southern African Society for Systematic Biology (SASSBX) held in Arniston.

- A paper on the origins of the finches found on Tristan and Gough was recently published in *Molecular Phylogenetics and Evolution*.

Research Team 2012

Prof. Tim Crowe (PFIAO)
 Assoc. Prof. Peter Ryan (PFIAO)
 Dr Per Alström (Swedish Species Information Centre, Uppsala)
 Dr Jacqueline Bishop (Biological Sciences, UCT)
 Prof. Paulette Bloomer (Univ. Pretoria)
 Asst Prof. Rauri Bowie (CoE Core Team Member, UC Berkeley)
 Dawie de Swart (National Museum, Bloemfontein)
 Dr Jérôme Fuchs (UC Berkeley)
 Bengt Hanssen (Lund Univ., Sweden)
 Rick Nuttall (National Museum, Bloemfontein)
 Dr Graeme Oatley (Post-doctoral fellow, PFIAO)
 Dr Gary Voelker (Texas A&M)

Students: Owen Davies (PhD, UCT), Potiphar Kaliba (PhD, UCT), Tshifhiwa Mandiwana-Neudani (PhD, UCT), Lisa Nupen (PhD, UCT), Bianca Viviers (BSc Hons, Pretoria)

Coevolutionary arms races in brood parasites and their hosts

Coevolution is the process by which two or more species reciprocally influence one another's evolution, and can escalate to produce beautifully refined adaptations. Brood parasitic birds such as cuckoos provide powerful models for studying coevolution: coevolutionary battles result as hosts learn to reject foreign eggs, parasites mimic host eggs, and hosts respond by developing distinctive egg signatures that make them increasingly hard for the parasites to copy. Since 2006, Claire Spottiswoode has developed a joint programme between the Fitz and University of Cambridge to study ancient brood parasitic model systems in Zambia.

Cuckoo Finches: the genetics of egg mimicry

Cuckoo Finches *Anomalospiza imberbis* mimic the eggs of their prinia and cisticola hosts to increase their chances of being accepted. In turn, host parents have evolved individual-level variation in egg colour and pattern to make eggs harder to copy. We have been carrying out field experiments on these coevolutionary inter-actions for several years. Now, we have initiated a project to assess the genetic underpinnings of such coevolutionary arms races, tackling a century-old puzzle: how do female brood parasites lay eggs that mimic those of their chosen host, despite interbreeding with males raised by other hosts? Lineages of female Cuckoo Finches have stayed faithful to their chosen host species for hundreds of thousands of years, which might allow specialised adaptations to evolve in the female line alone, via the female-specific W chromosome. We are trying to locate the genes involved in mimicry of different host species by combining breeding experiments on captive Cuckoo Finches with powerful new genomic techniques.

Highlights:

- In collaboration with Michael Sorenson, we have found that Cuckoo Finches specialising on different host species are highly distinct maternal genetic variants.
- In 2012 we successfully hatched and hand-reared 19 Cuckoo Finch chicks. By knowing their egg type, we can carry out crosses between and within host-races to facilitate locating the genes involved in egg mimicry.
- The presence of distinct genetic host-races allows us to characterise adult Cuckoo Finches by DNA sequencing. We can thus test the long-term effects of different host-rearing environments on adult phenotypes. In late 2012, we caught over 200 adult Cuckoo



A three-day old African Cuckoo chick hoists a drongo egg over the rim of the nest, in order to monopolise the host parents' care. After completing the task it dropped back, panting, into the nest bowl. (Photo: Claire Spottiswoode)

Finches and are testing how their host species affected their growth, condition, and immunity.

- This work was boosted in 2012 through a five-year David Phillips Fellowship from the Biotechnology and Biological Sciences Research Council (BBSRC, UK) and a one-year L'Oréal-UNESCO for Women in Science Fellowship. Post-doctoral student Wenfei Tong, who recently completed a PhD at Harvard University (USA), has joined the team to work on Cuckoo Finch genetics for the next four years.
- In collaboration with Martin Stevens and Jolyon Troschianko, we showed that Cuckoo Finches also trick their hosts by manipulating the ratio of parasitic to host eggs, which explains why Cuckoo Finches remove host eggs and often lay more than one of their own.



Bird-keeper Silky Hamama and Claire Spottiswoode outside the Cuckoo Finch aviaries in Zambia: the aviaries are snake-, rat- and ant-proof, thanks to the stilts standing in pots of engine oil. (Photo: Ian Bruce-Miller)

- A paper was published in *The American Naturalist* showing that the arms race between Tawny-flanked Prinia egg signatures and Cuckoo Finch egg forgeries appears to be progressing with great speed, with changes in egg colour and pattern being detectable over just 30 years.

Honeyguides, cuckoos, indigobirds and whydahs

Previous annual reports have highlighted studies of other brood parasites in Zambia, including the Greater Honeyguide *Indicator indicator* and African Cuckoo *Cuculus gularis*. In 2012 we gave them a break from field experiments, if not from our meddling presence altogether. However, we started research into one of the most interesting genera of brood parasites, the indigobirds and whydahs (*Vidua*). These finches are remarkable for their extremely rapid host-specific speciation, driven by both sexes imprinting on the song of the host species that raised them. *Vidua* finches also are a textbook example of host-specific adaptation, with chicks of each host species having distinctive, ornate mouth spots, that are mimicked exactly by their associated brood parasite. This raises a puzzle: how do lineages of *Vidua* finches persist in a new nest environment following a host switch, despite initially not mimicking their new host's distinctive mouth markings? We are hoping to solve this conundrum by testing the role of behavioural plasticity in facilitating such host-switches.

Highlights:

- Pilot studies showed that the Zambia study site is suitable for experimental research on *Vidua* finches, with parasitism rates of some host nests >50%. A grant was obtained from the Leverhulme Trust to allow PhD student Gabriel Jamie to start a four-year study on the role of phenotypic plasticity in driving the remarkable radiation of *Vidua* finches.
- The BBC Natural History Unit spent five weeks filming African Cuckoos at our study site for 'Survival'.
- We started a collaboration with Robert Fleischer to use next-generation DNA sequencing to confirm whether honeyguides' ability to digest wax owes to specialised gut bacteria.
- Nicholas Horrocks was awarded a Marie Curie Fellowship from the European Commission to carry out post-doctoral research on the evolution of immunity in honeyguides. Honeyguides are ideal for studying trade-offs between growth and immunity because their chicks are raised in pathogen-rich environments, surrounded by rotting host eggs (punctured by their mothers at the time of laying) and chicks (killed by the young honeyguide).

Key co-sponsors

The Royal Society, UK (through a Dorothy Hodgkin Research Fellowship and Research Grant);
 Biotechnology and Biological Sciences Research Council, UK (through a David Phillips Fellowship);
 L'Oréal-UNESCO for Women in Science programme.
 From 2013: a Research Project Grant from The Leverhulme Trust and a Marie Curie FP7 Intra-European Fellowship from the European Commission

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 Dr Nicolas Horrocks (Post-Doctoral Fellow, Cambridge)
 Prof. Michael Sorenson (Boston Univ., USA)
 Dr Martin Stevens (Exeter Univ., UK)
 Dr Jolyon Troscianko (Exeter Univ., UK)

Student: Gabriel Jamie (PhD, Cambridge)

Research assistants: Charles Banda, Mbewe Banda, Kisswell Chonga, Ailsa Green, Silky Hamama, Martin Hamoonga, Monty Hamoonga, Lazaro Hamusikili, Oliver Kashembe, Jeroen Koorevaar, Kiverness Mono, Collins Moya, Obvious Mudenda, Avedy Munkombwe, Refi Munkombwe, Oliver Munsaka, Sanigo Mwanza, Calisto Shankwasiya.

Cooperation and Population Dynamics in the Sociable Weaver

Cooperation is a fascinating behaviour because individuals help others at a cost to themselves, apparently defying Darwinian evolution. Yet cooperation is pervasive in nature, from unicellular organisms to humans. Sociable Weavers *Philetarius socius* are unique in the extent of their cooperative behaviour – from non-breeding helpers that bring food to offspring and participate in nest defense to communally building a unique nest structure. Our research project investigates the adaptive bases of cooperation in this species, and the results have revealed a fascinating mixture of hidden benefits and unexpected costs. The project builds on a long-term ringing study extending back to 1993 that has allowed us to identify a long-term decline in the population and to assess the effects of climate and social structure on this trend.

Cooperative breeding

A central expectation of cooperative breeding studies is that the presence of helpers should enhance reproductive output. But this is not always the case. In Sociable Weavers, helpers usually have a positive effect only under adverse breeding conditions. This relatively weak effect could be due to a decrease in nestling feeding by the parents assisted by helpers. PhD student Matthieu Paquet (University of Montpellier, France), supervised by Rita Covas and Claire Doutrelant, has shown that females assisted by helpers also produce smaller eggs and with different hormonal contents. Hence, instead of using the additional food brought by helpers to maximize reproductive output, female Sociable Weavers use it to save energy. This suggests a trade-off between reproduction and survival. As expected, Matthieu's survival analyses have revealed that females assisted by helpers have increased survival. Females also can benefit by being in a group through the energy saved by communal roosting during cold Kalahari nights. Females that roost in large groups lay eggs earlier than females that roost in pairs or small groups. Matthieu is currently concluding a brood swapping experiment to show that the differences found are a real response of females to the presence of helpers before laying, and not a confounding factor of female quality and helper presence during the nestling stage. This experiment will also play a crucial role in understanding the hormonal allocation to eggs in relation to helper presence.



Every year before the onset of the breeding season the Sociable Weaver team capture the resident birds at ca. 17 colonies that form the core study population. All individuals have a unique numbered metal and colour ring combination. Capture histories are entered into a data base and Rita Covas and Matthieu Pacquet retrieve the capture history of each individual caught to determine whether any additional blood samples or measurements are needed. (Photo: Claire Doutrelant)

The presence of helpers is expected to be beneficial for young during the post-fledging period, when the fledglings learn crucial skills such as flight, foraging and predator avoidance.



The social hierarchy can be inferred by observing interactions at a feeder where there is competition for food. We can determine social dominance relationships within colonies as well as associations to assess the social network. In this particular photo, there is a conflict between the two individuals at the top (directing their beaks to each other) and an association between the others (feeding peacefully next to each other). (Photo: Margaux Rat)

It was therefore surprising when we found a negative effect of helper presence on apparent juvenile survival during their first year (Covas et al 2011, *Animal Behaviour*). However, this unexpected finding could result from increased dispersal by juveniles in larger groups. To distinguish between these two possibilities. MSc student Lara Broom (CIBIO, University of Porto, Portugal), supervised by Rita Covas, studied survival during the first three months post-fledging, before dispersal occurs. Lara confirmed the negative effect of helper presence on post-fledging survival. She also found that most mortality occurs in the two weeks after fledging; subsequently no effects of helper presence were detectable. These results raise important questions concerning both the mechanisms of increased mortality in the presence of helpers and the evolutionary pay-offs that might compensate such an important cost for parents. Future work will attempt to explain both questions.

Highlights:

- PhD student Matthieu Paquet gave a talk at the International Society for Behavioral Ecology meeting in Lund, Sweden, and published a paper in *PLoS One* reporting the reduced size of eggs laid by females assisted by helpers.

Dominance and cooperation

Dominance hierarchies provide an important way to mediate conflicts between individuals that interact frequently, helping individuals negotiate over resources without wasting energy and risking injury. Understanding how dominance rankings are settled, and how they influence social organization and mate choice is thus important to understanding conflict resolution and cooperation. PhD student Margaux Rat, supervised by Phil Hockey, Rita Covas, Claire Doutrelant and René van Dijk, initiated a project to establish whether there are dominance hierarchies in Sociable Weaver groups, whether dominance can be signalled by phenotypic traits such as plumage patches, and whether there is a relationship between dominance, cooperation and social organization. Margaux's initial results indicate that the Sociable Weaver society is not as egalitarian as it may seem. Colonies form moderate to highly linear hierarchies which seem to remain stable over time. Dominance status is sex-dependant, with males dominant over females, and related to the size of the bib (the dark plumage patch on the throat). Margaux has also started investigating whether dominance rank affects investment in cooperative tasks by using a stuffed snake to simulate predator attacks. Her initial observations indicate that mobbing is an

effective way of defending a nest from attacks by small snakes. Data on individual investment according to dominance rank and relatedness to the brood in the nest is now being gathered.

Highlights:

- PhD student Margaux Rat presented a poster at the International Society for Behavioral Ecology meeting in Lund, Sweden, showing that dominance rank is linked to plumage bib size in sociable weavers.

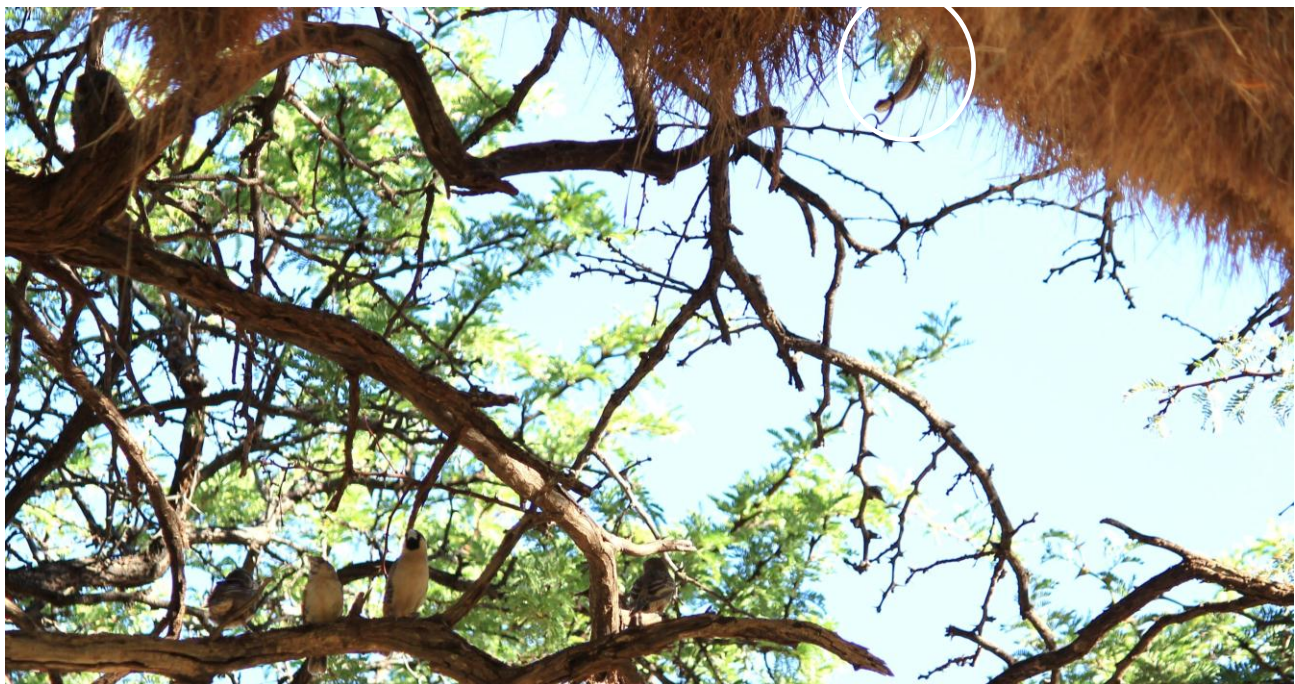
Cooperative nest building

Sociable Weavers build communally the largest nest structure of any bird. Although nest chambers are built by the birds that roost and breed in them, the greater nest structure is built continuously by the colony members, forming a 'common good' shared by all colony members. This raises the question why group construction doesn't suffer from the 'tragedy of the commons', a situation where, although it's in the group's interest that everyone cooperates to maintain the nest, an individual's interest to let others do the work leads to societal collapse. A project led by Ben Hatchwell is studying how the weavers avoid the tragedy of the commons and keep their nest structures for several decades. As a first step, Post-doctoral Fellow René van Dijk demonstrated the thermoregulatory benefits of the Sociable Weaver nest structure. The large nest buffers variation in ambient

temperature, and reduces temperature variability within nest chambers. The extent of this buffering depends on the position of nest chambers within the communal structure and nest volume, although nests are often much larger than the size needed to maximize these benefits. There appears to be competition for access to the best nest sites; older birds tend to occupy the chambers with the highest thermoregulatory benefits. The work is now focusing on describing who builds more and where and determining whether the level of investment made by individuals in this cooperative task is i) related to kinship with other colony members, ii) enforced by other colony members, or iii) a signal to other colony members of individual quality. Social, spatial and genetic clustering of individuals within the communal nest mass and its ramifications on cooperative investment is also being investigated.

Highlights:

- René van Dijk has published a paper in the *Journal of Avian Biology* describing how the Sociable Weavers' communal nest buffers variation in ambient temperature and how this relates to nest position within the communal nest mass. This paper was also presented at the European Conference on Behavioural Biology in Essen, Germany.
- Collaboration with Claire Spottiswoode (University of Cambridge, UK) has resulted in



Sociable weavers keep an eye on this young boomslang, probably waiting for him to make a mistake. This juvenile seems to have experienced sociable weavers mobbing before: it has rolled its tail around its head to protect itself. (Photo: Margaux Rat)

a paper in *Oecologia* on how the social environment of Sociable Weavers may affect the size and composition of their eggs.

Population dynamics

Understanding the dynamics of the Sociable Weaver meta-population is a key aspect of the project. Ringing at multiple colonies has been conducted annually at Benfontein since 1993 in one of the few long-term studies of an African passerine. This provides individual histories as well as opportunities to understand the factors that affect population dynamics and determine population trends. Colony counts indicate a slow decrease in the population over this 19-year period, indicating that reproduction and immigration are less than mortality and emigration. A study with Res Altwegg (SANBI) provided some understanding of how these demographic parameters were affected by environmental, demographic and social factors. Survival varied between years, increasing with rainfall and decreasing with extreme temperatures. Disturbance also was a factor, with survival linked to the intensity of field work conducted at a colony. Reproduction was also positively related to rainfall, while movement between colonies was related to colony size: individuals were more likely to



Each morning a whole colony of Sociable Weavers is captured and many experienced hands are needed to quickly extract the birds from the mistnets and process them. The help of experienced ringers such as Graham Grieve and Colin de Kock has been fundamental to the success of the project. (Photo: Res Altwegg)



Understanding how parental investment and reproductive output vary in relation to helper presence has been one of the central aims of this project. This requires detailed monitoring of different reproductive parameters. Here a brood of four-day-old chicks has been taken out of the nest for weighing. (Photo: Matthieu Paquet)

move from small colonies to large colonies and from colonies that were either well below or above their long-term average size. We still need to understand how social and genetic factors interact with environmental factors to determine reproduction and survival. A new post-doctoral researcher, Rafael Mares, has joined the project to investigate some of these questions.

Highlights:

- A paper in press with *Oecologia* demonstrated the link between climatic variation and the three key population parameters survival, reproduction and movement, providing an important basis to understand population dynamics and local decline in this species.

Key co-sponsors

FCT (Portuguese Science and Technology Foundation), ANR (French National Research Agency), NERC (National Environmental Research Council, UK), Marie Curie-International Research Staff Exchange Scheme (EU)

Research Team 2012

Dr Rita Covas (PFIAO Research Affiliate; CIBIO, Portugal)
 Dr Res Altwegg (SANBI)
 Dr Claire Doutrelant (CEFE-CNRS, France)
 Prof. Ben Hatchwell (Univ. Sheffield, UK)
 Dr René van Dijk (Post-doctoral Fellow, Univ. Sheffield, UK)

Students:

Margaux Rat (PhD, UCT), Matthieu Paquet (PhD, Univ. Montpellier II, France), Lara Broom (MSc, CIBIO, Univ. Porto, Portugal)

Pied Babbler and Fork-tailed Drongo

Behavioural Research

The Pied Babbler Research Project, established and maintained by Amanda Ridley, has been running continuously in the southern Kalahari desert since 2003. The primary aim of the project is to understand the causes and consequences of cooperative breeding behaviour in Southern Pied Babblers *Turdoides bicolor*. These questions require an understanding of factors affecting the fitness of different individuals, so researchers combine short-term experimentation with long-term life history records for each bird. Thanks to the habituated nature of individuals, we are able to monitor birds throughout their lives, recording changes in body mass on a daily basis, and study the development of foraging proficiency, age at dispersal and first breeding, and lifetime reproductive success. This gives us a wealth of information to answer important ecological and evolutionary questions.



An adult Southern Pied Babbler. (Photo: Peter Ryan)

The scope of cooperative breeding research

The Pied Babbler Research Project includes researchers from a diversity of institutions who are either directly affiliated with, or collaborate with, members of the FitzPatrick Institute. Assoc. Prof. Amanda Ridley is based at the University of Western Australia, but remains an HRA at the Fitztitute. Amanda's research focuses on the causes and consequences of helping behaviour, the benefits of group-living, sexual selection, and population demographics. Amanda's recent grant is focussed on the climatic versus demographic factors that influence group stability and Allee effects.

Post-doctoral Fellows Martha Nelson-Flower and Tom Flower are both based at the Fitz. Martha's work relates genetic patterns to cooperative

behaviours, focussing on determining how reproduction is shared among group members, the effect of competition on reproductive success, and dispersal strategies. Tom's primary interest is to investigate interactions between the klepto-parasitic Fork-tailed Drongo *Dicrurus adsimilis* and their hosts, including Pied Babblers and Sociable Weavers *Philetairus socius*. The drongos sometimes mimic other species' alarm calls to aid their stealing raids. Tom is testing whether the drongos can learn synthetic alarm calls for a suite of radio-controlled animatrons he affectionately terms 'wombles'.



One of Tom Flower's habituated Fork-tailed Drongos waits for the chance to steal some food. (Photo: Peter Ryan)

Five PhD students are currently involved in the Pied Babbler Research Project. Two completed their projects in 2012 and submitted in early 2013: Dave Humphries studied the mechanisms and consequences of social recognition in Pied Babblers under Amanda Ridley, and Alex Thompson studied parent-offspring conflict and begging behaviour under Phil Hockey and Nicola Raihani. They are replaced by three new PhD students. Elizabeth Wiley is assessing the relative importance of climatic versus social influences on group stability and population dynamics under Amanda Ridley. Sabrina Engesser is studying the syntactic structure of Pied Babbler calls in relation to the evolution of complex vocal communication under Simon Townsend and Marta Manser. Finally, James Westrip is studying vocal information exchange among group members under the supervision of Matt Bell.

Highlights:

- Intense drought in the Kalahari in summer 2012/13 severely depressed Pied Babbler numbers; only six fledglings recruited to the adult population. We have seen considerable demographic change as a result, including group extinctions and the merging of neighbouring groups. Although the population decline has impacted our capacity to do



Tom Flower recording drongo and babbler vocalisations. (Photo: Peter Ryan)



A Fork-tailed Drongo perches above a 'womble', ready to steal any food it unearths. (Photo: Tom Flower)

research, the changes are interesting from a demographic point of view. We are hoping that better rains in 2013/14 boost population numbers.

- Three new PhD students have started fieldwork on the population.
- Our work has received good media coverage, with two high-profile papers recently published in *The Proceedings of the Royal Society B – Biological Sciences*.

Key co-sponsors

The Australian Research Council (ARC) and the Natural Environment Research Council (NERC).

Research team 2012

Prof. Phil Hockey (PFIAO)

Assoc. Prof. Amanda Ridley (Univ. Western Australia)

Dr Matt Bell (Edinburgh Univ.)

Dr Tom Flower (PFIAO Post-doctoral Fellow)

Prof. Marta Manser (Zurich Univ.)

Dr Martha Nelson-Flower (PFIAO Post-doctoral Fellow)

Dr Nichola Raihani (University College, London)

Dr Simon Townsend (Zurich Univ.)

Students Sabrina Engesser (PhD, Zurich), David Humphries (PhD, Macquarie), Alex Thompson (PhD, UCT), James Westrip (PhD, Edinburgh), Elizabeth Wiley (PhD, UWA)

Saving Cape Parrots and their forests

The Cape Parrot *Poicephalus robustus* is an endangered species endemic to South Africa. With fewer than 1,000 remaining in the wild, it is threatened by a diversity of impacts ranging from habitat loss to poaching and disease. The challenge of tackling this array of threats makes it a useful model for developing and testing a variety of conservation strategies.

The threats to Cape Parrots include historical persecution as a crop pest, continued habitat loss, poor nesting success due to lack of nest cavities and suitable food resources, a resurgence of illegal wild-caught bird trade, and an outbreak of Psittacine Beak and Feather Disease (PBFD) virus exacerbated by a food resource bottleneck occurring after the breeding season and during the annual moult. Every year, several Cape Parrots are rescued that are unable to fly due to the debilitating effects of the PBFD virus and secondary infections from avian tuberculosis and *Pseudomonas*. The Cape Parrot Project aims to ensure the persistence of Cape Parrots in the wild using a number of approaches: restoration of parrot habitat restored through the installation of nest boxes and a series of community-based conservation projects to plant important food trees. Four aerial surveys with the Bateleurs have identified priority areas for restoration, as well as located three forest patches where illegal logging of indigenous timber is taking place. Our research has also discovered that large hardwoods and pole-size indigenous trees are missing from most forest patches, resulting in changes in forest management practices and a review of the current yellowwood quota by the Department of Agriculture, Forestry and Fisheries (DAFF).

In the fight against the PBFD virus, a successful rehabilitation protocol has been developed for sick birds with four of 12 birds being released back into the wild. Quantitative PCR tests during the rehabilitation process demonstrated that provisioning yellowwood (*Afrocarpus*) fruits resulted in a rapid decline in blood viral loads. Research at the University of KwaZulu-Natal has demonstrated strong anti-microbial activity in the fruit and seed kernel. Field observations suggest that affected birds can be detected with spotting scopes from evidence of degraded beaks with black blotches. All captured Cape Parrots tested positive for high levels of PBFD virus in their blood, but observations of feeding flocks at the time suggest that only 50-75% of the Amathole population was infected, suggesting that sick birds may be easier



A healthy Cape Parrot perches in a pecan tree in the Cape Parrot Sanctuary on the campus of the University of Fort Hare in Alice. (Photo: Rodnick Biljon)

to catch in mist nets. Blood samples supplied to Prof. Bragg at the University of the Free State are being used to develop a vaccine that is scheduled for field testing in 2014.

In October 2012, DAFF signed a long-term lease for the iZingcuka Forest Station and approved its future use as a tree nursery and research station. The Fitzpatrick has since refurbished the station to provide accommodation for fieldworkers on the Cape Parrot Project. In December, the station hosted 25 interns from the surrounding communities for a month of tree-planting and nest box monitoring. The interns planted over 1,500 indigenous trees, establishing a future Cape Parrot feeding patch and a model indigenous forest plot. A group of Conservation Biology MSc students have since stayed at the station to conduct fieldwork in the Cape Parrot Sanctuary in Alice, where some 85% of the local parrots feed on pecan nuts for over five months of the year.



The Hala and Gilton community planting teams with Fitz Research Assistant David Nkosi and Project Horticulturalist, Nic Armstrong. They planted 500 wild plums, wild olives and yellowwoods that afternoon. (Photo: Steve Boyes)

Highlights:

- Field observations in 2012 suggest that only 25-50% of the Amatole population was PBFD-positive, indicating an encouraging decline from 50-75% infection rates in 2011.
- We erected 258 wooden nest boxes in suitable trees with nearby Cape Parrot roosts or nest cavities. Our long-term research with 105 nest boxes for Meyer's Parrots *Poicephalus meyeri* in the Okavango Delta suggests that it takes up to five years for nest boxes to be occupied.
- Over the last two years some 25,000 indigenous trees (mainly key fruiting plants for the parrot) have been planted in Afromontane forest patches in the Amathole Mountains.
- By the end of 2012 the project was directly benefitting over 250 local community members through the micro-nursery programme, seed collection teams, clearing teams, and tree-planting teams. Several villages in adjacent valleys have requested that the project be expanded to include them.
- In 2012, National Geographic and SABC's 50/50 filmed the Cape Parrot Project, generating considerable public awareness. The project also generated 25 popular articles in magazines and newspapers and several radio interviews.
- The Cape Parrot Project group on Facebook has over 5,600 members, promoting regional collaboration, media contact, new discoveries, and raised over R80,000 in donations in 2012
- The Cape Parrot is being promoted as an "ecosystem ambassador" for the Afromontane

forests that attract tourists to the Amathole region. The Hogsback Inn has sponsored an arch saying "You are entering Cape Parrot country!" at the entrance to Hogsback.

- Steve Boyes published papers in the *Journal of Tropical Ecology* on aerial surveillance by African parrots and in the *Journal of Ornithology* on the consumption of invertebrates prior to the breeding season.

Key co-sponsors

Abax Foundation; African Bird Club; Arminel Mountain Lodge; Conservation International (Critical Ecosystems Partnership Fund); Hans Hoheisen Charitable Trust; Hogsback Inn; Mazda Wildlife Fund; National Geographic Society; Prins Bernhard Natuurfonds; Rance Timber; The Bateleurs; Wild Bird Trust; Wilderness Safaris; Wildlands Conservation Trust.

Research team 2012

Prof. Phil Hockey (PFIAO)
 Dr Steve Boyes (PFIAO Post-doctoral Fellow)
 Nic Armstrong (Wild Bird Trust)
 Dr Inga Hitzeroth (Microbiology, UCT)
 Mcoseleli Jakavula, (DAFF)
 Welile Kedama (DAFF)
 Dr Rowan Martin (PFIAO Post-doctoral Fellow)
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 Prof. Ed Rybicki (Microbiology, UCT)
 Dr Kirsten Wimberger (UCT Baboon Research Unit)

Students: Guy Regnard (PhD, Microbiology UCT), Riel Coetzer (PhD, UKZN)

Research assistants: John Hilton, Pieter Hugo, David Nkosi, Richard Stirling

Blue Swallows on the brink

The Blue Swallow *Hirundo atrocaerulea* remains in serious trouble, with the South African population red-listed as Critically Endangered and consisting of only about 40 pairs. Nearly all these birds are in the KwaZulu-Natal midlands, and this is where the work of the CoE / Endangered Wildlife Trust partnership is focused. During 2012, the CoE sponsored a review of the Blue Swallow Action Plan, consisting of a two-day workshop attended by representatives from all the swallow's major range states. The year also saw significant progress with the PIT-tagging of chicks in KZN, and the development of the technology necessary to monitor nests for returning birds.

International Workshop

During March 2012, the CoE sponsored an international workshop to review the International Action Plan developed for the Blue Swallow in 2002. Attended by representatives from all the species' major range states, this workshop provided an opportunity to collate up-to-date information on the species' status and review the conservation priorities for various parts of its range. A key aspect of the workshop was an evaluation of the current IUCN Red List Status of Blue Swallows in each country, based on current population trends. The workshop identified several current and potential future threats facing the species throughout its African range, most notably extensive forestry developments planned for the highlands of southwestern Tanzania. Another key point to emerge from the workshop was the dearth of information regarding the Blue Swallow population in the Democratic Republic of Congo, a shortcoming that we hope to address within the next few years.

Injecting technology to save a species

The lack of ring recovery data for Blue Swallows means that several basic aspects of the species' biology remain unclear, such as the extent of cooperative breeding, and whether juveniles return to their natal breeding areas in successive years. This information is vital for developing effective conservation strategies, and several years ago the ongoing partnership between the Fitz's CoE and the Endangered Wildlife Trust began a project using Passive Integrated Transponder (PIT) tags to identify individual swallows. During 2012, Dr Ian Little (EWT) fitted swallow chicks in KZN with PIT tags. When



Reaching Blue Swallow nests in Aardvark burrows requires teamwork. (Photo: Thomas Birch)

these birds return to KZN, the PIT tags they carry will allow us to detect them as they fly into nest sites, providing a clearer picture of the species' breeding biology.



Ian Little of the Endangered Wildlife Trust PIT-tagging a Blue Swallow chick. (Photo: Thomas Birch)

Highlights:

- Leigh Combrink and Ian Little compiled a report summarising the proceedings of the international workshop held in early 2012.
- A manuscript on the current global status of the Blue Swallow is being prepared for publication.
- 24 Blue Swallow chicks in KZN received PIT tags, which will allow us to remotely monitor them when they return from their wintering grounds.

- Ian Little worked with BioMark to develop new antenna designs suitable for placement around the entrances to Blue Swallow nest sites.
- The Swaziland population was monitored by a team of South Africans for the first time in over 6 years.

Plans for 2013 and beyond

In addition to the continued PIT-tagging of KZN chicks, 2013 will see comprehensive surveys of Blue Swallow populations and habitat in Malawi and Mozambique. In addition, we are currently putting plans in place for surveys of swallow populations in the southern DRC in early 2014.

Key co-sponsors

Endangered Wildlife Trust, Identipet.

Research team 2012

Prof. Andrew McKechnie (CoE Core Team member, Univ. Pretoria)

Dr Ian Little (EWT Threatened Grassland Species Programme)

Dr Rob Little (PFIAO CoE)

Research assistant: Rina Theron



In March 2012, delegates from the major range states of the Blue Swallow attended a two-day workshop to discuss the species' status throughout its range. (Photo: Jessica da Silva)

Southern Ground-Hornbill Conservation

The Southern Ground-Hornbill *Bucorvus leadbeateri* has experienced a two-thirds reduction in its national range, and presumably population size, in the past 100 years. Since 2000, they have been studied at the Fitz, investigating their habitat use, reproductive success and post fledging dispersal, largely to inform activities of the Mabula Ground-Hornbill Project and the national Ground-Hornbill Action Group who are our partners in implementing the national Species Recovery Plan. The main study area is the Associated Private Nature Reserves (APNR), one of the largest privately owned conservation areas in the world, covering some 180 000 ha adjacent to the central Kruger National Park, and supporting about 30 hornbill groups. We have reproductive histories spanning a decade for more than 20 groups. We found that breeding success increases with group size and the amount of open habitat within 3 km of the nest.



Before and after tropical storm Dando: views of the Klaserie River from the front of the project house. (Photos: Kate Meares)

January floods

In January 2012, Tropical Storm Dando hit parts of the lowveld, cutting off some of Kruger's rest camps and forcing helicopter evacuations. Our research station on the Klaserie River received more than the average annual rainfall in under 48 hours and the river rose 4 m. Three dams burst upriver of the research station and, at 04h30 on 18 January, project staff were given 20 minutes to evacuate. Flood-waters rose almost to ceiling level, washing away most of our research equipment. The data were mostly salvaged, but traps, laptops, binoculars, books, radio- and satellite-tracking equipment were gone. Happily, no project staff were injured and there were no fatalities on the reserve. The project house was repaired within a few months, damaged equipment fixed or replaced and our research could continue as normal. The most challenging aspect of the aftermath was driving on the reserve because many roads were washed away. We were however able to recover a few satellite transmitters which had dropped off the birds during the floods.

Dispersal and satellite tracking

Colour-ringing has shown that sub-adult females disperse from their natal groups usually before they are two years old, whereas sub-adult males stay with the natal group for many years before dispersing. We thank the Endangered Wildlife Trust's Large Birds of Prey Programme for alerting us to sightings of our ringed birds. Local movements of six groups in the APNR have been tracked by equipping one group member with a satellite transmitter since early 2010. The last two satellite transmitters dropped off during the heavy rains in early 2012. This study has allowed new insights into seasonal movements and home range use. Former BSc Hons student, William Wyness, quantified seasonal habitat selection and home-range vegetation characteristics, showing home-range contractions during the breeding season. He also showed that within-season habitat use is non-random, with habitat selectivity greatest during the wet season. Fitz MSc student Blair Zoghby is currently under-taking a fine-scale analysis of home range use, providing more detailed spatial and temporal resolutions using a combination of tracking data and satellite imagery to identify optimal sites for the proposed reintroduction programme.

Highlights:

- A sub-adult male from a nest in central Klaserie was sighted in Kruger with a group near Phalaborwa, 30 km from its natal nest.
- First record of an APNR female dispersing obtained: a subadult was sighted and photographed near Satara, 25 km from her natal nest in southern Timbavati.

Nest monitoring and harvesting second-laid eggs

Reintroduction protocols depend on the availability of birds for reintroduction. Ground-hornbills almost always lay two eggs, yet invariably rear only a single chick. Second-laid, insurance eggs hatch a few days after the first, and the chicks usually die of dehydration if the first chick is healthy. Second chicks are therefore available for harvest and captive rearing. A harvesting program to carefully remove second chicks, providing their sibling was healthy, was initiated to rear them for captive breeding and reintroduction programmes. Since 2010, with permission from APNR management, we have harvested 17 second-hatched chicks. Chicks from the APNR and Kruger National Park are transported by Mabula Ground-Hornbill Project staff to partner facilities at Loskop Dam, Boscia Birds, Montecasino Bird Gardens and the Johannesburg Zoo where they are reared for the captive breeding and reintroduction programmes.

The 2011/12 breeding season was successful despite flooding in January. One week before fledging, we colour-ringed, measured and took blood samples from the nestlings. For the second year, we had a veterinary technician from the Hans Hoheisen Wildlife Research Station take samples for their research into diseases in ground-hornbills, including the presence of Avian Influenza, Newcastle Disease and West Nile Virus.



A second-hatched chick harvested for the captive rearing and reintroduction programme. (Photo: Hein Nel)

Highlights:

- Six of the 23 nests monitored in the APNR were active during the 2012/2013 summer breeding season, and we successfully

harvested three second-hatch chicks from these nests.

- In May 2012, a one year old juvenile originating from an APNR nest was released on Mabula Private Game Reserve to join the reintroduced group there.
- Ongoing repairs to artificial nest boxes ensure that ground-hornbills can continue to thrive in an area which has a paucity of natural nest cavities.

Mitigating threats to ground-hornbills

Electrocution from uninsulated conductors on electrical transformer boxes is a known threat to all large birds of prey, including ground-hornbills. Conductors are being insulated by placing plastic pipes over the conductor wires in many reserves throughout the country. We undertook an assessment of transformer boxes in the APNR to identify unsafe transformers needing insulation.

Highlights:

- We checked 48 transformer boxes in the APNR, of which 15 were identified as high priority for insulation because they were within two km of an active ground-hornbill nest.
- A report was submitted to the EWT's Wildlife and Energy Programme, who work with Eskom to install insulation.

Impact of the project

This project provides the basic science for the national SGH Species Action Plan and has substantial applied components assisting with the implementation of the plan. Rob Little and Kate Meares represent the Fitz on the national SGH Action Group while Rob is also Vice Chairman of the MGHP management board.

Key co-sponsors

Associated Private Nature Reserves; Department of Trade & Industry Technology & Human Resources for Industry Programme (THRIP); Dow Southern Africa (Pty) Ltd; Hans Hoheisen Charitable Trust; Senelala Estates.

Research team 2012

Prof. Phil Hockey (PFIAO)

Dr Rob Little (PFIAO CoE)

Student: Blair Zoghby (MSc, UCT)

Research assistants: Kate Meares, Cassie Carstens, Barend Visser

Shoebill conservation in the Bangweulu Wetlands, Zambia

The aim of the Shoebill Research Project is to understand the best way to manage the Bangweulu Wetlands in Zambia to ensure the conservation of their Shoebill *Balaeniceps rex* population. This enigmatic bird species, highly prized by many bird watchers, is endemic to large well-vegetated wetlands in central and eastern Africa. Our research is particularly focussed on understanding whether human activities, for example through over-fishing or disturbance, could be a limiting factor for the long term viability of this important Shoebill population.

The Bangweulu Wetlands comprise swampy flood plains with papyrus, reeds and floating vegetation. These wetlands support the most southern breeding population of Shoebills. The swamps are however shared with a considerable number of fishermen. It is estimated that 50,000 people are dependent on the productivity of this system, with the economic value of fish extracted estimated to be worth around \$75 million per annum. The area is thus of considerable economic importance to Zambia and the region. At the same time, people from all over the world come to the wetlands to see the enigmatic Shoebill, as this is one of the most accessible populations in the world. Thus, there appears to be a conflict between the local community and the Shoebill population, as both utilize the same fish resource base, specifically the catfish populations. We are investigating the interactions between Shoebills and the human population, from a perspective of understanding the needs of the Shoebills. Our main objectives are to study the factors determining their distribution throughout the swamps and to estimate their population size. To achieve this, we have been conducting regular aerial surveys and using GPS-transmitters to understand their movements. Catching an adult Shoebill has proved to be a challenge and thus far we have only been able to deploy tags on Juvenile birds. These have provided great insight however on the initial distribution patterns of Shoebills. We are also investigating their general feeding and breeding ecology. Throughout the year we have made focal observations in order to understand foraging strategies, prey preference, habitat suitability and interactions with humans. Shoebills mainly forage on top of floating



Dr Ralf Mullers and assistant Brighton Mofya weighing a Shoebill chick. Chicks were measured regularly to monitor their growth and fledging success. (Photo: Moses Nyirenda)

vegetation, waiting above holes in the vegetation where catfish occasionally come up to gulp air. Shoebills spent most of their time patiently waiting above these holes. Catfish is the preferred species for shoebills in the Bangweulu and they can catch fish up to 50 cm in size, which is a substantial meal, weighing about 600 grams. To understand the behaviour of parents and

chicks on the nest, we have deployed camera traps at the nests and can thus monitor the nests 24 hours per day. With these data we hope to establish provisioning rates and identify the prey species fed to chicks.

Highlights:

- Two Shoebills that were confiscated in 2011 and hand-reared at Chikuni Research Station were successfully released into the wild. One bird, Bwalya, was equipped with a GPS transmitter and provides information on its whereabouts. The other bird, Kapotwe, was more challenging to release and became somewhat of a celebrity in the process. She managed to take care of herself after about 6 months and was independent by the end of 2012.
- A pioneering programme was initiated in which local fishermen were employed as Shoebill Guards, to protect and monitor Shoebill nests. Four nests were monitored by three Shoebill guards and three chicks fledged from these nests, with one bird being

predated. This programme actively involves the local community with protecting their natural resources.

- Two Shoebill chicks monitored during the breeding season were equipped with GPS-transmitters when they were about to fledge, which allowed us to follow individuals in their daily movements and distribution patterns. The transmitters fix the position of birds on an hourly basis and provide us with valuable information, as not much is known about individual Shoebill movement patterns.

Key co-sponsors

African Parks Network, WWF Netherlands.

Research team 2011

Dr Arjun Amar (PFIAO)

Assoc. Prof. Peter Ryan (PFIAO)

Dr Ralf Mullers (PFIAO Post-doctoral Fellow)

Frank Willems (Kasanka Trust)

Craig Reid (African Parks Network)

Research Assistants: Brighton Mofya, Elijah Mofya



Bushnell

09-15-2012 07:54:24

A Shoebill family on their nest, photographed by a camera trap. The chick here is about 5 weeks old and it will be fed by both parents until it fledges.

Power line Collisions

Large, open-country birds such as bustards and cranes are relatively cumbersome in flight, and are unable to react rapidly when they encounter aerial obstructions. Historically, they have had the freedom of open skies, but the proliferation of power lines and other aerial hazards poses a significant threat to these birds. Southern Africa has a rich diversity of bustards and cranes, with several endemic species. This project investigates the conservation implications of power line collisions on bustards and cranes in South Africa and Namibia.

In 2012, PhD student Jess Shaw completed the bulk of her long-running census and power line survey fieldwork and shifted her attention to data analysis and writing up. CB MSc student Maurice Schutgens also finished his work on bias experiments, which are important to account for dead birds not found under power lines because of scavenger removal and varying searcher efficiency. The focus of the project has shifted northwards to Namibia where John Pallett will register for an MSc in 2013 and start surveying power lines in this part of the Ludwig's Bustard *Neotis ludwigii* and Kori Bustard *Ardeotis kori* ranges.

Highlights:

- High levels of scavenger activity were recorded in a winter scavenger experiment run near Calvinia, in contrast with Maurice's summer results at the same site. Camera traps revealed a wide diversity of scavengers. Although there were several avian scavengers (note in *Ornithological Observations*), the species that removed large bird carcasses were all nocturnal mammals.
- Adjusted for survey biases, mortality surveys on Karoo power lines suggest that more than 40,000 Ludwig's Bustards die annually in collisions in South Africa, the bulk of these on low voltage lines. Of the other 41 species recorded on power line surveys, Kori Bustards also appear to suffer worryingly high levels of collision mortality. Initial observations from southern Namibia confirm this concern, with Kori Bustards killed almost as frequently as Ludwig's Bustards.
- A survey of 60 km of power line around Humansdorp and Mossel Bay revealed very low numbers of Denham's Bustard *Neotis denhami* collisions, perhaps because most of these lines ran along roads. This factor also reduced mortality of Ludwig's Bustards on



A pair of Ludwig's Bustards lumber into the air in Namaqualand. (Photo: Peter Ryan)

Karoo low voltage lines.

- Data collection continued every six weeks at our large-scale marking experiment near De Aar where we are testing the efficacy of two marking devices to reduce collisions on 72 km of high voltage line. Preliminary results suggest a positive effect for Blue Cranes *Anthropoides paradiseus*, but there are not yet enough data to assess results for Ludwig's Bustards or to compare devices. Data collection will run until at least the end of 2013, by which time we should have more conclusive results.
- A winter aerial survey was conducted with the help of the Bateleurs to complete the Karoo terrestrial bird survey, with overall results suggesting no detectable change in the Ludwig's Bustard population (although smaller numbers of korhaans were counted).
- Two Ludwig's Bustards were successfully tagged with satellite transmitters on a farm near Richmond, bringing the total to eight tagged birds. One of these was our first



Peter Ryan, Harold Bloch (Bateleurs) and Andrew Jenkins pose next to Harold's plane at Springbok Airport during the winter 2012 aerial survey of bustards in the Succulent Karoo. Harold is a member of the Bateleurs, a group of dedicated pilots who assist with conservation work that requires aerial support. (Photo Peter Ryan)

female, who was observed later in the year on a nest. We lost two birds in this period; one transmitter failed and one bird died in a collision with overhead railway cables. Most birds have so far demonstrated consistent east-west movements with the seasons, and strong fidelity to summer sites in the east (where they presumably go to breed). Day to day they move only a few kilometres, so are perhaps at greatest risk when they settle in an area near power lines. Tagged birds were within 5 km of a power line on 46% of days.

- Stable isotope analysis of Ludwig's Bustard feathers in the Karoo broadly supported satellite tracking results, with evidence of partial migration between the Nama and Succulent Karoo, and eastern origins for juveniles.

Key co-sponsors

Abax Foundation; Bateleurs; Endangered Wildlife Trust-Eskom Strategic Partnership; Mazda Wildlife Fund; Mohamed bin Zayed Species Conservation Fund and J.W. Jagger Post-graduate Scholarship. Francois van der Merwe provided invaluable assistance with field work around Calvinia.

Research team 2012

Assoc. Prof. Peter Ryan (PFIAO)
Dr Andrew Jenkins (PFIAO Research Associate)
Megan Diamond (EWT)
Bradley Gibbons (EWT)
Ann & Mike Scott (NamPower Namibia Nature Foundation Strategic partnership)

Students: Jess Shaw (PhD, UCT), John Pallett (MSc, UCT), Maurice Schutgens (CB MSc, UCT)

Research assistants: Delia Davies, Ben Dilley, Erica Essig, Allan Kafene



Bushnell

07-13-2012 22:56:13

A Cape Fox *Vulpes chama* is captured on a camera trap removing an Egyptian Goose carcass during the winter scavenger trial at Calvinia.

Raptors and Scavengers

The Fitz's Raptor Research Programme aims to understand population processes of raptors and scavengers, including species that are expanding their ranges and populations, as well as rare or declining species. This research provides up-to-date information for effective management decisions, taken in conjunction with regional and national conservation organizations.

Black Sparrowhawks

The Black Sparrowhawk *Accipiter melanoleucus* is polymorphic, with light and dark morphs. The light morph is more common over most of the species' range, but in the Western Cape dark birds are more common. Stable polymorphism has long fascinated evolutionary ecologists, because natural selection should favour the fittest morph. Our research shows that morph type is inherited in a classical Mendelian manner, with alleles for the light morph being dominant. We are now trying to infer why the Western Cape population shows a reversal in morph frequency, and have been gathering data on morph frequencies across South Africa. MSc student Gareth Tate is studying whether the seeming advantage of dark morphs on the Cape Peninsula is linked to their breeding taking place in the wet season, unlike most of the species' South African range. Gareth is using nest cameras to assess whether the two morphs differ in their timing of hunting, and GPS tags to see if male habitat use differs. Gareth is also testing whether survival rates of the two morphs differ using a re-sightings database of the colour ringed adults.

Post-doctoral Fellow Rowan Martin has analysed the long-term data series to assess which factors influence pair fidelity in the Peninsula's newly-formed population. Divorce is relatively rare (between 4-11% of pairs each year) compared with many other raptor species, and the rate of divorce does not appear to have changed as the population increased. Divorce is much more likely when a pair failed to breed successfully. Rowan has also expanded research carried out by CB MSc student Lovelater Sebele on the timing of breeding, attempting to determine which climatic cues the birds use to decide when to breed. Surprisingly, given the large differences in climate, he found that neither rainfall nor temperature variation explained timing of breeding within the Cape Peninsula. However, birds which breed earlier



A trap-caught male Black Sparrowhawk fitted with a GPS logger using a teflon back pack harness. These loggers accurately record the bird's position every five minutes. (Photo: Gareth Tate)

(i.e. those which had shifted their timing of breeding) produce more young. This phenological shift in breeding time probably helped the species colonise the Western Cape.

In 2013, we have two honours students working on the Black Sparrowhawk project. Julia van Velden will be investigating the occurrence and impact of microscopic *Knemidocoptes* mites that burrow under the skin on the legs or crown of birds, causing a type of avian mange. Known as the scaly-leg or scaly-face mite, it results in feather loss on the crown and encrustations or lesions on the bird's legs. In extreme cases, infections can result in missing digits, and a completely bald bird, probably affecting breeding success and survival. Bruce Baigrie will be examining whether the diet of the Cape Peninsula population varies according to the surrounding habitat type. He will relate diet composition at a range of nests to the abundance of different prey species within surrounding habitats.



Powerful motherly instinct: a female Black Sparrowhawk shows surprising determination to defend her eggs and nest against an intruding climber. (Photo: Mark Cowen)

Highlights:

- A paper describing plumage polymorphism and its genetic underpinning was published in the *Journal of Zoology* and was presented at the Pan-African Ornithological Congress in Arusha, Tanzania, in October 2012.
- Motion triggered cameras were placed at 13 Black Sparrowhawk nests on the Cape Peninsula, capturing 214 days of breeding activity and recording more than 2,000 prey deliveries.
- GPS loggers were fitted to two male Black Sparrowhawks, providing very accurate positional fixes every 5 minutes.
- Bonnie Lei, a visiting undergraduate from Harvard, USA, found that light morph birds had significantly higher parasite loads than dark morphs on the Cape Peninsula, providing a potential mechanism by which dark morph birds may have a selective advantage in this region. This work will be published in the journal *PLoS ONE*.
- Rowan Martin has submitted papers on divorce rates to *Oecologia* and on breeding phenology to *Oikos*.
- Two articles were published in *Africa Birds & Birding*; one on the potential factors driving the evolution of colour poly-morphism and one documenting the brutality of the interactions between Egyptian Geese *Alopochen aegyptiaca* and Black Sparrow-

hawks when the geese try to usurp the sparrowhawks' nests.

Bearded Vultures

The Bearded Vulture *Gypaetus barbatus* occurs patchily across southern Europe and Asia, and extends south through Africa to South Africa. The southern African population is isolated from the East African population and is declining, resulting in it being re-assessed as regionally Critically Endangered. The population is decreasing due to numerous threats, and these are set to escalate if plans go ahead to develop extensive wind turbine 'farms' in the Drakensberg and Maluti Mountains.

PhD student Sonja Krüger is studying the factors limiting population growth and reproductive success as well as the species' movement and foraging behaviour. Movement and survival is being studied by tracking birds with satellite transmitters. Twenty-four Bearded Vultures have been tracked since 2007. The threat posed by proposed wind turbine developments is being modelled by Post-doctoral Fellow Dr Tim Reid based on the movement patterns and flight heights of the tracked vultures to describe the areas that are most likely to be used by the vultures. These models will be crucial to assess the ecological viability of the proposed wind farm sites. However, the species appears to be in serious trouble even before any

wind turbines are erected. Of the 24 marked birds, seven have died: three were poisoned, three showed signs of lead poisoning, and one collided with a power line. This high rate of mortality appears to be unsustainable, and presumably is linked to increased human densities and associated infrastructure in the species' range. Road counts conducted in 2012 suggest that the species' population has decreased by more than half since Chris Brown's studies in the 1980s. A more formal population viability analysis awaits better estimates of the population's demographic parameters.

Molecular analyses were undertaken to determine whether the southern African population is genetically distinct from other populations. A previous genetic study reported two lineages, one in western Europe and one in Africa, eastern Europe and central Asia. However, this was handicapped by the small numbers of samples from Africa. An additional 46 samples (43 from southern Africa and three from Ethiopia) suggest that the sub-Saharan African populations can be managed as a single large population which is distinct from the European and Asian populations. These results will help to guide conservation management decisions, especially any that relate to reintroductions or translocations.

Highlights:

- Road counts were undertaken to determine the population age structure and to compare with similar counts conducted by Chris Brown in the 1980s.
- A series of stakeholder workshops resulted in the species' Biodiversity Management Plan being finalised during 2012. The plan has been submitted to the Department of Environmental Affairs for public participation before it is gazetted.
- Sonja presented some of her research results at the 9th Pan-African Ornithological Congress in Arusha, Tanzania, in October 2012.
- A paper reviewing the status and decline of Bearded Vultures in South Africa and Lesotho will soon be published in *Bird Conservation International*.

Martial Eagles

The Martial Eagle *Polemaetus bellicosus*, the largest eagle in Africa, is an apex predator within savannah habitats and is thus a potential indicator of the threats facing this habitat type. The species was recently listed as Near-Threatened by the IUCN, because its population appears to have decreased dramatically over recent decades. Given concerns over the species'



An adult Bearded Vulture carrying a GPS satellite tag. Understanding the movements of this species will be vital for their conservation. (Photo: Riekert van der Westhuizen)

status, several research projects have been initiated at the Fitz.

CB MSc student Daniël Cloete has used the data from the two SABAP projects to quantify changes in the distribution and relative abundance of Martial Eagles in South Africa. Atlas reporting rates have decreased by almost 60% over the last two decades, and decreases were greatest in areas with high densities of power lines (possibly due to electrocution and collision mortality), in areas where temperatures have increased markedly since the 1980s, and where prey abundance appears to have declined. Decreases also occurred in natural grasslands used for stock farming, suggesting that persecution may be a factor. Many farmers still consider eagles to be a threat to small livestock. Until recently, protected areas have featured as a stronghold for many raptor species, but Daniël also found an alarming 45% decline in Martial Eagle reporting rates in large reserves such as the Kgalagadi Transfrontier Park and Kruger National Park.

These findings resulted in Rowen van Eeden starting a PhD project to determine the cause of Martial Eagle declines in the Kruger National Park. Over the next three years Rowen will study Martial Eagle breeding success, survival and habitat use, but his main focus will be on dispersal of immature birds. Using GPS trackers, he will test whether the decline in the park is due to insufficient recruitment because immatures disperse outside park boundaries, where they are at greater risk of electrocution and persecution. Potential threat factors within the park will also be assessed, such as possible impacts of changes in elephant numbers and fire regimes on the availability of nesting trees. Daniël's analyses suggest that Martial Eagle declines within Kruger National Park were most marked in areas where elephant densities were greatest.

In addition, Andrew Jenkins has initiated a project with MSc student Jessie Berndt on the Martial Eagles that breed on high voltage power lines crossing the Karoo. Jessie will assess whether these pylons support a high density of Martial Eagles, which would otherwise be absent from the mostly tree-less landscape. A 2006 survey found 60 breeding pairs along less than 10% of the Karoo's high voltage power line network. If this is typical of the entire region, the current population estimate of Martial Eagles in South Africa may be too low, and the

power line network may be a double-edged sword: providing novel nesting opportunities while also posing a threat through collisions and electro-cutions. Hopefully these research efforts will improve our knowledge of one of Africa's iconic raptors, and provide ways to halt the apparent population decrease.



The apparent decline of Martial Eagles in South Africa is the focus of several studies at the Fitz. (Photo: Peter Ryan)

Black Harriers

Rob Simmons' 12 years of research on Black Harrier *Circus maurus* ecology is beginning to pay dividends. Satellite tracking continues to reveal fascinating insights into the species' movements. We have also started to look more closely at genetic variation within this species. Small populations are subject to an increased risk of stochastic extinction, and inherently small populations may contain less genetic variation than a large one, exposing them to other risks such as disease or climate shifts. The global Black Harrier population is thought to be fewer than 1,000 mature individuals, and as such lack of genetic variation may put the species at further risk. In 2013, Marie-Sophie Garcia-Heras will become the first PhD student on the Black Harrier programme. She will analyse Black Harrier breeding data to assess the factors limiting the fitness of birds in different habitats. Adding to our satellite-

tracking programme, she will use GPS trackers to determine where birds forage and how successful they are in different landscapes. She will also assess diet specialization and the health of nestlings through blood sampling, relating this to where their parents forage.

Highlights:

- Former CB MSc student Julia Jenkins, published her study showing that Black Harriers were useful indicators of biodiversity on renosterveld patches in the Overberg in *Bird Conservation International*.
- The non-breeding dispersal of six birds has been tracked since 2009, with several spending the summer in Lesotho (see <http://www.blackharrierspace.blogspot.com/>)
- Starting in September 2012 Marie-Sophie Garcia-Heras spent four months undertaking a mouse trapping programme in breeding territories, blood sampling nestlings to assess their health, and learning how to find nests and catch adults.
- Former Fitz Post-doctoral Fellow Jerome Fuchs, now based at UC Berkeley, California, has studied the population genetic structure of Black Harriers from feathers collected from moulting adults at nests. He found no variation in a series of mitochondrial and nuclear genes across 59 individuals, suggesting that the species has been through one or more severe bottlenecks. We plan to add to this sample from further afield to verify this troubling finding.

Fish Eagles as indicators of pesticide contamination

CB MSc student Masumi Gudka, in collaboration with Simon Thomsett and Munir Virani from the Peregrine Fund and the National Museums of Kenya, studied the impact of organochlorine pesticides on Lake Naivasha and its African Fish Eagles *Haliaeetus vocifer*. Masumi explored whether burgeoning flower farms around Naivasha resulted in high levels of pesticide contamination in the eagles. Blood samples were taken from 20 birds captured at Naivasha and a control site, Lake Baringo. Levels of organochlorine pesticides in the eagles' blood was compared with that in sediment, water and fish samples. As expected, 17 pesticides were found, of which Endrin and DDE were the most abundant. Pesticide residues in the eagles close

to the flower farms were significantly higher than those from elsewhere on Lake Naivasha. While the concentrations in the eagles were below that known to cause harmful effects (such as egg-shell thinning) the levels in the water, sediment and fish in both Naivasha and Baringo were above threshold safety levels as laid down by the US Environmental Protection Agency. This is a concern for Kenyans because fish from the lake are caught, sold and eaten by local fishermen.

Mystery buzzards breeding in the Western Cape

MSc student Lisle Gwynn collected measurements and blood from a total of 23 buzzards in the Western Cape, including samples from injured birds taken to local rehabilitation centres. Genetic work is currently being carried out on the blood samples by Rauri Bowie at UC Berkeley to establish the identity of these individuals, using genetic markers. Despite repeated attempts, these birds remained elusive and no adults were captured.

Population changes and potential impacts of Pied Crows

Although not raptors, the predatory nature of Pied Crows *Corvus albus* means that they are sometime viewed as honorary raptors. Anecdotal evidence suggests that Pied Crows have undergone a dramatic population increase in South Africa in recent decades, and some people have been calling for their systematic control due to their perceived damage to livestock, wild birds and other species of conservation concern. CB MSc student Chrissie Madden tested whether bird atlas data supported the perceived increases across South Africa. She found that although increases in reporting rates have occurred, the increase has been modest (around 12% overall), and they have not occurred uniformly across the country. Substantial increases have occurred in the west, whereas reporting rates decreased in eastern and northern areas. Changes appeared to correlate most with changes in climate rather than changes in land use, although this analysis is still continuing. To get a broader overview of the likely impacts that any increase in this species might have, Chrissie also reviewed the scientific literature on the impacts of corvids on biodiversity. Although some studies linked



Analysis of Pied Crow atlas data suggest numbers have increased in the east of South Africa, but have declined in the west. These changes were most closely linked to changes in climate. (Photo: Peter Ryan)

corvids to decreases in the population size or breeding performance of prey species, most studies found no evidence for such an effect. Overall, it appears that perceptions of corvid population trends and impacts are not always supported by empirical evidence.

Key co-sponsors

African Bird Club; Aspen Pharmaceuticals; BirdLife South Africa; Ezemvelo KZN Wildlife; Hawk Mountain Sanctuary (USA); Inkwazi Bird Club; Jakkalsfontein Private Nature Reserve; Maluti-Drakensberg Transfrontier Project; Marriott; National Research Foundation; Natural Research Ltd (UK); Riverbanks Zoo and Gardens; Sasol through the Endangered Wildlife Trust; South African National Parks; The Opvoedkundige Trust; The Peregrine Fund (USA); Two Oceans Slope Soarers; University of Cape Town Research Committee; Weismann International Internship Program; Wildlands Conservation Trust; Wits Bird Club.

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Seabird Conservation

Seabirds are among the most threatened groups of birds because they face threats both at their breeding sites and at sea. Almost one-third of all seabirds are on the global Red List, and seabirds comprise roughly half of all threatened birds in southern Africa. The Fitz's Seabird Research Programme has a strong applied focus, assessing the severity of threats faced by seabirds, and attempting to provide practical management solutions to reduce these threats. Here we highlight progress made in the last year regarding at-sea threats. Land-based threats are covered mainly in the section on island conservation (p. 43).

The Benguela: competition with fisheries

Three of the seven seabirds endemic to the Benguela upwelling ecosystem rely on small pelagic fish (mainly anchovies and sardines): African Penguins *Spheniscus demersus* (Endangered), Cape Gannets *Morus capensis* (Vulnerable) and Cape Cormorants *Phalacrocorax capensis* (Near-threatened). All three are threatened by a variety of factors, but a reduction in the availability of their preferred prey appears to be the main threat. Pelagic fish have greatly reduced in abundance off the South African west coast, where most seabird breeding islands are located, having moved to the south coast, where there are very few suitable breeding locations.

African Penguins remained a key study species, with research under the leadership of post-doctoral fellow Lorien Pichegru centred in Algoa Bay. The experimental closure to fishing within 20 km of St Croix Island, in effect from 2009-2011, was switched to Bird Island in 2012. This had unfortunate consequences for the penguins breeding at St Croix, with reduced breeding numbers, their highest foraging effort in five years, resultant slow chick growth and very poor breeding success. Given that St Croix currently supports the largest African Penguin colony in the world, representation was made to the Department of Environmental Affairs to extend the fishing closure at this island. In addition to papers published in *Biological Conservation*, *Bird Conservation International*, *Ardea* and the *African Journal of Marine Science*, 2012 highlights from the ongoing studies on this species included:

- Rowen van Eeden was awarded his MSc thesis with distinction and received the Purcell Memorial Prize for the best dissertation in zoology at UCT. He showed that penguins breeding in Algoa Bay were

limited more by the patchy distribution of prey than a heterogeneous marine environment. When diving, they targeted thermoclines as a potential cue to locate prey, diving deeper and foraging below the thermocline when warm Agulhas water intruded into Algoa Bay.

- PhD student Alistair McInnes worked with post-doctoral fellow Ben Murrell and Hons student Arjun Khoosal from the Department of Computer Science, Stellenbosch University, to develop software to analyse fish acoustic data collected in conjunction with penguin foraging tracks in Algoa Bay.
- CB MSc student Craig Harding worked with BirdLife SA's Christina Moseley and Ross Wanless to track the post-breeding dispersal of African Penguins. Birds from Dassen Island off the west coast travelled much farther during the pre-moult period (up to 500 km from their colony), whereas Algoa Bay penguins remained close to their breeding islands. Dassen birds also foraged in areas subject to much greater fishing pressure. This may reduce their chances of surviving the annual moult, when birds must fast for three weeks.
- Working with several Rhodes University zoology honours students, Lorien Pichegru showed that male penguins dived deeper and longer than females. Females compensated by diving more often, and foraged over larger areas. Analyses of admissions of penguins to SANCCOB show a bias towards females, suggesting sex-biased mortality in African Penguins, and a possible bias in the adult sex ratio.
- Harvard BSc student Bonnie Lei, investigated temperatures inside natural and artificial penguin burrows for her research thesis. She found that natural burrows buffer extreme



Lorien Pichegru and Alistair McInnes check an African Penguin chick in front of their dilapidated house on St Croix Island. (Photo Lloyd Edwards)

temperatures and humidity better than artificial nests, and that cement nests were superior to fibreglass nests.

Lorien Pichegru and Fitz HRA David Grémillet continued to study Cape Gannets in 2012. This species shows greater flexibility in diet than the African Penguin, as it is also able to exploit fishery discards, and has a much greater foraging range while breeding. These characteristics have allowed it to better withstand regional changes in fish abundance, but the annual tracking of breeding bird foraging effort over the last decade has provided fascinating insights into the responses of a central place predator to shifts in prey distribution and abundance.

Highlights:

- CNRS Post-doctoral Fellow Emilie Tew-Kai published a paper in the *Journal of Applied Ecology* on the degree to which gannets depend on fishery wastes when natural food availability is low. Using high resolution GPS tracks from birds and fishing vessels, she showed that breeding birds only scavenged from trawlers when pelagic fish biomass was very low.
- CB MSc student Lea Cohen conducted the 11th consecutive field season tracking Cape Gannets from Malgas Island. Using the long-term data series, she showed that chick growth was lowest when natural prey is scarce, despite increased parental foraging effort. Adult body condition also decreased with an increasing proportion of fishery discards in their diet, suggesting a limit to their behavioural compensation for natural food shortages.
- Former CB MSc student Christina Moseley published her thesis on Cape Gannet body condition and foraging ecology in the *Journal of Experimental Marine Biology and Ecology*.
- We deployed stomach temperature recorders in some birds, together with GPS and depth recorders, to better understand gannet foraging ecology. The data will allow us to see which dives are successful, and how much

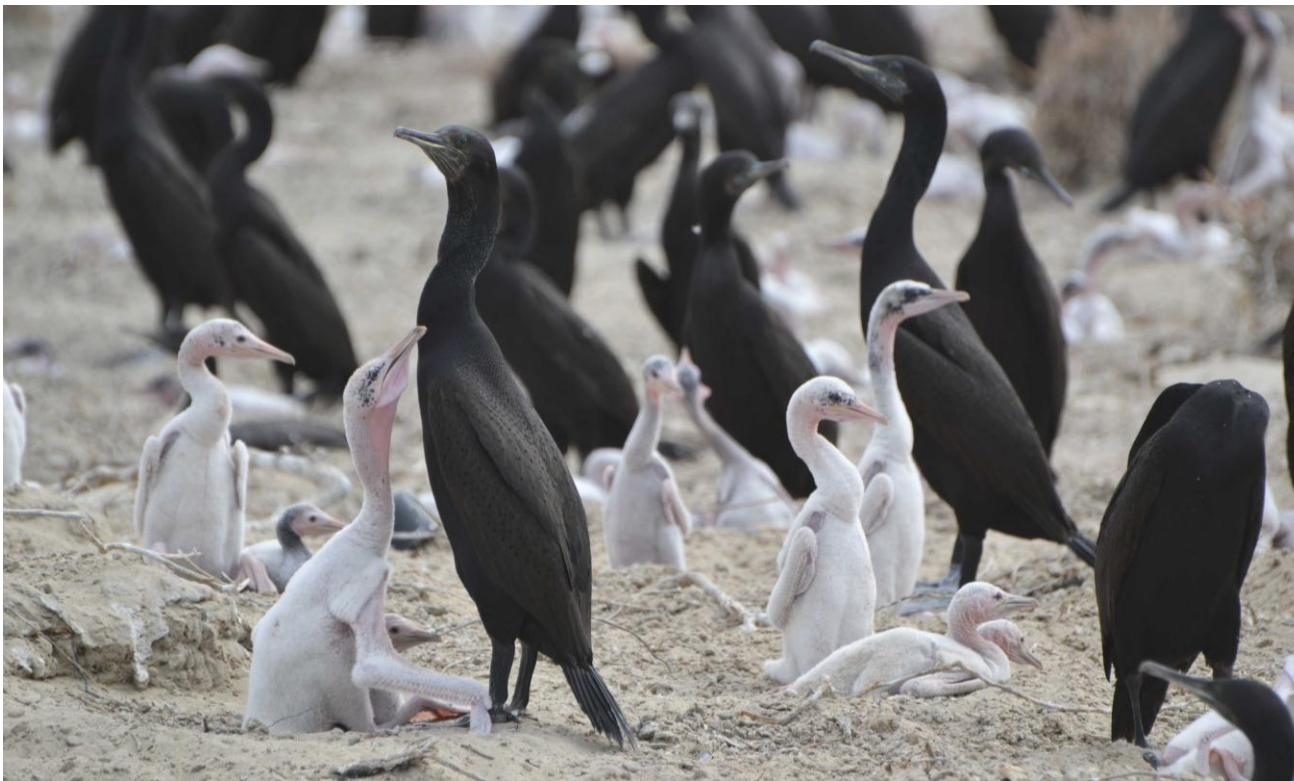
food they catch in each dive.

- Together with Animal Demography Unit Post-doctoral Fellow Katrin Ludynia, we deployed geolocators to track the post-breeding dispersal of gannets from their main breeding regions: southern Namibia, the Western Cape and Algoa Bay.

Little field work was conducted on Cape Cormorants in 2012, but two papers arising from previous research were published: former CB MSc student Maike Hamann reported on the foraging ranges of Cape Cormorants from different west coast colonies in relation to local differences in fishing effort (*African Journal of Marine Science*), and Post-doctoral Fellow Tim Cook showed how the structure of their foraging dives differ depending on whether they target benthic or pelagic prey (*Marine Biology*). Tim also initiated a collaboration with Sabir Muzaffar from the University of El Ain, United Arab Emirates, on the ecology of the Socotra Cormorant *Phalacrocorax nigrogularis* (Vulnerable). Little is known about this species' ecology, although it has several similarities to the Cape Cormorant such as feeding in flocks on pelagic prey and sometimes roosting at sea. It is threatened by destruction of breeding habitat through coastal development, oiling and climate

change, as well as competition with fisheries for food. The foraging ranges, diving depths and diets of breeding adults were studied in November 2012, and further field work is planned for 2013.

Research on the Endangered, Benguela endemic Bank Cormorant *Phalacrocorax neglectus* commenced in 2012 in collaboration with the Animal Demography Unit. With fewer than 500 pairs left in South Africa, it is the country's most threatened seabird species. Two hypotheses have been proposed to account for its ongoing population decreases: competition for food with the rock lobster fishery and/or the impacts of climate change. Honours student Jenni Roberts explored the latter hypothesis, comparing the effect of ambient air temperature and operative temperature on heat-stress behaviours among breeding birds. MSc student Corlia Meyer is continuing this work, while MSc student Philna Botha is testing whether food limitation explains the bird's poor performance in recent years. Preliminary results suggest that food shortage could be important. We are using foraging trip duration as a proxy for food availability. Foraging trips of adults differ at three colonies with different population trends, being longest at the decreasing colony and shortest at the only increasing colony.



Socotra Cormorant chicks are unusual in being whitish, which presumably is an adaptation to the high ambient temperatures they experience at their colonies in the Middle East. (Photo: Tim Cook)

Tim Cook led a team producing an energetic model to estimate the energetic demands of seabirds on the Benguela region. Using fine-scale activity data from logger deployments, the model is much more accurate than previous models, and is spatially explicit. It will contrast energetic demands of seabirds from the late 1970s, when most seabird populations were first estimated throughout the Benguela, with the current situation. This will highlight how the seabird community has changed over this period, and provide an estimate of the amount of fish that needs to be set aside for seabirds in terms of an ecosystem approach to fisheries management.

Finally, Viviane Barquete completed her PhD on the use of stable isotopes (SI) as a tool to help conserve Benguela seabirds. Age, year and colony all influenced stable isotope signatures of African Penguin and Cape Gannet blood and feathers. Comparing SI signatures of feathers collected before the advent of commercial fisheries with those from recent samples showed little difference in penguins, but a shift to higher trophic levels in gannets, linked to their increased reliance on fishery discards. Surprisingly, current gannet samples also differed between males and females, with females seemingly taking fewer fishery discards, perhaps because they are slightly smaller and less aggressive than males. Perhaps her most interesting findings were on the moult and SI signals of White-chinned Petrels *Procellaria aequinoctialis*, the seabird most often killed by long-lines in the Southern Ocean and off southern Africa. She showed that White-chinned Petrels breeding at South Georgia winter in coastal waters around South America, while those breeding at islands in the south-west Indian Ocean spend the winter off southern Africa. This has implications for the species' conservation, given that South Georgia supports roughly half of the world's population.

Accidental fishing mortality

The other major impact that fisheries have on seabirds is through direct mortality, typically when birds get entangled by fishing gear. This problem occurs mainly in fisheries operating farther offshore than the purse-seine fishery, and is most serious for non-breeding migrants to southern African waters. Two main fisheries are involved. Long-line fisheries kill birds that either swallow baited hooks or get entangled in

the lines, whereas the demersal trawl fisheries entangle seabirds on their warps or in their nets. Much of the work combating these problems is being conducted by NGOs, notably BirdLife International through its Albatross Task Force and WWF-South Africa through its Sustainable Seafood Initiative. We work closely with both initiatives.

Highlights:

- PhD student Dominic Rollinson cleaned up all pelagic long-line bycatch and effort data for an analysis of changes in bycatch over the last five years, and the factors underpinning them.
- Ben Dilley and Delia Davies deployed depth loggers on White-chinned Petrels breeding on Marion Island. This species has been implicated in the bycatch of albatrosses because it can dive down to retrieve sinking hooks, which are then stolen by albatrosses. The only previous dive depth data for this species was maximum depths estimate with simple capillary depth gauges in the early 1990s. Dominic Rollinson is currently analysing the digital data, which shows petrels reaching depths of up to 16 m.
- Ben and Delia also recovered 10 geolocators deployed on White-chinned Petrels on Marion Island in 2009, providing three-years of movement and activity data. Preliminary analyses show that they spend most of their time foraging along the shelf-edge off South Africa. This supports the conclusions drawn by Viviane Barquete from stable isotope data. Ben and Delia also obtained fine-scale movement data from GPS loggers attached to breeding White-chinned Petrels. During incubation, most birds from Marion Island also forage off the South African coast.
- The first population estimate of White-chinned Petrels at the Prince Edward Islands was published in *Polar Biology*.

Crested penguin conservation

The crested penguins (*Eudyptes* spp.) are the largest genus of penguins, with seven species, all of which are globally threatened. Two species, the Macaroni *E. chrysolophus* and Southern Rockhopper *E. chrysocome*, breed at South Africa's Prince Edward Islands, where since 1995 their populations have decreased by 30% and 70%, respectively. More than 85% of Northern Rockhopper Penguins *E. moseleyi* breed at Tristan da Cunha and Gough Island, where they



A Macaroni Penguin returned to its nest bearing a package containing GPS and TDR data loggers that allow us to see where it has been and how much diving it undertook during a foraging trip. (Photo: Otto Whitehead)

have undergone marked decreases in the last 50 years. And although their numbers were roughly stable at Tristan in the last decade, the wreck of the M.S. *Oliva* on Nightingale Island in March 2011 oiled thousands of birds. Reasons for population decreases among these species, and crested penguins in general, are poorly understood. As a result, a new research programme to study the at-sea ecology was initiated in 2012 in conjunction with Rob Crawford and Azwianewi Makhado (Department of Environmental Affairs), Richard Cuthbert (RSPB) and Trevor Glass (Tristan Conservation Department). We got a head-start on the project, when initial tracking, diving and diet data were collected by Otto Whitehead at Marion Island and by Karen Bourgeois and Sylvain Dromzée at Gough Island in 2011/12, and the project expanded to Nightingale Island in 2012/13.

Highlights:

- Foraging data were obtained for both Macaroni and Southern Rockhopper Penguins at Marion Island in 2011/12 and 2012/13. During incubation and some trips to provision large chicks, they foraged up to 500 km from the island, but females remained within 70 km of the island while males were guarding small chicks. The maximum dive depths recorded were 150 m and 105 m, respectively.
- Breeding success of Northern Rockhopper Penguins at Nightingale Island was lower (28%) than at Gough Island (50%) in 2012/13. No pairs raised more than one chick. The low breeding success on Nightingale was linked to very long incubation trips, with some birds remaining away from the colony for up to 10 weeks and foraging up to 600 km from the island, although birds from Gough Island travelled even farther (up to 700 km). Birds provisioning chicks foraged within 100 km of the islands, and females remained within 50 km of the islands while males were guarding small chicks. The maximum dive depth recorded was 119 m.
- After breeding, Macaroni Penguins embark on a month-long trip to the nutrient-rich waters of the Antarctic Polar Front, 600-

800 km south of Marion Island. Satellite tracks show that these waters also are important during their post-moult overwintering trips when they spend more than 6 months at sea. In early 2013 we obtained the first pre-moult data for Southern Rockhopper Penguins to supplement post-moult satellite tracks. Geolocators have been used to track the year-round movements of Northern Rockhopper Penguins from Gough Island.

Other research highlights

- Genevieve Jones had a paper on the incidence and drivers of extra-pair paternity in Wandering Albatrosses appear in *Behavioural Ecology and Sociobiology*.
- Peter Ryan contributed to a paper by Abad et al. on the incidence of avian influenza in Antarctic seabirds (*Antarctic Science*), and was involved in multi-author reviews on the priorities for seabird conservation and management (*Endangered Species Research*) and on conservation challenges in Antarctica (*Science*).

Key co-sponsors

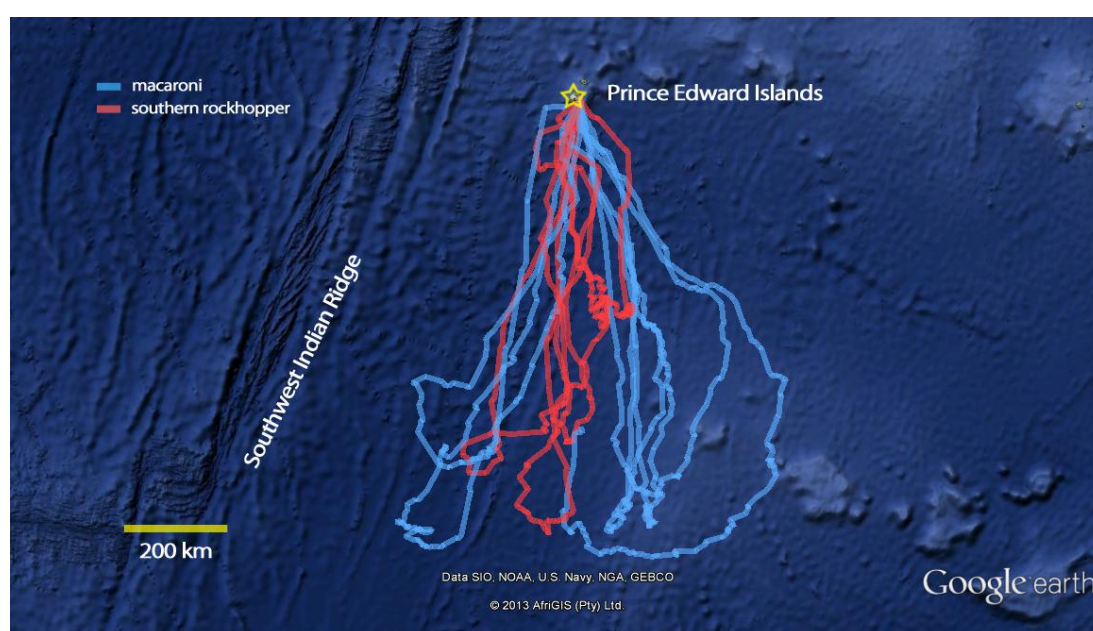
BirdLife International; BirdLife South Africa; Charl van der Merwe Foundation; CNRS; European Union; Plastics Federation of South Africa; Raggycharters Whale Watching; Royal Society for the Protection of Birds; Seaworld; South African National Antarctic Programme; UK Overseas Territory Environment Programme.

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Research assistants on Marion Island: Otto Whitehead (2011/12), Ben Dilley and Delia Davies (2012/13)



Both Macaroni and Southern Rockhopper Penguins forage well south of Marion Island during the post-breeding period when they accumulate fat reserves prior to moulting.

Conserving islands and their birds

Islands, especially those that have never been connected to one of the continental land-masses, hold a disproportionately large amount of terrestrial biodiversity, yet are among the most sensitive of terrestrial ecosystems. The arrival of man and his commensals has had catastrophic impacts on island biotas: more than 90% of modern avian extinctions have been of island birds. Where island ecosystems remain reasonably intact, they are vulnerable to new introductions, requiring strict controls on the import of people and materials. Islands are key breeding sites for seabirds and many islands support endemic landbirds. These birds can act as flagships for the conservation-management and restoration of island ecosystems.

A new programme at Marion Island

As part of the Fitz's long-term study of seabirds at sub-Antarctic Marion Island, a new, three-project commenced in 2012 to look at the legacy of mammal introductions on seabird populations at the island. House Mice *Mus musculus* were introduced to Marion by sealers in the 1800s, and when the island was annexed by South Africa in 1949, cats were introduced to control mice around the newly-established weather station. The cats soon established a feral population that by the 1970s killed an estimated 450 000 birds (mainly burrow-nesting petrels) each year. Efforts to eradicate the cats finally succeeded in 1990, so the burrowing petrel population has had more than two decades to recover. Depending on the extent of immigration from nearby Prince Edward Island (which remained free of introduced mammals), we would expect the petrel populations to have increased at least three-fold over this period. However, the initial signs were not encouraging. MSc student Mia Cerfonteyn who spent a year on the island in 2010/11 confirmed that Marion Island's Subantarctic Skua *Stercorarius antarctica* population has roughly halved since cats were eradicated. The skuas are major predators of burrowing petrels, so a burgeoning petrel population should have allowed skuas to increase. MSc student Ben Dilley went to Marion in 2012/13 to study the burrowing petrels directly. He was greatly assisted by Mike Schramm, a former Fitz student who spent a year studying petrels on Marion Island in 1979/80. Mike was able to join the annual relief voyage to Marion in April 2012 – his first time back on the island since 1980 – to show Ben how he had conducted his surveys more than 30 years before.

Highlights:

- Burrow densities of most petrel species breeding in the north-east sector of Marion Island have increased since 1980, but increases



Mike Schramm, back on Marion Island after 30 years, checks a Grey Petrel in its burrow. (Photo: Peter Ryan)

have been modest (20-100%).

- Petrel breeding success was high for all species studied except the Grey Petrel *Procellaria cinerea*. There was no evidence of mouse predation on petrel chicks, but mouse densities were low in 2012/13.
- A comprehensive survey was made of Blue Petrel *Halobaena caerulea* colonies on Marion Island, increasing their known distribution and population size.
- The first population estimate of White-chinned Petrels *Procellaria aequinoctialis* at the Prince Edward Islands was published, completing the population estimate for the nominate sub-species (*Polar Biology*). This is the seabird species most often killed by long-lines in the Southern Ocean and off southern Africa.

Ongoing work at the Tristan archipelago

The Tristan da Cunha archipelago and Gough Island are British Overseas Territories in the central South Atlantic Ocean. The Fitz is involved in restoration projects at these islands in collaboration with the UK's Royal Society for the Protection of Birds and Tristan's Conservation

Department. The main project demonstrated the calamitous impact of introduced House Mice on birds at Gough Island, and is now gearing up for an eradication attempt using poison bait spread by helicopters. Subsidiary projects are attempting to eradicate invasive plants at Gough and Inaccessible Islands. Work at Gough Island continued as planned during the review period, with Chris Bell and Mara Nydegger replacing Karen Bourgeois and Sylvain Dromzee as field workers on the island. No visits were made to Inaccessible Island during the review period, but CB MSc student Heinz Ortmann spent September-November 2012 studying Wilkins' Bunting *Nesospiza wilkinsi*. This species, which is confined to tiny Nightingale Island (3 km²), is one of the naturally rarest birds in the world, with an estimated population of only a few hundred individuals. Heinz's project involved individually banding as many birds as possible to gain a more accurate estimate of the population size and provide a baseline for future monitoring work. He also investigated the impact of introduced scale insects on the Island Tree *Phylica arborea*, whose fruits are the mainstay of the diet of Wilkins' Buntings. Previous work, conducted in 2011, showed that Soft Brown Scale *Coccus hesperidum*, and an associated sooty mould greatly reduce *Phylica* fruit production at Inaccessible Island.

Highlights:

- The sooty mould associated with scale insects on *Phylica* trees at Inaccessible Island has been identified as a new species, *Seiridium phylicae* (described in the journal *Persoonia*).
- At least 55 pairs of Wilkin's Buntings were found on Nightingale, and the total population is thought to be 80-100 pairs.
- The introduced scale insect on Nightingale Island is Greedy Scale *Hemiberlesia rapax*, not *Coccus hesperidum*. Fortunately *Hemiberlesia* is not associated with a sooty mould and does not reduce *Phylica* fruit production, but quarantine measures are needed to prevent the accidental introduction of *Coccus* and *Seiridium* to Nightingale Island.
- Former MSc student Alex Jansen van Rensburg reported ancestral polymorphism in the major histocompatibility complex in *Nesospiza* and *Rowettia* finches in *BMC Evolutionary Biology*, suggesting they experience little selection pressure from pathogens
- Further information on the predation of Atlantic Petrel *Pterodroma incerta* chicks by mice was published by former PhD student and

current Honorary Research Associate, Ross Wanless (*Animal Conservation*).

Impact of the project

This is a largely applied project. If successful, the eradication of mice from Gough will have immense benefits for the long-term conservation status of the island and its biota, including two endemic landbirds and the once vast seabird populations. Our research over the last decade has been instrumental in changing the perception that mice are relatively innocuous to bird faunas on oceanic islands.



Wilkins' Bunting has a global range of less than 3 km².
(Photo: Peter Ryan)

Key co-sponsors

Agreement on the Conservation of Albatrosses and Petrels; BirdLife International; Centre of Excellence for Invasion Biology (Stellenbosch); Royal Society for the Protection of Birds; South African National Antarctic Programme; UK Overseas Territories Environment Programme.

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Endangered species research in Angola and the Gulf of Guinea

Conserving Angola's forest birds

2012 was a year of consolidation for the Angolan bird conservation programme. The project continues to focus on conserving two main habitats because of their high concentrations of endemic and threatened birds: the Afromontane forests on Mount Moco, and the mid-elevation Angolan scarp forests. The Mount Moco Project (www.mountmoco.org) aims to save and expand the last fragments of Afromontane forest that remain in these mountains, which include the highest peak in Angola. Three visits were made to Mount Moco to monitor the nursery established by the project in July 2010. Most seedlings were healthy, 22 saplings have been planted, and measurements taken to monitor their growth. In May a new nursery was constructed with the support of Gerrit Laubscher and Michael Sturesson of the Gulf Agency Company in Luanda. Unfortunately, this nursery suffered major structural damage during a severe storm in June; for the time being it has been decided to expand the original nursery located at the edge of a small patch of forest.

The Angolan scarp forests form the core of Angola's only Endemic Bird Area, which supports 14 of the 15 species endemic to the country. The forests of the central scarp are the most important in terms of endemism. The forests in Kumbira Valley (Conda) are of particular importance, but human pressure in the area has increased since the end of the civil war in 2002, resulting in the conversion of forests to open plantations. The Kumbira Forest Project (<http://kumbiraforest.blogspot.pt/>) aims to address this conservation problem through a combination of research and advocacy. Aimy Cáceres started a PhD in September 2011 to determine the impacts of deforestation and forest degradation on bird communities.

Highlights:

- Aimy Cáceres commenced fieldwork in October 2012, guided by Martim Melo. They designed a survey protocol to assess differences in bird communities across different land-uses.
- Meetings were held with the administrator



Plants in the nursery at Mount Moco continue to thrive and the adjacent pilot forest rehabilitation project appears to be succeeding. In 2014 the nursery will be expanded and the rate or replanting increased. (Photo: Juliet Mills)

of Conda to raise awareness of the biological importance of the area and promote the formation of a protected area. A short proposal was prepared for the administrator to present to the governor of Kwanza Sul Province.

- A five-day ornithology training workshop was taught by Michael Mills in Kissama National Park for the Kissama Foundation and the Ministry of the Environment.
- A new Nissan Hardbody was bought for the project – an absolutely essential tool for the Angolan work.
- The process to launch an Angolan bird and nature conservation association was initiated.
- The production of 80 Vesto Fuel Efficient Stoves to be distributed to the community around the Mount Moco forests was

initiated; it is hoped these stoves will reduce the demand for fuelwood.

- A revised Angolan bird checklist was prepared to be published electronically in 2013.

Gulf of Guinea Islands

In 2012, the work on the evolution and conservation of the endemic birds of the islands was under the spotlight. It was the subject of an article in the April-May issue of *Africa Birds & Birding* as well as a nature documentary to be aired in 2013. In the lab, the production of a panel of thousands of nuclear molecular markers (single nucleotide polymorphisms, SNPs) for the Príncipe Seedeater *Serinus rufobrunneus* and the São Tomé Grosbeak *Neospiza concolor* was initiated in Edinburgh. From this set of markers we shall have both thousands of neutral markers to reconstruct in detail the evolutionary history of these sister species that appear to have originated sympatrically on the island of São Tomé, and we will be able to identify markers putatively under selection. These will point us to the areas of the genome that may be involved in the speciation process. We hope to make use of the full genome sequence obtained for *Nesospiza acunhae* to map the regions of interest.

A new project was launched to understand the factors that underlie evolutionary patterns on islands. As part of the so-called 'island syndrome', island birds tend to be less strikingly coloured than their mainland counterparts, which suggests that sexual selection may be reduced on islands. Several hypotheses have been proposed to explain this. We shall consider the potential role of parasites in shaping evolutionary trajectories. Islands have a depauperate fauna and flora, and might be expected to have fewer parasites than adjacent mainland communities. Bird ornaments are often honest signals of individual health. If islands are indeed benign environments, most individuals should be healthy, reducing the pressure to advertise healthiness through ornamentation. This project will compare parasite communities in birds from the Gulf of Guinea islands with those from neighbouring Gabon. The immunological condition of island and mainland birds will be assessed by experiments using inactivated vaccines. Finally, strength of ornamentation will be assessed,

including measuring the colour with photography and spectrophotometry.

Finally, a conservation genetics project was initiated as part of a larger project on the impact of hunting on the three endemic pigeons of São Tomé. The objectives of the genetic work are to i) clarify the taxonomy of the three species using genetic markers to infer the history of the insular populations (phylogenetic position, colonisation route and dates, genetic differentiation), and ii) estimate their effective population sizes and search for evidence of past demographic events such as population expansion or contraction.

Highlights:

- A paper by Rita Covas and Claire Doutrelant in the *Proceedings of the Royal Society B* demonstrated that island birds are indeed less colourful than their mainland counterparts.

Key co-sponsors (Angola)

A. P. Leventis Ornithological Research Institute; CGG Veritas; Julian Francis and the International Turaco Society; The Rufford Small Grants Foundation.

Research team 2012

Michael Mills (PFIAO Research Affiliate, APLORI)

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Francisco Gonçalves (Instituto Superior da Ciências e Educação, Lubango, Angola)

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Research assistants: Gerrit Laubscher, Juliet Mills, Michael Rogerson, Michael Sturesson.

Key co-sponsors (Gulf of Guinea)

Parasites: British Ecological Society; National Geographic/Waitt Grants; Pigeons: Portuguese Science Foundation (PTDC/BIA-BIC/115223/2009).

Research team 2012

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Dr. Bengt Hansson (Lund, Sweden)

Dr Martim Melo (PFIAO Research Affiliate; CIBIO, Portugal)

Dr Maja Tarka (Lund, Sweden)

Students: Hugo Pereira (MSc, CIBIO), Martin Stervander (PhD, Lund)

Research assistant: Alexandre Vaz

Climate change and Fynbos birds

South Africa's most dramatic global biodiversity hotspot, the Cape Floral Kingdom or fynbos biome, is a hyper-diverse Mediterranean-type shrubland with complex species mutualisms. The country's remarkable biodiversity is one of its strategic advantages for tourism, rural economic development and human well-being, so alterations to the fynbos biome stemming from global change are of importance for the economy and society at large. Fortunately much of the mountain fynbos is protected for water catchment, and the threat posed by invasive plants is well understood. However, we need to assess the vulnerability of the biome and its avifauna to climate change.

The project to assess the vulnerability and adaptation of fynbos endemic birds to land use and climate change started in 2008 as part of the Fitz's Climate Vulnerability and Adaptation Programme, run by Phoebe Barnard from the South African National Biodiversity Institute (SANBI). The project explores how fynbos birds are being impacted by climate change, land use change, and associated ecological changes such as biological invasions, novel predators, and changing fire regimes. Fynbos birds are increasingly threatened by the unravelling of plant-pollinator mutualisms, invasion by woody plants, shifting predation contexts, novel diseases associated with urban encroachment, and too-frequent fires. The project focuses on the six passerine species endemic to mountain fynbos, and its key questions include:

1. How vulnerable are fynbos endemic birds to climate and land use change (including fire)?
2. How do the endemic birds disperse across transformed ecosystems, and what evidence is there for historic gene flow?
3. Does urbanization influence adaptation options and survival traits (e.g. disease, predation, stress parameters) for birds?
4. Are any range shifts and phenotypic changes consistent with climate change predictions?
5. How can conservation planning and management help birds to adapt to global change?

The landscape overview for conservation

Post-doctoral Fellow Dr Alan Lee initiated a biome-wide fynbos endemic bird survey at the start of 2012. Summer and winter surveys were conducted at 900 points from the Cederberg to the eastern Baviaanskloof. These data have been



Based on its current distribution, the Cape Rockjumper appears to be the fynbos endemic bird that is most susceptible to warmer climate. (Photo: Mike Buckham)

used to calculate density estimates for the endemic birds, allowing the first robust estimates of their global populations. Cape Sugarbirds *Promerops cafer*, Orange-breasted Sunbirds *Anthobaphes violacea* and Victorin's Warblers *Cryptillas victorini* appear to be vulnerable to changes in vegetation structure expected to occur if predictions of a warmer, drier and more fire-prone environment come about. The range of Cape Rock-jumpers *Chaetops frenatus* appears to be limited by an upper temperature threshold, suggesting it is most vulnerable to climate change. This species already occurs at the low densities and has a highly fragmented distribution, suggesting it is especially vulnerable to climate change.

In addition to a broad overview of the

biophysical limits on the ranges of endemic birds in the biome, the project has study sites in the Cape Peninsula, Kogelberg Biosphere Reserve buffer zone, Hottentots Holland Mountains, Langeberg Mountains, and Baviaanskloof. Given the potential importance of habitat fragmentation, birds were mist-netted and ringed during 2012 at sites of varying distances apart in the Kouga, Outeniqua and Kammanassie mountains. More than 3 000 birds have been captured, but although there have been plenty of within-site recaptures, there has been no evidence of movements between sites. Camera traps are now being deployed at flowering Proteas to increase recapture rates of colour-ringed birds. Once researchers know how long birds of different age classes and sexes survive, when they breed, moult and disperse, and where they disperse, they can build a detailed picture of their population ecology, behaviour and phenology.

At a fine scale, researchers are assessing the extent to which urbanisation creates

opportunities and poses novel threats for fynbos birds. For example, birds might be able to seek refuge in urban gardens during fires, hot, dry winds, or rainstorms, but at the same time expose birds to commensal predators and pathogens. The research team are quantifying indicators of stress, including the incidence of feather stress-barring, asymmetry in body size and feather growth, and diseases such as avian pox which is a contagious virus potentially facilitated by warm temperatures.

While the Fynbos endemics, climate and land-use change project is grounded in population, community, spatial, behavioural and evolutionary ecology, it will increasingly cast light on conservation planning, policy and land management. As attention is paid to the security of biodiversity in the fynbos, this project will help guide landowners to make more robust conservation planning decisions based on fine-scale understanding of the implications of climate-driven change in this very special biodiversity hotspot.



Postdoctoral Fellow Alan Lee conducted bird surveys across the entire range of mountain fynbos on his mountain bike. (Photo: Alan Lee)

Key co-sponsors

South African National Biodiversity Institute (SANBI); UCT Research Committee; National Research Foundation.

Research team 2012

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 Dr Yvonne Collingham (Univ. Durham)
 Prof. Rhys Green (Cambridge University; RSPB)
 Dr Brian Hole (Conservation International; Univ. Durham)
 Prof. Brian Huntley (Univ. Durham)
 Chris Johnson (Univ. Stellenbosch)
 Dr Alan Lee (Post-doctoral Fellow, PFIAO/SANBI)
 Giorgio Lombardi (Vogelgat Nature Reserve)
 Dr Martine Maron (Univ. Queensland)
 Prof. Guy Midgley (SANBI)
 Prof. Jeremy Midgley (UCT)
 Dr Anton Pauw (Univ. Stellenbosch)
 Dr Matthias Schleuning (Senckenburg, Frankfurt)
 Dr Frank Schurr (Univ. Potsdam)
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 Dr Steve Willis (Univ. Durham)

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Research assistants: Gavin Bell, René Delport, Mike Ford, Lorraine and Peter Holloway, Johan Johansson, Chris and Jo Johnson, Robyn Kadis, Margaret McCall

Hot Birds – Climate change and desert birds

The 'Hot Birds' project seeks to predict the ways in which climate change will affect birds living in hot, arid environments, with most work currently focussing on bird communities of the southern Kalahari Desert. During 2012, we continued to examine the role of body size in determining susceptibility to heat stress, the links between physiological and behavioural variables, and how temperature affects the fitness of breeding birds. The year also saw the project expanding in exciting new directions, with projects on the heat tolerance and evaporative cooling capacity of Kalahari Desert species, and the effects of high environmental temperatures on breeding decisions in Southern Yellow-billed Hornbills.

Body size effects

A major focus of the Hot Birds project since its inception in 2009 has been exploring the use of behavioural differences between species as a proxy for how heat tolerance varies. Using data collected over the last three summers from 35 Kalahari Desert species, phylogenetically independent analyses conducted by PhD student Ben Smit showed that activity levels played a major role in explaining heat-dissipation behaviours. Species that are active during the day, especially during hot weather (e.g. Acacia Pied Barbet *Tricholaema leucomelas* and Red-eyed Bulbuls *Pycnonotus nigricans*), tend to show elevated levels of panting and gular-fluttering behaviours at significantly lower temperatures than species that spend most of the day inactive (e.g. sit-and-wait predators such as Common Fiscal *Lanius collaris* and Lesser Grey Shrike *L. minor*). Body mass also played a significant role in heat dissipation patterns, with larger species showing heat-dissipation responses at lower temperatures than smaller birds. Larger species also had significantly lower activity levels than smaller species at high temperatures, supporting predictions that larger species need to avoid heat loading during hot weather. Large species have high thermal inertia and are less efficient at dissipating heat than smaller species. The heat dissipation patterns observed in Kalahari birds might represent a trade-off between maintaining high activity levels to forage at high temperatures and being exposed to increased heat loads and elevated demands for evaporative water loss.

A particularly exciting aspect of the team's activities during 2012 involved a project by Grace Russell, a BSc (Hons) student at the University of Western Australia. Grace examined behaviour among Australian species at a field



The Red-eyed Bulbul *Pycnonotus nigricans* is one of the Kalahari bird species that remains active in hot weather. (Photo: Peter Ryan)

site in the Upper Gascoyne region of Western Australia to establish whether the same relationships between heat dissipation behaviour, body mass and ecological variables occur in Australian species, most of which are phylogenetically very different to the species we have been working on in southern Africa.

At the same time, Post-doctoral Fellow Rowan Martin used heat transfer models to predict how birds of different sizes should use thermal landscapes. This research focused on three different-sized ploceids: Scaly-feathered Finch *Sporopipes squamifrons*, Sociable Weaver *Philetarius socius* and White-browed Sparrow-weaver *Plocepasser mahali*. Using copper-core models of each species, Rowan measured how



The Hot Birds team used stable isotope tracers to investigate water resource use by species such as this Burchell's Sandgrouse *Pterocles burchelli*. (Photo: Ben Smit)

each species' thermal environment differs between habitats. Combining these data with observations of how birds behave in the wild, he was able to show that each species avoids heat stress and minimises the need for evaporative cooling by adjusting the time they spend in the hottest microclimates. Rowan has drawn on this study to develop ideas on the role of thermal environments in the evolution of behaviour and life-history strategies, particularly focusing on the implications of highly variable and unpredictable thermal environments.

Linking physiology and environment

PhD student Ben Smit completed his field work on the physiological processes underlying behavioural and ecological patterns seen in Kalahari bird communities. His data provide exciting insights into how species such as White-browed Sparrow-weavers cope with very high temperatures, and shed new light on how populations inhabiting climatically distinct regions may vary in their biology. Much of his work focused on patterns of body temperature and how water and energy demands vary with air temperature. This involved monitoring body temperature in free-ranging sparrow-weavers using miniature temperature loggers and stable isotopic tracers to infer rates of water turnover and metabolic rates.

Highlights:

- Ben Smit had a paper on intraspecific physiological and behavioural variation in White-browed Sparrow-weavers accepted in the prestigious journal *Ecology*.
- Andrew McKechnie, Phil Hockey and Blair Wolf published a guest editorial in *Emu* highlighting the need for a concerted effort to understand the impacts of more intense and frequent heat waves on Australian terrestrial avifaunas.
- Ben Smit presented a talk on his sparrow-weaver data at the 5th North American Ornithological Conference in Vancouver, Canada.
- Andrew McKechnie presented a plenary lecture at the Frontiers in South African Ornithology conference in Port Elizabeth.
- Ben Smit accepted an appointment as a Lecturer at Nelson Mandela Metropolitan University, Port Elizabeth.

Fitness – the ultimate leveller?

Body size, foraging guild and local climate may affect behavioural and physiological adaptations to high temperatures. To predict how these adaptations affect population persistence, we need to understand how they translate into fitness through survival and reproduction. The fitness of an individual is a function of its

lifetime reproductive success, but this correlates with a number of proxies that can be measured over shorter time-scales. The Hot Birds team has investigated how temperature affects two such fitness proxies. A paper arising from former CB MSc student Kate du Plessis's project on the effects of high temperatures on body mass in Southern Pied Babblers *Turdoides bicolor* recently was published in the prestigious journal *Global Change Biology*.

Post-doctoral Fellow Susie Cunningham completed her study of the links between temperature and breeding success in Common Fiscals at Tswalu Kalahari Reserve. She assessed how temperature affects thermoregulation, foraging behaviour and parental investment choices of breeding birds – and how these affect nestling growth and fledging success. As temperatures increase, breeding adults spend more time in shaded sites, cutting their foraging efficiency and reducing provisioning rates to nestlings. High maximum daily temperatures also compromise nestling mass gain in part due to the direct effects of temperature on the nestlings. The relationship between air temperatures and the size of fledglings was non-linear, linked to the number of days when air temperatures exceeded critical thresholds. This study is currently under review with the open-access journal *PLoS ONE*.



A Hot Birds researcher measures the tarsus of a Common Fiscal nestling in order to assess how growth rates are affected by air temperature. (Photo: Susie Cunningham)

During 2012, PhD student Tanja van de Ven initiated a new study in the Kalahari of how temperature affects fitness, and the threshold temperatures above which fitness costs begin to increase in the hole-nesting Southern Yellow-billed Hornbill *Tockus leucomelas*. Hornbills are particularly vulnerable to high maximum daily air temperatures because the female seals



This summer, PhD student Tanja van de Ven collected preliminary data on how breeding male Yellow-Billed Hornbills alter their behaviour in response to air temperature. Tanja found changes in hornbill time budgets at high air temperatures, which may have knock-on effects for breeding success. (Photo: Andrew McKechnie)

herself into the nest cavity as a protective mechanism against predators. She spends most of the chick-rearing period inside the cavity and undergoes a moult of the tail and flight feathers. This places high energy demands on the male as he is solely responsible for food provisioning. The hornbill population at the study site breed in nest boxes which facilitates the collection of nest box microclimate data as well as measures of female and chick condition. The males are semi-habituated, allowing the collection of foraging data. The 2012/13 breeding season was very dry, limiting breeding effort, but preliminary results suggest that high temperatures affect male energy budgets. Heat dissipation behaviour was observed above 34°C, and the proportion of time spent foraging decreased by 14% during the hottest periods in the afternoon. There was no clear relationship between maximum air temperature and foraging success, but foraging attempts tended to fail more often during the hottest hours in the afternoon. Males prioritised provisioning the nest in the afternoon, suggesting that breeding performance may be especially vulnerable to rising temperatures.

The existence of thresholds which trigger large fitness costs is an emerging theme of this branch of the Hot Birds programme. Such threshold temperatures could be used to define heat wave events in terms relevant to the fitness of bird species. In 2012, we collaborated with the South African Weather Service to develop this method, assessing how patterns of hot weather events have changed over the last five decades in the

north-western regions of South Africa. Results from this collaboration showed that:

- The number of days exceeding threshold temperatures has increased significantly across the study region, as has the frequency, duration and intensity of heat waves.
- Maximum heat wave intensity has increased faster than other heat wave parameters, including average intensity.
- Spatial patterns of temperature increase are not uniform across the study region. The technique thus has the potential as a conservation planning tool.
- Southern African Bird Atlas data collected in the 1990s suggests that Common Fiscal population densities were lower in areas with rapid warming trends.



MSc student Maxine Whitfield uses a field laboratory in a southern Kalahari hunting lodge to investigate bird evaporative cooling rates. (Photo: Andrew McKechnie)

Heat tolerance and evaporative cooling

MSc student Maxine Whitfield spent two months in the Kalahari collecting data on evaporative cooling and body temperature regulation in a variety of birds, but focusing mainly on doves (*Namaqua Oena capensis*, Laughing *Streptopelia senegalensis* and Cape Turtle *S. capicola*) and ploceids (Scaly-feathered Finch, Sociable Weaver, White-browed Sparrow-weaver). This project forms part of a collaboration between Andrew McKechnie, Blair Wolf and Todd McWhorter. While resting and inactive, all these species appear able to avoid hyperthermia even at air temperatures higher than those that currently occur in the Kalahari. The doves are generally more tolerant of extremely high temperatures than the finches, most likely because doves can dissipate heat rapidly across their skins, whereas the ploceids are more reliant on panting. These data

will be combined with comparable data collected from birds in the Sonoran and the central Australian deserts to provide a global picture of the upper limits of avian heat tolerance.

Highlights:

- Using cutting-edge equipment to measure evaporative water loss rates and body temperature, Maxine Whitfield used a laboratory temporarily set up in a hunting lodge in the southern Kalahari to collect a novel data set on avian heat tolerance and cooling capacity.
- Ben Smit spent a month in Arizona assisting with collection of similar data for species in the Sonoran Desert.

And into 2013

The New Year has seen several additions to the Hot Birds team. PhD student Ryan O'Connor started work on the physiology and breeding biology of nightjars in hot, arid environments. Matthew Noakes joined the team for an MSc on geographic and seasonal variation in the physiological traits of White-browed Sparrowweavers. CB MSc students Phenias Sadondo and Robyn Milne will work on the effects of temperature on risk-taking behaviour in Kalahari birds, and the links between temperature tolerance and range restriction in fynbos birds, respectively. We are also awaiting the outcome of a grant application, which if successful will allow us to expand the project in some very exciting new directions... watch this space!

Key co-sponsors

Tswalu Foundation; University of Cape Town Research Committee, National Science Foundation (USA), National Research Foundation (South Africa).

Research Team 2012

Prof. Phil Hockey (PFIAO)

Prof. Andrew McKechnie (CoE Core Team Member, Univ. Pretoria)

Dr Susie Cunningham (PFIAO Post-doctoral Fellow)

Dr Rowan Martin (PFIAO Post-doctoral Fellow)

Dr Todd McWhorter (Univ. Adelaide)

Dr Nicola Mitchell (Univ. West Australia)

Dr Blair Wolf (Univ. New Mexico)

Students: Ben Smit (PhD, Pretoria), Tanja van de Ven (PhD, Cape Town), Maxine Whitfield (MSc, Pretoria), Grace Russell (BSc Hons, U. Western Australia)

Research assistants: Carryn Hojem, Sue-Joy Schultz, Barry Schultz, Yolanda Chirango

Ducks, dispersal and disease

In this programme we are using water-associated birds as models from which to understand some of the complex interrelationships between landscape heterogeneity, wetland dynamics, the movements of waterfowl, the bird communities in which our study species occur, and the occurrences of pathogens and parasites.

Movement is a dominant theme in evolution, biogeography, community ecology, conservation and management. Southern African waterfowl, with their high movement capability and semi-nomadic lifestyle, provide an intriguing test case for understanding poorly known elements of movement ecology and their relationships to other bodies of ecological theory. Waterfowl movements are enigmatic. Despite decades of often intensive ringing and counting efforts, relatively little is known about the causes and consequences of the long-distance movements of most southern African ducks. For instance, Red-billed Teals *Anas erythrorhynchos* ringed at Barberspan, in the Northwest Province (roughly mid-way between Kimberley and Mafikeng), have been recaptured as far north as Tanzania and as far south as Cape Town. Equally intriguingly, anecdotal accounts suggest that huge influxes of ducks occur occasionally. However, it has been difficult to understand these movements and their transient nature means that they are often overlooked by monitoring efforts such as the biannual African Waterfowl Census.

Uncertainties over the nature and frequency of waterbird movements create difficulties for waterfowl conservation and management, as well as the health of South Africa's poultry stocks, and ultimately human health and wellbeing. Many seemingly simple questions are currently unanswerable. For example: if populations of some of our ducks are declining (as has been proposed for African Pygmy Geese *Nettion auritus* and Maccoa Ducks *Oxyura maccoa*), would we be able to demonstrate it? How strong a regional decline can we detect? What would be the impact on aquatic and riparian ecosystems if duck abundance greatly increased or decreased, or particular kinds of species were lost? And if a virulent pathogen such as highly pathogenic avian influenza (H5N1) were to enter southern Africa, how far and how fast could wild birds carry it? Were the recent outbreaks of the fatal H5N2 avian influenza in Ostrich farms in the Cape caused by inadequate precautions relating to the movements of domestic poultry, or by strains of the virus that were transported by wild Egyptian Geese *Alopochen aegyptiaca*? And just how worried should people



Fulltime field technician David Nkosi measuring a Yellow-billed Duck *Anas undulata*. (Photo: Chrissie Madden)

be that H5N1 has made its way south as far as Kenya?

Since 2007 the Fitz has been working on improving our understanding of the movement ecology of waterfowl and the epidemiology of their pathogens. We have pursued several lines of enquiry in the hopes of finding complementary strands of evidence that together will create a solid understanding of both waterfowl and pathogen dynamics. The primary strands of empirical evidence at our disposal include ringing recoveries, count and atlas data, satellite telemetry data, data on dietary composition from feather isotope ratios, population genetics, information on avian parasite and pathogen composition, and phylogenetics. It should in theory be possible to use these kinds of data, individually and together, to provide rigorous tests of competing hypotheses that explain when, where, and why ducks move.



PhD student Chevonne Reynolds combs a Red-billed Teal to collect any seeds attached to the feathers. (Photo: Chrissie Madden)

Highlights:

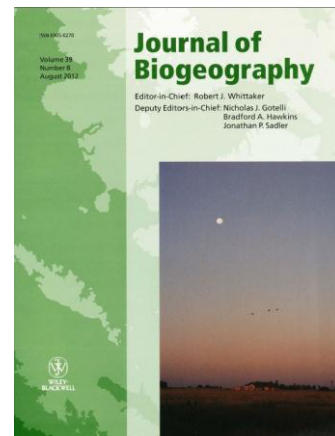
- Mduduzi Ndlovu completed his PhD thesis on the movements and moulting ecology of Egyptian Geese, and graduated in December 2012. Mduduzi was able to show that southern African ducks exhibit greater flexibility in the timing of life history events than European species, challenging existing assumptions about anatid ecology.
- Sharon Okanga found interesting patterns in avian malaria in wetland passerines in the Western Cape, including clear influences of climate, land cover, and the bird community on infection prevalence. She submitted her PhD in early 2013.
- Dominic Henry upgraded his MSc to a PhD and completed the fieldwork component of his study. This has involved counting waterbirds



Dominic Henry releases an Egyptian Goose after attaching a satellite transmitter. This is one of four birds tagged in Kwa-Zulu Natal, which together will provide fine-scale goose movement data. (Photo: Graeme Cumming)

every two months, over a 16-month period, at 70 locations across the Pongola Floodplain and Lake St. Lucia.

- Chevonne Reynolds began her PhD on the role of ducks in seed dispersal. She has so far captured and sampled >400 ducks for external propagules, as well as collecting faecal samples and the entrails of birds shot by hunters. She is currently engaged in germination trials and seed identification.



- We published six peer-reviewed journal articles on waterbirds and animal movement ecology, including a detailed analysis of the movements of Red-billed Teal and Egyptian Geese in which we argue that the species ranges of African ducks are limited by internal factors rather than by their movement or navigational capabilities. This paper, together with a photograph of Egyptian Geese at Barberspan, was featured on the cover of the *Journal of Biogeography*.

Key co-sponsors

The National Research Foundation of South Africa; the University of Cape Town's Research Committee.

Research team 2012

Prof. Graeme Cumming (PFIAO)

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Dr. Celia Abolnik (Onderstepoort Veterinary Institute)

Dr. Alexandre Caron (Cirad, Harare)

Dr. Daniel Corn  lis (Cirad, Montpellier)

Dr. Nicolas Gaidet (Cirad, Montpellier)

Dr. John Grewar (Veterinary Services, Elsenburg)

Asst. Prof. Jeffrey Peters (Wright State University, Ohio, USA)

Dr. Ricky Taylor (Ezemvelo-KZN Parks)

Students: Dominic Henry (PhD, UCT), Mduduzi Ndlovu (PhD, UCT), Sharon Okanga (PhD, UCT), Chevonne Reynolds (PhD, UCT) Christine Moore (CB MSc, UCT)

Research assistant: David Nkosi

Spatial resilience of Protected Areas

The protected areas programme focuses on understanding influences on the long-term sustainability of protected areas in South Africa, the contributions of protected areas to the national biodiversity estate, and the ways in which they function as both members and creators of socioeconomic networks.

Protected areas represent one of society's preferred strategies for achieving conservation goals. Given their widely assumed importance for conservation, and the many case studies that have focused on individual reserves, there has been surprisingly little comparative work on protected areas. For instance, little is known about the long-term dynamics of most protected areas; patterns in their creation and collapse are poorly understood; and their overall contributions to biodiversity conservation, particularly within the private sector, remain unclear.

People create and manage protected areas in order to provide ecosystem goods and services (whether aesthetic, cultural or economic) to society. Social goals influence management activities; and in turn, management successes or failures influence both ecosystem service provision and societal attitudes. For example, demand for game viewing drives the stocking of large animals in small southern African protected areas; die-offs of elephants in times of drought have resulted in the creation of artificial watering points in many protected areas, with negative impacts (via elephant activities) on baobab trees and other ecosystem components; and societal values and preferences, such as a dislike of fire and burned areas, may influence supposedly scientific ecological management plans. Protected areas are thus best described as linked social-ecological systems, rather than the pristine fortresses of popular belief.

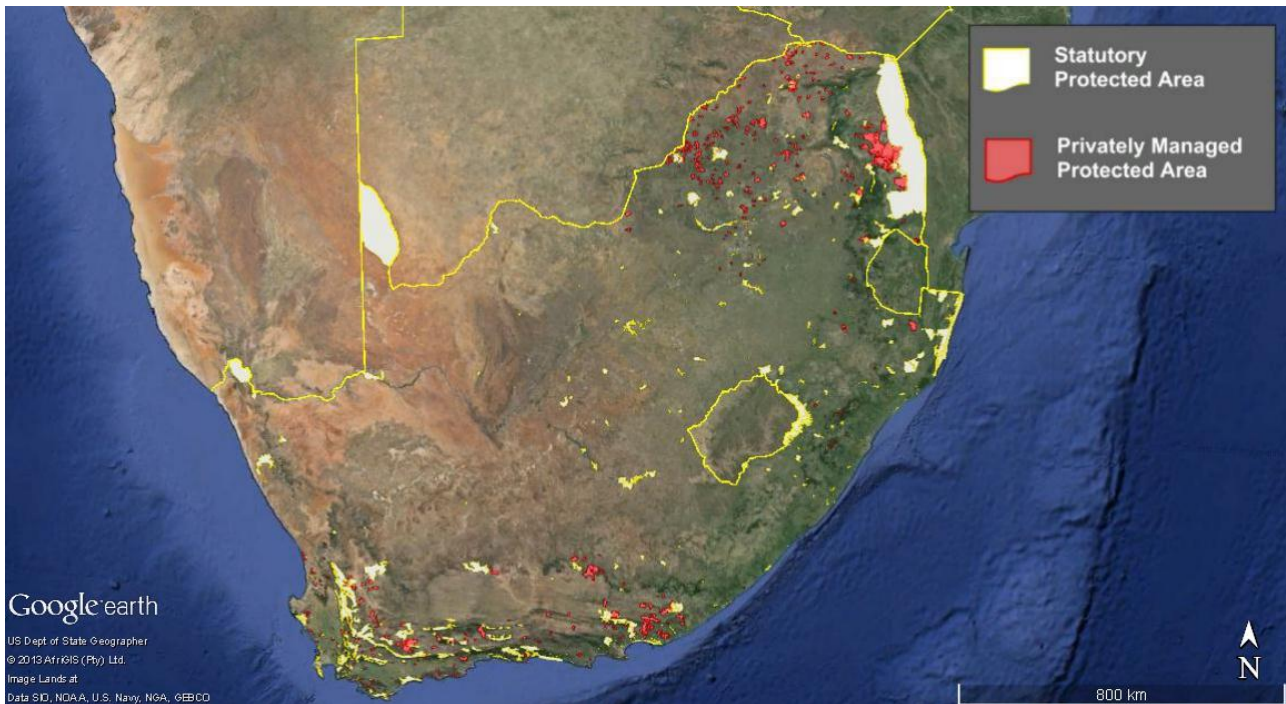
In recent times, South Africa has seen the rise of an intriguing phenomenon: the private nature reserve. The area of land in private nature reserves (both individually and community-owned) is estimated at nearly twice that in public nature reserves. The rise and fall of private protected areas, and their overall contributions to the national biodiversity estate, are, however, largely undocumented and poorly understood. Can we rely on private nature reserves to support biodiversity conservation over time frames of 50-100 years? Can we

predict where they will be successful and where they will go out of business? How do they contribute to both social and ecological elements of conservation goals and strategies? And how resilient will they be, in an uncertain future, to the winds of social, economic, and ecological change?

The answers to these questions depend heavily on spatial patterns and relationships: where reserves occur along biophysical and socio-economic gradients, how their location relates to infrastructure, and how – or whether – membership in networks of such things as animal exchanges, transactions, and information processing influences their long-term viability. We are thus adopting a comparative, spatially explicit, and network-based approach to analyse and understand the dynamics that drive pattern-process relationships relating to private protected areas.

Highlights:

- Grant Joseph graduated with a PhD in Dec 2012. His research explored the ecological role of termite mounds in Chizarira National Park, in Zimbabwe, and their contributions to functional diversity in plant and bird communities.
- The programme received major cash infusions in the form of a Complexity Scholar award to Graeme Cumming from the James S. McDonnell Foundation, and an NRF Competitive Programme for Rated Researchers (CPRR) grant. This allowed the programme to grow rapidly, with several new students and Post-doctoral Fellows starting in 2012:
 - Julia Baum (PhD) is focusing on understanding the socioeconomic interactions between private protected areas and the relevance of location and network membership for protected areas resilience.
 - John Heydinger (MSc) is exploring the role of birds as providers of cultural services to tourists using protected areas.
 - Kristi Maciejewski (Post-doctoral Fellow) is looking at the connections between private and provincial protected areas as well as



There are, by some estimates, perhaps twice as much conservation land in private hands than is managed by the government. Despite this, we know very little about the state of our "private conservation estate". Our group is working with numerous collaborators to map out private conservation areas as a first step towards understanding their dynamics and resilience. *Google Map Data collated by Alta de Vos.*

approaches for thinking about the correspondence between the scales of socioeconomic influences (particularly tourism) and ecological processes.

- Alta de Vos (Post-doctoral Fellow) started working with numerous collaborators to assemble a first comprehensive map of private protected areas in South Africa, as well as on understanding the role of spatial variation (connectivity, location along gradients, etc.) on the numbers of tourists visiting SANParks. This exercise will allow a summary of the conservation area under private ownership and a first approximation of how much private areas contribute to national conservation goals.
- Jeremy Goss completed a CB MSc project on networks of wildlife trade in the Western Cape. This analysis has since been published in a high-impact journal, *Frontiers in Ecology and the Environment*. Jeremy analysed permit data provided by Cape Nature to show that >160,000 animals were moved around the Western Cape over the period 2001-2011. More than one quarter of these translocations were of species that are non-native to South Africa. He also showed an increase in movement rates and volumes for most taxonomic groups, raising concerns over the possible spread of disease and the potential for

introductions of non-native species into the Western Cape.

- We published five additional peer-reviewed journal articles on this theme.

Key co-sponsors

James MacDonnell Foundation's Complex Systems Program; National Research Foundation of South Africa; SANParks numerous private nature reserve owners and managers.

Research team 2012

Prof. Graeme Cumming (PFIAO)
 Prof. David Cumming (PFIAO)
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 Dr Oonsie Biggs (Stockholm Resilience Centre)
 Dr Georgina Cundill (Rhodes University)
 Dr Alta de Vos (Post-doctoral Fellow, PFIAO)
 Prof. Christo Fabricius (NMMU)
 Marna Herbst (SANParks)
 Dr Kristi Maciejewski (Post-doctoral Fellow PFIAO)
 Zaccheus Mahlangu (ZWA)
 Christine Moore (PFIAO)
 Dr Belinda Reyers (CSIR)
 Dr Xanic Rondon (PFIAO/Univ. Florida)
 Dr Colleen Seymour (SANBI)
 Prof. Jane Southworth (University of Florida)

Students: Julia Baum (PhD, UCT), Grant Joseph (PhD, UCT), John Heydinger (MSc, UCT), Jeremy Goss (CB MSc, UCT)

Research assistant: David Nkosi

Conservation Biology Masters programme

2012

The 20th cohort of Conservation Biology students completed their projects early in 2012, with eleven graduating in June 2012 and one in December 2012. Special congratulations go to Christine Moore, who obtained her degree with distinction. By the end of 2012, 229 students had completed the course successfully since its inception in 1992.

The 21st cohort of CB students started their studies in January 2012, with participants from seven countries: South Africa, Australia, Canada, Germany, Mauritius, the UK and the USA. Eleven of these students handed in their research projects during February 2013, and the remaining four handed in by June 2013. The 2013 intake of CB students, our 22nd cohort, comprised 13 students from six countries: South Africa, Canada, Kenya, Tanzania, the UK and Zimbabwe. Unfortunately, a fourteenth student, Peter Sankai, a Maasai from Kenya, was unable to get to Cape Town in time for the start of the year due to problems with his paperwork. Hopefully he will be able to join the next intake at the start of 2014.

The course continues to be supported by a wide variety of people both inside and outside UCT. We owe particular thanks to module leaders from outside UCT for their willingness to teach on the course and for the consistently high academic standards that they have maintained. 2012 saw some changes to the teaching roster, with Dr John Hanks, former director of the Peace Parks Foundation, leading the opening module with great aplomb. Dr Jackie King decided that 2012 was time to pass the baton on running the freshwater ecology module, and shared teaching this section with Dr Geordie Ractliffe. 2012 also saw Phil Hockey's involvement in the course greatly curtailed through ill-health.

Other module leaders from outside UCT in 2012 were Dr Woody Cotterill (biodiversity), Dr Phoebe Barnard (climate change), Dr Peter Carrick (restoration ecology) and Dr Georgina Cundill (conservation and society). Teachers from within UCT came from Economics (Dr Jane Turpie), Philosophy (Dr Jack Ritchie), and Zoology (Assoc. Prof. Colin Attwood, Dr Jacqueline Bishop, Assoc. Prof. John Hoffmann).

In addition to the module leaders, many other people contributed through guest lectures, field trips and discussions. This diversity of perspectives adds greatly to the value of the course, and it is unfortunate that pressure is mounting to reduce the amount of teaching conducted by people from outside the newly-formed Department of Biological Sciences.

Into 2013...

The advent of 2013 saw further upheavals in the CB teaching roster. Phil Hockey's untimely death resulted in the need for a new leader for the community ecology module, and we were extremely grateful to Prof. William Bond for taking it over in 2013. John Hanks was forced to stand down due to health issues, and we were very fortunate to be able to call on Prof. David Cumming to take on the important and challenging role of running the opening module, which sets the scene for the rest of the course. Fitz HRA Phoebe Barnard led the climate change module for perhaps the last time in 2012, with this module being run in 2013 jointly with the ACDI coursework masters class under the leadership of Prof. John Bolton and Dr Cecile Reed (in the absence of Dr Lindsey Gilson, who was on sabbatical).

2014 and beyond

The 2011 Fitz annual report concluded that "the CB course currently seems well placed to deal with potential [future] contingencies". But a lot has changed in the past 18 months. The preceding account highlighted the personnel changes resulting from an aging cohort of module leaders, and these are set to continue. It is unclear who will lead the community ecology module in 2014, when William Bond has retired. Geordie Ractliffe has already given notice that she will be unavailable to lead the freshwater ecology module from 2015 (and perhaps 2014), and John Hoffmann, the leader of the alien invasives module, is set to retire in a couple of years. The success of each module depends very much on their being a module 'champion' who takes responsibility for the bulk of the teaching, and ensures continuity between sections when a



A wind-swept 2012 CB class on their orientation outing up Devil's Peak. Back from left: Lea Cohen, Jah Namah, Jessica Greenston, Kat Forsythe, Wade Lane, Lou Palframan, Kirsten Retief (obscured), Caz Sanguinetti, Heinz Ortmann, Daniël Cloete. Front: Koebraa Peters, Vera Liebau, Craig Harding, Chrissie Madden. Absent: Kimon de Greef. (Photo: Peter Ryan)

diversity of teachers are brought into a module.

Perhaps even more worrying is the perception that the CB course doesn't require a dedicated staff member to run efficiently. The Science Faculty staffing formula allocates one academic teaching position to each coursework MSc programme that attracts at least eight students each year. The CB course has always attained this goal. However, the newly-merged Biological Sciences Department is deemed to be overstaffed, and so there is pressure to not replace people as they retire. The Faculty staffing plan calls for the collapse of the CB teaching position, currently held by Peter Ryan, into the Fitz post currently held by Prof. Tim Crowe, when Tim retires in 2013. It is unclear quite what this plan means for the future of the CB course.

The CB course continues to attract top students from all over the world, but its ability to do so rests heavily on its reputation. This in turn depends on word-of-mouth support from

past students. The course has already suffered somewhat from the interregnum caused by Phil's death, and the resultant loss in supervisory capacity. If the capacity to run the course is further compromised, there is a real chance that its future will be in jeopardy.

Key co-sponsors

The CB programme again received support in 2012 from the Umhlanga Rotary Club, who provided a R50 000 per annum bursary in 2011 and 2012. Edward Rice was the Rotary Bursary holder for 2011 and Heinz Ortmann for 2012. The DST/NRF Centre of Excellence at the Fitz also contributes two R75 000 bursaries annually and contributes to CB student project running costs. The programme is also strengthened by the dedication of the Fitztitute support staff, especially Hilary Buchanan who administers the CB applications and generally assists with the settling-in process for the newly arrived foreign students.

Course co-ordinators

Prof. Graeme Cumming

Assoc. Prof. Peter Ryan

External/Contractual lecturers

Assoc. Prof. Colin Attwood (Zoology, UCT)

Dr Phoebe Barnard (SANBI)

Dr Jacqueline Bishop (Zoology, UCT)

Dr Peter Carrick, (Botany, UCT)

Dr Woody Cotterill (Geological Sciences, UCT)

Dr Georgina Cundill (Rhodes University)

Assoc. Prof. John Hoffmann (Zoology, UCT)

Prof. Astrid Jarre (Zoology, UCT)

Dr Jackie King (Water Matters)

Prof. Norman Myers (Oxford University)

Dr Geordie Ractliffe (Water Matters)

Dr Jack Ritchie (Philosophy, UCT)

Dr Jane Turpie (Economics, UCT & Anchor Consultants)

Conservation Biology projects 2012/2013

Cloete, Daniël: Investigating the decline of the Martial Eagle *Polemaetus bellicosus* in South Africa.
Supervisor: Arjun Amar.

Cohen, Lea: Increased foraging effort of breeding Cape Gannets fails to compensate for reduced prey availability.
Supervisors: David Gremillet, Lorien Pichegru and Peter Ryan.

De Greef, Kimon: The booming illegal abalone fishery in Hangberg: tough lessons for small-scale fisheries governance in South Africa. Supervisors: Serge Raemakers, Merle Sowman.

Forsythe, Katherine: Exploring the relationship between restored ecosystem function and species composition: a meta-analysis. Supervisors: Peter Carrick and Arjun Amar.

Greenston, Jessica: Assessing the suitability of an individual transferable quota system to address unregulated by-catch in South Africa's inshore trawl fishery. Supervisors: Charles Griffiths and Tony Leiman.

Harding, Craig: Tracking African penguins *Spheniscus demersus* outside of the breeding season: regional effects and fishing pressure during the pre-moult period. Supervisors: Ross Wanless, Peter Ryan, Christina Moseley and Lorien Pichegru.

Lane, Wade: Is the grass really greener on the other side? The potential effects of additional soil nitrogen, phosphorus and water on the feeding behavior and diet of the large herbivores within an African savannah. Supervisors: Edmund February, Leigh-Ann Woolley.

Liebau, Vera: Exploitation of rocky intertidal marine resources in South Africa: implications for the conservation of boulder shores. Supervisor: Charles Griffiths.

Namah, Jayaneesh: Do mutualisms matter? A case study of the Sausage Tree *Kigelia africana* in Kruger National Park, South Africa. Supervisor: Jeremy Midgley.

Madden, Chrissie: The impacts of corvids on biodiversity. Supervisor: Arjun Amar.

Ortmann, Heinz: Conserving Wilkins' Bunting *Nesospiza wilkinsi*: an endangered, single island endemic. Supervisors: Peter Ryan. Michele Pfab.

Palframan, Louise: From cost-effectiveness to economic-efficiency in conservation planning: the importance of considering the economic benefits of conservation. Supervisor: Jane Turpie.

Peters, Koebraa: Marine alien species in Western Cape harbours, South Africa: A tool for strategically focusing monitoring efforts. Supervisors: Charles Griffiths and Tamara Robinson.

Retief, Kirsten: Cycad forensics: tracing the origin of poached cycads using stable isotopes, trace element concentrations and radiocarbon dating techniques. Supervisor: Adam West.

Sanguinetti, Carolyn: Patterns in reef fish assemblages as determined by baited remote underwater video (BRUV) along the western side of False Bay: effects of site, depth, and protection. Supervisors: Colin Attwood, Albrecht Gotz.

Profiling and outreach

Apart from research, education and training, the Fitztitute continues to develop profiling and outreach activities including information brokerage, networking, service rendering and community involvement in its field research projects.



Delegates at the Fitz and BirdLife SA co-hosted *Frontiers in South African Ornithology* conference. (Photo: Leslie Clemence)

Information Brokerage

Forty semi-popular articles and seven book chapters were published during 2012. Following the termination of the popular magazine *Africa: Birds & Birding*, Phil Hockey, Andrew McKechnie and Peter Ryan were asked to act as scientific advisors for a new magazine, *African Birdlife*, launched in late 2012 by BirdLife South Africa.

Fitz staff and students presented regular public talks to partner organisations and interested parties, such as NGOs, environmental action groups, conservancies and bird clubs. Radio interviews were done on Cape Talk Radio, Radio 702, OFM Radio, two BBC national radio stations, German and Canadian national radio, and the Hectic Nine-9 live television show for the youth on SABC2.

Fitz staff and students attended 17 international and nine local conferences during 2012. The Fitz and BirdLife SA co-hosted a *Frontiers in South African Ornithology* conference in Port Elizabeth during March 2012. The conference was attended by 65 delegates, including seven Fitz staff and research associates and 12 Fitz students. Andrew McKechnie and Mandy Ridley gave invited keynote addresses.

The Fitz also co-hosted an *International Blue Swallow Action Plan Review Workshop* organized by Andrew McKechnie and the Endangered Wildlife Trust, held in Howick during March 2012. Twenty-eight delegates from nine range states assessed the *status quo* of Blue Swallow knowledge and conservation activities and refined the species action plan for these birds.

The Albatross and Petrel Agreement's honorary Information Officer, John Cooper, received a Lifetime Achievement Award from the Pacific Seabird Group at its 39th Annual Meeting during February 2012 in Hawaii. In the presentation address by Alan Burger, an old colleague of John's at the Fitz, now based in Canada, mention was made of the information service that the Agreement and Conservation of Albatrosses and Petrels (ACAP) provides to the community through *ACAP Latest News*. John's role as Founding Editor of the journal *Marine Ornithology* was also highlighted.

The Fitz presented a stand at the DST/NRF 2012 CoE Annual Day held at the University of Pretoria on 13 November 2012, at which Rob Little gave an overview of the alignment and delivery of the Fitz to the South African Government's Outcomes Approach, specifically for research and development.

UCT celebrates Africa Day on 25 May each year, which is an opportunity to highlight the Fitz's contribution to higher education and development in Africa. The week long Africa Exhibition from 21-25 May 2012 highlighted academic research and capacity building endeavours, collaborations and links UCT staff have forged with continental universities, and the contribution made to the generation of African knowledge. The Fitz presented a stand with a banner and posters that reflected our activities and impacts in Africa.

Peter Ryan and Aurore Cannoville, a post-doctoral fellow from Prof. Anusuya Chinsamy-Turan's laboratory (Biological Sciences, UCT)



PhD student Sharon Okanga's research on avian malaria attracted media attention during 2012. (Photo: David Nkosi)

presented a full day course "The Never Ending Story: Bird Evolution from Dinosaurs to the latest splits" in collaboration with the Cape Bird Club during August 2012.

The Cape Parrot project Facebook page has become the largest parrot conservation group with over 5,000 subscribers. In 2012, the project produced a TV show "Endangered" which was screened in the US on PBS and local networks. It will be screened on SABC3. A six-part reality TV series was produced on the activities of the 2012 Okavango Wetland Bird Survey as a spin-off from Steve Boyes's Meyer's Parrot research, in collaboration with BirdLife Botswana and the Okavango Research Institute. The TV series created for Carte Blanche National Geographic Wild will give the Fitz considerable exposure, in support of the nomination of the Okavango Swamps for World Heritage Status. Claire Spottiswoode's African Cuckoo project in Zambia was filmed by the BBC's Natural History Unit during 2012 for a forthcoming 'Survival' series.

Don Pinnock published an article titled 'The secret life of cats' on the findings of Sharon George's MSc CB project in the February 2012 issue of *Getaway Magazine*. Jess Shaw and Sharon Okanga's PhD projects were profiled as extensive blogs titled 'Saving the Ludwig's Bustard' and 'Avian malaria in Western Cape birds' on the SANParks Wildcard site during March and April 2012. These were linked to the Fitz Facebook site and to their personal pages on the Fitz website.

Jess Shaw also gave talks on the Ludwig's Bustard project and bird collisions with power lines to CapeNature in February, the Cape Bird Club in March and the Overberg Bird Club in June 2012. In addition, an article on the value of satellite telemetry for bird conservation featured in a book '*Sustainable Development in Africa & Satellites: Technologies and Wisdoms*'.

Sharon Okanga and Rita Covas published articles titled 'Avian malaria has spread its wings' and 'Ever wondered what's happening in those nests', respectively, as a new regular space for the Fitz in the *SANParks Times* (Spring & Summer editions 2012).

Karien Jordaan of OFM Radio compiled a sound clip with interviews by Rita Covas and



Research Associate Dr Rita Covas and her team received significant media outreach from their work on Sociable Weavers. (Photo: Claire Doutrelant)

Mark Anderson (BirdLife SA) on the Benfontein Reserve Sociable Weaver project which was aired during May 2012. Eben Human also wrote a focus article on the Sociable Weaver project titled 'Versamevoels raak ouer as wat baie dink' in a June issue of *Die Burger*. He also did a similar focus article on the Black Harrier project titled 'Valk migreer van Weskus na pieke in Drakensberg' in a May issue of *Die Burger*.

Networking

Close collaborative working relationships with scientific peers exist both nationally and internationally. Primary collaboration within the Fitz Centre of Excellence continued with Prof. Paulette Bloomer and Prof. Andrew McKechnie at the University of Pretoria, A/Prof. Rauri Bowie at the University of California, Berkeley, and with Dr Pierre Pistorius at the Nelson Mandela Metropolitan University. There is additional emphasis on working with historically black universities in South Africa and African universities, e.g. Fort Hare University, Tshwane University of Technology and the Universities of Zimbabwe and Zambia. Nine of the 13 Post-doctoral Fellows came from seven different foreign countries.

The Fitz continues research relationships with 11 Honorary Professors and Honorary Research Associates, of which six have UCT honorary status. These honorary Fitz members contribute to the course-work modules of the Conservation Biology MSc programme and co-supervise various thesis students. The MSc CB Course continues to build capacity in biodiversity conservation, with students from

South Africa (2), UK (2), USA (3), Canada, Liberia, the Netherlands and Zimbabwe graduating during 2012, and the enrolment of students from South Africa (6), the USA (2), Australia, Canada, Germany, Mauritius, the Netherlands and the UK during 2012.

Prominent research partners who visited the Fitz during 2012:

- Dr Yan Ropert-Coudert from the CNRS, Strasbourg, joined the annual voyage to Marion Island in April 2012 to initiate collaborative projects with students working on the island. While in Cape Town he gave a seminar on the trials and tribulations of bio-logging.
- Dr François Mougeot and Dr Beatriz Arroyo Lopez from the Spanish research agency (CSIS) visited the Fitz during December 2012. They both gave seminars to introduce their work to the Fitz.
- Prof. Stephen Redpath from the Aberdeen Centre for Environmental Sustainability (ACES), University of Aberdeen, visited the Fitz during December 2012, interacted with our students and gave a seminar on the role of ecology in transforming conservation conflicts.

Service rendering

Links continue to be serviced with conservation agencies, NGOs, government departments and industry partners. These include the Department of Environmental Affairs, the Department of Agriculture, Forestry & Fisheries (DAFF), the South African National Biodiversity Institute (SANBI), South African National Parks, IUCN, Conservation International, Fauna & Flora International, the Royal Society for the Protection of Birds (RSPB), BirdLife South Africa & Zimbabwe, the Endangered Wildlife Trust, the Namibian Ministry of the Environment, the Wildlife Conservation Society, the Nature Conservation Corporation, ESKOM, the South African Deep Sea Trawling Industry Association and Irvin & Johnson.

Fitz staff and students served on 18 journal editorial boards, 47 membership and advisory services, and reviewed 158 papers for 64 peer-reviewed journals during 2012.

The Fitz penguin research team based in Algoa Bay has been comparing two management strategies to increase African Penguin breeding

success which resulted in the culling of Kelp Gulls by SANParks on Bird Island as well as changing the design of artificial burrows, from fiberglass to cement pipes, which are increasing penguin chick survival. Results from the experimental fishing exclusion around some penguin colonies provided evidence to close the world's largest African Penguin colony permanently to purse-seine fishing. Timotheé Cook also advised the Robben Island Museum on strategies to protect cormorant breeding colonies from human disturbance.



Post-doctoral Fellow Dr Lorian Pichegru returns an African Penguin chick to its nest on St Croix Island, Algoa Bay, after assessing its growth as a measure of food availability. (Photo: Lloyd Edwards)

The Cape Parrot project has established the Eastern Cape Forest Research Forum to co-ordinate forest research and link findings to forest management, including a review of yellowwood harvesting quotas. By the end of 2013, the quota should be set at zero. Steve Boyes and Rowan Martin were consultants for the World Parrot Trust for the proposal to amend the CITES Appendix I with regard to parrot trade. Research on the Afromontane forests of Angola is guiding the Angolan Ministry of the Environment's conservation strategy, including identifying and designing appropriate protected areas.

The Ludwig's Bustard project contributed to a high-level consultancy investigating avian risks

for a proposed transmission line through the Kyrgyz Republic, Tajikistan, Afghanistan and Pakistan being conducted by Julia Robinson, Willmott, Normandeau Associates linked to Nigel Collar, BirdLife International. In South Africa, research on collision mortality and a large-scale experiment to test the efficacy of line marking devices will guide Eskom's future planning of power lines.

Community involvement

Some Fitz research has broad relevance to women's health and food security. Furthermore, community conservation projects and educational activities often target women to enhance buy-in and compliance from the community and, ultimately, ensure the success of the project.

In recent years, 29 full-time and 93 part-time jobs, mostly taken by women, have been generated as direct spin-offs from Fitz research activities. These include 19 full-time and 49 part-time jobs in South African previously disadvantaged communities, 10 full-time and 40 part-time jobs in Zambian rural communities, and four part-time jobs in Angola.

Some current examples:

Fitz research into avian malaria and avian influenza, which affect ostriches, chickens and other poultry, is providing information used to educate African women about the risks of handling poultry and causes of the spread of these diseases.

The Cape Parrot project has planted over 19,000 indigenous trees, employing local community members from the Hala, Zingcuka and Sompondo Villages below the Hogsback Mountains. The project has:

- employed 21 African men and 10 African women in tree-planting teams (one per household) that are paid R120 per day (including food and uniforms).
- paid a community reward each six months for caring for trees planted near the Sompondo Village (R5 000 to 42 African people) and Hala Village (R3 000 to 61 African people).
- established 25 micro-nurseries in local villages with 17 African women and eight African men being paid R10 per indigenous sapling they grow.

- employed three African men as forest plot managers (two days per week), paying them R1 200 per month.
- employed seven African women and four African men in seed-collecting teams, paying them R100 per bag (they can earn up to R300 per day).
- employed four African men to build Cape Parrot nest boxes, paying them R150 per nest box.
- employed an African male Community Manager from the local village on a salary of R4 000 per month.
- employed an African male Research Assistant from the local village on a salary of R3 000 per month.
- run the “Green Campus Initiative” at the University of Fort Hare where over 50 students have planted and cared for trees.
- donated 150 yellowwood trees to Hobbiton-on-Hogsback for school children to plant during field trips to the youth centre.

The brood parasite project in Zambia run by Claire Spottiswoode has provided a source of income to over 40 local people, including full time employment for 10 people. Claire is also a Mentor for the British Ecological Society's mentorship scheme for women in ecology.

The Shoebill project hired two local research assistants of which one was promoted to become the community development facilitator for the Bangweulu Swamps. During the breeding season we also hired three guards to monitor and protect the nest, two of which were paid by African Parks and one by the Shoebill project.

The Fitz Nelson Mandela Bay research team has been training formerly disadvantaged SANParks rangers to collect penguin data on Bird Island in the Eastern Cape.

The pattern and process spatial ecology project has employed Chizarira National Park rangers, and a Zimbabwean field-botanist, which resulted in the voluntary involvement of a number of National Park staff in the project and

re-kindled research interest from the present warden. It has also led to regional and international knowledge-sharing, as students from the University of Zimbabwe have collaborated with our team members. The composition of the team has been diverse, with researchers from the United States (2 MSc students), South Africa (2 MSc and one PhD student), and Zimbabwe (2 MSc students). It has also incorporated scientific researchers from SANBI, and has led to bilateral exchange with the National Herbaria of Harare and Pretoria.



Part of the Shoebill conservation project involves educating the community about the importance of conserving Shoebills. Chicks are often taken from nests, either to show to tourists or to sell illegally. We were able to return this chick to its nest and it then fledged successfully at the beginning of November. (Photo: Ralf Mullers)

Niven Library

During 2012 the Niven Library continued to broaden its outreach to Africa and the world. The Library Open Access Catalogue (OPAC) was visited by researchers in 32 countries, including 6 African countries. The combination of donations, exchanges and a library budget funded by the Centre of Excellence enabled the librarian to expand the ornithological collection with both retrospective and newly published material. Material required to support conservation biology was also sourced for the collection.

Staff and staff development

Margaret Koopman

2012 was a year spent looking for economical ways to keep the Niven Library at the cutting edge of service provision and technology. The launch of the LibGuide in mid-2011, specifically the tutorial on Mendeley Bibliographic software, a first at UCT, proved very popular with students at the Fitz and more broadly on the UCT campus.

The digitised collection of Fitztitute scientific papers is waiting in the wings for the development of a repository, either at the Fitz or at UCT. Where archival literature (out of copyright) is concerned, the librarian is collaborating with the Biodiversity Heritage Library to provide electronic access.

The down-scaling of the professional status of the Niven Library post is hopefully only a temporary situation, as the library requires the services of an experienced and competent librarian to maintain the collection and to provide the level of professional services required by staff and students at the Centre of Excellence.

Phelisa Hans

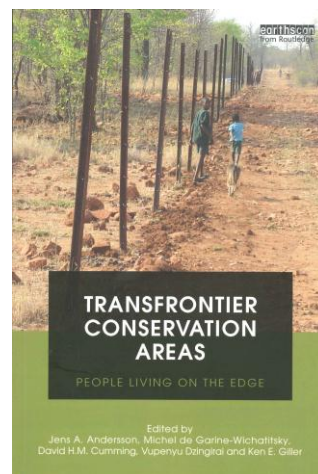
During 2012 Phelisa learnt how to catalogue maps and integrated the maps donated by the Animal Demography Unit into the Niven Library collection. She also organised and labelled all the nest record cards, which had been stored by the Animal Demography Unit. These are now housed in the compact storage unit in the Niven Library, neatly labelled, so that users can consult these historical data. Consideration is being given to seeking funds to having the cards scanned so they could be viewed online. Phelisa was also responsible for the entry of the Fitztitute publication output for 2012 on to the Irma database, a task she has carried out diligently since 2010.

Workshops given

Margaret conducted the annual Conservation Biology Masters information skills workshop. A seminar was organised in conjunction with the Centre for Higher Education Development on the progress being made internationally in the field of Open Access publishing. The response from those who attended was very positive as they felt that they had also learnt a lot about the publication process from the point of view of the publisher.

Workshops attended

Margaret attended a number of workshops on Open Access publishing organised under the auspices of the Centre for Higher Education Development. She also attended a training workshop at the UCT Library on the use of SciVal Focus, a component of the proprietary Elsevier Scopus suite. This can be used to evaluate research competencies at UCT and to investigate the collaboration between UCT and other global research and academic institutions.



Staff Books published during 2012

Cumming, D. 2012. Transfrontier conservation areas: people living on the edge. Abingdon: Earthscan from Routledge.

Use of the Library

The Niven Library continues to provide research support to the staff and students of the FitzPatrick Institute, BirdLife South Africa, the Zoology Department and international ornithologists. The total number of requests for information received during the period under review remained comparable to figures from previous years, with approximately 30% of these requests generated by staff and students of the FitzPatrick Institute. Pdf or jpg files were the preferred format emailed to users. In addition, literature searches were compiled and emailed to users, in particular in support of the updated Red Data List of southern African Birds. Over and above interlibrary loan requests, requests for information were received from the following organisations: bird NGOs (BirdLife Botswana; BirdLife South Africa; BirdLife Zimbabwe), conservation agencies (CapeNature), publishers (Christine Mauch, Thumbnail Productions; Daniel Philippe, Howard and Moore Checklist of the Birds of the World), private companies (Two Oceans Aquarium; Falcon Africa Safaris; Kwandwe Private Game Reserve) and universities (University of Stellenbosch, University of Botswana, Universidade Estadual de Campinas, São Paulo, and University of California, Berkeley).

Physical loans from the library decreased with the ongoing emphasis on digital copies (Table 1). Numbers of pdf requests showed a modest increase over 2011, but remained lower than in the previous few years (Table 2). The library assisted FitzPatrick staff and students to source material through inter-library loans (Table 3).

Collection management

The Niven Library purchased 31 books during the year, four titles were received from publishing houses for review and 132 titles were donated to the library. Other acquisitions are listed in Table 4.

Theses: During 2012 all Conservation Biology projects were scanned into pdf format and now can be accessed through the catalogue record. Thanks go to the Animal Demography Unit for hosting the pdfs on their server.

Journals: Black Eagle Press curtailed the publication of *Africa Birds & Birding* during 2012 and BirdLife South Africa initiated a new title, *African Birdlife*, to fill the gap. The first issue appeared toward the end of 2012 and is a high-quality magazine, which will be used to continue the journal exchange agreements put in place during 2007. The resulting exchanges are part of

Table 1. Niven Library stock circulation

	2012	2011	2010	2009
Monographs	264	280	281	228
Reprints	0	9	14	52
Theses	18	15	16	26
Journals	48	55	153	181
Audio-visual	157	1	6	3
Total	388	360	470	490

Table 2. Requests for PFI/O Reprints

	2012	2011	2010	2009
Number of reprint requests	123	106	177	238
Number of countries	13	21	33	23

Table 3. Niven Library inter-library loans

	2012	2011	2010	2009
Items requested (by staff/students)	35	47	134	61
Items supplied	48	117	121	78
Requests not satisfied	1	1	13	14

Table 4. Niven Library acquisitions over the last four years

	2012	2011	2010	2009
Monographs	167	137	185	155
Journals	270	392	443	530
Newsletters	166	215	165	328
Reprints	161	70	49	10
PDFs	1196	1338	1764	1332
AudioVisual	1	3	4	3

the BirdLife South Africa collection which is housed in the Niven Library.

Books: Long-term benefactors of the Niven Library, the Animal Demography Unit, John Cooper and Patrick Morant continue to donate pertinent titles to the collection. During 2012 Don Barrell donated a complete 10-volume set of Handbook of the Birds of India and Pakistan. Lynx Edicions generously donated volume 16 of Handbook of the Birds of the World to the collection and Pete Hancock from BirdLife Botswana donated useful titles on Important Bird Areas of Botswana and a very useful title on Avitourism. Faansie Peacock, a regular user of the Niven Library, donated his latest title on the identification of LBJs. Other donors in 2012 included: Roelf Attwell; BirdLife South Africa;

Black Eagle Press; Joost Brouwer; Tim Crowe; CSIR; CSP; David Cumming; Jenny Day; Jim Enticott Estate; Lloyd Kiff; Doug Loewenthal; Lynx Edicions; Heather Malan; Sean Marr; Media Natur; Cliff Moran; Museu Ciencias Naturals; Martha Nelson-Flower; Peter Ngoma; Graeme Oatley; Gordon Orians; Pippa Parker, Random Struik; Peter Prokosch; Angela Ribeiro; RMCA; Peter Ryan; Save our Seas, Shark Centre; Walter Stanford Estate; Carly Summers; University of Chicago Press; Zoology Department, UCT.

Cash photocopying and book sales

The copier-scanner was primarily used for scanning; only 90 cash copies were made during 2012. Ornithological book sales generated R5,696 in 2012.



Peter Ryan donated a signed copy of his Photographic Field Guide to the Birds of Southern Africa to the EcoSchool learners and teachers of the Roman Catholic Primary School in Port Nolloth, Northern Cape. The children competed in a wetlands based treasure hunt during January 2012 and the winning team, Die Pikkewyne, won a set of nature books and DVDs, including the book, as resources for their school. They loved the bird book, and were particularly excited that Peter had signed it personally and wished them well! Peter was sincerely thanked by Conservation South Africa, Working for Wetlands, the Department of Environment and Nature Conservation and the Richtersveld Community Work Programme for the book donation.

Scientific publications 2012

Names in **bold** are members of the Fitztute or the Centre of Excellence.

IF = Impact Factor.

- Altwegg, R., Broms, K., Erni, B., **Barnard, P.**, Midgley, G.F. & Underhill, L.G.. 2012. Novel methods reveal shifts in migration phenology of barn swallows in South Africa. *Proceedings of the Royal Society B* 279:1485-1490. IF 6.401
- Amar, A.**, Court, I.R., Davison, M., Downing, S., Grimshaw, T., Pickford, T. & Raw, D. 2012. Linking nest histories, remotely sensed land use data and wildlife crime records to explore the impact of grouse moor management on peregrine falcon populations. *Biological Conservation* 145: 86-94. IF 4.115
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Lark-like Bunting *Emberiza empetuani*. (Photo: Peter Ryan)

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