Percy FitzPatrick Institute of African Ornithology

DST-NRF Centre of Excellence

University of Cape Town

Biennial Report

2013-2014

FRONT COVER: **Malachite Sunbird *Nectarinia famosa* on a Honey flower *Melianthus major* (Photo: Peter Ryan)**

Contents

Director's Report

Director of the Fitz, Prof. Peter Ryan. (Photo: Callan Cohen)

The untimely death of Phil Hockey in January 2013 threw the Fitz into disarray, and the annual report was one of the casualties. We postponed the AGM, where the 2012 annual report was tabled, to August 2013. And in order to revert to an autumn report, covering the preceding calendar year, this report covers 2013 and 2014.

The reporting period has seen a series of staff changes at the Fitz. Prof. Tim Crowe retired at the end of 2013, but his post could not be filled until the situation with the Directorship was resolved. Eventually, after two rounds of advertising failed to identify a suitable candidate, I was persuaded to reconsider applying for the position. I was interviewed after presenting a seminar on my vision for the Fitz, and was offered the Directorship in early 2014. After taking over the reins formally in March 2014, we were able to advertise Tim's position at the senior lecturer level. This position attracted a strong field of applicants, which was whittled down to a shortlist of four: two South Africans, one Spaniard and one Portuguese scientist. With all four boasting strong publication records, it proved difficult to select just one candidate, but eventually an extended selection meeting voted to offer the position to Dr Robert Thomson.

Robert is a South African who completed his undergraduate training at the University of Pretoria but moved to Finland for his masters and doctoral studies. He has published high quality research findings on interactions between individuals in boreal bird communities, focusing on the impacts of predation and positive interactions in structuring breeding bird communities. After graduating, Robert worked for an international NGO studying the incidence of avian influenza and trade in wild birds in Cambodia and Mongolia before returning to Finland where he held a series of fellowships at Turku University. Closer to home and of value to the Fitz, Robert has worked on Pygmy Falcons and their relationship with Sociable Weavers in the Kalahari for the last three years. Although he will only formally join us in August 2015 due to the need to complete a final field season in Finland, he will contribute to selected teaching activities at the Fitz during the first half of 2015. We are very pleased to welcome Robert into the Fitz family.

December 2014 saw the retirement of Chris Tobler after 24 years at the Fitz. Chris was an invaluable jack-of-all-trades, at home balancing the budget, servicing vehicles, keeping computers running, building remote camera systems, and rescuing samples when freezers went down. He ensured the seamless running of all things technical and administrative at the Fitz, and was available to fix problems at virtually any time of the day or night. It was with great trepidation that we prepared for his departure, but thanks to Chris's meticulous attention to detail, the systems that he set up have made the transition less painful than we feared. We have also benefited from the experience brought by Gonzalo Aguilar, who has moved from a post in Biological Sciences to service the Fitz's technical support needs. However, I am very grateful to the rest of the support staff – especially Anthea Links, Hilary Buchanan and Tania Jansen – for picking up most of the financial administrative responsibilities left by Chris's departure.

Two more shocks were to follow at the end of 2014. Margaret Koopman, the Niven Librarian, gave notice of her intention to resign to

take up a new challenge as a database manager for SAEON, the South African Environmental Observation Network. We wish her well in her new position, but she will be sorely missed. Margaret instituted numerous innovations since taking over the library in 2002, and has been instrumental in overseeing the transition to an increasingly digital era. The librarian post is being advertised, and fortunately the Faculty has released funds to allow Phelisa Hans to stand in full time until the post is filled. Phelisa has been working as a part-time assistant to Margaret in the Niven Library for several years, so is well placed to maintain core library functions until a permanent replacement is recruited.

Then Prof. Graeme Cumming tendered notice that he intended leaving the Fitz in mid-2015 to take up a position at James Cook University in Townsville, Australia. Graeme was appointed to the Pola Pasvolsky Chair in Conservation Biology in 2006, and has been extremely productive, leading a series of initiatives ranging from studies of waterbird movement and avian diseases to investigations of the role of private nature reserves in the protected area network. His intellectual input to the Fitz will leave a considerable hole. Once again the Dean has moved quickly to allow advertisement of this prestigious Chair, and we shall move as fast as possible to find a suitable replacement.

One very positive development has been the appointment of Dr Susie Cunningham as a contract lecturer for the next five years through the Centre of Excellence (CoE). Susie has worked closely with our CoE core team member at the University of Pretoria, Prof. Andrew McKechnie to keep the 'Hot Birds' programme going following Phil's death. She arrived at the Fitz as a post-doctoral fellow in 2010 fresh from a PhD on tactile and chemosensory perception in Kiwis, and was thrown into an entirely different arena, assessing the impacts of hot weather events on desert birds. She handled the transition with ease, and has gone on to impress everyone with her unassuming efficiency and professionalism. In addition to running the UCT part of Hot Birds, she will also assist with running and teaching the Conservation Biology course. We are very lucky to have her, and we'll try our utmost to ensure that her tenure extends beyond that of the CoE.

Overal, the Fitz and its associated CoE continues to meet its targets in terms of numbers of students and publications. During 2013-2014, we graduated from UCT six PhD students, five MSc dissertation students and 28 Conservation Biology MSc students, and published 228 papers in peer-reviewed journals as well as 145 popular articles. And of course it's not just a numbers game – the real measure of our achievements are the awards our students receive, the useful jobs they go on to occupy, and the contribution our science makes to policy, particularly in the conservation arena. None of this would be possible without the massive contributions of our partners in the CoE, the many contributors teaching the Conservation Biology MSc programme and supervising their research projects, our research associates and post-doctoral fellows. My thanks go to the entire Fitz family for keeping the show on the road during this time of transition.

Peter Ryan, January 2015

Robert Thomson

Susan Cunningham

Staff, Students and Associates

UCT GRADUATES

PhD
Sharon Okanga, Jessica Shaw (June 2013); Alex Thompson (Dec 2013), Potiphar Kaliba (June 2014), Sonja Krüger, Lisa Nupen (Dec 2014)

MSc
Mia Cerfonteyn (Dec 2013); Philna Botha, John Heydinger, Corlia Meyer, Dane Paijmans (Dec 2014)

Conservation Biology MSc
Lea Cohen, Kimon de Greef, Katherine Forsythe, Jessica Greenston, Craig Harding, Vera Liebau, Christine Madden, Heinz Ortmann, Louise Palframan, Koebraa Peters, Carolyn Sanguinetti (June 2013); Daniël Cloete, Wade Lane, Jayaneesh Namah, Kirsten Retief (Dec 2013)
Wesley Bell, Philip Massie, Robyn Milne, Frances Morling, Phenias Sadondo, Tabitha Stokes (June 2014); Jordan-Laine Calder, Greg Campbell, Nadia de Souza, Kirsten Gallaher, Rukaya Johaadien, Elliot Kinsey, Zanne Labuschagne (Dec 2014)

BSc Hons
Bruce Baigrie, Julia van Velden (Dec 2013), Inge Adams (Dec 2015)

NEW STUDENTS

Post-doctoral fellows
2013 - Eleonore Hellard (Graeme Cumming)
2014 – Matthieu Pacquet (Peter Ryan and Rita Covas); Petra Sumasgutner (Arjun Amar)

PhD
2013 – Marie-Sophie Garcia-Heras (Graeme Cumming), Dominic Rollinson (Peter Ryan), Rowen van Eeden (Arjun Amar)
2014 – Hayley Clements (Graeme Cumming)

MSc
2013 – Jessie Berndt (Arjun Amar), Davide Gaglio, John Pallett, Noelle Tubbs, Minke Witteveen (Peter Ryan)
2014 – Ben Dilley, Amanda Kyne, Stefan Schoombie, Kim Stevens, Jenni Roberts (Peter Ryan)

Upgrade from MSc to PhD: Dominic Henry (2013); Gareth Tate, Otto Whitehead (2014)

Conservation Biology MSc
Fifteen students began the CB MSc in January 2013 and fourteen in January 2014.

Staff

Director:
Prof. Peter Ryan, PhD (Cape Town)*

Academic and Research Staff:
Prof. Tim Crowe, PhD (Cape Town) 2013*
Prof. Graeme Cumming, PhD (Oxford)*
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
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 Lorien Pichegru, PhD (Strasbourg) 2014
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)

Support Staff

Manager, DST-NRF CoE: Dr Rob Little, PhD (Cape Town)
Principal Technical Officer: Chris Tobler*
Administrative Assistant: Hilary Buchanan BA, HDipLib (UCT)*
Senior Secretary, DST-NRF CoE: Tania Jansen
Departmental/Accounts Assistant: Anthea Links*
Library Manager: Margaret Koopman, HDLS, MSc (KZN)*
Library Assistant: Phelisa Hans

Research Assistants:
Jonathan Aronson, Carina Becker, Joanne Bentley, Jan Bradley, Calvin Brizzi, Susan Burden, Bridget Calder, Cassie Carstens, Tara Cathcart, Paul Coombe, Mark Cowen, Cara Daneel, Lauren de Vos, Carla du Toit, Carmen Ferreira, Zoleka Filander, Kat Forsythe, Alistair Fyfe, Graham Gerhart, Thomas Gerhart, Oliver Goosen, Craig Haley, Craig Harding, Samantha Harebottle, Lisa Labinjoh, Gabi Leighton, Nina Lester, Dunyiswa Lumko. Christine Madden, Michelle Malan, Michelle Maritz, Megan Mehnert, Imke Meyer, Robyn Milne, Christine Moore, Frances Morling, Gregory Mutumi, David Nkosi, Toni Olsen, Nikita Peixe, Tshegofatso Pelego, Hana Petersen, Zoë Poulsen, Leslie Robersen, Sanjo Rose, Christian Setzer, Stefano Scribani, Eleanor Shadwell, Anja Teroerde, Marina Wang, Ralph Watson, Robert Williamson

*** Denotes permanent member of the UCT staff establishment**

Students

Post-doctoral fellows

Dr Steve Boyes, PhD (KwaZulu-Natal)
Dr Timotheé Cook, PhD (La Rochelle) 2013
Dr Susan Cunningham, PhD (Massey)
Dr Alta de Vos, PhD (Cape Town)
Dr Tom Flower, PhD (Cambridge)
Dr Eleonore Hellard, PhD (Lyon)
Dr Alan Lee, PhD (Manchester)
Dr Kristine Maciejewski, PhD (NMMU)
Dr Ralf Mullers, PhD (Groningen)
Dr Martha Nelson-Flower, PhD (Cape Town)
Dr Graeme Oatley, PhD (Cape Town) 2013
Dr Matthieu Paquet, PhD (Montpellier)-2014
Dr Tim Reid, PhD (Tasmania)
Dr Antje Steinfurth, PhD (Kiel)
Dr Petra Sumasgutner, PhD (Vienna) 2014

Doctoral

Julia Baum, MSc (KIT, Germany)
Hayley Clements, MSc (NMMU) 2014
Owen Davies, BSc (Hons) (Cape Town)
Dominic Henry, BSc (Hons) (Cape Town)
Potiphar Kaliba, MSc (Cape Town)
Sonja Krüger, MSc (KwaZulu-Natal)
Marie-Sophie Garcia Heras, MSc (Aix-Marseilles)
Tshifhiwa Mandiwana Neudani, MSc (Cape Town)
Alistair McInnes, MSc (KwaZulu-Natal)
Lisa Nupen, MSc (Cape Town)
Sharon Okanga, MSc (Nairobi) 2013
Margaux Rat, MSc (Claude Bernard Lyon)
Chevonne Reynolds, MSc (Wits)
Dominic Rollinson, MSc (KwaZulu-Natal)
Jessica Shaw, MSc (Cape Town) 2013
Gareth Tate, BSc (Hons) (Cape Town) 2014
Alex Thompson, BSc (Hons) (Cambridge) 2013
Tanja van de Ven, MSc (NMMU)
Rowen van Eeden, MSc (Cape Town)
Otto Whitehead, BSc (Hons) (Cape Town) 2014

MSc by dissertation

Jessie Berndt, BSc (Hons) (Cape Town)
Philna Botha, BSc (Hons) (Stellenbosch)
Mia Cerfonteyn, BSc (Hons) (Stellenbosch)
Davide Gaglio, MSc (Bologna)
Lisle Gwynn, BSc (Plymouth)
John Heydinger, BSc (Hons) (Cape Town)
Amanda Kyne, BSc (Wesleyan)
Corlia Meyer, BSc (Hons) (Stellenbosch)
Dane Paijmans, BSc (Hons) (KwaZulu-Natal)
John Pallett, BSc (Hons) Wits
Jenni Roberts, BSc (Hons) (Cape Town) 2014
Stefan Schoombie, BSc (Hons) (KwaZulu-Natal) 2014
Kim Stevens, BSc (Hons) (Cape Town) 2014
Gareth Tate, BSc (Hons) (Cape Town) 2013
Noelle Tubbs, BSc (Rhode Island)
Otto Whitehead, BSc (Hons) (Cape Town) 2013
Minke Witteveen, (BSc (Hons) (KwaZulu-Natal)
Blair Zoghby, BSc (Hons) (Wits)

Masters in Conservation Biology 2014/15

Salamatu Abdu, BSc (Hons) (Ahmadu Bello)
Alexander Atkins, BSc (Sussex)
Bruce Baigrie, BSc (Hons) (Cape Town)
Jenna Bowker, BSc (Hons) (Cape Town)
Kate Cronin, BSc (Hons) (Cape Town
John Dickens, BSc (Hons) (Rhodes)
Marcela Espinaze, BVet Sci (Astral de Chile)
Francesca Fazey, BSc (Hons) (Rhodes)
Kirsten Retief, BSc (Hons) (Cape Town)
Liezl le Roux, , BSc (Hons) (Cape Town)
Juan Millan, BSc (De Los Andes)
Binah Motlogelwa, BSc (Botswana)
Alexandra Russo, BSc (Goucher)
Dara Sands, BSc (Queens)

Masters in Conservation Biology 2013/14

Wesley Bell, BSc (Hons) (Cape Town)
Jordan-Laine Calder, BSc (Hons) (Cape Town)
Greg Campbell, BSc (Moncton)
Nadia de Souza, BSc (Hons) (Cape Town)
Kirsten Gallaher, BSc (Hons) (Cape Town)
Rukaya Johaadien, BSc (Hons) (Brunel)
Elliot Kinsey, BA (Macalester)
Zanne Labuschagne, BSc (Hons) (Stellenbosch)
Phil Massie, BSc (Hons) (Cape Town)
Robyn Milne, BSc (Hons) (Stellenbosch)
Frances Morling, BSc (Hons) (Cape Town)
Phenias Sadondo, BSc (Hons) (Zimbabwe)
Tabitha Stokes, BSc (Exeter)

Masters in Conservation Biology 2012/13

Daniël Cloete, BSc (Hons) (NMMU)
Lea Cohen, BA (California)
Kimon de Greef, BSc (Hons) (Cape Town)
Katherine Forsythe, BSc (Hons) (New South Wales)
Jessica Greenston, BA (Michigan)
Craig Harding, BSc (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)
Koebraa Peters, BSc (Hons) (Cape Town)
Kirsten Retief, BSc (Hons) (Cape Town)
Carolyn Sanguinetti, BSc (Kent)

BSc Honours

Inge Adams, BSc (Western Cape)
Bruce Baigrie, BSc (Cape Town)
Julia van Velden, BSc (Cape Town)

Externally registered students

Doctoral

Cambridge – Gabriel Jamie
Edinburgh – James Westrip
Montpellier – Matthieu Paquet
Pretoria – Ryan O'Connor; Darren Pietersen, Ben Smit
Michelle Thompson
Stellenbosch – Anina Heystek
Western Australia – Elizabeth Wiley
Zurich – Sabrina Engesser

MSc by dissertation

Porto – Lara Broom
NMMU - David Green, Gavin Rishworth
Pretoria – Matthew Noakes, Maxine Whitfield
Lisbon – Sofia Santos

BSc Honours

Pretoria – Nick Pattinson

Systematics: getting the basics right

Systematics unites taxonomy, phylogenetics and biogeography. Studies of the relationships among organisms are essential to characterize biodiversity and to understand the processes that generate it. Systematic studies 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.

Cisticolas

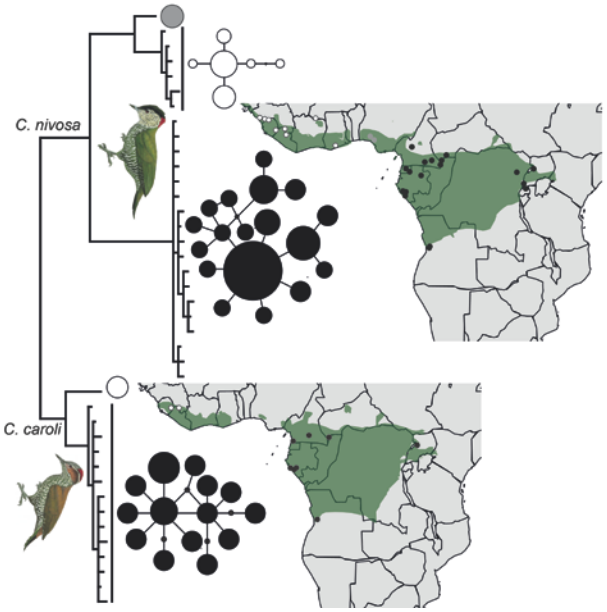
Tim Crowe's final PhD student, Owen Davies, submitted his thesis on the taxonomy and biogeography of the cisticolas in late 2014. It provides a modern context to Rear-Admiral Lynes's remarkable monograph of this quintessential African genus published in 1930. Using modern systematic tools, Owen confirmed that Lynes grouped species mostly by similarity. When his morphological data were re-analysed using cladistic methods, many of his groupings were not supported. To resolve the structure of the genus, six gene regions were sequenced for 90% of the currently recognised species. The resultant phylogeny recognised five main clades, with little support for recently proposed groupings. Analyses of songs indicated that frequency components were correlated with habitat type and body size, but these relationships disappeared when phylogeny was controlled for, suggesting that evolutionary history rather than habitat preference determines song types. Most species of cisticolas apparently evolved within the last five million years, with divergence dates correlated with periods of climate variability. This study has improved our understanding of the drivers of speciation among African birds associated with open habitats.

Harriers

The specific status of several island harrier populations needs to be resolved, because they are vulnerable to habitat loss and introduced species. Former Fitz PhD student Graeme Oatley (Palacký University) worked with Fitz HRA Robert Simmons and former post-doc Jérôme Fuchs (MNHN, Paris) to develop a robust phylogeny for all currently recognized harrier taxa. This confirms that the harriers evolved within the larger *Accipiter* genus some 5-12 million years ago, when open habitats became more common globally. The Northern Harrier *Circus cyaneus hudsonius* is more closely related to the Cinereous Harrier *C. cinereus* than the Hen Harrier *C. cyaneus cyaneus*, so should be elevated to species status. The African Marsh Harrier *C. ranivorus* is confirmed as sister to the European Marsh Harrier *C. aeruginosus*. The remaining marsh harriers, including the Indian Ocean island forms, exhibit very little genetic diversity, and are all recently diverged taxa with allopatric distributions. The southern African endemic Black Harrier *C. maurus* forms part of the Steppe Harrier complex and is most closely related to the Pallid Harrier *C. macrourus*, and probably evolved from Pallid Harriers that established a breeding population in the south (a so-called migratory 'drop-off' event).

Guineo-Congolian woodpeckers

The lowland rain forests of west and central Africa are split by two biogeographic barriers: the Niger River Delta in Nigeria, and the Dahomey Gap, a savanna corridor that reaches the coast from Ghana to Benin, which separates the Upper (western) and Lower Guinea (east-central) forest blocks. Previous studies on



Gene trees showing substantial differences between populations from the Upper and Lower Guinea forests in two woodpeckers, but among *C. nivosa* the primary divide spans the Niger River Delta, with a lesser segregation across the Dahomey Gap.

lizards, mammals and birds have detected genetic breaks at both these barriers, but the relative importance of each has not been assessed. Jérôme Fuchs and Fitz CoE core team member Prof. Rauri Bowie (UC Berkeley) compared the phylogeographic history of two sister species of woodpeckers that occur throughout these forests: Brown-eared *Campethera caroli* and Buff-spotted *C. nivosa*. Both the Dahomey Gap and the Niger Delta acted as strong biogeographic barriers, with the Niger being the first barrier to have formed, leading to three distinct populations of *C. nivosa* during the Pleistocene, supporting the Pleistocene refuge hypothesis. The Dahomey Gap probably appeared only about 500 000 years ago. No genetic structure was recovered among sampled populations in either the Upper or the Lower Guinea Forest Block for either species, despite the considerable geographic area covered. Their results suggest that both species should be split into eastern and western forms.

Seabirds

Lisa Nupen completed her PhD under the guidance of Dr Jacqui Bishop (Biological Sciences, UCT) and Prof. Peter Ryan, studying gene flow and population structure in three threatened Benguela seabirds: African Penguins *Spheniscus demersus*, Cape Gannets *Morus capensis* and Cape Cormorants *Phalacrocorax capensis*. Her main aim was to infer their responses to changing environments from their population structure. Lisa found strong regional connectivity and minimal loss of genetic variation despite recent population decreases. Her study also has implications for the captive management of these species. Lisa is now a post-doc at the National Zoo in Pretoria.

The long-running *Fregatta* storm-petrel saga is finally nearing its conclusion. Complications caused by one of Gary Nunn's samples ostensibly from Gough Island were resolved when it emerged that it probably came from the Pacific Ocean. There is still a confusing situation at the Tristan-Gough group though, with white-bellied Black-bellied Storm Petrels *F. tropica melano-leuca* breeding at both island groups, and two forms of White-bellied Storm Petrels *F. grallaria* breeding at uninhabited islands in the Tristan group. Whether any *grallaria* breed at Gough is unclear; all *Fregetta* storm petrels have become very rare on the island due to mouse predation.

Equally surprising, given their abundance, was the discovery of a new species of prion on Gough Island. Breeding three months later than the Broad-billed Prion *Pachyptila vittata,* it is morphologically and genetically similar to the enigmatic Macgillivray's Prion *P. macgillivrayi* from Amsterdam (extinct) and St Paul (<200 pairs) in the Indian Ocean. Gough thus supports >99% of the world population of this species!

Highlights:

- Owen Davies submitted his PhD on the phylogenetics and biogeography of cisticolas.
- Lisa Nupen graduated with her PhD on the population genetics of Benguela seabirds in December 2014.
- Papers on the diversification of harriers and the phylogeography of Guineo-Congolian woodpeckers were recently published in *Molecular Phylogenetics and Evolution*.
- The discovery that Gough Island supports a second species of prion.

The new species of Prion discovered on Gough Island. (Photo: Peter Ryan)

Research team

Prof. Tim Crowe (PFIAO)
Prof. Peter Ryan (PFIAO)
Prof. Rauri Bowie (CoE Core Team member, UC Berkeley)
Dr Jacqueline Bishop (Biological Sciences, UCT)
Dawie de Swart (National Museum, Bloemfontein)
Dr J Jérôme Fuchs (MNHN, Paris)
Dr Rick Nuttall (National Museum, Bloemfontein)
Dr Graeme Oatley (Post-doc, Palacký University)
Dr Bruce Robertson (Univ. Otago)
Dr Robert Simmons (PFIAO)
Dr Guinevere Wogan (Post-doc, UC Berkeley)
Prof. Gary Voelker (Texas A&M)

Students: Owen Davies (PhD), Lisa Nupen (PhD)

Understanding urban raptor populations

Many bird species decline once an area is urbanised, while others increase in abundance taking advantage of the new habitat and the altered patterns of predation and competition which occur with a shift in assemblage composition. Through long-term monitoring of Peregrine Falcon *Falco peregrinus* and Black Sparrowhawk *Accipiter melanoleucus* populations within the greater Cape Town area we are trying to understand the ecology of these urban dwelling raptors.

Some of this research focuses on whether we can identify source and sink habitats within the urban population. In this regard, the recruitment into the breeding populations of chicks which have been fledged locally is of special interest, because an urban population can only be self-sustaining if enough chicks survive and breed successfully in the area. Post-doc Petra Sumasgutner joined the Fitz in 2014 to explore these issues by running capture-recapture models using the birds that have been uniquely colour ringed as chicks in both the Black Sparrowhawk and Peregrine populations. We are exploring whether successful establishment as a breeder is linked to differences in individual quality of the birds (body condition indexes at chick status), brood characteristics and also the habitat composition of their natal territory as a measurement of its quality.

When individuals colonize a new habitat they also have to cope with competition from novel species for shared resources. The urban Black Sparrowhawk population competes with Egyptian Geese *Alopochen aegyptiaca* which usurp their nests and are the main cause of nest failure. Juan Millan explored this issue for his Conservation Biology Masters research project, testing the hypothesis that multiple nests increase the overall productivity of areas with high goose abundance to cope with this competitor.

Other research is focusing on how animals respond when they encounter novel environmental conditions. The Black Sparrowhawk

We are continuing our long-term monitoring and colour ringing of the Cape Peninsula Black Sparrowhawk population. Here Ann Koeslag and Post-doc Petra Sumasgutner explain the processing procedure to visiting University of Limpopo students. (Photo: Lisa Nupen)

population, which only colonised the Cape Peninsula in the mid-1990s, provides a valuable opportunity to study this process and highlights the importance of behavioural plasticity.

In a recent study published in *Oikos,* we looked at how Black Sparrowhawks in the Cape Peninsula adjusted their timing of breeding in response to a dramatically different climatic regime. Further east in their range, in the summer rainfall region, the species breeds in the cooler and drier winter months. In contrast, in the Cape Peninsula, the majority of rain falls in the winter. Heavy rain can be devastating for breeding raptors yet Black Sparrowhawks in the Cape Peninsula have thrived since their arrival. How can this be so? It turns out that the sparrowhawks breed earlier; a "phenological shift" of up to three months. These earlier breeding attempts were more successful than those made in the depths of winter, and this shift may have facilitated the successful colonisation by this species.

In another study, published in *Animal Behaviour*, we have explored how mate-choice decisions may have also played a role in the early expansion of the population. In common with many other raptors, Black Sparrowhawks generally stay with the same mate year after year. However divorce does happen, and we found it was particularly likely to occur if pairs failed to raise any young. Individuals that left their partner and dispersed to new territories saw a marked improvement in their breeding success, suggesting that this was an adaptive decision. In long-lived species that form long-term monogamous partnerships, breeding success is often lowest in the first few years and improves with the duration of the pair-bond. This may be due to partners improving their combined parenting skills; a phenomenon known as the "mate-familiarity effect". As a result, frequent divorce can suppress the rate of population growth. Divorce rates are likely to be lower in small populations, which could boost population growth rates in the short term. As populations grow, and numbers of alternative partners increase, divorce rates may also increase, with negative implications for population growth. This study was one of the first empirical tests of this hypothesis and, although we found a slight tendency for divorce rates to increase with an expanding population, we found no strong evidence to suggest that this was an important process facilitating the expansion of Black Sparrowhawks in the Cape Peninsula.

By using camera traps in nests, we have been able to get a unique insight into the behaviours of breeding Black Sparrowhawks.

Highlights

- In the reporting period, five papers were published on the Black Sparrowhawk population - with papers appearing in *Oikos*, *Animal Behaviour*, *PLos ONE*, *Ibis* and *Journal of Zoology*.
- In 2013, Honours projects were completed by Bruce Baigrie on Black Sparrowhawk diet and by Julia van Velden on infection by *Knemidokoptes* mites in the Black Sparrow-hawk. A paper on Julia's study has been submitted to *Scientific Reports.*
- A study examining brooding behaviour in the Black Sparrowhawk, which was carried out as part of an undergraduate project, has just been accepted for publication in the *Journal of Ornithology.*

Key co-sponsors

University of Cape Town Research Committee

Research team

Dr Arjun Amar (PFIAO)
Dr Res Altwegg (Statistical Sciences, UCT)
Dr Andrew Jenkins (HRA ADU, UCT)
Ann Koeslag (Volunteer)
Dr Rowan Martin (Research Associate, PFIAO)
Dr Petra Sumasgutner (Post-doc, PFIAO)

Students: Gareth Tate (PhD), Juan Millan (CB MSc), Bruce Baigrie (BSc Hons), Julia van Velden (BSc Hons)

Coevolutionary arms races in brood parasites and their hosts

Coevolution is the process by which two or more species influence one another's evolution. Brood parasitic birds, the cheats of the bird world, give us an ideal opportunity to study coevolutionary arms races as hosts evolve defences forcing parasitic counter-adaptations. Africa has a wide diversity of such fascinating cheats: cuckoos, honeyguides, indigobirds and whydahs. For the last eight years Claire Spottiswoode's team based jointly at the Fitz and the University of Cambridge have studied the coevolution between brood parasites and their hosts.

Cuckoo Finches: the genetics of egg mimicry

Cuckoo Finches *Anomalospiza imberbis* beautifully mimic the eggs of their various prinia and cisticola host species, to increase their chances of being accepted by choosy host parents. Some host species have evolved astonishing variation in the colour and patterning of eggs between individuals to make their eggs harder to mimic. Such egg "signatures" force the Cuckoo Finch to adapt not only to mimic several host species, but also to forge individual signature variants. As described in previous annual reports, we are conducting field experiments on these coevolutionary interactions to understand the genetic basis of the adaptations involved in this arms race. Egg colour and pattern is tightly genetically controlled, forcing host and parasite females to lay a consistent egg type throughout their lives. During 2013/2014, this was the primary focus of a project run in collaboration with Prof. Michael Sorenson (Boston) and Dr Wenfei Tong (Cambridge). We are hoping to solve a century-old evolutionary puzzle: how do individual females of the same brood parasitic species lay eggs that mimic those of their chosen host, despite interbreeding with males raised by other hosts?

Sequencing mitochondrial DNA, which is inherited only by females, shows that female Cuckoo Finch lineages have stayed faithful to their chosen host species for hundreds of thousands of years. In theory this might allow specialised adaptations to evolve in the female line alone, via the female-specific W chromosome. We had hoped to confirm this experimentally by inter-breeding different host-races in captivity, but attempts to persuade our painstakingly hand-reared Cuckoo Finches to lay eggs in aviaries failed. This was disappointing but not disastrous, because we have been able to address the same questions using DNA sequencing approaches, and because hand-rearing provided us with many more genetic samples than would otherwise have been possible owing to high levels of nest predation in the wild.

We collected genetic samples from nearly 200 Cuckoo Finches from four host-races (and many colour morphs within host-races), and have analysed these using next-generation RAD sequencing to obtain hundreds of thousands of genetic markers throughout the genome. This has revealed several exciting results which we are currently preparing for publication.

Highlights:

- The genes determining egg appearance are almost entirely unknown. To defend themselves against Cuckoo Finches, Tawny-flanked Prinias *Prinia subflava* lay some of the most diverse eggs of any bird in the world. We hope to identify the genes involved in generating these signatures by identifying which genes are expressed in the shell gland. In 2014 Wenfei Tong collected shell gland samples from prinias captured just before laying, and is sequencing the RNA (gene transcripts) they contained. Genes that are expressed here just after eggs have been formed (but not in other parts of the reproductive tract and not in the shell gland at other times) are likely to be good candidates for genes involved in determining egg colour and pattern.
- Cuckoo Finch females look remarkably like female bishops and widows (*Euplectes*). This may be an adaptation to reduce host recognition of parasites. A study in collaboration with William Feeney (ANU) used field experiments to show that prinia parents can't tell the difference between female bishops and cuckoo finches. This provides the first direct evidence that mimicry exists in adult brood parasites.
- Cuckoo Finches can also trick their hosts by manipulating the ratio of parasitic to host eggs. As the proportion of foreign eggs increases, Tawny-flanked Prinias need a greater discrepancy in egg colour to reject a foreign egg, which explains why Cuckoo Finches remove

A Purple Indigobird chick showing amazing mouth spot mimicry of its host. (Photo: Claire Spottiswoode)

host eggs and often lay more than one of their own. This research, carried out in collaboration with sensory ecologists Martin Stevens and Jolyon Troscianko from Exeter University, was published in *Nature Communications* in September 2013 and received a lot of media attention, including articles from the New York Times and BBC.

Honeyguides: natural born killers

Previous annual reports described the brutal behaviour of young honeyguides, which stab host young to death as soon as they hatch. Dr Nicholas Horrocks has carried out the bulk of honeyguide fieldwork for the last two years, assisted by Wenfei Tong and Tony Fulford, as part of his 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) and the corpses of host chicks.

Highlights:

- BBC's Natural History Unit spent two weeks filming Greater Honeyguide *Indicator indicator* chicks killing the chicks of their Little Bee-eater *Merops pusillus* hosts for their new 'Deception' series. Footage of our African Cuckoo *Cuculus gularis* study population was broadcast in the 'Parenthood' episode of the BBC's 'Life Story' series in November 2014.
- Claire Spottiswoode published a paper in *Biology Letters* in August 2013 showing that the resemblance between Greater Honeyguide eggs and those of their Little Bee-eater hosts has evolved primarily to trick other honey-guides who would otherwise destroy the eggs because of fierce competition for host nests. These findings suggest that when multiple parasitism is common, competing parasites can select for the mimicry of host eggs.
- Because hosts pay a high price if they are tricked into incubating a honeyguide egg, it is odd that hosts accept foreign eggs experimentally placed in their nests, even though they sometimes reject entire clutches containing a naturally laid honeyguide egg. Presenting model honeyguides to test whether hosts need multiple cues of parasitism before they reject eggs provided unexpected results. While most bee-eater parents angrily attacked the model, its presence didn't stimulate them to reject a foreign egg. The vulnerability of Little Bee-eaters to honeyguide trickery remains mysterious!

Indigobirds and whydahs: speciation in action

In 2013 we began research on indigobirds and whydahs (*Vidua*), which have remarkably rapid host-specific speciation. This is driven by both sexes imprinting on the song of the host species that raised them, meaning that host switches can result in instant reproductive isolation and speciation because males and females raised by the new host only mate with one another. *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. Funded by The Leverhulme Trust, Cambridge PhD student Gabriel Jamie is attempting to solve how 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.

Key co-sponsors

Biotechnology and Biological Sciences Research Council, UK; Leverhulme Trust: The Royal Society, UK, European Commission, L'Oréal-UNESCO for Women in Science programme.

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Cooperation and population dynamics in the Sociable Weaver

Sociable Weavers *Philetairus socius* are remarkable for their elaborate cooperative behaviour – from building their enormous communal nests to cooperatively raising young and mobbing predators. This research programme uses an individually marked Sociable Weaver population to study the evolutionary bases of cooperative behaviour in one of the longest running studies of an African terrestrial bird. Our long-term data also are used to address fundamental questions about the factors driving population dynamics and predict responses to environmental change.

The Benfontein game reserve near Kimberley is home to 15 Sociable Weaver colonies that have been studied in detail by Fitztitute researchers for the last 20 years. To monitor the weaver's breeding activity, the researchers inspect the nests from the top of a project vehicle on a custom built roof platform. (Photo: Franck Theron)

Cooperation and conflict: the role of social dominance

When living in groups, individuals face the dilemma of whether to cooperate or compete over resources, leading to conflicts of interest between group members. Social hierarchies might limit conflicts by preventing individuals from engaging in costly fights, and this would be facilitated by efficiently signalling their rank. PhD student Margaux Rat has found that the weavers have well ordered social hierarchies, and that the size of a weaver's black bib, a melanin-based plumage trait, is positively associated with dominance status, with even small changes in an individual's dominance status being reflected in bib size. These results are in press in *Behavioral Ecology and Sociobiology*.

Being dominant has advantages, but is likely to come at a cost. High-ranked males have more access to food, have better nest sites and, crucially, are more likely to breed and to be assisted by helpers. However, they do not benefit through higher reproductive success, suggesting a trade-off between dominance and parental care that requires further investigation. MSc student Paul Acker has started to investigate the cost associated with dominance and status signalling and found evidence of disruptive selection on patch size.

Dominance may also be used to favour close kin. Nepotism is widespread in human society, and Sociable Weaver societies also have their share. Margaux showed experimentally that helpers of dominant individuals obtained enhanced access to food placed in an artificial feeder and that social position was positively associated with their parents' rank. A particularly intriguing question when studying dominance in such a highly cooperative species is whether individuals use their status to force others to work harder in communal tasks. This question and how dominance affects the weaver's social networks are the two questions left to address before Margaux concludes her PhD in 2015.

Highlights:

- Margaux Rat gave a talk on 'Benefits of social status in societies of a cooperatively breeding bird' at the *International Society for Behavioral Ecology* conference in New York in 2014, and was co-awarded the prize for the best student oral presentation at the BLSA/ Fitz 'Learn about Birds' conference.

Hidden benefits of breeding cooperatively

Sociable Weavers often breed with the assistance of helpers, which is expected to increase breeding performance. However this is not always observed in cooperative breeding birds. One possible reason for this apparent paradox is that parents may decrease their reproductive effort when helped, which may lead to other benefits such as improved survival. University of Montpellier PhD student Matthieu Paquet completed his thesis on maternal investment and maternal effects in relation to helper presence in December 2013, and then in 2014 took a post-doctoral position at the Fitz, where he concluded another experiment and wrote up several papers.

Matthieu found that females with helpers produce smaller eggs, but the additional food brought by helpers compensates for this handicap and there are no differences in chick mass at fledging. This suggests that the benefits of helpers may be stronger for females than males. Matthieu used sophisticated capture recapture models to show that females did indeed have a higher survival probability when breeding with more helpers. Unexpectedly, however, male survival decreased with more helpers, although this antagonistic effect diminished among older birds.

The hormonal content of eggs also is linked to the presence of helpers. Hormones such as corticosterone and testosterone influence chick begging behaviour. We surmised that mothers deliberately reduce begging behaviour when the chicks are fed by more helpers since they have more food available. Matthieu conducted an egg cross-fostering experiment that confirmed that begging was influenced by the prenatal environment; nestlings originally from larger groups beg less than those from eggs laid by females with no helpers. This result has important implications for understanding cooperative breeding strategies, because producing offspring that beg less with more helpers may allow energy savings for offspring,

A recently fledged Sociable Weaver and its carer. Non-breeding weavers often bring additional food to the young, but the presence of these 'helpers' decreases post-fledging survival. However, females invest less in reproduction and survive better in the presence of helpers, which probably explains why helpers are tolerated. (Photo: Matthieu Paquet)

females, and related helpers. MSc student Sofia Santos (University of Lisbon) started work in 2014 to assess whether hormonal allocation is influenced by laying order and whether gape colour, another known begging signal, is also influenced by maternal effects.

Although the benefits of helpers are typically expected during the breeding season, in most cooperative species families remain in groups year round and helpers may assist the alpha pair by protecting against predators or assisting with thermoregulation on cold nights by huddling. We confirmed that nest temperature at night is related to the number of birds roosting together, and roosting group size predicted breeding group size. Taken together, these results suggest a strong but overlooked benefit of helpers out of the breeding period.

Highlights:

- Matthieu Paquet published a paper in *PLoS ONE* showing for the first time that females of a cooperatively breeding species change the hormonal contents of their eggs in relation to the presence of helpers.
- The cross-fostering experiment showing that the pre-natal social environment influences nestling behaviour via maternal effects was presented at the *International Society for Behavioral Ecology* conference.

Costs of helping

One of the reasons why cooperation is puzzling is that individuals cooperate at a cost to themselves, to the benefit of the group. Much research has been conducted to identify the benefits that cooperation provides, because for

cooperation to persist, its benefits must outweigh the costs. However, few studies have attempted to quantify the costs of cooperation. A new project by post-doc Sophie Lardy is going to address this imbalance. Awarded a Claude Leon Fellowship in 2014, Sophie will spend the next two years at the Fitz studying the physiological costs of helping. Short and medium-term physiological costs of cooperation will be estimated by measuring oxidative stress from plasma samples and telomere length in relation to helping investment. To assess whether these short-term costs result in a change in survival and reproduction, Sophie will use a capture-recapture approach and state-of-the-art transponder monitoring. She also will manipulate helper condition to determine whether individuals show behavioural modifications to reduce the long-term cost of cooperation.

Highlights:

- Sophie Lardy was awarded a Claude Leon Fellowship in 2014. Her project featured on the SABC nature documentary 50/50 in October 2014.

Kin recognition and inbreeding avoidance

One of the main explanations for the evolution and maintenance of cooperation is Hamilton's kin selection hypothesis, which suggests that individuals gain indirect fitness benefits by helping close kin and thereby indirectly contribute to success of their genes. This implies that individuals should prefer to associate and cooperate with close kin, raising two key questions: What mechanisms are used for kin recognition? And do individuals increase their helping investment in relation to their relatedness to the recipient? Associating with kin may also have costs if it leads to increased competition among kin or to incestuous mating (given the costs of inbreeding).

The extent to which individuals can make adaptive decisions about mate choice and cooperative investment will depend on their ability to recognise close kin. This question is particularly relevant in species with multiple levels of social organisation such as the Sociable Weaver. Ben Hatchwell (University of Sheffield) recently obtained funding to collaborate with Rita Covas and Claire Doutrelant to investigate the mechanisms of kin recognition, cooperative investment and inbreeding avoidance in the Sociable Weaver.

In five of our study colonies, each bird has been equipped with a small pit-tag that will allow us to automatically follow its movements when entering the breeding chamber to incubate eggs or feed chicks. This bird has just received a pit-tag and is being put through the antenna to verify the pit-tag number. (Photo: Franck Theron)

Highlights:

- A NERC grant was awarded to Ben Hatchwell and Rene van Dijk to investigate kin recognition and inbreeding avoidance in Sociable Weavers.

Population dynamics

Understanding the dynamics of Sociable Weaver populations is a key aspect of our research programme. We use our long-term capture-recapture dataset, dating back to 1993, to determine population trends and study the factors affecting population dynamics. A study conducted in collaboration with Res Altwegg (SEEC, UCT) showed that survival varied between years, increasing with rainfall and decreasing with extreme temperatures. The intensity of field work conducted at a colony (number of captures) also affected survival. Reproduction was positively related to rainfall, while movement between colonies was related to colony size: individuals were more likely to move from small colonies to large colonies and from colonies that were either well below or above their long-term average size. Another important question is how the population trends are likely to react to environmental changes and Res Altwegg's PhD student Dorine Jansen, spent three months at the CNRS to build an Integrated Population Model using the long-term weaver data set with ecological statistician Roger Pradel.

We are also particularly interested in understanding how social factors influence population dynamics. Although helpers appear to have a positive effect on some Sociable Weaver breeding parameters, helper presence is also associated with a 15% decline in post-fledging

Sociable Weavers are captured early in the morning as they leave the colonies, where they spend the night sheltering from the frosty Kalahari winter. The birds get caught in the mist nets placed around the colony and several experienced researchers extract them from the nets – as quickly as the cold-numb fingers allow. (Photo: Franck Theron)

survival. MSc student Lara Broom (CIBIO, Porto) studied the post-fledging stage and found that the reduction in survival is detected soon after fledging, and hence is not confounded by dispersal. Because Sociable Weaver females assisted by helpers produce smaller eggs, we conducted a cross-fostering experiment to investigate whether decreased juvenile survival could be a result of differential maternal investment. We found that juvenile survival decreased with the number of helpers in the rearing nest and not the nest of origin, indicating the importance of the social environment as opposed to maternal effects. Hence, the presence of helpers may represent a net cost in terms of reproductive output. This is a puzzling result given the high frequency of cooperative breeding in our population (30-80% of nests). However, females assisted by helpers experience improved survival, which is an important fitness benefit in this long-lived species inhabiting an unpredictable environment. Models simulating populations with and without helpers show that having helpers is beneficial to population performance overall. This study illustrates how cooperative behaviours can be maintained in the face of important costs and that cooperation is directly reflected in population dynamics.

Highlights:

- A paper published in 2014 in *Oecologia* by Altwegg *et al*. demonstrated the link between climatic variation and the three key population parameters of survival, movement and reproduction, providing an important basis to understand population dynamics and local decline in this species.
- MSc student Lara Broom (CIBIO, Porto) concluded her thesis on the effect of helpers on post-fledging survival in 2013.
- Rita Covas presented a talk showing that in spite of tangible fitness costs, the presence of helpers has a positive influence on Sociable Weaver population trends at the International Society for Behavioral Ecology conference in New York.
- A new MSc student, André Ferreira (CIBIO, Porto) started a project to understand the mechanisms underlying the negative effect of helpers on the post-fledging period.

Key co-sponsors
Marie Curie-International Research Staff Exchange Scheme (EU), FCT (Portuguese Science and Technology Foundation), NERC (Natural Environmental Research Council, UK), Région Languedoc-Roussillon (France)

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Dr Claire Doutrelant (CEFE-CNRS, France)
Dr Sophie Lardy (Post-doc, PFIAO)
Prof. Ben Hatchwell (Sheffield)
Dr René van Dijk (Sheffield)

Students: Margaux Rat (PhD), Matthieu Paquet (PhD Montpellier/Post-doc UCT), Paul Acker (MSc, Montpellier), Lara Broom (MSc CIBIO, Porto), Sofia Santos (MSc, Lisbon)

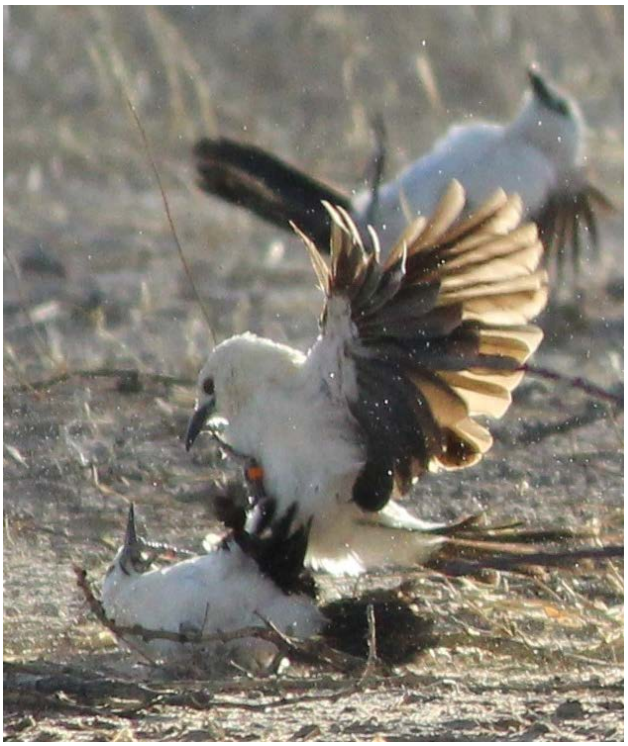
Research Assistants: Franck Theron, Maxime Loubon Cécile Houllé, Elise Blatti, Lisa Malm, Aurélien Prudor

Pied Babblers and Fork-tailed Drongos

Tim Clutton-Brock established the Kuruman River Reserve to study group living in meerkats, but it has become the focus of several other long-running animal studies. Amanda Ridley's Pied Babbler Research Project was initiated in 2003 and uses habituated, free-living groups of Southern Pied Babblers *Turdoides bicolor* to understand the causes and consequences of cooperative breeding behaviour. In 2006 Tom Flower expanded the study to include the local Fork-tailed Drongo *Dicrurus adsimilis* population, investigating interactions between drongos, babblers and other species. In particular, he studies the drongos' use of false alarm calls to steal food from other animals.

Amanda Ridley is a Fitz HRA based at the University of Western Australia and her research focuses on the causes and consequences of helping behaviour, population dynamics (including causes of local extinction), sexual selection, interspecific interactions, and vocal communication. Amanda's recent Pied Babbler grant is focussed on the climatic versus social factors that influence group stability between years, and the influence of Allee effects on population dynamics. Several researchers from various institutions collaborated on the project during 2013-14. Post-doc Martha Nelson-Flower was based at the Fitz until the end of 2014, relating genetic patterns to cooperative behaviours. She will continue her research on the Pied Babblers from her new position at the University of British Columbia, focussing on patterns of reproductive sharing among group members. Martha is also interested in the effects of intrasexual competition on reproductive skew and dispersal strategies.

PhD student Elizabeth Wiley (based at UWA, supervised by Amanda Ridley) is conducting research on long-term population dynamics, and how this affects intra- versus inter-group stability between years. In particular, she is interested in the strength of the pair bond on group stability, as well as the social versus climatic influences on group size declines and extinction rates. PhD student Sabrina Engesser (Zurich University, supervised by Simon Townsend) is interested in the information encoded in Pied Babbler vocalizations, and is searching for evidence of a syntax, which is considered a precursor to language. PhD student James Westrip (Edinburgh University, supervised by Matt Bell) is assessing how group members communicate, and how differences in the reliability/quality of information provided affects the efficiency of information transfer. This diversity of research is unraveling fascinating discoveries regarding the complexity of social life.



Babbler groups fight one another over their borders on a daily basis. Occasionally, these fights get physical, and rivals can injure one another. We rarely manage to photograph these fights since they happen so quickly, so this one is a rare gem! Here, two dominant females from neighbouring groups fight one another. (Photo: Amanda Ridley)

Tom Flower's group has studied the behaviour of over 200 habituated drongos, providing fascinating insights into the ecology and evolution of interactions between species, food theft and deceptive communication. Research in 2013/14 focused primarily on the tactics

drongos use to steal food, and how drongos acquire these tactics. This has proven extremely fruitful, with manuscripts published in top international journals, popular articles in South African and international magazines, and both radio and TV programs featuring drongo research broadcast internationally.

Tom supervised two honours student projects on drongo behaviour in 2013-14. The first, by Bruce Baigrie in 2013, investigated how parasitic relationships between species can transition to one of mutual benefit when species evolve behaviours profitable to both parties. The second project by Inge Adams investigated the drongos' mimicry of other species' alarm calls, indicating a possible function in predator deterrence.

Tom finished his post-doc at the Fitz at the end of 2014, but has been appointed as an HRA and will continue his involvement in the study from his new base at Simon Fraser University in Vancouver. Tom has also embarked on a collaborative project with Claire Spottiswoode (Cambridge and Fitz) investigating interactions between the drongos and their brood parasite, the African Cuckoo *Cuculus gularis*. This work has the potential to demonstrate the adaptations and counter-adaptations possessed by brood parasites and their hosts, thereby illustrating the process of co-evolution.

Highlights:

- Post-doc Tom Flower published a paper in the prestigious journal *Science* on babbler-drongo interactions and deceptive mimicry in 2014. This attracted extensive media coverage, with newspaper articles in Australia, Brazil, China, France, the UK and USA, and led to an interview on Canadian Public Radio.
- A paper arising from Bruce Baigrie's honours project was published in the *Proceedings of the Royal Society B* (2014), an outstanding achievement for an honours student.
- Both David Humphries and Alex Thompson's PhD theses were awarded without need for corrections, garnering impressive reviews from the examiners. Alex was awarded UCT's Science Faculty Medal for his thesis.
- Amanda Ridley was commissioned to write a chapter on the Pied Babblers for the latest edition of the very successful book 'Cooperative Breeding in Birds'
- A manuscript on the evolutionary causes for food theft in animals was published in the *Journal of Animal Ecology* (2013), resulting in an interview with Tom Flower on Irish Public Radio.
- Several film crews have filmed babbler or drongo behaviour, including three BBC productions (*Africa, Deception* and *Talking to the Animals*) and NHK (Japan).
- The Pied Babbler population has rebounded well after the drought in 2012, and once again we have more than 15 groups in the study population.

Acoustic man: Tom Flower prepares to record false alarm calls by Fork-tailed Drongos after presenting a tasty treat to a Pied Babbler. (Photo: Peter Ryan)

Key co-sponsors
The Australian Research Council (ARC); The National Environmental Research Council (NERC).

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Dr Matt Bell (Edinburgh)
Dr Tom Flower (Post-doc, PFIAO)
Prof. Marta Manser (Zurich)
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Saving Cape Parrots and their forests

The Cape Parrot *Poicephalus robustus* is an endangered species endemic to a few Afromontane forest patches in South Africa. With fewer than 1 000 individuals remaining in the wild, it is threatened by a diversity of impacts ranging from habitat loss to illegal trade and disease. Tackling this array of threats makes it a useful model for developing and testing different conservation strategies, and it is a valuable flagship species for conserving its habitat.

The endangered Cape Parrot has been studied for the last six years in the Amatole region of the Eastern Cape, where historic exploitation of large yellowwood trees removed both the parrots' preferred food and nest sites. (Photo: Rodnick Biljon)

The Cape Parrot is confined to small, isolated populations in Afromontane forest patches from the Amathole Mountains through the Transkei highlands, southern Drakensberg, and remote parts of the southern Soutpansberg near Magoebaskloof. Threats to Cape Parrots include historical persecution as a crop pest, continued habitat loss, poor nesting success due to the paucity of nest cavities and suitable food resources, a resurgence of the illegal wild-caught bird trade, and an outbreak of Psittacine Beak and Feather Disease (PBFD). Vulnerability to this disease is exacerbated by a food bottleneck after the breeding season when the parrots moult. Prevalence of PBFD peaked in the Amathole region in 2011, when all parrots sampled tested positive for the disease. Since then the infection rate has decreased yearly to only 23% in 2014. Only one sick Cape Parrot was handed in by the public in 2013. This bird was rehabilitated and is now ready for release into the wild. Provisioning PBFD-positive parrots with yellowwood *Afrocarpus falcatus* fruits reduces viral loads in the blood to below detectible levels. The oils in the seed kernel have a strong anti-microbial activity that may also combat secondary infections like *Pseudomonas* spp., avian tuberculosis and influenza.

The Cape Parrot Project is a long-term research and conservation initiative in partnership with the government, local stakeholders, conservation partners, research

The Cape Parrot project has co-ordinated the planting of thousands of indigenous trees as part of a community-based conservation initiative to restore Afromontane forest patches. (Photo: Steve Boyes)

collaborators, and local communities. It aims to ensure the persistence of Cape Parrots in the wild by restoring parrot habitat through the installation of nest boxes and planting important food trees. Our community-based conservation initiatives come under the umbrella of the iziKhwenene Project, which aims to support the establishment of new forest reserves, oversee the planting of over one million indigenous trees, clear alien vegetation, attract ecotourism investment, and establish a UNESCO Biosphere Reserve along the Amathole Mountain Range.

Highlights:

- Five of the 258 nest boxes erected to date have been used by Cape Parrots. Wood Owls *Strix woodfordii*, starlings and bees have also taken up residence in some boxes. Boxes that have remained unoccupied by parrots will be cleaned and moved to hopefully boost parrot occupancy. We aim to have at least 25% nest box occupancy by the end of 2017.
- Successful trials were conducted to attract parrots to fruiting yellowwood trees using call playback.
- The Cape Parrot Project received over R2.7 million of leveraged funding during 2013-14. Land agreements and partnerships have been sought to support long-term sustainability of the project.
- Technical reports have been drafted for the establishment of two new forest reserves: the Aukland Forest Reserve and Wolfridge Forest Reserve.
- A three-year partnership was signed with the Wildlands Conservation Trust to implement a R3 million Natural Resource Management grant from DEA to clear alien invasive plant species and to plant over 30 000 indigenous saplings.
- More than 1 000 ha of land were cleared of alien invasives in the Cata and Mnyameni catchments during 2014 in partnership with the Border Rural Committee.
- A long-term lease for the use of the Zingcuka Forest Station near Hogsback has seen the building refurbished to establish the Zingcuka Research Station as a permanent base for the Cape Parrot Project.
- Over 250 local community members in six villages benefit directly or indirectly from the iziKhwenene Project.
- The Green Campus Initiative at the University of Fort Hare (Alice) has planted 2 100 indigenous saplings to provide food for parrots.
- The project continues to attract considerable media attention, with television programmes in South Africa (50/50 in March 2013 and Carte Blanche in January 2014), and internationally (DTV in November 2014).
- The Cape Parrot Project won the 'Biodiversity Stewardship Award' at the Mail & Guardian's Greening the Future Awards in November 2014, and Steve Boyes was awarded a TED Fellowship, a Gifted Citizen Fellowship and an INK Fellowship for his work on the Cape Parrot Project.

Key co-sponsors

Abax Foundation; Amathole Forestry Company; Conservation International; Disney Worldwide Conservation Fund; Hogsback Inn; Mazda Wildlife Fund; National Geographic Society; Rance Timber; Roland and Dawn Amall Foundation; The Bateleurs; Wild Bird Trust; Wilderness Safaris; Wildlands Conservation Trust; World Parrot Trust.

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Blue Swallows

Blue Swallows *Hirundo atrocaerulea* are intra-African migrants that breed in mist-belt grasslands. Their breeding range is spread across eight countries, the south-eastern Democratic Republic of Congo, Malawi, Mozambique, South Africa, Swaziland, southern Tanzania, Zambia and Zimbabwe. The birds arrive on their breeding grounds in early September and depart in early to mid-April. They spend the remainder of the year in their central and east African non-breeding range. The South African population constitutes approximately 4% of the total breeding population, currently consisting of around 40 breeding pairs, and is listed as Critically Endangered.

To date, South Africa is the only range state with a regular annual monitoring programme, a fact highlighted by the 2012 International Blue Swallow Action Plan [developed at a workshop hosted by the Endangered Wildife Trust (EWT) and the FitzPatrick Institute Centre of Excellence (CoE). The 2012 workshop also assessed the current red-list status of each regional population and identified the two- and five-year conservation priorities for the major range states. To remedy some of the key gaps in current knowledge identified at the workshop, surveys were conducted in Mozambique and Malawi during 2013 by Dr Ian Little of the EWT.

Sites to be surveyed were identified by contacting conservation authorities and local birders and through extensive literature review. The surveys were conducted in November 2013, during the Blue Swallow breeding season. The Malawi population appears to be limited to Mt Mulanje, the Viphya region and the Nyika Plateau. Although the Mt Mulanje population is theoretically protected and is relatively protected from extensive encroachment by its inaccessibility, this reserve does not have a functional management plan and local people are impacting on the fauna and flora within the reserve. The Viphya region is heavily impacted by plantation forestry, with the so-called North Viphiya site now completely transformed and only a few birds seen in the limited remaining habitat in the South Viphiya. Nyika Plateau, on the other hand, is one of the strongholds for this species and the population remains abundant and apparently stable. This national park, although under-staffed and under-resourced, is still in good condition with the only perceived threats involving potential over-grazing by the expanding ungulate population and runaway fires (due to the lack of capacity to implement fire breaks). Other historical or predicted sites (Zomba Plateau, Kirk Range/Ntcheu/Dedza and Misuku Hills) were all heavily transformed, and do not hold any Blue Swallow populations.

Only two sites in Mozambique were confirmed as having Blue Swallows. The Manica population is a newly-recorded population on the border of Zimbabwe. This population persists on a bauxite mine property, nesting down old prospecting holes and the area is partly protected by the presence of landmines. Threats in the area include plantation forestry and over-grazing. The isolated plateau near the town of Catandica is an unlikely Blue Swallow breeding area given that most of the plateau is around 1650 m.a.s.l and the highest point is only about 1780 m.a.s.l. The area is also largely disturbed by human habitation, agriculture and cattle grazing, along with frequent intensive burning. There is one isolated high-altitude area, however, which is less impacted and in this area 13 birds were counted. Two other pairs were found in the lower, more disturbed slopes (one of which was

Prime Blue Swallow habitat – the moist grasslands of Nyika Plateau in northern Malawi. This is one of the species' strong-holds, with several hundred Blue Swallows occurring here during the breeding season. (Photo: Andrew McKechnie)

A handsome male Blue Swallow perches on a favoured site near the nest. (Photo: Henry Combrink)

actively breeding in the only aardvark hole located); these are however probably the only birds remaining on this plateau. The confirmed nest was at only 1406 m.a.s.l. These surveys allowed us to complete a red list assessment for Mozambique and assign a regional threat status (this wasn't possible during the 2012 workshop as no Mozambican representative attended).

PIT tags for understanding breeding biology

To conserve Blue Swallows, we need to better understand the species' breeding biology. The remaining known nest sites in South Africa are relatively secure and the EWT Blue Swallow Working Group, with CoE funding, works actively to ensure that these sites are protected. To further ensure the persistence of the remaining population, we need to understand how this population is performing in terms of nest survival, fledgling survival, natal philopatry, recruitment rate, age at first breeding, longevity and other associated factors which play a role in population maintenance.

To answer these questions we attempted to use Passive Integrated Transponder (PIT) tags injected subcutaneously in near-fledging nestlings. PIT tags have proven highly effective in many studies of small vertebrates including bats, rodents, lizards, snakes and small birds (including other swallows). Ethics approval and permits were obtained and tagging began in 2011. All tagged chicks survived to fledging and the project was set to produce fascinating results. However, in order to retrieve data from the tagged birds, they need to fly through an antenna placed around the nest entrance (typically either an aardvark-excavated or natural sink hole). While this was easily achieved for many other species, Blue Swallows proved unexpectedly sensitive to the presence of foreign objects near the nest entrance. The Wits Bird Club sponsored the purchase of a custom-designed, light-weight antenna but even when this antenna was camouflaged by hessian and grass, the adults refused to pass through the device. Unfortunately this means that, even though a significant proportion of the South African wild population now have PIT tags, the technology appears to be un-useable with this species. This proved yet another salutory lesson in the difficulties of working with highly threatened species and the unforeseeable difficulties that natural systems throw at research attempts.

Going forward, we will attempt to answer these important questions using genetics. By tracing the parentage of all nestlings each season we should be able to "map" aspects such as juvenile-to-adult survival, natal philopatry, nest fidelity and other associated questions within three to four seasons (the assumed longevity of the species). This will be a lot more expensive and time consuming but is the only perceived means of understanding this complicated species.

Key co-sponsors
Endangered Wildlife Trust

Research team
Dr Ian Little (Endangered Wildlife Trust)
Prof. Andrew McKechnie (CoE Core Team Member, Univ. Pretoria)

Threatened Grassland Birds

Despite their uniform appearance, grasslands are one of the most diverse ecosystems in South Africa and support more than 3,300 plant species, 15 endemic mammals and 12 endemic birds, five of which are globally threatened. South Africa's grasslands comprise around 16.5% of the country's land surface and are one of the most threatened ecosystems, with more than 60% irreversibly transformed and only 2.8% formally protected.

A Yellow-breasted Pipit fitted with a tiny VHF transmitter (the antenna can be seen extending past the tail-feathers). The transmitter allows researchers to obtained detailed information on the home range of the bird. (Photo: Darren Pietersen)

Current techniques for monitoring the ecological integrity of grasslands make use of labour-intensive floral or invertebrate studies. We are endeavouring to use bird communities to infer grassland integrity in an attempt to simplify and speed up the assessments of grassland condition. Birds are relatively easy to observe and identify, making them the ideal taxon to monitor. They also respond rapidly to changes in habitat structure and management, and are thus indicative of the ecological processes occurring in these systems. By recording the bird communities in grasslands with differing ecological integrities and relating the composition of these to plant community data recorded at the same sites, CoE-funded University of Pretoria PhD student Darren Pietersen aims to create a rapid assessment technique for moist highland grasslands using bird communities as focal taxa.

The Yellow-breasted Pipit *Anthus chloris* is restricted to the eastern escarpment moist highland grasslands during its summer breeding season. It occurs in a series of purportedly isolated populations, although pairs and small numbers are occasionally found between these strongholds. Recent evidence suggests that some populations in the Eastern Cape and Lesotho have become locally extinct or at least dramatically reduced in size. The main factors driving these apparent declines are believed to be habitat loss and fragmentation, mostly attributed to crop agriculture and incompatible grazing and fire regimens, with afforestation also being a historical contributing factor. Both grazing pressure and burning regime are known to influence the distribution and density of Yellow-breasted Pipits, although previous studies have been of limited geographical extent and the results suggest that the relative importance of grazing intensity and fire regime may be habitat- or site-specific. Darren is currently conducting bird community and vegetation surveys across the entire known and

predicted distribution of the Yellow-breasted Pipit to ascertain whether there are any geographical differences in habitat preferences. Farm management approaches are being ascertained via questionnaires, in order to establish the effects of burning frequency and timing on Yellow-breasted Pipits. These data will also be used to re-assess the current Extent of Occurrence and Area of Occupancy of this species to verify whether there has been a range reduction since the last formal conservation assessment in 2012.

The driving forces that result in some species being range-restricted habitat specialists, whereas apparently closely-related taxa are habitat generalists is an issue that often surfaces in Moist Highland Grassland bird community studies, and one that still needs to be adequately answered. In an attempt to address this question, Darren is conducting a comparative study of the widespread African Pipit *Anthus cinnamomeus* and the range-restricted Yellow-breasted Pipit. Home range data are being obtained by capturing pipits and attaching small, light-weight transmitters to them. They are then monitored and their location recorded twice daily to determine home range sizes, to investigate whether these are differences in ecology between the two species. Nests of these two species are also being monitored using automated cameras, to assess whether there are any differences in breeding biology, predation rates or breeding success.

Yellow-breasted Pipit nest. (Photo: Darren Pietersen)

Key co-sponsors

Tshwane University of Technology, Endangered Wildlife Trust.

Research team

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Prof. Ray Jansen (Tshwane University of Techology)
Dr Ian Little (Endangered Wildlife Trust)

Student: Darren Pietersen (PhD, Pretoria)

Fire is a key determinant of the plant communities that comprise Moist Highland Grassland and management practices may have important implications for Yellow-breasted Pipits and other endemic bird species. (Photo: Darren Pietersen)

Southern Ground-Hornbill conservation

In the past 100 years, the Southern Ground-Hornbill *Bucorvus leadbeateri* has experienced a two-thirds reduction in its range in South Africa, and presumably in its population size. Since 2000, we have studied their habitat use and reproductive success as well as natal and breeding dispersal, largely to inform activities of the Mabula Ground-Hornbill Project (MGHP) and the national Ground-Hornbill Action Group who are implementing the national Species Recovery Plan. The main study area is the Associated Private Nature Reserves (APNR), covering some 180 000 ha adjacent to the central Kruger National Park (KNP), and which supports about 30 ground-hornbill groups. We have reproductive histories spanning a decade for more than 20 groups, and have found that breeding success increases with group size and the amount of open habitat within 3 km of the nest site.

Dispersal and satellite tracking

Colour-ringing has shown that sub-adult females usually disperse from their natal groups before they are two years old, whereas sub-adult males stay with the natal group for many years. 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. In 2011, William Wyness (BSc Hons) quantified seasonal habitat selection and home-range vegetation characteristics, showing home-range contraction during the breeding season. He also showed that within-season habitat use is non-random, with habitat selectivity greatest during the wet season. Blair Zoghby (MSc, submitted) completed a fine-scale analysis of home range use to identify optimal sites for the proposed reintroduction programme. He also analysed seasonal patterns of roost-site use based on night-time GPS fixes. Kate Carstens registered for a PhD at the beginning of 2014. Her research is focussing on the fine-scale genetic structure of groups in the study site with the objective of characterising dispersal and breeding dynamics in this species.

The alpha-female is the central core and breeding unit of a ground-hornbill group. (Photo: Kate Carstens)

Highlights:

- Resighting of colour-ringed individuals up to 120 km from their natal group shed new light on the dispersal ability of this species.
- First record of breeding dispersal when a beta-male became an alpha-male after it dispersed into a neighbouring group.
- All commercial lodges in the APNR and their field guides have committed to reporting ground-hornbill sightings to boost the sighting frequencies of groups and ringed individuals.

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 programme to remove second chicks,

providing their sibling was healthy, was initiated to rear them for captive breeding and reintroduction programmes. Chicks from the APNR and KNP are transported by MGHP 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 2013/14 season saw 11 active nests fledge nine chicks, and four second-hatch chicks were harvested for the captive breeding and wild-release programmes. One week before fledging, we colour-ringed, measured and took blood samples from the nestlings.

Highlights:

- Since 2010, the APNR has contributed over 20 second-hatched chicks for the species action group, of which nine are ear-marked for wild-release.
- In May 2012, a one-year old juvenile from an APNR nest was released on Mabula Private Game Reserve to join the reintroduced group and is now an accepted member of the group.
- Ongoing repairs to artificial nest boxes ensure that ground-hornbills can thrive in areas that lack natural nest cavities.
- One artificial nest, inactive for years, became active at the end of 2013 when a new group established itself in the area. Their first chick fledged in March 2014.

Mitigating threats in the APNR

Electrocution from uninsulated conductors on electrical transformer boxes is a known threat to all large birds of prey as well as to 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 2 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.

Outreach

Together with Children's Eco-Training and the Mabula Ground-Hornbill Project, we hosted a four-day workshop at the study site for 320 local children. A strong conservation message was built into play and art activities, with booklets provided for their parents so the message could reach a wider audience in the surrounding communities.

The second-laid egg produces an insurance chick which is available to harvest for the reintroduction programme. (Photo: Kate Carstens)

Highlights:

- The workshop included a trip to an artificial nest in the APNR. For many of these children, it was their first game drive experience.

Impact of the project

This project has contributed towards our basic understanding for the national SGH Species Recovery Plan and the SGH Reintroduction Plan, and will assist with the implementation of these plans. Rob Little and Kate Carstens represent the Fitz on the national Southern Ground-Hornbill Action Group while Rob is also Vice-Chairman of the MGHP management board. During 2013 and 2014, the project published two scientific papers in *Ostrich* and *Ibis* as well as semi-popular articles in *Environment* and the e*lectronic newsletter of the Southern African Wildlife Management Association,* and six articles in the local magazine *Klaserie Chronicle* which is distributed to surrounding private reserves and the greater Hoedspruit community.

Key co-sponsors

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

Research team

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Research Assistant: Cassie Carstens

Shoebill conservation in the Bangweulu Wetlands, Zambia

The objective of the FitzPatrick Institute's Shoebill research project is to find the best way to manage Zambia's Bangweulu Wetlands to ensure the conservation of the Shoebill *Balaeniceps rex* population. Shoebills are classified as Vulnerable due to their small declining population (fewer than 10 000 mature individuals). To implement effective conservation strategies, we need a better understanding of Shoebill foraging and breeding ecology, their movement patterns and their population trends.

The main conservation goal of the Bangweulu Wetlands Management Board (BWMB) for Shoebills is to increase their breeding success and recruitment rates. By increasing the breeding population, BWMB aims to maintain a viable and secure Shoebill population and to support community and tourism development. Surprisingly, little is known about this fascinating bird and our research has focussed on filling the gaps in the current knowledge of the species. It was crucial to investigate and understand the threats to Shoebills in the Bangweulu Wetlands and to identify the factors which limit their population size.

Our research has generated a better understanding of preferred prey species and suitable habitat types, as well as enhanced knowledge about the behaviour of parent birds and chicks. The breeding success of Shoebills was worryingly low in areas without protection, and conservation measures are needed urgently at key breeding areas. Through aerial surveys and from engaging with local communities we located many of the key Shoebill breeding areas and found that the main threats experienced by Shoebills in the Bangweulu Wetlands are fires, disturbance by fishermen and most importantly the illegal trade in chicks. This is despite the fact that Shoebills are listed on Appendix II of the Convention on International Trade in Endangered Species (CITES).

The enigmatic Shoebill is highly sought after by bird watchers. Our research aims to ensure ecotourism in this region is practiced sustainably. (Photo: Peter Ryan)

The primary conservation needs identified by our research were to protect suitable Shoebill habitats and food sources from degradation and disturbance; continue with annual aerial nest location and census surveys to monitor the population; and to collect data on breeding success. However, these measures will only be effective through engaging with the local communities to prevent disturbance of nest sites. The BWMB needs to demonstrate the benefits of Shoebill protection to these communities, including the creation of jobs through Shoebill conservation and avi-tourism programmes.

We recommend the development of guidelines for responsible tourism to limit disturbance and to continue the nest protection programme. It is also crucial to test the effectiveness of the existing legal instruments for the protection of Shoebills in Zambia. To fully achieve the added value aspects of Shoebill conservation, we recommend that there is significant scope to market Shoebill viewing in the Bangweulu Wetlands internationally and to train local birding guides to develop this industry.

An unusual case where two Shoebill chicks at one nest are nearing successful fledging. (Photo: Ralf Mullers)

With the implementation of these strategies we hope to ensure a viable Shoebill population in the Bangweulu Wetlands to be enjoyed by future generations of Zambians and global tourists.

Highlights:

- At the beginning of 2014 we presented a Management Plan for the conservation of the Shoebill population in the Bangweulu Wetlands at a meeting of the stakeholders (African Parks, WWF Zambia and the Zambian Wildlife Authority). The objectives and strategies were approved by the BWMB and several strategies have been implemented as adaptive conservation measures.
- A nest protection programme has been implemented as an annual conservation activity that involves local communities in Shoebill conservation. Most nests that were protected by a guard successfully fledged a chick. Nineteen Shoebill guards were employed by the project during 2013-2014.
- The project has generated substantial attention by publications in popular media and during public talks. Two scientific papers are in press, and at least two more manuscripts are being prepared for publication.
- In 2013 we deployed seven GPS transmitters on Shoebills; one adult and six juveniles. Five of these transmitters were still working at the end of 2014, generating data on daily movement patterns. Bwalya, the first Shoebill to have been deployed with a GPS-transmitter, moved about 60 km from its release site deeper into the swamps, a year after its deployment, where it stayed for 1.5 years.

Several papers will be published from this project in the coming year. Data from the GPS satellite tags on the chicks and sub-adults will continue to be collected and will be analysed at a later date, as will the data from the ongoing aerial monitoring which will continued by African Parks for the foreseeable future.

Key co-sponsors
African Parks, WWF Netherlands.

Research team
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Frank Willems (Kasanka Trust)
Craig Reid (African Parks)

Research Assistants: Brighton Mofya, Elijah Mofya

Postdoc Ralf Mullers with the only adult Shoebill that is deployed with a GPS transmitter in the Bangweulu Wetlands. Six fledglings have also been fitted with transmitters – the data received gives us insight into their movement patterns. (Photo: Brighton Mofya)

Powerline Collisions

Large, open-country birds such as bustards and cranes that are relatively cumbersome in flight 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 even fences 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.

Low-level flights provide the best way to count Ludwig's Bustards – provided the plane is low enough and noisy enough to flush all birds. (Photo: Peter Ryan)

This project, run in conjunction with the Endangered Wildlife Trust (EWT), Eskom, the Namibia Nature Foundation (NNF) and NamPower, is designed to assess and mitigate collision mortality of large birds on powerlines. Following PhD student Jess Shaw's pioneering work in the South African Karoo, MSc student John Pallet's monitoring of collision mortality on powerlines in southern Namibia in 2013 confirmed that bustards are the species most at risk, accounting for 75% of casualties. Mortality rates for Ludwig's Bustards *Neotis ludwigii* were similar to those estimated in the Karoo (~1 bird per km of transmission line per year), but mortality rates of Kori Bustards *Ardeotis kori* were substantially higher in Namibia due to their greater abundance compared to the Karoo. Other species recorded killed in Namibia included Secretarybirds *Sagittarius serpentarius*, Martial Eagles *Polemaetus bellicosus*, Lappet-faced Vultures *Torgos tracheliotus*, and both Lesser Flamingos *Phoeniconaias minor* and Greater Flamingos *Phoenicopterus roseus*. There was considerable temporal variation in collision rates linked to local movements of bustards.

In 2014, the focus of John's work was to obtain a better estimate of the global population of Ludwig's Bustard (given concerns that the mortality estimates were excessive relative to the best population estimate). Estimating the population of Ludwig's Bustards was based primarily on low-flying aerial surveys, which rely on flushing birds to count them. We spent four days surveying more than 3 000 km of transects in western South Africa and in central and southern Namibia. However, the fourth flight was in a small, relatively quiet aeroplane, which detected fewer birds than we knew were

Kori Bustards are killed in worryingly large numbers by power lines in southern Namibia. (Photo: Peter Ryan)

on the ground. Given concerns about the reliability of aerial surveys, we may have to revert to vehicle surveys, which are much more time consuming and introduce potential biases caused by being restricted to roads.

On a more positive note, the findings are being applied in the design of Namibia's expanding powerline network. John Pallett was the bird specialist for a major powerline EIA in northern Namibia that will pass close to Etosha Pan and the wetlands in north-central Namibia, threatening bustards, raptors and flamingos. NamPower agreed to mark half of the new line with bird flight diverters, which is a major breakthrough for the principle of pre-emptive marking of lines when they are being erected. This mitigation will cost approximately R60 million; NamPower is thanked for committing to this mitigation. Other EIAs in South Africa and Namibia also have benefited from the data arising from this project, and the results also are being used to guide infrastructure development for the burgeoning renewable energy sector.

Highlights:

- Jess Shaw was awarded her PhD in 2013 on the impacts of collision mortality on Ludwig's Bustards and other large birds in the Karoo. Jess has published three papers from her thesis, plus one with 2011 CB MSc student Maurice Schutgens, and has several more papers nearing completion.
- Data collection continued every three months at the large-scale marking experiment near De Aar that we designed to test the efficacy of two marking devices to reduce collisions on 72 km of high voltage line. Preliminary results continue to show a benefit to marking lines for Blue Cranes *Anthropoides paradiseus*, but there are still not enough data to assess results for Ludwig's Bustards or to compare devices.
- By the end of 2014, four Ludwig's Bustards equipped with GPS-satellite transmitters were still sending information on their movements. The only female fitted with a transmitter has nested in three successive seasons in the same area near Richmond, with all nests within 5 km. She abandoned her nest in 2012 when we went to confirm she was indeed breeding. Since then we have left her alone, but based on her movements, it appears that she failed again in 2013/15 and in late 2014, but then relaid in early 2015 and may have finally raised a brood.
- The stable isotope analysis of Ludwig's Bustard feathers that broadly supports satellite tracking results (i.e. partial migration between the Nama and Succulent Karoo, and an eastern origins for juveniles), was published in *Austral Ecology*.

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.

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Conservation of Bearded Vultures in southern Africa

The Bearded Vulture *Gypaetus barbatus* is a Critically Endangered species in southern Africa and their entire range in the Southern Hemisphere falls within the Maloti-Drakensberg mountains of South Africa and Lesotho. Sonja Krüger completed her PhD thesis in 2014 on the decline of this population. The study synthesized 15 years of research to investigate the mechanisms of this decline and determined the most appropriate management actions necessary to attain the short-term conservation target of a positive population growth rate.

Sonja's PhD study confirmed that the high mortality rate of the species is unsustainable, even without the added threat of wind farm developments, and is linked to increased human densities and associated infrastructure in the species' range.

Three hypotheses were examined to identify the factors associated with territories being abandoned; those related to human impact, food availability and climate change. Of the seven covariates examined within the home range of an adult pair, the strongest support was for the human impact hypothesis, with abandonment more likely in territories with higher densities of power lines and human settlements. Similarly, an investigation of the movements of all age classes to determine exposure to anthropogenic risks found that immature birds increased the size of their range as they aged and older birds (those aged between 4-6 years) faced the greatest exposure to risk factors, such as increased housing and power line densities. The overall foraging range of the population was estimated to be 52 000 km^2 and immature birds were found to use 65% of this area whereas adult birds focussed their activities in an area of about 286 km^2 around their nests.

A population viability analysis was undertaken, with estimates of the population's demographic parameters obtained during the study, to determine the future population trend and identify the primary demographic and environmental constraints on the population. The models predicted a negative growth rate for the population over the next 50 years with a high probability of extinction as a result of reduced productivity and low survival estimates, particularly for adults. To achieve a positive growth rate, mortality rates need to be reduced, productivity increased and the population should be supplemented, possibly by initiating a captive breeding programme. Recommendations to address the primary threat of poisoning include supplementary food provision, exploring alternative, effective and legal predator control measures, focussed outreach programmes and addressing the use of lead in hunting/culling programmes.

In addition to the pressures identified, the population is facing another major and potentially catastrophic threat from the multiple wind farms which are planned for the Lesotho highlands. Because of their high soaring flights and their wide ranging nature, the species is

A Bearded Vulture killed by the ingestion of poison - the majority of dead birds we found had been poisoned. (Photo: Rickert van der Westhuizen)

The Bearded Vulture is an iconic species of the Maloti Drakensberg Mountains in South Africa and Lesotho. The population is in steep decline and the prospect of a wind farm in Lesotho is of great concern to the species' survival. (Photo: Sonja Krüger)

considered particularly vulnerable to colliding with the turbine blades.

To ensure that wind farm developments are placed in the least damaging locations, we used habitat-use models to identify intensively used areas where Bearded Vultures may come into conflict with wind turbines. The models simulate the frequency of area use and hence how often birds are likely to approach potential sites of wind turbines. This allows estimates of mortality rates and hence the population's viability. We can thus examine the outcome of various scenarios, e.g. what impact might there be if we had different numbers of wind turbines placed in different risk categories. This will be invaluable for planning over an area greater than that typically considered by site-specific development proposals, and will allow national development plans to be informed by a habitat use map at a considerable scale.

Highlights:

- The Biodiversity Management Plan for Bearded Vultures was gazetted by the South African government during 2014.
- Sonja presented the results of her ranging behaviour research at the BirdLife SA/Fitz Learning about Birds conference and a paper on differential range use between age classes of southern African Bearded Vultures was recently published in *PLoS ONE*.
- A paper on how anthropogenic activities influence the abandonment of Bearded Vulture territories in southern Africa has been accepted by *Condor* to be published in 2015.
- A paper on reduced genetic diversity in Bearded Vultures was published in *Ibis* in early 2015.
- A paper on modelling habitat use by Bearded Vultures in Lesotho to help with wind farm placement has been accepted by *Journal of Applied Ecology* to be published in 2015.
- Sonja Krüger graduated with her PhD in Zoology in December 2014.

Key co-sponsors
Ezemvelo KZN Wildlife's Maloti Drakensberg Transfrontier Programme; Wildlands Trust; Sasol through the Endangered Wildife Trust.

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Martial Eagle research in South Africa

The Martial Eagle *Polemaetus bellicosus* is Africa's largest eagle and is one of the defining species of the African savannah, where it functions as an important apex predator. Recent analysis suggests that in South Africa, the species may be in trouble, with declines recorded even within our large protected areas. We are undertaking several research projects to understand why this is happening.

We are studying the dispersal and survival of juvenile Martial Eagles in the Kruger National Park to uncover the cause of the decline in the population. (Photo: Barbie Vos)

In 2013, Daniël Cloete explored changes in the species' reporting rates using South African Bird Atlas Project (SABAP) 1 and 2 data for his Conservation Biology Masters mini-dissertation. He found that Martial Eagle reporting rates had declined by 60% across South Africa and, most alarmingly, these declines were apparent even in South Africa's largest protected areas, such as the Kruger National Park (KNP) where reporting rates had declined by over 50% in the last 20 years. Protected areas (PAs) such as the KNP have long been considered strongholds for the species and these declines raise a number of important questions pertaining to the effectiveness of PAs for the conservation of low density species. This is particularly true for species which hold large territories or have dispersal phases in their life history. Protected areas provide suitable habitats for species that are unable to cope with highly transformed habitats in the surrounding landscape or with the impacts of high human pressure. As such, PAs can enable the persistence of species, which might otherwise be completely lost from a region, and any declines within PAs are of particular concern.

Given these concerns, research on the declines within the KNP was initiated in 2013 by Rowen van Eeden for his PhD. By GPS tracking adult and juvenile Martial Eagles, Rowen has begun to unravel the mystery of where juvenile Martial Eagles disperse to after fledging and how both

adults and juveniles utilize their habitat. Juvenile birds spend as much as 60% of their time beyond PA boundaries (see map), traversing much of the low veld and Mozambique. Losses of tagged adults and juveniles have so far been attributed to electrocutions (both within KNP and beyond its boundaries), persecution and intra-specific conflict during territorial disputes. Over 70 000 GPS locations have been recorded for adults and juveniles and these location data will be modelled to understand habitat requirements. Territory sizes of adult birds average 110 km^2, which suggests that KNP potentially holds up to 175 breeding pairs. Breeding success appeared to be unusually low during 2013 and 2014, averaging just 0.24 chicks fledged per pair per year, far lower than the 0.5 recorded elsewhere in Africa. This low productivity will be further investigated in 2015. A further 18 adults were colour ringed and a re-sighting campaign was launched to determine survival rates and population turn-over in the KNP breeding population.

In a separate research project, MSc student Jessie Berndt explored the importance of Martial Eagles nesting on power transmission pylons. Although the species mainly nests in trees in South Africa, it nests on electricity pylons in the open areas of the Karoo. In collaboration with supervisors Andrew Jenkins, Res Altwegg and Arjun Amar, Jessie developed habitat association models to predict where Martial Eagles are likely to nest on pylons based on the known distribution of nests derived from an earlier study investigating nesting behaviour on the Karoo transmission lines. This model has been ground-truthed and refined and Jessie has used it to estimate a further 50 eagle territories beyond the 92 nests found through aerial surveys. Thus, we expect a total of 142 Martial Eagle territories on the South African transmission network - this population is clearly of national importance for a declining species. Jessie's analyses suggest that South Africa's power transmission network is an important resource for the species, particularly in areas without trees.

Key co-sponsors
National Research Foundation, Natural Research UK Ltd, Riverbanks Zoo and Gardens, Columbus Zoo and Aquarium, Raptor Research Foundation - Leslie Brown Award, National Geographic Society, African Bird Club, IdeaWild, The Bataleurs

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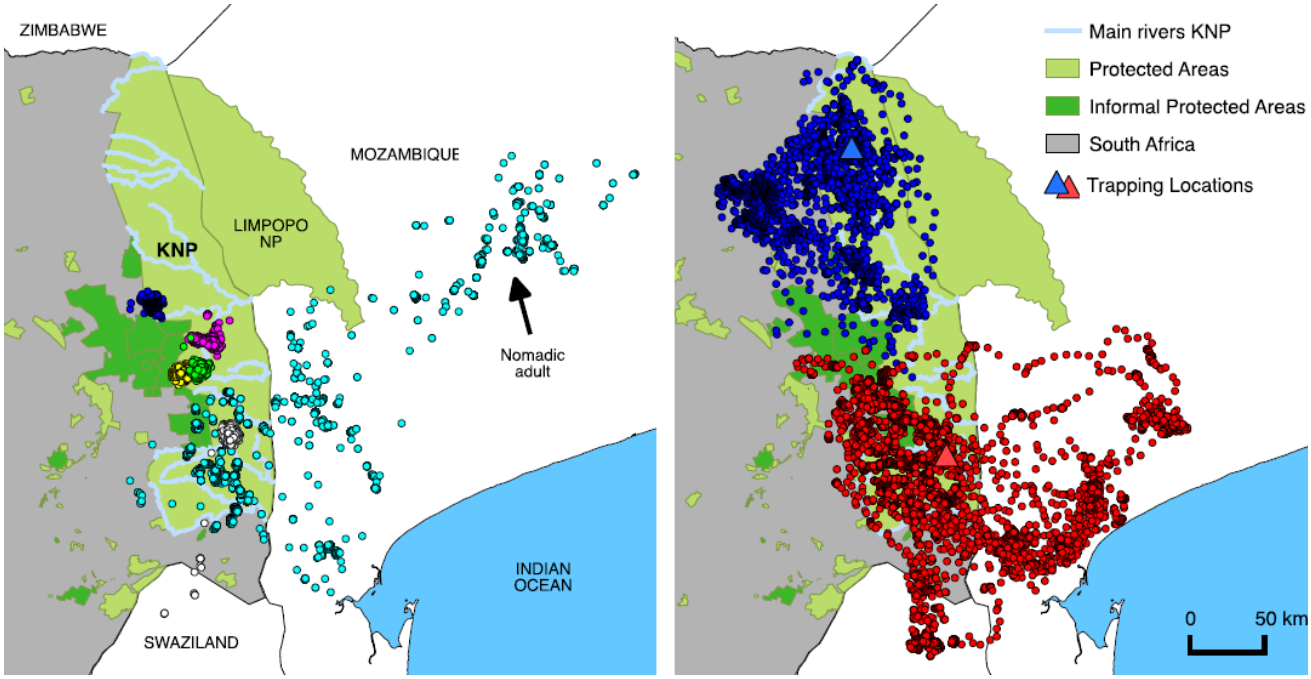

Six adult (left) and two juvenile (right) home ranges of Martial Eagles GPS tagged in the Kruger National Park.

Black Harrier – Ecology and Fitness

Black Harriers *Circus maurus* are southern Africa's rarest endemic raptor, considered as globally Vulnerable and regionally Endangered, with an estimated total world population of less than 1 000 mature breeding birds. Recent population declines have been suspected, but the reasons for the scarcity or decline of this species are poorly understood.

As ground-nesting predators, Black Harriers need to defend their nests against all intruders – including humans. While crows and buzzards are easily chased away, some nests fall prey to small carnivores. (Photo: Davide Gaglio)

Carrying on the research initiated by Rob Simmons in 2000, PhD student Marie-Sophie Garcia-Heras is aiming to determine the factors responsible for the scarcity of the Black Harrier population in Southern Africa. Her current research focuses on factors influencing Black Harrier breeding success, in particular diet, prey abundance and habitat quality. She is also assessing movements between breeding and non-breeding areas, and levels of connectivity between subpopulations, which may influence the level of genetic mixing. Other threats such as the impact of pollutants are also being investigated. Marie-Sophie's research is supervised by Dr Rob Simmons, Prof. Graeme Cumming (PFIAO) and Drs Beatriz Arroyo and François Mougeot (CSIC, Spain).

Highlights:

- Field work was conducted in two main areas in order to identify differences between breeding populations in coastal areas along the South African West Coast versus inland areas surrounding Nieuwoudtville, Northern Cape.
- During the 2013/14 breeding season, 46 nests were monitored and data from 91 chicks and 32 adults were collected on condition and health (i.e. bio-metrical measurements, blood samples for carote-noids, contaminants and parasite analyses, stress hormone level and pictures for external ornamentation).
- Three satellite transmitters and five GPS/GSM transmitters were fitted to adult

birds during 2013/14, providing accurate data on the foraging habitats of breeding Black Harriers.

- These tracked birds have confirmed the west-east-west migration routes and have identified non-breeding areas in Lesotho and the Eastern Cape.
- Automated cameras were placed at 18 Black Harrier nests in 2014, recording both video and still images, allowing the identification of prey items and feeding rates, as well as behavioral interactions.

Black Harriers are genetically depauperate

Molted feathers have been collected across the Black Harrier's breeding range to assess their level of genetic diversity and how this might affect their long-term viability under global change scenarios.

In collaboration with Drs Jerome Fuchs (University of California) and Graeme Oatley (Palacký University of Olomouc), 50 harriers were assessed for diversity in both mtDNA and nuclear DNA. While there were few specimens from the Eastern Cape, the results were alarming: there was no genetic variation in the birds sampled. In comparison with 11 other species of raptors, only the Galapagos Hawk *Buteo galapaoensis* showed no variation in mtDNA. Of the likely causes, a recent severe bottleneck is the most likely explanation. It is hoped that Marie-Sophie's PhD will reveal any health issues that the low genetic diversity may cause.

A follow up study of the genetics of the entire harrier group is underway by Dr Graeme Oatley. Early results have revealed that the harriers diversified rapidly during the Miocene, when grasslands were appearing across the world, particularly on the African plains. Furthermore, the closest relative of the Black Harrier is the Eurasian migrant, the Pallid Harrier *Circus macrourus*, and may represent a relatively recent colonist of southern Africa.

Key co-sponsors
National Research Foundation, Golden Fleece Merinos

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Student: Marie-Sophie Garcia-Heras (PhD)

Tagged and ready to go: a female Black Harrier ready for release by Marie-Sophie near Calvinia. (Photo: Francois Mougeot)

Coastal bird conservation

Human population densities are greatest in coastal areas, with 44% of people living within 150 km of the sea. As a result, many coastal birds face significant threats, whereas some species that are able to adapt to human-modified landscapes are increasing in numbers, sometimes resulting in cascade effects on other species. This programme considers the impacts of disturbance and development on coastal birds.

Numbers of African Oystercatchers *Haematopus moquini* continue to increase throughout their range. This is in part due to the ban on off-road vehicles on South African beaches, but is also linked to the spread of the invasive mussel *Mytilus galloprovincialis*, which has greatly increased the availability of food for oystercatchers. Dane Paijmans completed his MSc on the change in clutch size in this species. Three-egg clutches were only very rarely recorded prior to 1975, but they have increased in abundance since then, and there have even been records of four-egg clutches since 2000. This represents a substantial change in life history for a strongly K-selected species. Dane expanded on the 33-year database tracking reproductive investment in oystercatchers (including changes in egg size). Surprisingly, he found that larger clutches offer no fitness benefit because they do not result in an increased fledgling output. This is primarily due to inefficient incubation as a result of the extra egg, as well as the inability to maintain and feed a larger brood size. Which begs the question why larger clutches persist in the population.

MSc student Dane Paijmans recording an African Oystercatcher egg clutch size. (Photo: Lea Cohen)

Kelp Gulls *Larus dominicanus* are another successful coastal species that are able to coexist with humans. Their numbers have decreased in their core breeding range off the west coast of South Africa (Dassen Island and the Saldanha Bay region) due to chick predation by Great White Pelicans *Pelecanus onocrotalus*, but have increased in urban areas, including the greater Cape Town region and around Port Elizabeth. MSc student Minke Witteveen worked with Mark Brown from the Nature's Valley Trust to explore the likely impacts of global change on Kelp Gulls Western Cape coast over the last three decades, mirroring similar decreases reported from other regions. HRA Rob Simmons followed up this work with an analysis of coastal bird trends at the two largest coastal wetlands in Namibia, Walvis Bay and Sandwich Harbour. Working with Namibian Conservationists Rod Braby and Holger Kolberg, and Birgit Erni from UCT's Statistical Sciences Dept, he used 'state-space' models to show that numbers of many long-distance Palearctic waders have declined over the last 25 years, whereas numbers of their resident southern African counterparts are stable or increasing. Because Walvis Bay supports an international harbour and major salt works, and Sandwich Harbour is a pristine embayment, they concluded that the declines cannot be attributed to anthropogenic influences in the wintering grounds. This agreed with findings from the Western Cape, where declines in migrants occurred irrespective of the conservation status or level of disturbance of the coastal region. Counting waders is more efficient when they are highly concentrated in their winter quarters than trying to do so when they are dispersed across their vast northern breeding grounds, and so we hold the key to the long-term monitoring of these vulnerable populations.

Unfortunately not all coastal breeding species are doing well. Peter Ryan's repeat counts of Western Cape coastal birds showed decreases in

The numbers of the migrant shorebirds, Knots, Grey Plovers and Curlew Sandpipers, from the boreal tundra have decreased at the main Namibian coastal wetlands as well as in the Western Cape. (Photo: Peter Ryan)

White-fronted Plovers *Charadrius marginatus*, especially on the Cape Peninsula and around False Bay. Their numbers had fallen more in open access areas than in reserve areas, suggesting that direct disturbance was driving their decrease (and local extinction in some areas). Selena Flores, who volunteered with the Nature's Valley Trust in 2014, started collecting data on the impacts of human disturbance to breeding plovers and oystercatchers, and will continue this work in 2015 for her MSc.

Highlights:

- MSc student Dane Paijmans showed that more is not always better, as the three-egg clutches did not improve breeding success of African Oystercatchers.
- The ongoing population increase may see the African Oystercatcher moved to Least Concerned on the IUCN Red List.
- MSc student Minke Witteveen showed how drones could be used to count large, dense gull colonies without causing undue disturbance to the birds.
- A paper on the long-term decreases in migrant shorebirds in Namibia is in press with *Conservation Biology*.

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Numbers of White-fronted Plovers have decreased, especially at beaches with large numbers of beach-goers, indicating their susceptibility to human disturbance. (Photo: Peter Ryan)

Conserving Benguela endemics

All three seabirds endemic to the Benguela upwelling ecosystem that rely on anchovies and sardines are threatened by a reduction in the availablity of their preferred prey. Small pelagic fish have greatly reduced in abundance off the South African west coast, where fishing effort is concentrated and most seabird breeding islands are located. Fish stocks have increased off the south coast, where fishing pressure is low and there are very few suitable breeding locations. The main challenge is to ensure adequate spatial management of this fishery.

Competition with fisheries

The African Penguin *Spheniscus demersus* (Endangered) and the Cape Gannet *Morus capensis* (Vulnerable) are the two main study species, although we continue to monitor the populations of Cape Cormorants *Phalacrocorax capensis* (Endangered). African Penguin research at the Fitz is under the leadership of Dr Lorien Pichegru (Algoa Bay) and Dr Antje Steinfurth (west coast), in collaboration with Dr Richard Sherley (ADU) and Dr Rob Crawford and Dr Azwianewi Makhado at DEA. Much of this research has centred on the possible conservation benefits of stopping fishing around key penguin breeding colonies. This long-running study, dating back to 2008, came to a head in December 2014, when the Island Closure Task Team presented its findings to the meeting of the International Stock Assessment Review Panel. Despite vigorous debate the Panel endorsed the conclusion that fishing closures benefit penguins, and together with evidence of regional stock structure among at least sardines it seems likely that spatial management of catches will finally be implemented in this fishery off South Africa.

MSc student Jenni Roberts continued Craig Harding's (CB MSc 2012) initial tracking of pre-moult African Penguins, and extended the study to include post-moult birds. Birds from Dassen Island off the west coast travelled much farther during both periods than birds from Bird Island, Algoa Bay, and visited areas subject to much greater fishing pressure. This likely reduces their chances of surviving the annual moult, when birds must fast for three weeks, and the critical post-moult recovery period.

Lorien Pichegru and Fitz HRA David Grémillet continue to study the foraging ecology of Cape Gannets breeding on Malgas Island. This species shows greater flexibility in diet than the African Penguin, as it is also exploits 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, which were drawn together in CB MSc student Lea Cohen's project, recently published in *Marine Ecology Progress Series*. Stomach temperature recorders have also been deployed in conjunction with GPS loggers to estimate the sizes of individual prey items, showing exactly when and how birds feed at sea. The results will be used to determine the proportion of successful feeding events in relation to diving behaviour.

CoE core team member Pierre Pistorius (NMMU) has established a project on Cape Gannets at Bird Island, Algoa Bay, which is the only increasing colony and now supports more than two-thirds of all Cape Gannets. David Green completed his MSc in 2014 on their foraging ecology, assessing long-term changes in diet as well as current foraging effort. Gavin Rishworth also completed his MSc in 2014 on their activity budgets, after equipping 50 pairs with miniature radio transmitters that allow us to log each bird's visits to the island. This radio-logging system was also installed at Malgas Island in 2014, where gannet numbers are dwindling, and the comparison of the two colonies will form a key component of Rabi'a Rijklief's PhD research.

The Swift Tern *Thalasseus bergii* is unusual in that it feeds predominantly on small pelagic fish yet its population is increasing. Davide Gaglio (MSc) is studying their diet and breeding biology to understand how they are flourishing while other seabirds that specialise on pelagic fish are threatened. By photographing prey being carried by the terns, Davide has 'sampled' more than 12 000 prey items, vastly increasing our knowledge of the species' diet, and confirming that anchovies are their main prey, irrespective of breeding stage. He is also monitoring the duration of parental support after fledging, and tracking juvenile dispersal using field-readable colour rings. Comparative diet data for Caspian Terns *Hydroprogne caspia* are also being obtained from the colony near the Berg River mouth.

Feeling the heat

Research on the Bank Cormorant *Phalacrocorax neglectus* (Endangered) continued in collaboration with the Animal Demography Unit. MSc student Corlia Meyer completed her degree in 2014 on the impact of rising temperatures on the species. Corlia confirmed that Bank Cormorants appear to be particularly susceptible to high temperatures, with breeding birds exhibiting heat-stress behaviours at lower temperatures than other sympatric cormorants. Given that the birds already breed in winter, it appears to be vulnerable to a warming climate. Philna Botha, who also completed her MSc in 2014, found evidence that food limitation may also explain the bird's poor performance in recent years. Foraging trips of breeding adults, which can be used as a proxy for food availability, are longer at colonies with decreasing population trends, and shortest at the only increasing colony.

African Penguins also suffer from high temperatures. Exchange student Bonnie Lei showed how artificial nests installed to help conserve penguins can actually do more harm than good as they attain excessive temperatures. Noelle Tubbs (MSc), supervised by Lorien Pichegru and Jon Green, showed that the upper limit of the penguin's thermal neutral zone is only 28°C, less than expected. She has also documented the penguins' behavioural responses to changes in ambient temperature.

Highlights:

- The first deployment of animal-borne video cameras on African Penguins confirmed their elaborate prey searching and pursuit behaviours first inferred in the 1980s by then PhD student Rory Wilson.
- Alistair McInnes (PhD) has shown that the relatively cheap fishfinder (R100 000) provides comparable results to a scientific acoustic system costing roughly 50 times more. This paves the way for cost-effective fish surveys in Algoa Bay that can be used to assess the factors influencing penguin foraging movements.
- Reason Nyengera completed his MSc at NMMU on the impacts of seismic operations on African Penguins. He showed that breeding penguins equipped with GPS loggers actively avoided seismic operations, and estimated mortality rates from carcasses washed ashore immediately after the operations.
- The Benguela seabirds group published nine papers and one book chapter during the review period. Team members presented 26 talks and posters at seven conferences, including the 2nd Climatic Impacts on Oceanic Top Predators Symposium (Noumea), the 5th Bio-Logging Symposium (Strasbourg), the 8th International Penguin Conference (Bristol) and the 20th Biennial Conference on the Biology of Marine Mammals (Dunedin).
- Lorien Pichegru was given a SANCOR award for Emerging Scientists at the 14th SAMSS conference, held in Stellenbosch in July 2014.

Swift Terns are bucking the trend in the Benguela, increasing in numbers while penguins, gannets and Cape Cormorants that target the same prey are declining. (Photo: Davide Gaglio)

Key co-sponsors

BirdLife International; BirdLife South Africa; Charl van der Merwe Foundation; Raggycharters Whale Watching; Seaworld.

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Conserving Southern Ocean seabirds

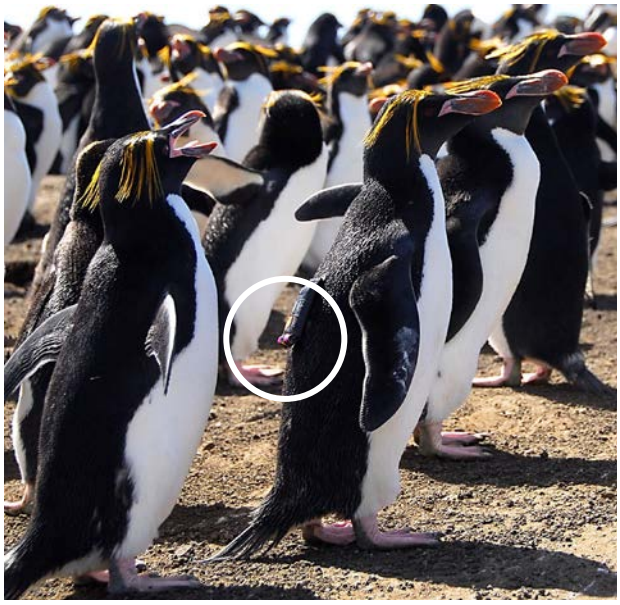
Seabirds are among the most threatened groups of birds because they face challenges both at their breeding sites and at sea. Almost one-third of all seabirds are on the global Red List, and seabirds comprise nearly half of all threatened birds in South Africa. The Fitz's Seabird Research Programme assesses the severity of threats faced by seabirds, and attempts to provide practical management solutions to reduce these threats. This section deals with Southern Ocean species, which face threats at sea through fishing mortality and climate change.

Accidental fishing mortality

One of the major impacts that fisheries have on seabirds is through direct mortality, typically when birds get entangled by fishing gear. In our region, this problem mainly occurs in longline fisheries, which kill birds that either swallow baited hooks or get entangled in the lines, and demersal trawl fisheries, which 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 (ATF). We work closely with the ATF and Fitz HRA Dr Ross Wanless, African Seabird Conservation Officer for BirdLife International. Currently, most of our work focusses on the longline fishery for tunas and swordfish, which remains the most problematic fishery for seabird bycatch in our region. PhD student Dominic Rollinson is working on various mitigation measures for this fishery, as well as studying the foraging ecology and movements of White-chinned Petrels *Procellaria aequinoctialis*, the species most often killed on longlines in our region.

Tracking birds at risk

In order to understand the threat level posed by fisheries bycatch, we need a better understanding of where seabirds go, so we can estimate their overlap with different fisheries. The advent of small, compact GPS and geolocator data loggers has revolutionised our ability to track seabirds, which are among the most mobile organisms on Earth. Working with the CNRS's Yan Ropert-Coudert and Akiko Kato we have deployed data loggers on a wide range of seabirds breeding at Marion and Gough Islands. Analysis of some of these data are being conducted in collaboration with colleagues in France, New Zealand, the UK and USA, but Fitz



A Macaroni Penguin equipped with a GPS-TDR logger on its back. (Photo: Ben Dilley)

MSc students Stefan Schoombie and Kim Stevens are studying movement patterns in the two species of sooty albatrosses *Phoebetria* spp. and Grey-headed Albatrosses *Thalassarche cryso-stoma*, respectively. They also estimated their breeding success, and used nest cameras to document causes of breeding failure at Marion Island in 2013/14. Stefan will return to Marion Island in 2015 to continue working on Sooty Albatrosses, as they are the only albatross breeding on the island thought to have a negative population trend. Tracking with loggers is largely confined to adult birds where there is a reasonable chance of recovering the devices. Much less is known about the dispersal movements of juvenile seabirds. In collaboration with DEA and BLSA (who have funded the much more expensive devices!), we have started tracking dispersal of juvenile albatrosses from both Marion and Gough Islands using PTT satellite transmitters.

Penguins and climate change

The crested penguins (*Eudyptes* spp.) are the largest genus of penguins, with seven species, all of which are globally Threatened. Populations of Macaroni *E. chrysolophus* and Southern Rockhopper *E. chrysocome* have decreased sharply at South Africa's Prince Edward Islands since 1995. Reasons for these population decreases are poorly understood. PhD student Otto Whitehead has been working on Marion Island's crested penguins since 2012, tracking their movements during the breeding season and pre-moult period with GPS loggers, and over-winter movements with a combination of geolocators and PTTs (the latter in collaboration with DEA). Penguins, being flightless, are more spatially constrained than most other seabirds, and so must have reliable foraging areas within commuting distance of their breeding and moulting islands. We now have a good idea of where Marion's crested penguins forage year round, which is the first step to understanding how environmental change in the region is likely to affect their populations.

Similarly, numbers of Northern Rockhopper Penguins *E. moseleyi* at Tristan da Cunha and Gough Island have undergone marked decreases in the last 50 years. Post-doc Antje Steinfurth initiated a two-year project in 2012 to attempt to learn the causes of these population declines. She collected data on penguin diet and foraging ecology at Nightingale Island, one of the islands in the Tristan archipelago, and compared these data with information gathered by field teams on Gough Island. In 2013 she was joined on Nightingale Island by CB MSc student Rukaya Johaadien, who concentrated on penguin breeding biology, freeing Antje to focus on their foraging ecology. In both years of the study, egg size and breeding success was greater and foraging effort lower on Gough Island, suggesting the population on Gough should be doing better than that on Nightingale. However, the Gough population appears to have declined more rapidly than that at Nightingale; it is possible that predation by Subantarctic Fur Seals *Arctocephalus tropicalis* at Gough is responsible for the faster decline at this island.

Highlights:

- Dominic Rollinson spent a month at sea testing the efficacy of Smart Tuna Hooks to reduce seabird bycatch in this fishery. The hooks significantly reduced seabird bycatch and were readily accepted by fishers.
- Plans are at an advanced stage to test hookpods, another new mitigation device which open at a predetermined depth, on a Korean longliner in 2015.
- Studies on the diving ecology of White-chinned and Grey Petrels *P. cinerea*, which facilitate bycatch of albatrosses by diving down to retrieve sinking hooks that can then be stolen by albatrosses, suggest that mitigation needs to protect baited hooks to at least 20 m.
- European Union ESASTAP funding was obtained to strengthen links with Yan Ropert-Coudert's group in Strasbourg. These funds paid for Pierre Pistorius and Otto Whitehead to attend the 5th Bio-Logging Symposium held in Strasbourg in 2014.
- Otto Whitehead published a note on pseudostalked barnacles attached to killer whales in South Africa.

Key co-sponsors

Agreement on the Conservation of Albatrosses and Petrels (ACAP); CNRS; European Union; Royal Society for the Protection of Birds; South African National Antarctic Programme; WWF Australia.

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Plastics in the ocean

Plastics are used in a plethora of applications because they are lightweight, durable, have excellent barrier properties and are relatively cheap. These properties also make inappropriately handled waste plastics a significant environmental threat. Plastic litter persists for many years, is readily dispersed by water and wind, and has been accumulating in the sea for decades. It entangles and is eaten by a wide diversity of marine fauna, killing them directly, or reducing their appetite. Concerns about 'microplastics' introducing persistent organic pollutants (POPs) into marine foodwebs, combined with the discovery of 'garbage patches' in all the main ocean gyres, has sparked renewed interest in the subject.

Peter Ryan has been studying the impacts of plastics on seabirds since the 1980s. Although he continues to monitor plastic ingested by seabirds, most of his recent research has focused on assessing the abundance and distribution of marine plastics, and understanding how plastics move through marine systems. His review paper on monitoring marine plastics, published in the *Philosophical Transactions of the Royal Society* in 2009, has been cited more than 200 times.

In 2012 Peter was invited to assist with top predator surveys in the Bay of Bengal aboard the French research vessel, the *Marion Dufresne*. With few seabirds in the region, but an abundance of marine litter, he devised a simple method for quantifying floating litter at sea, which was published in *Marine Pollution Bulletin* in 2013. This technique has been used on subsequent cruises to record the composition and distribution of floating debris off South Africa, resulting in papers on the South Atlantic garbage patch, the low density of plastics in the Southern Ocean, and contributed to a major review paper estimating the amount of litter drifting at sea globally, led by Marcus Eriksen.

A Kelp Gull nest with plastic bags, probably regurgitated by incubating adults. (Photo: Peter Ryan)

To gain a better idea of long-term trends in larger litter items, Applied Marine Science (AMS) MSc student Annerie Lamprecht compared daily litter accumulation rates at Milnerton and Koeberg beaches, north of Cape Town. Predictably, there was much more litter on Milnerton Beach, close to the city centre, than at Koeberg, more distant from the city. Annerie's study repeated surveys made by CB MSc student Debbie Swanepoel in 1994, and showed that despite attempts to reduce littering, the growth in the amount of litter has greatly outstripped Cape Town's population growth rate. These studies also resulted in a paper on the effect of sampling frequency on estimates of beach litter accumulation rates. Another AMS MSc student, Antoni Massot Mascaro, studied the abundance of litter in the surf zone of False Bay. He showed that there were consistently higher densities of litter towards the head of the bay, but that the amount of litter varied enormously on a daily basis. Most litter was very small fragments that appeared to have been in the sea for some time, and days associated with very high litter loads occurred when there was localized upwelling, suggesting that there is a large pool of submerged plastic on the sea bed in False Bay.

More recently, in 2014, CB MSc student Francesca Fazey conducted field trials to test the importance of plastic size and buoyancy on the time taken for biofouling to cause litter items to sink. This project arose from observations at sea which suggested that only relatively large and/or buoyant litter items were observed far from major land-based litter sources, suggesting that small items with little inherent buoyancy sink more rapidly to the sea floor. Surveys of

Litter densities at sea in the Straits of Malacca, off Malaysia, are among the highest recorded anywhere in the world. (Photo: Peter Ryan)

newly-stranded beach litter conducted at various distances from Cape Town confirmed this pattern. Francesca's fouling trials showed the predicted relationship between the volume of a plastic object and the time taken to sink, providing a plausible mechanism for the millions of tons of 'missing' litter reported by surveys of floating litter. Her results also suggest that there is much more litter on the sea floor or suspended in mid-water than previously suspected.

And finally, MSc student Minke Witteveen included a chapter in her thesis on the presence of plastics in the nests of Kelp Gulls. She found plastics in the nests of gulls at all eight colonies surveyed, but the amounts and types differed among colonies. Nest plastics come from two sources: those used by the gulls in nest construction – typically at beach colonies where there is little natural material for construction – and those brought with meals fed to chicks that accumulate in the nest as the breeding season progresses. Elsewhere, researchers have advocated using plastics in nests as a tool to track the abundance of marine litter, but Minke's study shows that to do so you need a thorough understanding of the factors resulting in plastics reaching nests.

Highlights

- Peter Ryan was a member of the United Nation's GESAMP Working Group 40, set up to assess the impact of microplastics on ocean health. He attended a week-long workshop held at the IMO head offices in London in 2013, and the group's final report will be released in early 2015.
- Leading expert in POPs, Prof. Hideshige Takada from the Tokyo University of Agriculture and Technology, visited Cape Town during November and December 2013 to collect samples and discuss further collaboration. We supplied him with preen gland oil and adipose tissue from a range of Southern Ocean seabirds to assess the prevalence of plastic-related POPs in these birds.
- Annerie Lamprecht was awarded her AMS MSc in 2013 for her study of changes in litter accumulation rates at two Cape Town beaches over the last two decades.
- Peter has been invited to contribute chapters to two books on marine plastics: a concise history of marine plastics research for a book on *Marine Anthropogenic Litter* (to be published in April 2015), and one on ingestion of plastics by marine vertebrates for a book to be titled *Hazardous chemicals associated with plastics in the environment* (due for release in 2016).

Research team
Prof. Peter Ryan (PFIAO)
Marcus Eriksen (5 Gyres)
Assoc. Prof. Coleen Moloney (MaRe, UCT)
Prof. Hideshige Takada (Tokyo)

Students: Francesca Fazey (CB MSc), Annerie Lamprecht (AMS MSc), Antoni Massot Mascaro (AMS MSc)

Conserving islands and their birds

Islands, especially those that have never been connected to a continental landmass, hold a disproportionately large amount of terrestrial biodiversity, yet are among the most sensitive of terrestrial ecosystems. Island ecosystems are particularly vulnerable to introduced species, requiring strict controls on the import of people and materials. The arrival of man and his commensals has had catastrophic impacts on island biotas: more than 90% of recent avian extinctions have been of island birds. Islands are key breeding sites for seabirds and often support endemic landbirds. These birds are flagships for the conservation-management and restoration of island ecosystems.

Cats and mice on Marion 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 in the newly-established weather station. The cats soon turned feral, and by the 1970s some 2 000 cats killed an estimated 450 000 birds (mainly burrowing petrels) each year. Efforts to eradicate the cats finally succeeded in 1990, so the petrel population has had more than two decades to recover. Depending on the extent of immigration from nearby Prince Edward Island (which remains free of introduced mammals), we would expect the petrel populations to have increased 4-40 fold over this period. However, MSc student Mia Cerfonteyn confirmed that Marion Island's Subantarctic Skua *Stercorarius antarctica* population has roughly halved since cats were eradicated, contrary to expectations that they should increase as their petrel prey recovered. Petrels stlll comprise less than one third of skua diet on Marion, similar to the situation in 1989, and in stark contrast to Prince Edward Island, where petrels comprise about 96% of skua diets.

MSc student Ben Dilley repeated Mike Schramm's 1979 petrel transects on Marion Island to assess how petrels have recovered since the height of the cat era. He found that there have been at best modest recoveries of burrowing petrel populations since the eradication of cats, with White-chinned Petrels *Procellaria aequinoctialis*, the only threatened species surveyed, showing the strongest increase. The rate of population recovery is related to petrel body size (large species recovering more than small species) and breeding season (summer breeders recovering more than winter breeders). This mirrors patterns of breeding success at Gough Island, where mice are serious predators of petrel chicks. Although there was no direct evidence of mouse predation on petrels in monitored nests at Marion during the last three years, there was circumstantial evidence of mouse attacks on Blue Petrel *Halobaena caerulea* chicks, and mice were recorded to eat Blue Petrel eggs at Marion in the 1980s. We strongly suspect that mice are the cause of the slow recovery of petrel populations on Marion Island. We shall assist in assessing the feasibilty of eradicating mice from Marion during the 2015 relief visit.

Mice cause havoc on Gough Island

In 2000/01, Post-doc Richard Cuthbert suspected that mice were killing Tristan Albatross *Diomedea dabbenena* chicks on Gough Island. Subsequent studies by then PhD student Ross Wanless confirmed that mice are significant predators of seabird chicks, especially the winter breeding species. Tristan Albatrosses and Gough Buntings *Rowettia goughensis* were listed as Critically Endangered and Atlantic Petrels *Pterodroma incerta* as Endangered, making Gough a top priority for restoration. This stimulated a slew of research into the feasibility of eradicating mice from the island. During the review period, helicopter bait drops were conducted to assess bait retention rates on steep vegetated slopes, which is a significant concern given the very rugged terrain on Gough (published in *Conservation Evidence*). Richard Cuthbert also published papers summarising the impacts of mice on burrowing petrels in *Bird Conservation International* and albatrosses and giant petrels in *Antarctic Science*.

Ben Dilley and Delia Davies spent 2013/14 on Gough Island and confirmed mouse predation on several more species of burrowing petrels. Predation reached record levels in 2014; breeding success of Tristan Albatrosses fell below 10% for the first time in 2014 (typically 60-70% in the absence of predators) and there was complete breeding failure among monitored nests of both prion species. Ben and Delia put considerable effort into filming mouse attacks to learn more about how mice actually kill chicks. They discovered several instances of mice eating petrel eggs, which is alarming because many petrels temporarily leave their eggs during incubation, leaving them vulnerable to attack. Mice struggled to bite into larger eggs, but eggs of species up to the size of Great Shearwaters *Puffinus gravis* were eaten. Mouse predation on petrel chicks was somewhat erratic in summer, but was ruthlessly efficient in winter, when other food sources are scarce. All seven Atlantic Petrel chicks that hatched in nests monitored by burrow cameras were killed within 24 hours of hatching, despite the presence of their parents in the nest. Nest cameras also found that mice were the primary cause of death of Tristan Albatross chicks, despite the large size discrepancy between predator and prey. It had been assumed that many albatross chicks were killed by giant petrels (*Macronectes spp.)* after being weakened by mice, but the camera footage showed attacks by only a few mice over 2-3 nights were sufficient to kill chicks outright. This footage has proved valuable in convincing the RSPB to push forward with plans for an eradication attempt in winter 2018; a final decision on this will be made by the RSPB council in June 2015.

Ben Dilley and Delia Davies filmed a series of heart-wrenching incidents of House Mice killing Tristan Albatross chicks. Their video on the impacts of mice on Gough Island has helped convince the RSPB to move forward with an eradication attempt.

Highlights:

- Mia Cerfonteyn was awarded her MSc on the status of Subantarctic Skuas on Marion Island.
- Ben Dilley and Delia Davies obtaining high-quality video footage of mice killing petrel and albatross chicks on Gough Island. This footage is invaluable for garnering support for the call to eradicate mice from the island, and particularly in mobilising public support for such an effort.
- Ben Dilley made the first detailed population estimate of Grey Petrels on Gough Island.
- Blue Petrels were discovered breeding on Gough Island, 800 km farther north than their previous northern limit.
- Genetic data suggest that the newly discovered prion breeding on Gough Island is sister to the little-known Macgillivray's Prion, which survives as a tiny relict population on an offshore stack at St Paul Island in the central Indian Ocean, having been extirpated from St Paul and Amsterdam.
- The impacts of introduced scale insects and associated sooty mould on *Phylica* trees, and the likely knock-on effects on large-billed *Nesospiza* finches at the Tristan archipelago was published in *Biological Conservation.*
- A new herbicide treatment regime appears to be containing invasive weed *Sagina procumbens* on Gough Island.

Key co-sponsors

Agreement on the Conservation of Albatrosses and Petrels; BirdLife International; Royal Society for the Protection of Birds; South African National Antarctic Programme; UK Overseas Territories Environment Programme.

Research team

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Dr Richard Cuthbert (RSPB)
Trevor Glass (Tristan Conservation Department)
Dr Ross Wanless (PFIAO HRA and BLSA)

Students: Mia Cerfonteyn (MSc), Ben Dilley (MSc), Heinz Ortmann (CB MSc)

Research assistants: Chris Bell, Mara Nydegger (2012/13), Delia Davies, Ben Dilley (2013/14), Michelle Risi, Chris Jones, Werner Kuntz (2014/15)

Climate change and fynbos birds

South Africa's Cape Floral Kingdom, centred on the fynbos biome, is one of the planet's smallest biodiversity hotspots. We are studying the six birds endemic to mountain fynbos, using insights from global change biology, epidemiology, stress ecology and conservation biology, to try to ensure the long-term future of the biome and its birds.

This research programme started in 2008 as part of the Fitz's Climate Vulnerability and Adaptation Programme to assess how fynbos birds are affected by a complex web of challenges. Key questions include:

1. How vulnerable are fynbos endemic birds to climate and land use change (including fire)?
2. Do endemic birds disperse across transformed ecosystems?
3. Is there genetic evidence for large-scale paleo-dispersal?
4. Does urbanization influence adaptation options and survival traits for birds?
5. Are spatial, phenotypic or population changes consistent with climate change predictions?
6. How can conservation planning and manage-ment help birds to adapt to global change?

The research team, led by Fitz HRA Dr Phoebe Barnard from the South African National Biodoversity Institute (SANBI), includes ornithologists, pollination ecologists, population and stress ecologists, behavioural ecologists, spatial modelers, epidemiologists, a veterinarian and a network of volunteer observers, assistants, and bird-ringers. The establishment of marked populations is bearing fruit in terms of resightings and recaptures, allowing us to start building a detailed picture of their population ecology, behaviour, movements and phenology.

Stress, climate and urbanization

Beth Mackay's MSc thesis within UCT's African Climate and Development Initiative (ACDI), assessed how stress parameters and an invasive disease in Cape Sugarbirds *Promerops cafer* was linked to urbanization and climate change. Urban environments pose novel challenges and opportunities for birds. Birds can seek refuge in urban gardens during fires, hot, dry winds, or rainstorms, but are exposed to novel predators, pathogens and other stressors. We used a range of stress indicators, including feather bars, asymmetry in body size and feather growth, and infection rates by *Knemidocoptes* mites and avian pox. These contagious pathogens are potentially facilitated by warm temperatures, birdbaths and bird feeders.

Highlights

- Beth Mackay's work on stress ecology, climate and urbanization is being prepared for publication.

Pollination mutualisms and vulnerability

Our work on plant-pollinator relationships is central to understanding vulnerability of both plants and birds, as well as their coevolutionary histories. Anina Heystek upgraded her MSc thesis to a PhD in 2013, and plans to submit in late 2015. She is exploring Orange-breasted Sunbird *Anthobaphes violacea* pollination as a driving force in the radiation of *Erica*, and the reliance of sunbirds and sugarbirds on urban resources in the Cape Town area.

Highlights:

- Anina Heystek's experiments on poly-morphic *Erica perspicua*, published in *Evolutionary Ecology,* showed that sunbird preferences for pink flowers did not translate into higher plant fitness.

The landscape overview for conservation

Fruitful collaborations with Durham and Cambridge universities have modeled the palaeohistory of the Quaternary period to infer the

Fynbos fires have become more frequent over the last 40 years. (Photo: Peter Ryan)

stability of the Cape centre of diversity through ecological time. We are looking both backwards and forwards to understand the limits of dispersal and gene flow, the latter as an emerging collaboration with Dr Jacqui Bishop, in framing species' current options for climate change adaptation. We defined the biophysical limits on fynbos endemics' ranges based on studies in the Cape Peninsula, Kogelberg, Hottentots-Holland, Langeberg and Outeniqua Mountains, and Baviaanskloof.

All six fynbos endemics are vulnerable to direct or indirect influences of climate change. Cape Sugarbird, Orange-breasted Sunbird and Victorin's Warbler *Cryptillas victorini* prefer tall, structured vegetation, threatened by increased fires and a drying climate. Cape Rockjumper *Chaetops frenatus*, Protea Seedeater *Serinus leucopterus* and Cape Siskin *Serinus totta* all prefer high altitudes, suggesting they are temperature limited.

In 2013, our programme joined forces with the Hot Birds desert birds and climate change team to co-supervise Robyn Milne's CB MSc project. Robyn determined species' physiological responses to temperature. Inflection points for evaporative water loss, an index of thermal stress, occurred at the lowest temperatures for the Cape Rockjumper. Atlas records suggest that Rockjumpers have declined, despite the expectation that this species should benefit from increased fire frequency and insect activity associated with warmer conditions. In response to Robyn's findings, we have initiated a behavioural and territory mapping project on this species to see how small-scale movements, foraging and provisioning change with rising temperature. This project is being carried out by an MSc student, Krista Oswald, based at NMMU and co-supervised by the Fynbos and Hot Birds teams.

Long-term SAFRING ringing records show that female Cape Sugarbirds weigh less in hot years. In 2015, CoE funded MSc student Jerry Molepo, (based at NMMU but co-supervised at the Fitz), will investigate how gender differences in foraging strategies may account for this, and whether males and females differ in their physiological responses to hot weather. Robyn's, Krista's and Jerry's projects are covered in more detail in the Hot Birds section of the Annual Report.

Meanwhile, our data suggest that Protea Seedeaters may be vulnerable to large-scale, frequent fires which compromise food and nesting resources, but benefit from small fires that trigger the release of protea seeds. The good news is that occupancy modelling shows that this species is difficult to detect, and may be more widespread than thought.

Highlights

- Former MSc student Loic Chalmandrier led a paper on fire impacts in *Acta Oecologica.* Alan Lee and Phoebe Barnard published papers on fynbos bird abundance in *Bird Conservation Intenational* and *African Zoology*. Papers on palaeoclimate change and demography were published in *Ibis*, *Global Ecology and Biogeography* and *Journal of Biogeography*

Key co-sponsors

SANBI; UCT Research Committee, National Research Foundation, Leverhulme Foundation, BirdLife South Africa

Research team

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Dr Res Altwegg (Statistical Sciences, UCT)
Dr Wendy Anneke (SANParks)
Dr Jacqueline Bishop (Biological Science, UCT)
Dr Mark Brown (Nature's Valley Trust)
Marie-Pascale Colace (CNRS, Grenoble)
Dr Yvonne Collingham (Durham)
Dr Susie Cunningham (Post-doc, PFIAO)
Dawie de Swardt (National Museum Bloemfontein)
Dr Brett Gardner (Johannesburg Zoo)
Dr Sjirk Geerts (CPUT)
Prof. Rhys Green (Cambridge; RSPB)
Dr Brian Hole (Conservation International; Durham)
Prof. Brian Huntley (Durham)
Dr Emily Lane (National Zoo, Pretoria)
Dr Alan Lee (Post-doc SANBI/PFIAO)
Giorgio Lombardi (Vogelgat Nature Reserve)
Dr Martine Maron (Queensland)
Prof. Guy Midgley (SANBI/Stellenbosch)
Bongani Mnisi (City of Cape Town, Stellenbosch)
Prof. Anders Pape Møller (Université de Paris-Sud)
Assoc. Prof. Anton Pauw (Stellenbosch)
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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. Although most work is focused on bird communities of the southern Kalahari Desert, the project has recently expanded to consider Fynbos birds as well as desert birds in the southwest United States of America and Australia.

Hot Birds research focuses on the links between temperature, behaviour and physiology, including how temperature affects fitness in breeding birds. During 2013-14, the project expanded in exciting new directions thanks to a large grant from the US National Science Foundation (NSF). This grant facilitated research into the physiological bases of interspecific variation in the temperature-dependence of heat-dissipation behaviour, in Kalahari birds. It also allowed team members to spend six weeks in the Sonoran Desert collecting behavioural data.

Fitness and the importance of behaviour

A major Hot Birds research theme is to understand how high temperature affects individual fitness, hence influencing population persistence. Post-doc Susie Cunningham published two papers in *PLoS ONE* in 2013, reporting threshold temperatures above which birds struggle to maintain their breeding success and body mass, both proxies for fitness. The second of these papers related thresholds to recent temperature trends in South Africa, highlighting high risk areas and potential climate refugia for birds.

Current work aims to identify how temperature-related fitness impacts are mediated by changes in bird behaviour. In 2013, CB MSc student Phenias Sadondo analysed behavioural data of breeding Southern Fiscals *Lanius collaris*. Most nest-attendance work is by females in this species, but Phenias found that males start to shade nestlings when air temperatures exceed 35°C. Increased nest attendance by males is not compensated for by increased provisioning effort by females, and net provisioning rate decreases on hot afternoons. In addition, nestlings spent increasing amounts of time panting as temperatures increased, suggesting they experienced increased energy and water costs of thermoregulation. These costs, combined with reduced provisioning by parents, likely underlie observed reductions in nestling body mass gain on hot days.

A male Southern Fiscal surveys the landscape from a high, sunny perch. Such perches are preferred as hunting posts by this species, but are highly exposed to solar radiation. On hot afternoons, temperatures on these perches can be more than 4°C higher than similar locations in the shade. (Photo: Matthew Schurch)

In Southern Fiscals, male nest-provisioning reduces with increasing temperature, even when males do not take up nest-shading duties. To understand the mechanism behind this, Susie Cunningham analysed data on Southern Fiscal foraging and microsite use. She found that breeding males preferred to use high, sunny perches for pouncing on prey from above, and that low and shaded perches were normally avoided. Additionally, foraging success was significantly higher from high, sunny perches, than from any other perch type. However, temperatures at high sunny perches were 3-4°C hotter than shaded perches, and this difference was largest on hot afternoons. At these times, Southern Fiscals switched preference to high, shaded perches, simultaneously suffering a reduction in foraging success, and reducing the amount of food provided to the nest. This provides an example of the costs of behavioural thermoregulation, which have the potential to affect species' fitness under climate change.

Susie has a manuscript in press for the Phil Hockey Memorial Issue of *Ostrich* on this topic.

PhD student Tanja van de Ven continued data collection on the effect of high temperatures on the breeding performance of Southern Yellow-billed Hornbills *Tockus leucomelas* in the Kalahari. Yellow-billed Hornbills are cavity nesters. The female seals herself inside the nest, and the male is solely responsible for providing food to the female and chicks. Tanja found that male hornbills increase use of shaded microsites as temperatures increase. As with Southern Fiscals, these shaded sites limit foraging opportunities, leading to lower nest-provisioning rates. At temperatures > 35°C, nest-provisioning is halved. Hornbill chicks hatch asynchronously and food allocation to the chicks is done by the female inside the nest. Daily body mass changes of females and chicks suggest that the first born chick receives a constant food supply irrespective of temperature. In contrast, body mass of the second- and third-hatched chick is heavily influenced by temperature, as is the female's body condition.

The Hot Birds project works on the links between behavioural thermoregulation and fitness highlights the importance of thermal biology in understanding patterns of animal behaviour. In August 2014, Susie Cunningham and former Hot Birds Post-doc Rowan Martin organised a symposium on this topic at the prestigious International Society for Behavioural Ecology (ISBE) congress in New York City, USA. They were able to attract speakers from the Netherlands (Dr Samuel Caro), Canada (Dr Louise Barrett), USA (Dr Steve Oswald) and UK (Dr Tom Mason) as well as South Africa (Dr Andrea Fuller); giving rise to a successful and international session. Susie, Rowan and Tanja van de Ven all presented talks as part of this symposium.

Robyn Milne's CB MSc project found that Cape Rockjumpers are particularly susceptible to high temperatures. (Photo: Peter Ryan)

During 2014, two new CB MSc students joined the 'Hot Birds' programme: Salamatu Abdu and Binah Motlogelwa. Salamatu assessed whether birds' use of water points in the Kalahari can be altered by providing artificial shade during the heat of the day. Binah is using SABAP data and publically available climate data to assess whether any of South Africa's endemic bird species show evidence of responding to recent climate change.

Hot Birds in the Fynbos

In 2013, the Hot Birds team made its first foray into the Fynbos, joining forces with Climate Change and Fynbos Birds team members Dr Alan Lee and Dr Phoebe Barnard. Alan, Susie and Dr Ben Smit (formerly of the Hot Birds project, now lecturing at NMMU) collaborated to co-supervise CB MSc student Robyn Milne. Robyn used field respirometry techniques to investigate physiological thermal tolerances of the six Fynbos endemic passerines, and six non-endemic passerines which include the Fynbos within their ranges. Robyn worked at Blue Hill Nature Reserve in the Baviaanskloof and processed an astonishing 101 birds over 80 days of field work. She discovered that thermal tolerances of Fynbos birds varied with body size, such that larger birds had lower temperature thresholds for evaporative water loss than smaller birds. She also showed that Fynbos birds, especially the Cape Rockjumper *Chaetops frenatus*, had lower thermal tolerances than similar-sized species from other regions of the world. Comparisons of SABAP1 and SABAP2 data for Cape Rockjumpers show that this species has declined most in areas of its range that have undergone significant climate warming. These data, together with Robyn's study, provide clear evidence of the vulnerability of this species to further climate change. Robyn graduated in 2014, and currently has a paper under review with *Conservation Physiology* on these results.

'Fynbos Hot Birds' is set to expand in 2015 with two new MSc students joining Ben Smit's group at NMMU. They will be co-supervised by Susie Cunningham and Alan Lee. Krista Oswald

will investigate behavioural mechanisms linking Cape Rockjumpers to their restricted climate envelope, as well as detailing further their thermal physiological limits. Jerry Molepo will investigate behavioural and physiological differences between male and female Cape Sugarbirds *Promerops cafer* in an attempt to understand why female sugarbirds show reduced in body mass in hot years (resulting in generally smaller females as the climate warms), but males do not (as indicated by SAFRING data).

Highlights

- CB MSc students Phenias Sadondo and Robyn Milne graduated in April 2014, Robyn with distinction.
- Tanja van de Ven was awarded best student presentation at the BLSA/Fitz 'Learn About Birds' Conference in the Drakensberg, March 2014.
- Robyn Milne was awarded best poster at the Biodiversity Southern Africa Conference, Cape Town 2013.
- Susie Cunningham and Rowan Martin organised a symposium on the importance of thermal biology in animal behaviour at the ISBE congress in New York, August 2014.
- Susie Cunningham published two papers in international open access journal *PLoS ONE,* and together with Rowan Martin has two more in press with *Ostrich*.

Thermoregulation in the heat

A second major research theme of Hot Birds focuses on physiological mechanisms that allow birds in hot environments to maintain their body temperatures below environmental temperatures. In 2013-14, this collaborative project, involving the research groups of Andrew McKechnie (Univ. Pretoria), Blair Wolf (Univ. New Mexico) and Todd McWhorter (Univ. Adelaide), yielded detailed physiological data for ~45 species from the Kalahari Desert, the Sonoran Desert of North America, and the deserts of South Australia. These data, which are currently being written up for publication, provide unprecedented insights into how avian heat tolerance and evaporative cooling capacity varies with body mass, phylogenetic affiliation and ecological variables. MSc student Maxine Whitfield spent two summers in the Kalahari collecting data as part of this project, and recently completed her MSc, with distinction.

A Rufous-cheeked Nightjar on a Kalahari sand dune at night. This species, like many nightjars, spends the day roosting in exposed locations where birds may be subjected to very high environmental temperatures. Ryan O'Connor's PhD project is focussing on the physiological mechanisms that allow them to avoid lethal hyperthermia and dehydration. (Photo: Justin Boyles)

PhD student Ryan O'Connor is currently investigating thermoregulatory capacity in two southern African nightjar species, Rufous-cheeked Nightjars *Caprimulgus rufigena* and Freckled Nightjars *Caprimulgus tristigma*. Like many nightjars, these species roost and nest on the ground in microsites without shade, therefore experiencing high levels of solar radiation and high environmental temperatures, often far above body temperature. The physiological challenges these birds face are compounded by the fact that they take in virtually no water between sunrise and sunset. Ryan aims to understand how nightjars avoid lethal hyperthermia and dehydration during very hot weather, and evaluate their vulnerability to higher temperatures in the future.

During 2013/2014, Matthew Noakes collected data for his MSc on thermoregulatory responses of White-browed Sparrow-weavers *Plocepasser mahali*, at three sites with different seasonal air temperature extremes. To our knowledge, this is the first study to quantify intraspecific variation in avian heat tolerance and evaporative cooling capacity at high air temperatures. Matthew found significant variation correlated with air temperature maxima at both intra- (between seasons) and inter-population (across different geographical locations) levels. He also collected data on summit metabolism and basal metabolic rate, making his one of the few studies to investigate these variables in a subtropical bird.

Validating a behavioural index of avian sensitivity to heat stress

Before his untimely death in January 2013, Prof. Phil Hockey co-wrote a funding application to the US National Science Foundation with Andrew McKechnie. In mid-2013, we received the exciting news that this application had been successful. The project aims to assess the use of a behavioural heat-dissipation index as a proxy for species' vulnerability to rising air temperatures. During the summer of 2013/14, PhD student Michelle Thompson housed birds in large outdoor aviaries in the Kalahari and examined the functional links between heat dissipation behaviour, activity patterns, body temperature and hydration status on days differing in maximum air temperature. Preliminary data from the first field season suggest that heat dissipation behaviour of captive birds is very similar to wild individuals of the same species. Michelle's results also suggest that during periods when air temperatures are high and water is scarce, birds limit heat dissipation behaviours associated with evaporative water loss i.e. panting, reduce activity levels dramatically and allow their body temperature to escalate. The first season focused on three species, Fawn-coloured Larks *Calendulauda africanoides*, Sociable Weavers *Philetairus socius* and African Red-eyed Bulbuls *Pycnonotus nigricans*. Further work will assess whether these findings are similar in species differing in phylogeny, foraging guild and body mass.

During June/July 2014, Michelle Thompson and Nick Pattinson (BSc Hons) spent six weeks in Arizona, collecting behavioural data for a bird community in the Sonoran Desert. These data, combined with the comparable data sets from the Kalahari and Western Australia, provide a global picture of avian heat dissipation and the ecological correlates of interspecific differences in heat dissipation responses. Michelle and Nick worked with Blair Wolf and his students at a number of sites in southern Arizona, including Organ Pipe Cactus National Monument, and returned to South Africa with a sizable data set, which Nick analysed and wrote up.

Highlights:

- Ben Smit was awarded his PhD from the University of Pretoria in 2013. His thesis title was *Taking the heat: integrating behavioural and physiological variables to predict avian responses to climate change in the Kalahari Desert.* Ben has since taken up a lectureship in the Department of Zoology at NMMU.
- Matthew Noakes, Ryan O'Connor, Blair Wolf and Andrew McKechnie presented papers at the 31st Annual Meeting of the Australia and New Zealand Society for Comparative Physiology and Biochemistry, held in Armidale, Australia in December 2014. Matthew won an award for best Honours/MSc student presentation.
- Michelle Thompson and Nick Pattinson spent six weeks in the Sonoran Desert in Arizona, collecting behavioural data for a North American desert bird community.

Alamo Canyon in Organ Pipe Cactus National Monument, Arizona – one of the field sites where University of Pretoria Honours student Nick Pattinson and PhD student Michelle Thompson collected behavioural data in 2014. (Photo: Andrew McKechnie)

Key co-sponsors

National Science Foundation, USA; University of Cape Town Research Committee.

Research Team

Prof. Andrew McKenzie (CoE Core Team member, University of Pretoria)
Dr Susie Cunningham (Post-doc, PFIAO)
Dr Blair Wolf (New Mexico)
Dr Todd McWhorter (Adelaide)
Dr Alex Gerson (Massachusetts)

Students: Ryan O'Connor (PhD, Pretoria), Ben Smit (PhD, Pretoria), Michelle Thompson (PhD, Pretoria), Tanja van de Ven (PhD), Matthew Noakes (MSc, Pretoria), Maxine Whitfield (MSc, Pretoria), Salamatu Abdu (CB MSc), Robyn Milne (CB MSc), Binah Motlogelwa (CB MSc), Phenias Sadondo (CB MSc), Nick Pattinson (BSc Hons, Pretoria)

Research Assistants: Craig Kenny, Pauline Ruffenach, Sue-Joy Schultz, Tim Vink, Josephine Bruning, Dean Portelli, Ryno Kemp, Pieter Erasmus, Alexandra Howard

Ducks, dispersal and disease

In this programme we use water-associated bird models to understand complex inter-relationships between landscape heterogeneity, wetland dynamics, the movements of waterfowl, the bird communities in which our study species occur, and the occurrence 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. Despite decades of ringing and counting efforts, little is known about the causes and consequences of the long-distance movements of most southern African ducks.

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. If a virulent pathogen such as the H5N1 strain of avian influenza were to enter southern Africa, how far and how fast could wild birds carry it? Just how worried should people 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. Tracking data for Red-billed Teals *Anas erythrorhyncha* and Egyptian Geese *Alopochen aegyptiaca* have allowed us to address questions of habitat selection, environmental drivers and scales of waterfowl movement. Our results highlight the importance of agricultural habitats in meeting the life history needs of ducks. We can also test how these birds balance trade-offs between using habitats that are safe from predators and those that provide high quality forage. Rainfall and primary productivity seem to be the dominant environmental drivers of both teal and goose movements.

We can also investigate the influence of the composition of bird communities on the prevalence of avian malaria (*Plasmodium* and *Haemoproteus*). These blood parasites infect a wide range of bird species but the community dynamics of infection patterns are poorly known. One of the challenges is to summarise the community in a way that makes sense for the

An Egyptian Goose being swabbed for avian influenza. (Photo: Chevonne Reynolds)

epidemiology of the parasite – grouping birds according to their capacity to introduce or maintain the disease. Fundamental questions on the relative importance of birds' life-history traits (e.g., reproductive rate, development rate, lifespan) and behaviour (e.g., foraging, roosting and movement ecology) in explaining differential infection risks of bird species are being investigated. We have also used network analysis to assess the vulnerability of the Ostrich *Struthio camelus* production network to outbreaks of avian influenza.

Extending our focus beyond disease, we have investigated how waterbird movement may affect other aspects of aquatic ecology. Waterbirds often disperse propagules of aquatic plants and invertebrates, which is important for colonising isolated aquatic systems and for maintaining genetic continuity among populations. Samples collected from multiple waterbird species across three wetland sites in South Africa confirm that waterbirds have a high capacity for dispersing seeds and invertebrates either transported attached to feathers or passing through the gut. In some cases over 80 seeds have been germinated from a single faecal sample. We have also conducted experiments with captive waterbirds to gauge the time taken for seeds to pass through the digestive tract and which seed traits facilitate their survival through the gut. Dispersal of aquatic invasive species by

waterbirds is plausible (especially for invertebrates) and has to be considered when managing these invasive species.

Highlights:

- Sharon Okanga found that climate, land cover and the bird community affect infection prevalence in avian malaria in wetland passerines in the Western Cape. Sharon graduated in June 2013 and has so far published four of her PhD thesis chapters.
- Dominic Henry upgraded his MSc to a PhD and completed the fieldwork component of his study. This involved counting waterbirds every two months over a 16-month period, at 70 locations across the Pongola Flood-plain and Lake St. Lucia. He has analysed our telemetry data to explore spatiotemporal variation in community-level patterns in the KZN data. He expects to submit his PhD thesis in mid-2015.
- Chevonne Reynolds has collected faecal samples and feather brushings from nearly 1 000 ducks, finding large numbers of germinating seeds. From field studies, Chevonne has identified 49 plants which can potentially be dispersed by waterbirds. She has collaborated with Dr Nelson Miranda (NMMU) to produce a review paper of the role of waterbirds in the dispersal of alien aquatic organisms (manuscript now in its second round of review at *Diversity and Distributions*). She should complete her thesis in 2015.
- In July 2013, Eléonore Hellard started a Post-doc on the influence of bird community composition on avian malaria prevalence. She developed epidemiological functional groups that can predict avian malaria prevalence in four communities of wetland-associated birds in southern Africa (manuscript under review in *Ecology*). Eléonore also showed that communities rich in ecological functions favour disease.
- Jordan-Laine Calder completed her CB MSc project on weaver movements, based on Dr Dieter Oschadleus' long-term ringing data, which showed that weavers move easily through the urban matrix. This research is currently being revised for *Biological Conservation*. Jordan-Laine graduated in June 2014.
- Graeme Cumming took ten students from the waterbirds and protected areas programmes to present papers at the 'Resilience 2014' conference in Montpellier, France. Dominic Henry also presented his work on duck movements at the Ecological Society of America meeting in August 2014.

The Barberspan waterbird ringing team at work (Photo: Chevonne Reynolds)

Leman minuta on a Yellow-billed Duck at Strandfontein. (Photo: Chevonne Reynolds)

Key co-sponsors

National Research Foundation; University of Cape Town Research Committee

Research team

Prof. Graeme Cumming (PFIAO)
Dr Celia Abolnik (Onderstepoort Veterinary Inst.)
Dr Alexandre Caron (Cirad, Harare)
Dr Nicolas Gaidet (Cirad, Montpellier)
Dr John Grewar (Veterinary Services, Elsenburg)
Dr Eléonore Hellard (Post-doc, PFIAO)
Prof. Jeffrey Peters (Wright State Univ. Ohio, USA)
Dr Ricky Taylor (Ezemvelo KZN Wildlife)

Students: Dominic Henry (PhD), Sharon Okanga (PhD), Chevonne Reynolds (PhD), Jordan-Laine Calder (CB MSc) Marcela Espinaze (CB MSc)

Research Assistants: Christine Moore, 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 are 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.

Protected area managers interact with one another in terms of exchanging information, resources, or even wildlife, thereby forming a protected area network. Ecological theory suggests that intermediate connectivity between protected areas will increase their resilience by facilitating dispersal, recolonisation and genetic mixing. In a similar manner, socioeconomic interactions between managers should enhance the spread of effective management strategies and the sharing of scarce resources.

In recent times, South Africa has seen the rise of an intriguing phenomenon: protected areas on private land. Such private reserves make up a significant portion of the country's conservation estate. Additionally, private communities are being awarded ownership over land in many erstwhile state-owned protected areas as part of the country's restitution programme. Thus, it is important to understand the dynamics and functioning of privately-owned protected areas; their rise and fall, their overall contributions to the national biodiversity estate and their contribution to the sustainability and resilience of our protected area network.

Private protected areas, unlike public reserves, receive minimal institutional funding and are therefore dependent on private funds and/or ecotourism, hunting and game breeding enterprises to generate the income necessary for their persistence. Little is known about the economic objectives of private reserves or how these objectives influence reserve management (e.g. the types of business models employed and their impact on species stocking rates, tourist number management etc.). By quantifying and modelling the interactions between economic incentives and ecological management, we can explore the implications for private protected area resilience.

Can we rely on private nature reserves to support biodiversity conservation over the next 50-100 years? Can we predict where they will be successful and where they fail? 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 have adopted a comparative, spatially explicit, and network-based approach to analyse

Resilience expert, Prof. Buzz Holling, poses with Graeme and students at the 'Resilience 2014' conference in Montpellier. (Photo: Alta de Vos)

and understand the dynamics that drive pattern-process relationships relating to private protected areas.

Highlights:

- The programme received major funding from a Complexity Scholar award to Graeme Cumming from the James S. McDonnell Foundation, and an NRF Competitive Programme for Rated Researchers grant. This allowed the programme to grow rapidly, with several new students and Post-doctoral Fellows starting in 2012 and 2013:
  - 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.
  - Hayley Clements (PhD) is studying the conservation and economic objectives of private protected areas, and how their interaction influences long-term viability.
  - Kristi Maciejewski (Post-doc) explored the connections between private and statutory protected areas.
  - Alta de Vos (Post-doc) assembled a first comprehensive map of private protected areas in South Africa, and analysed the role of spatial variation (e.g. connectivity, location along gradients, context) on the numbers of tourists visiting SANParks. She also mapped the protected areas pending or settled under South Africa's land restitution programme. Alta accepted a junior lectureship at Rhodes University in mid-2014; we wish her luck in her new faculty position.
  - Zanne Labuschagne (CB MSc) received a distinction for her CB thesis on elephant movements in and around Zakouma National Park in Chad.
- John Heydinger graduated with an MSc in December 2014. His dissertation developed methods to measure the cultural ecosystem services of South Africa's birds. He is now pursuing a PhD at the University of Minnesota focusing on the development of scientific theories of species extinction as linked to social-ecological system concerns.
- Graeme and ten students from the protected areas and waterbirds programmes presented research papers at the 'Resilience 2014' Conference in Montpellier, France, and contributed three articles to a special feature in *Ecological Applications* on 'Protected areas as social-ecological systems'.
- With several collaborators from Germany, Graeme led a review paper that was published in *Nature*.

Key co-sponsors

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

Research team

Prof. Graeme Cumming (PFIAO)
Prof. David Cumming (PFIAO)
Dr Duan Biggs (Australian National University
Dr Oonsie Biggs (Stockholm Resilience Centre)
Dr Georgina Cundill (Rhodes University)
Dr Alta de Vos (Post-doc, PFIAO)
Marna Herbst (SANParks)
Dr Kristi Maciejewski (Post-doc, PFIAO)
Zaccheus Mahlangu (ZWA)
Judith Ament (Visiting Fox Fellow from Yale)
Dr Belinda Reyers (CSIR)
Dr Colleen Seymour (SANBI)
Prof. Jane Southworth (University of Florida)
Prof. Craig Allen (University of Nebraska)
Prof. Andreas Buerkert (University of Kassel)
Prof. Eva Schlecht (University of Kassel)
Prof. Teja Tscharntke (Uversityof Gottingen)
Prof. Stephan von Cramon-Taubadel (University of Gottingen)
Dr Ellen Hoffman (University of Kassel)

Students: Julia Baum (PhD), Hayley Clements (PhD), John Heydinger (MSc), Jenna Bowker (CB MSc), Zanne Labuschagne (CB MSc)

Research Assistants: Christine Moore, David Nkosi

Managing Egyptian Geese on golf courses

Human-wildlife conflict is increasing as humans usurp indigenous wildlife habitats or create novel habitats that attract wildlife. South African golf courses experience similar problems with Egyptian Geese *Alopochen aegyptiaca* as are experienced with Canada Geese *Branta canadensis* on golf courses in North America.

Although indigenous to the Western Cape, Egyptian Geese numbers have recently increased. Habitat choice is influenced by the presence of predators and visual obstructions which decrease perceived safety levels. Preferred habitats are at water bodies, particularly man-made dams, with open shorelines and unhindered view of the surrounding area. Predation risk is also influenced by group size, with less per capita vigilance required in large groups. Urbanization may further alter perceived predation risk, since natural predators are often scarce and open areas with open water are plentiful, thus geese experience safer conditions than in natural landscapes. South African golf courses are attractive to geese because large, irrigated grazing lawns are interspersed with artificial water bodies and predators are largely absent. The accumulation of goose faeces pollutes the greens and fairways which diminishes the aesthetic and recreational value of the area.

Assessing the issue

To assess perceptions towards Egyptian Geese, Reddam House Grade 12 scholar Jess Sutton surveyed the residents and members of the Steenberg Golf Estate, Cape Town. Most (84%) of the 548 respondents considered that geese were a problem on the estate. However, only 57% of non-golfers perceived geese as a problem, suggesting that the issue is more problem-specific to the golfers. Most golfers (87%) felt that the goose population requires active management. Overall, 86% of respondents considered that the goose population should be reduced by 50% or more.

Egyptian Geese are attracted to the large, irrigated grazing lawns and artificial water bodies of golf courses. (Photo: Richard Gie)

Traditional goose control methods can be non-lethal or lethal. Non-lethal methods have included visual and audio displays, including scarecrows, fake predators, flashing lights, bird alarms and fireworks. However, most have had little success because the geese soon become habituated to their presence. The use of trained herding dogs has proved to be more successful. However, trained dogs are expensive and have high maintenance costs. Relocation of geese to new habitats is also expensive and there are concerns that the geese will return to the site of capture, or will begin novel conflicts in other areas.

Lethal measures include egg addling and culling. However, the high mobility of the geese renders both relatively ineffective at the level of local populations. Furthermore, when geese abandon unsuccessful nests, they typically make a new nest and thus a repeated clutch. Shooting geese in residential areas is considered unethical, and while lethal methods are more cost-effective than non-lethal options, they are often deemed socially unacceptable. In general, the failure of most control methods is due to their short term efficacy, high cost or ethical unacceptability, with no long-term solutions to the problem. While it is not necessary to eliminate geese from a property, managing their numbers at a level where they are tolerated by managers and golfers may be important.

Dealing with the issue

Following the perceptions survey, Beth Mackay (BSc Hons) investigated the vigilance behaviour of Egyptian Geese at Steenberg and the attributes of various habitat features at ten golf courses in the

Western Cape to understand what makes them attractive to geese. Predation risk is reduced by being vigilant, which includes visual scanning to increase the probability of detecting a predator. Vigilance is greater in areas of increased predation risk and can act as a surrogate for the perceived safety of geese in their surroundings. Beth found that although goose vigilance levels were inversely related to group size, vigilance levels were lower in favoured 'hotspots' than in 'non-hotspots', independent of group size, confirming that certain habitat characteristics cause the geese to feel secure. Hotspots, where geese aggregate on a daily basis, and thus where goose faeces need to be removed most frequently, were defined by two predictable habitat features: distance to water (hotspots usually being <100m from water) and the size of open patches of lawn (favouring patches >1.5ha)

Golf course management should therefore shift from focusing on the birds themselves to reducing the number of favoured sites or to having favoured sites located in non-playing areas. Although water bodies adjacent to large, open lawns could be avoided when designing a golf course, poorly sited ponds on existing courses should be modified with physical barriers to restrict access to the water. These barriers can be fences along the edge of the water, or a wire grid placed over the water surface. The most inexpensive and attractive method is to plant vegetation along the edge of the water which will interrupt goose access to the water and decrease their ability to detect predators.

Considering that large patches of open lawn are attractive safety features for geese, tall grass and shrubs can also be planted around the fairways of existing golf courses which will reduce the openness, and hence the safety levels perceived by the geese. Designing golf courses and adjacent vegetation so that they are attractive to local bird species while simultaneously being less attractive to Egyptian Geese involves short-term costs with potential long-term benefits.

As an extension of the investigation of potential management practices during the second half of 2014, Alex Atkins (CB MSc) assessed the efficacy of using Harris Hawks *Parabuteo unicinctus* to harass Egyptian Geese on Rondebosch Golf Course. He measured both the response of the course population numbers and the vigilance levels before, during and after the harassment pressure from the raptor.

Highlights:

- The perceptions and habitat manipulation aspects of the research were published in *Ostrich* (2013) and in the *Journal of Wildlife Management* (2014).
- Comprehensive articles on the research appeared in *African Birdlife, Environment* and the national *Golf Club Management* magazine during 2014.
- A management plan, research presentation, and implementation advice have been given to Steenberg Golf Estate in collaboration with NCC Environmental Services.
- Research findings and management best practice guidelines for golf courses have been conveyed to the Western Cape golf course managers' committee and to CapeNature.

Egyptian Geese are considered 'pleasant' until the damage caused to lawns reaches unacceptable levels. (Photo: Richard Gie)

Thanks go to the golf course managers for their assistance, the members of the Steenberg Golf Estate for participation in the perceptions survey, and to Rachel Colyn at NCC Environmental Services who helped with GIS mapping of the golf courses.

Key co-sponsors
NCC Environmental Services; Steenberg Golf Estate

Research team
Dr Rob Little (PFIAO)
Dr Arjun Amar (PFIAO)

Students: Alex Atkins (CB MSc), Beth Mackay (BSc Hons)

Research Assistant: Frances Morling

Conservation Biology Masters programme 2013-2014

The 21st cohort of Conservation Biology (CB) students completed their projects early in 2013, with 11 graduating in June 2013 and four in December 2013. Special congratulations go to Kat Forsythe and Jessica Greenston, who obtained their degrees with distinction.

The 22nd cohort of CB students started their studies in January 2013, with 13 participants from six countries: Canada, Kenya, South Africa, the UK, USA and Zimbabwe. Ten of these students handed in their research projects during February 2014, and the remaining three handed in by June 2014. Robyn Milne, Kirsten Gallaher and Zanne Labuschagne were awarded their degrees with distinction; several other students were unlucky not to make the cut, despite vigorous appeals to Faculty on their behalf. More discussion is needed on the criteria used to award coursework masters degrees with distinction.

The 2014 intake of CB students, our 23rd cohort, comprised 14 students from eight countries: Botswana, Chile, Colombia, Ireland, Nigeria, South Africa, the UK and USA. Unfortunately one student dropped out during the coursework component to pursue an alternative career option, but the remaining 13 students completed the course, with 12 submitting their mini-theses by the mid-February deadline. The 24th cohort of students started in early 2015, although the arrival of two students was delayed by visa issues; the new Home Affairs regulations will require even earlier offers of places to foreign students. The class comprises 13 students from India, Japan, Mauritius, Mozambique, South Africa, the UK, USA and Zimbabwe.

Course structure and teachers

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. As ever, there were some changes to the teaching roster. Unfortunately Dr John Hanks, former director of the Peace Parks Foundation, was unable to continue leading the opening 'Big Picture' module; we were very fortunate to be able to replace him with UCT Honorary Prof. David Cumming from the University of Zimbabwe. We are also grateful to Prof. William Bond for running the Community Ecology module following Phil Hockey's untimely death at the beginning of 2013. When William retired at the end of 2013, Profs Timm Hoffman and Jeremy Midgley kindly picked up the reigns for 2014. From 2015, Dr Robert Thomson, the new Fitz senior lecturer, will assist Timm to run the module.

Assoc. Prof. Lindsey Gillson took the lead on the Climate Change module from 2013, and it is now run jointly with the African Climate Development Initiative (ACDI) MSc programme, although Dr Phoebe Barnard continues to be involved in teaching. However, as Lindsey was on sabbatical in 2013, Prof. John Bolton and Dr Cecile Reed coordinated the module in that year. Cecile also took over the Freshwater Ecology module from Dr Geordie Ractliffe, who took up a new challenge as a high school teacher. A new module 'Conservation in Practice' was introduced in 2014, focusing on human-wildlife conflict. It was proposed by Prof. Justin O'Riain, but as he was on sabbatical in the second half of 2014, the module was run by Dr Guy Balme, who works on large cat conservation for *Panthera*. The module was exceptionally well received by the class.

Other module leaders from outside UCTwere Dr Woody Cotterill (Biodiversity), Dr Peter Carrick (Restoration Ecology) and Dr Georgina Cundill (Conservation and Society). Dr Cundill was unable to continue in 2014 and was replaced by Dr Gladman Thlondana, also from Rhodes University. Other teachers from within UCT included Assoc. Prof. Colin Attwood (Marine Ecology), Dr Jacqueline Bishop (Conservation Genetics), Assoc. Prof. John Hoffmann (Alien Invasives) and Dr Jane Turpie (Resource Economics). In addition, many other people contributed through guest lectures, field trips and discussions. This diversity of perspectives adds greatly to the value of the course.

Challenges and opportunities

Like the rest of the Fitz, the CB course suffered from the staffing upheavals of the last two years. Despite greater input from the broader Biological Sciences Department, co-ordination of the course suffered as the depleted Fitz staff struggled to

The 2013 class enjoying an opportunity to get out of the classroom. From left: Frances Morling, Jordan-Laine Calder, Nadia de Souza, Kirsten Gallaher, Zanne Labuschagne, Phenias Sadondo, Greg Campbell, Tabby Stokes, Wesley Bell and Elliot Kinsey. Front, Rukaya Johaadien and Robyn Milne. (Photo: Peter Ryan)

meet their commitments. The situation was exacerbated when the decision was made to not replace Peter Ryan as course coordinator for the masters programme. UCT's staffing formula awards one academic position to coursework masters programmes that enrol at least eight students annually, but the merged Biological Sciences Department is deemed to be overstaffed, so this post was lost during the staff reshuffles at the Fitz. With no obvious candidate to take over the coordinator role, we took the decision to advertise a contract lecturer position funded by the DST-NRF Centre of Excellence (CoE) to maintain UCT's commitment to the 'Hot Birds' programme and also to assist with running the CB course. We are delighted that Dr Susie Cunningham was appointed to this position, and despite still awaiting her work permit, she was able to teach the Biodiversity module in 2015.

Other challenges remain, with no clear replacement for the Alien Invasives module following the retirement of Assoc. Prof. John Hoffmann at the end of 2014. Fortunately we have persuaded John to once again lead the module in 2015, but a longer term solution is needed for this module. Dr Peter Carrick also has given notice that 2015 will be the last time he will lead the module on Restoration Ecology. Finally, the resignation of Prof. Graeme Cumming from mid-2015 to take up a position in Australia will create a gap in the Spatial Ecology module in 2016. We are currently exploring options for replacing these key teaching positions. One opportunity arising will be through appointing a new person to the Pola Pasvolsky Chair in Conservation Biology.

Although the CB course continues to attract students from all over the world, its ability to do so rests heavily on its reputation, which depends on word-of-mouth support from past students. The Fitz is committed to maintaining an excellent course that sets the standard for coursework masters degrees in the Science Faculty, as evidenced by the fact that we are prepared to invest substantial funds from the CoE to achieve this goal. However, unless the course coordinator position is reinstated, the future of the course will depend on the Fitz retaining CoE status. This is assured until 2019, with the possibility that it might extend even beyond then, but we need to have a contingency plan in place to allow effective coordination of the course beyond the life of the CoE.

These comments notwithstanding, the continued success of the programme is testament to the dedication of the Fitz support staff, especially Hilary Buchanan who administers applications and generally assists with the settling-in process for new students.

Course co-ordinators

Prof. Graeme Cumming
Assoc. Prof. Peter Ryan

Module Leaders

Dr Arjun Amar (PFIAO)
Assoc. Prof. Colin Attwood (BioSci, UCT)
Dr Guy Balme (Panthera), 2014
Prof. John Bolton (BioSci, UCT), 2013
Prof. William Bond (BioSci, UCT), 2013
Dr Jacqueline Bishop (BioSci, UCT)
Dr Peter Carrick, (BioSci, UCT)
Dr Woody Cotterill (Geological Sciences, UCT)
Prof. David Cumming (PFIAO)
Dr Georgina Cundill (Rhodes), 2013
Assoc. Prof. Lindsey Gillson (BioSci, UCT), 2014
Prof. Timm Hoffmann (BioSci, UCT), 2014
Assoc. Prof. John Hoffmann (BioSci, UCT)
Prof. Jeremy Midgley (BioSci, UCT), 2014
Dr Geordie Ractliffe (Water Matters), 2013
Dr Cecile Reed (Biological Sciences, UCT)
Dr Gladman Thondlhana (Rhodes), 2014
Dr Jane Turpie (Economics, UCT & Anchor Consultants)

Conservation Biology projects 2013/2014

Bell, Wesley: Pheromonal responses of *Dactylopius opuntiae* males in cross pairings of two female biotypes. (Supervisor: John Hoffmann).

Calder, Jordan-Laine: Understanding the permeability of an urban matrix to passerine movement between wetlands. (Supervisors: Graeme Cumming, Dieter Oschadleus).

Campbell, Greg: Effects of temperature on gular fluttering and evaporative water loss in four sympatric cormorants in southern Africa. (Supervisors: Peter Ryan, Timothée Cook, Richard Sherley).

de Souza, Nadia: Host plant associations of two cochineal insect species, *Dactylopuis ceylonicus* and *D. Opuntiae,* on the invasive cactus species *Opuntia monacantha, O. ficus indica* and a possible hybrid cactus, in South Africa. (Supervisor: John Hoffmann).

Gallaher, Kirsten: The influence of rainfall seasonality and climate change on the demography of *Aloe dichotoma*, a long-lived succulent tree from semi-arid southern Africa. (Supervisors: Timm Hoffman, Sam Jack, Tony Rebelo).

Johaadien, Rukaya: Comparative breeding bioogy of the Northern Rockhopper Penguin *Eudyptes moseleyi* on Gough and Nightingale Islands. (Supervisors: Peter Ryan, Antje Steinfurth).

Kinsey, Elliot: Burning for birds: The response of bird communities to recent fire history in the Serengeti ecosystem. (Supervisors: William Bond, Colin Beale).

Labuschagne, Zanne: Movement patterns of African elephants *(Loxodonta africana*, Blumenbach) in a seasonally variable ecosystem in south-eastern Chad. (Supervisors: Graeme Cumming, David Cumming).

Massie, Philip: A statistical investigation of the behavioural responses of a deep diving predator to mesoscale oceanographic features. (Supervisors: Isabelle Ansorge, Trevor Mcintyre, Peter Ryan).

Milne, Robyn: Physiological tolerances of high temperatures in Fynbos birds: implications for climate change. (Supervisors: Peter Ryan, Susan Cunningham, Alan Lee, Ben Smit).

Morling, Frances: Cape Town's cats: reassessing predation through kitty-cams. (Supervisors: Rob Simmons and Justin O'Riain).

Sadondo, Phenias: The influence of temperature on parental investment in Common Fiscal and consequences for nestling growth. (Supervisors: Susan Cunningham, Rowan Martin, Peter Ryan).

Stokes, Tabitha: An evaluation of game fences as a potential solution to human-baboon conflict around Table Mountain National Park. (Supervisors: Justin O'Riain, Arjun Amar, Carly Cowell)

Conservation Biology projects 2014/2015

Abdu, Salamatu: Does the availability of shade limit use of water holes by desert birds? (Supervisors: Susan Cunningham, Peter Ryan).

Atkins, Alexander: An experimental assessment of the efficacy of falconry to mitigate a human-wildlife conflict: Egyptian Geese *Alopochen aegyptiaca* on golf courses. (Supervisors: Arjun Amar, Rob Little).

Baigrie, Bruce: Fun and fear in False Bay Nature Reserve: Green space affordances in the post-apartheid city (Supervisors: Pippin Anderson, Shari Daya, Dale Wright).

Bowker, Jenna: Using real-time forest loss alerts and global deforestation maps to assess the effectiveness of Africa's tropical protected areas. (Supervisors: Graeme Cumming, Alta de Vos).

Cronin, Kate: Aliens in the nursery: assessing the awareness and attitudes of Cape Town nursery managers in regard to invasive species regulations. (Supervisors: Timm Hoffman, Haylee Kaplan).

Dickens, John: Extracting fish abundance indices from recreational fishing competition data. (Supervisor: Colin Attwood).

Espinaze, Marcela: Understanding host-tick interactions: risk assessment of mammalian infection in South Africa. (Supervisors: Graeme Cumming, Eléonore Hellard).

Fazey, Francesca: The role of buoyancy in the dispersal of marine plastic debris and the impact of biofouling: does size matter? (Supervisors: Peter Ryan, Coleen Moloney).

le Roux, Liezl: The relationship between MHC diversity, parasite load and mate choice in Black Sparrowhawks *Accipiter melanoleucus.* . (Supervisors: Jacqui Bishop, Arjun Amar).

Millan, Juan: Multi-nest building in Black Sparrowhawks *Accipiter melanoleucus*, an adequate strategy to cope with Egyptian Geese *Alopochen aegyptiaca* conflict in an urbanised landscape (Supervisors: Arjun Amar, Petra Sumasgutner).

Motlogelwa, Binah: Does climate niche predict bird population trends in South Africa. (Supervisors: Susan Cunningham, Peter Ryan).

Russo, Alexandra: The prevalence of documentation discrepancies in CITES (Convention on the International Trade in Endangered Species of Wild Fauna and Flora) trade data for Appendix I and II species exported out of Africa between the years 2003 and 2012. (Supervisors: Timm Hoffman, Markus Burgener)

Sands, Dara: Mapping the sensitivity of Lesotho's avifauna to wind farm developments (Supervisors: Rob Simmons, Samantha Ralston, Shane McGuinness, Arjun Amar).

The 2014 CB class on the Marine Ecology fieldtrip led by Assoc. Prof. Colin Attwood. Back from Left: Alex Atkins, Dara Sands, Juan Millan, Jenna Bowker, Bruce Baigrie, Kate Cronin, Marcela Espinaze, Rhiân Ebrey. Front from left: Allie Russo, Francesca Fazey, Binah Motlogelwa, John Dickens, Salamatu Abdu and Liezl le Roux (Photo: Colin Attwood)

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.

Ditiro Moloto (BSc 3rd year), Elle Musekwa (BSc Hons) and Deo Masotla (MSc) visited the Fitz during June and July 2014 as part of the new collaboration with Prof. Derek Engelbrecht at the University of Limpopo. Peter Ryan took them bird-watching at the Strandfontein sewage works. (Photo: Peter Ryan)

Information brokerage

Fitz members published 74 semi-popular articles in 2013 and 71 in 2014. We also authored one book and six book chapters during these years. Peter Ryan and Rob Little contributed 112 species accounts for *The Ultimate Companion for Birding in Southern Africa* which was published in two volumes in June 2014. Peter Ryan and the late Phil Hockey were scientific editors for this book.

Fitz staff and students attended 38 international and 26 local conferences during 2013 and 2014, at which the Fitz was awarded six best oral presentations and four best poster presentations. The second BirdLife South Africa (BLSA)/Fitz co-hosted conference 'Learn About Birds' (LAB) was held at Mont Aux Sources in the KZN Drakensberg in March 2014. The conference attracted 160 delegates, double that of the first conference held in Port Elizabeth in March 2012. Eight Fitz staff and Honorary Research Associates and 14 Fitz students attended LAB. The intention is to co-host these conferences every two years, linked to BLSA's Annual General Meeting.

At least 50 public talks and outreach activities were undertaken by Fitz members each year to partner organisations and interested parties, such as environmental action groups, various NGOs, bird clubs and membership-based societies. Numerous radio interviews were conducted, including 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.

Post-doc Tom Flower's drongo mimicry research was filmed by Oxford Scientific Films during March 2014 for a TV documentary 'Family Matters' for BBC1 (UK) and by the NHK (Japanese public broadcasting) during August 2014 for a TV documentary entitled 'The legend

of Darwin: the Fork-tailed Drongo'. A comprehensive Cape Parrot project documentary was aired on German TV and in 14 other countries during late 2014 and will be aired in South Africa in early 2015. Furthermore, the Cape Parrot, Blue Swallow and Sociable Weaver projects received extensive coverage during the South African nature television show 50/50 (SABC3) on 2 February, 26 May and 7 December 2014, respectively. The penguin research team in Algoa Bay received significant coverage during the M-Net Carte Blanche show on 18 May 2014.

Rob Little co-ordinates regular feature articles in *SANParks Times* and *Environment* magazine. Peter Ryan and Andrew McKechnie act as scientific advisors for *African Birdlife*. The British Ornithologists' Union blog has been running for two years and Arjun Amar's blog titled 'Hen Harriers: going, going ...' posted on 6 August 2014 claimed first place in the top ten most read blogs just three weeks later, on 28 August.

MSc student John Pallett's power line monitoring work was featured in an online article for *Travel News Namibia* in May 2013. Following a graduation ceremony press release by UCT's Communication Department, Blanché de Vries published an article entitled 'Kommer oor kragdrade in Karoo talle voëls eis' in *Die Burger* on 17 June 2013, and Guy Rogers published an article titled 'Saving iconic Karoo bird' in *The Herald* on 20 June 2013, both about Jess Shaw's PhD research on the Ludwig's Bustard and power line collisions.

Charné Kemp published an article titled 'Voëlspesie verstom' on Thursday 5 September 2013 in the *Volksblad* which started an electronic media interaction on the Sociable Weaver project. Tanya Wagner wrote an article titled 'Too hot to handle' for the online publication *green times* on 4 June 2013 following Post-doc Susie Cunningham's talk at an instalment of UCT's 'Climate Change Impacts & Adaptation Seminar Series 2013'.

Fitz Advisory Board member, Harriet Nimmo was instrumental in arranging for Dr Jane Goodall, world-renowned British primatologist, ethologist, anthropologist, and United Nations Messenger of Peace, to present a Vice-Chancellors' open lecture titled "The Life and Times of Dr Jane Goodall – in celebration of her 80th year" on 6 February 2014 at the Baxter Theatre.

Networking

The Fitz maintained its broad network of collaborations between individuals and institutions. Primary collaboration continued with the University of California, Berkeley (Rauri Bowie), the University of Pretoria (Paulette Bloomer and Andrew McKechnie), and Nelson Mandela Metropolitan University (Pierre Pistorius), and a new partnership was fostered with the University of Limpopo through Prof. Derek Engelbrecht.

A diversity of close collaborative working relationships with over 50 scientific peers from 16 countries now exist both nationally and internationally. Additional emphasis has been placed 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.

Graeme Cumming's research team arranged the southern African node Resilience Alliance Science Meeting, funded by the NRF, which was held in KwaZulu-Natal during April 2013. Peter Ryan spent a week in July 2013 at the International Maritime Organization headquarters in London attending the UN's Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) workshop on microplastic pollution in the oceans. The group's final report will be released in early 2015.

Rob Little participated in the Higher Education Innovation in the Development of Biodiversity Skills Role Player Engagement, Western Cape Regional Workshop held at Kirstenbosch, SANBI, in June 2013 which was facilitated by the NGO GreenMatter. The workshop's aims were to

Dr Jane Goodall with Peter Ryan after her Vice-Chancellor's open lecture on 6 February 2014. (Photo: Michael Hammond)

Research assistant David Nkosi explaining about ringing and sampling to local school children at the Waterbird project study site in Barberspan (Photo: Chevonne Reynolds)

increase efficiency and transformation of the biodiversity conservation sector in South Africa. Inputs from the Fitz focused on initiating a mechanism to get the Fitz's activities (bursaries and project adverts/opportunities) to reach as many potential black candidates as possible, and requested an update of the published transformation trends in the Biodiversity Sector.

Service rendering

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

Fitz members served on the editorial boards of 23 scientific journals, and on 58 membership and advisory services. We also reviewed 135 papers for 62 journals during 2013, and 120 papers for 61 journals during 2014. Fitz members contributed to two NRF grant application evaluations and Andrew McKechnie participated on the five-year review panel for the Centre for African Conservation Ecology, NMMU.

Fitz Honorary Research Associate, Phoebe Barnard, successfully worked with DEA in 2013 to adopt the biodiversity monitoring policy concept of "Biodiversity early warning systems", building on two recent booklets published by SANBI/DEA/UCT (2009 and 2012). Plans were also developed in late 2013 to promote national conversations on climate change, biodiversity and society using media and social media platforms. Peter Ryan provided policy advice to DEA on alien bird regulations in terms of the recently promulgated NEMBA Act (October 2014), and reviewed the second edition of the best practice guidelines for monitoring and mitigating impacts of wind energy infrastructure on birds.

Post-doc Alta De Vos and the protected areas research team worked closely with the DEA and SANBI to complete the protected area register, particularly to incorporate private protected areas that have been gazetted, but since lost from official records. The project is also working with SANBI to assess the contribution of privately owned protected areas to South Africa's Biodiversity Goals. Alta also managed projects for the MAPA Project, an NGO making conservation more visible and accessible using online maps.

Members of the Fitz Algoa Bay penguin research team led by Lorien Pichegru, have been monitoring the foraging behaviour of African Penguins in Algoa Bay since 2008. Experimental purse-seine fishing exclusions have shown the impact of competition with industrial fisheries on seabirds and the benefits of closing areas around breeding colonies to fishing. The results were used by SANParks and the DEA in 2013 to increase the extent of their Marine Protected Area permanent no-take zone for purse-seine fishing in Algoa Bay to include foraging habitat of African Penguins from St Croix Island, the world's largest African Penguin colony. This MPA was declared in 2014. Lorien and fellow post-doc Antje Steinfurth were instrumental in collating all data from the seven-year island closure experiment for a DAFF working group meeting in November 2014.

The Cape Parrot project has on the request of the Office of the President and in partnership with DAFF, established the Eastern Cape Forest Management and Research Committee to better co-ordinate forest research and link findings to relevant forest managers. Through this, the project has played a fundamental role in the establishment of three new forest reserves covering over 5 000 ha in the Amathole Region

(Eastern Cape) and in the reduction of the *Afrocarpus falcatus* yellowwood harvesting quota for the Eastern Cape. Similarly, Fitz research on the Afromontane forests of Angola is being used to support and guide Angola's Ministry of the Environment to develop a conservation strategy for this endangered habitat, including choosing and designing appropriate protected areas.

During 2013, the Ludwig's Bustard project contributed information 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 from BirdLife International. In South Africa, research on collision mortality and a large scale experiment to test the efficacy of line marking devices will be used to guide Eskom's future planning of power lines, and the extension of this work to Namibia has seen pre-emptive marking of a new power-line being erected near Etosha.

The Ground-Hornbill project investigated the positioning of overhead electrical transformer boxes in the Associated Private Nature Reserves (APNR) to determine possible threats to ground-hornbills and raptors perching on these structures. This project is in collaboration with the Endangered Wildlife Trust's Wildlife & Energy Programme, Eskom and the Mabula Ground-Hornbill Project. The project also provides second-hatched chicks for the Ground-Hornbill Action Group's captive-breeding and wild-release programmes.

A Biodiversity Management Plan for the Bearded Vulture, facilitated and edited by PhD student Sonja Krüger, was gazetted for public comment during 2013. Sonja also presented a vulture identification and monitoring methods training course for Ezemvelo KZN Wildlife staff.

An Egyptian Goose management plan compiled from the findings of the research on the conflict issue and the attractiveness of golf courses to the geese was compiled in collaboration with NCC Environmental Services and submitted to the Steenberg Golf Estate and to CapeNature during May 2014.

Post-doc Ralf Mullers presented the outcomes of the Shoebill research project in the Bangweulu Wetlands, Zambia, and its implications for conservation strategies to the

Shoebill research assistant and nest guards in the Bangweulu Swamps, Zambia. (Photo: Ralf Mullers)

Board of the Zambian Wildlife Authority (ZAWA) on 27 May 2013. He also contributed to the Zambian Single Species Action Plan for Shoebills compiled by the Agreement on the Conservation of African-Eurasian Migratory Waterbirds, an international programme to formulate conservation strategies for Shoebills throughout their range states. He also presented a Shoebill Management Plan to the Bangweulu Wetlands Management Board and ZAWA during March 2014 to formulate objectives and strategies to protect Shoebills in the Bangweulu Wetlands and to increase revenue from marketing the Shoebill population for tourism purposes.

Gender and equity impacts of research

The Fitz has a proactive recruitment policy to attract female postgraduates to ensure gender parity in the student body. This policy is successful, with 51% of post-docs and postgraduate students being women. The academic and support staff gender profile of the CoE has remained at 47% female.

Fitz research projects continue to generate work opportunities related to research activities for adjacent disadvantaged community members, with 148 full-time or part-time jobs, mostly filled by women, active during 2013 and 2014. This included 25 full-time and 77 part-time jobs in South Africa, 12 full-time and 40 part-time jobs in Zambia, and four part-time jobs in Angola.

The Cape Parrot project in the Amatole Mountains, Eastern Cape, has a "one person per

household" employment policy and employed 77 unemployed local community members to grow indigenous trees and to build and erect nest boxes. The project has refurbished 30 "micro-nurseries", built ten new nurseries in the Sompondo, Gilton and Hala villages, and taught local woman to use "worm farms" to produce fertilizer and grow indigenous saplings to plant in designated forest patches. The women were trained to take care of these saplings and paid per sapling every six months (up to R50 000 each year). The project has also taken over the management of a pecan nut orchard at the University of Fort Hare near Alice. The orchard has been fenced and local women contracted to gather, shuck and package the pecan nuts. Revenue from this small business is shared between the women and the management of the pecan orchard.

PhD student Dominic Rollinson works with BLSA's Seabird Division, designing bird-scaring lines for reducing seabird bycatch from longline and trawl vessels. These lines are made by the Ocean View Association for People with Disabilities, and he facilitates the making and delivery of the lines to the various fishing companies. A large proportion of the profits from each line produced are given to the Ocean View centre to help improve the centre and for community upliftment.

Dr Claire Spottiswoode and nest-finders with Cuckoo Finch eggs. (Photo: Callan Cohen)

The brood parasite project in Zambia run by Research Associate Claire Spottiswoode has provided employment for 40 part-time and 2 full-time research assistants, mostly otherwise unemployed farm labourers. Previously, few of these were women, but we are actively trying to recruit more women to take part in the project. Claire is also a Mentor for the British Ecological Society's mentorship scheme for women in ecology.

The Shoebill project in Zambia implemented a community-based nest protection programme employing 12 local Shoebill guards. The project also employed one local Zambian man as a research assistant, and two Shoebill nest guards who were local (Zambian) fishermen. Furthermore, Post-doc Ralf Mullers trained various Bangweulu Wetlands scouts, guides and community members on the technicalities of Shoebill conservation and their interactions with tourists. Similarly, the Martial Eagle project employed six SANParks game guards from the Kruger National Park to assist with fieldwork.

The surrounding communities of the Table Mountain National Park have been involved in the Fynbos Endemic Birds Vulnerability Programme during 2013 and 2014. This programme also employs as a field assistant a rare-sarcoma patient, who is a skilled and hardworking field ornithologist and trainee bird ringer. The eastern field site of the programme, Blue Hill Escape Nature Reserve, employed 11 disenfranchised members of the Uniondale community during 2013 to clear alien vegetation as part of a job creation scheme. A project was initiated in 2013 with the City of Cape Town's Biodiversity Network (Bongani Mnisi), Stellenbosch University (Anton Pauw, Anina Heystek), SANParks and selected under-privileged Cape Flats schools (Crestway High School and others) to establish a climate change adaptation/restoration project to increase connectivity for aerial pollinators across the Cape Flats and within the Cape Peninsula. The CoE contributed funds for a film on this project during 2014.

The Fitz Algoa Bay research team has been training formerly disadvantaged rangers from SANParks to collect penguin data on Bird Island in the Eastern Cape. The project at Mount Moco in Angola has employed, on a part-time basis, four young men from the Kanjonde community to run a nursery with forest species that will be used to expand the remaining forest fragments. The project is also promoting Mount Moco as a tourist destination, increasing the work opportunities for the local guides. The Maluti Drakensberg vulture project employed three black men to monitor vulture nests near their communities. The Fork-tailed Drongo project has hired a Tswana research assistant from the local community at the research site in Vanzylsrus, Northern Cape.

Niven Library

The focus during 2013 and 2014 was on fine-tuning the new library information system Amlib and introducing data archiving to the staff and students of the Fitztitute and to Biological Sciences more broadly.

Overview

The library manager took the lead in a digital data archiving initiative at the FitzPatrick Institute during the period under review. An MoU was drafted for incoming students making data archiving mandatory and ensuring that sufficient metadata (description of the data) accompanies the submitted data. A partnership with SAEON was established, so that Fitztitute data archived with SAEON can in future be made available for further study.

During 2013 a portrait of Patrick Niven was donated to the Fitztitute by Marina Niven and this is mounted on the eastern wall of the Niven Library next to the existing portraits of Sir Percy FitzPatrick and Cecily Niven.

Photo: Rob Little

The Niven Library reading room was used for meetings and seminars on 48 occasions. During August 2013, MARE used the reading room for their meeting with Korean collaborators. In November 2013 the Michael and Susan Dell Foundation used the reading room to film interviews with young graduates on Dell Foundation scholarships

Staff and staff development

Margaret Koopman

The library manager attended Microsoft Access training at ICTS in February 2013 to investigate if the use of Access would be appropriate for the database migration from WinIsis to Amlib. She also attended a 9-week course on digital curation during 2013, which included certification at Master's level. UCT's Library and Information Studies (LIS) Department then invited her to enrol for the Master's degree in LIS in 2014. This resulted in a further elective in Research Librarianship being completed in the first semester while the second semester was dedicated to research for a mini-dissertation. The title of the mini-dissertation is *Data archiving and management initiatives and expertise in Biological Sciences, University of Cape Town – a comparison of the pre-digital/digital eras*. The Fitztitute sponsored the library manager's MLIS.

Phelisa Hans

During 2013 Phelisa took a higher level of control of periodicals management, using the periodicals component of Amlib. During 2014 she took over this responsibility having learnt the new system. She has also taken on the job of checking the book shelves for books which were dropped in the migration from the WinIsis to the Amlib system, and ensuring that these are re-assigned to the catalogue. This has given her some cataloguing experience as she has been able to import records directly from OCLC and add the modifications for the Niven Library collection.

Phelisa registered at the University of the Western Cape at the beginning of 2014 to study for a 4-year degree in Library and Information Studies. Her work at the Niven Library has given her a good background and we wish her success in the completion of this qualification and her future career.

Workshops

The library manager conducted annual Conservation Biology Masters information skills workshops in January. In October 2013 she presented a seminar to the staff and students of the Fitztitute and Biological Sciences on the use of Altmetrics to evaluate publication impact. Almetrics takes social media and alternative

forms of publications such as blogs and webpages into account as well as the traditional measures of research impact such as H-index and citation analyses. In the same month a seminar on Digital Data Archiving was presented to staff and students of the Fitztitute and Biological Sciences in order to bring the community up to speed with the initiative about to be launched at the Fitztitute.

During November 2013, Victoria Goodall from SAEON gave a presentation to Fitztitute staff and student on the data access and archiving initiatives available at SAEON.

The librarian and the library assistant received intensive training in the use of Amlib from Paul Meyer of Infosolve during 2013. This was hands-on training in the library and included manuals demonstrating the various components of the Amlib system.

During August and September 2013 the library manager attended a map projects workshop and a data management for postgraduate students and workshop hosted by UCT Libraries. During November 2013 the library manager attended an Almetrics Webinar hosted by UCT Libraries.

Research support

The Niven Library continues to provide research support to the staff and students of the FitzPatrick Institute, BirdLife South Africa, and local and international ornithologists. The library manager also assisted members of Zoology and UCT wishing to use the specialised collection in the Niven Library and the specialised skills of the library manager.

Collection management

Theses*:* UCT Library has launched a digital repository and all UCT theses, including MSc Conservation Biology projects, form part of this collection. Retrospective titles are linked to the Niven Library catalogue. The Niven Library continues to be the repository for Biological Sciences Honours Projects, with the project pdf files linked to the catalogue record. Phelisa continues to digitise old Honours Projects so that these can be made available electronically.

Journals*:* Duplicate journals were donated to the Department of Biodiversity at Limpopo University. Titles included *The Babbler* (Botswana), *Birding in southern Africa, Bokmakierie, Honeyguide, Ibis, Lammergeyer,*

Photo: Margaret Koopman

Madoqua, Ostrich, South African Avifauna Series and *Vulture News*.

Books*:* Roy Siegfried donated his ornithology books to the Niven Library in April 2014. Sam Hockey allowed the Niven Library to select books not in the collection from Prof Phil Hockey's collection. During November 2014 a large and generous donation of bird books was received from Dr Jerzy Przybojewski.

The Niven Library purchased 40 books during the period under review, 10 titles were received from publishing houses for review and 149 titles from donations were added to the collection.

Book Sale: R16 674 was raised through the sale of ornithological books during 2013- 2014.

Niven Library Database

Early in 2013 the Centre of Excellence approved the upgrade of the Niven Library database to a fully integrated Library Management System to replace the CDS/ISIS database which had run successfully for 10 years. Amlib, proprietary software from OCLC, the US based Online Computer Library Centre, was chosen. This is marketed in South Africa by the South African bibliographic network (SABINET). Developed in Australia, Amlib is ideal for a specialist library such as the Niven African Ornithology Library. The library manager introduced a self-service loan system to replace the paper slips for book loans. A scanner enables the user to scan the barcode on a UCT ID card and scan a barcode on the back of the book. The system automatically notifies a user when the loan period has expired and enables the self-renewal of an item online.

Migrating from one system to another is never easy and is inevitably time-consuming. Paul Meyer from Infosolve made this as painless as possible and was also responsible for the training of library staff. The project was initiated at the beginning of March 2013 and was complete by the beginning of July. Tidying up of records and fine-tuning the system to match the needs of the Niven Library continued into 2014.

Use of the Library

Document Delivery

The interlibrary loan service has gradually tailed off due to the growing range of online electronic journals. Social media sites such as Research Gate have also contributed to the demise of interlibrary loans as researchers make their research available to their peers through such portals.

Niven Library stock circulation over the period under review

Type of material	**2014**	**2013**
Monographs	230	193
Theses	12	3
Journals	161	124
Audio Visual	5	4
Nest Record Cards	26	44

Reprint requests

Reprint requests have also tailed off because of the Research Gate service and because researchers increasingly handle their own reprint requests. While some research staff copy the library manager in on this email correspondence, the overall figures would be too inaccurate to report as was done in the past. Services such as Public Library of Science and the various Altmetrics services are probably a more accurate reflection as one is able to get figures of downloads.

Research requests

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 Fitztitute. Pdf or jpg files were the preferred format supplied by e-mail to users. In addition literature searches were compiled and e-mailed to users, in particular in support of the updated Red Data List of southern African Birds.

Requests for information (2013/2014)

Requests for information over and above interlibrary loan requests were received from the following National and International organisations and individuals:

Bird NGOs: BirdLife Botswana; BirdLife South Africa; BirdLife Zimbabwe.

Conservation NGOs: Kevin Shaw, CapeNature.

Publishers: Daniel Philippe, Howard and Moore checklist of the birds of the world.

South African Universities: University of Botswana Stellenbosch University

International Universities and Colleges:
Ronald Eggert, Selian Lutheran Hospital (Arusha, Tanzania)

Donations (2013/2014)

Donations were received from the African Bird Club, Carter T. Atkinson, S. Bandeira, BirdLife Botswana, the British Museum of Natural History at Tring, Callan Cohen, Timotheé Cook, John Cooper, Tim Crowe, Graeme Cumming, Jenny Day, Tim Dodman, Bob Dowsett and Françoise Dowsett-Lemaire, Charles Griffiths, Vernon Head, G. Heydenrych, Phil Hockey, Rob Little, Lynx Edicions, Martim Melo, Juan Millan, Patrick Morant, Dieter Oschadleus, Mike Perrin, Jerzy Przybojewski, Peter Ryan, Roy Siegfried, Mrs S.K. Stuttaford, Les Underhill and Liz Wheeler.

Photo: Margaret Koopman

Scientific publications 2013-2014

Names in **bold** are members of the Fitztitute or the Centre of Excellence.
IF = Impact Factor.

2013

Abad, F.X., Busquets, N., Sánchez, A., **Ryan, P.G.**, Majó, N. & González-Solís, J. (2013) Serological and virological surveys of Influenza A virus in Antarctic and sub-Antarctic penguins. *Antarctic Science* 25:339-344. *IF 1.556*

Alström, P., Barnes, K.N., Olsson, U., Barker, F.K., Bloomer, P., Khan, A.A., Qureshi, M.A., Guillaumet, A., Crochet, P-A. & **Ryan, P.G.** (2013) Multilocus phylogeny of the avian family Alaudidae (larks) reveals 4 complex morphological evolution, non-monophyletic genera and hidden 5 species diversity. Molecular Phylogenetics and Evolution 69:1043-1056. *IF 4.066*

Amar, A., Koeslag, A. & Curtis, O. (2013) Plumage polymorphism in a newly colonized black sparrowhawk population: classification, temporal stability and inheritance patterns. *Journal of Zoology* 289:60-67. *IF 2.043*

Amar, A. & Esselstyn, J. (2013) Positive association between rat abundance and breeding success of the critically endangered Mariana Crow *Corvus kubaryi*. *Bird Conservation International* 24:192-200. *IF 1.074*

Andersson, J., **Cumming, D**., de Garine-Wichatitsky, M. Dzingirai, V. & Giller, K. (Eds) (2013) *Transfrontier conservation areas: people living on the edge*. Earthscan, London. ISBN-13: 978-1849712088.

Andersson, J,, de Garine-Wichatitsky, M., **Cumming, D.H.M.**, Dzingirai, V. Giller, K.E. (2013) Chapter 1 – People at wildlife frontiers in Southern Africa. In: *Transfrontier conservation areas: people living on the edge*. Andersson, J., Cumming, D.H.M., de Garine-Wichatitsky, M. Dzingirai, V. & Giller, K. (Eds) Earthscan, London. ISBN-13: 978-1849712088. Pp. 1-11.

Andersson, J,, Dzingirai, V. & **Cumming, D.H.M.** (2013) Chapter 2 - TFCAs and the invisible peoples. In: *Transfrontier conservation areas: people living on the edge*. Andersson, J., Cumming, D.H.M., de Garine-Wichatitsky, M. Dzingirai, V. & Giller, K. (Eds) Earthscan, London. ISBN-13: 978-1849712088. Pp. 12-24.

Andersson, J, & **Cumming, D.H.M**. (2013) Chapter 3 - Defining the edge: boundary formation in TFCAs in southern Africa. In: *Transfrontier conservation areas: people living on the edge*. Andersson, J., Cumming, D.H.M., de Garine-Wichatitsky, M. Dzingirai, V. & Giller, K. (Eds) Earthscan, London. ISBN-13: 978-1849712088. Pp. 25-88.

Authier, M., Péron, C., Mante, A., Vidal, P. & **Grémillet, D**. (2013) Designing observational biologging studies to assess the causal effect of instrumentation. *Methods in Ecology and Evolution* 4:802-810. *IF 5.924*

Barquete, V., Strauss, V. & **Ryan, P.G.** (2013) Stable isotope turnover in blood and claws: A case study in captive African Penguins. *Journal of Experimental Marine Biology and Ecology* 448:121–127. *IF 2.263*

Bates, M.F. & **Little, I.T.** (2013) Predation on the eggs of ground-nesting birds by *Dasypeltis scabra* (Linnaeus, 1758) in the moist highland grasslands of South Africa. *African Journal of Herpetology* 62:125-134. *IF 0.815*

Bayliss, A.M.M., Wolfaardt, A.C., Crofts, S., **Pistorius, P.A.** & Ratcliffe, N. (2013) Increasing trend in the number of Southern Rockhopper Penguins (Eudyptes c. chrysocome) breeding at the Falkland Islands. *Polar Biology* 36:1007-1018. *IF 2.006*

Boakye, M.K., **Little, I.T.**, Panagos, M.D. & Jansen, R. (2013) Effects of burning and grazing on plant species percentage cover and habitat condition in the highland grassland of Mpumalanga Province, South Africa. *Journal of Animal & Plant Sciences* 23:603-610. *IF 0.638*

Bourgeois, K., Wilson, J.W. & Dromzée, S. (2013) First records of the northern giant petrel *Macronectes halli* ashore on Gough Island. *Marine Ornithology* 41:135-136.

Bowie, R.C.K., Cohen, C. & Crowe, T.M. (2013) Ptilopachinae: a new subfamily of the Odontophoridae (Aves: Galliformes) *Zootaxa* 3670:097-098. *IF 0.974*

Boyes, R.S. & Perrin, M.R. (2013) Access to cryptic arthropod larvae supports the atypical winter breeding seasonality of Meyer's Parrot *(Poicephalus meyeri)* throughout the African subtropics. *Journal of Ornithology* 154:849-861. *IF 1.632*

Carrick, P.J. & **Forsythe, K.J.** (2013) Abstract SAAB Annual Meeting: New ecological understanding from old restoration sites – unifying concepts, relationships and thresholds among ecosystem processes. *South African Journal of Botany* 86:144. *IF 1.409*

Chalmandrier, L., Midgley, G.F., **Barnard, P**. & Sirami, C. (2013) Effects of time since fire on birds in a plant diversity hotspot. *Acta Oecologica* 49:99-106. *IF 1.621*

Chambers, L.E., Altwegg, R., Barbraud, C., **Barnard, P.**, Beaumont, L.J., Crawford, R.J.M., Durant, J.M., Hughes, L., Keatley, M.R., Low, M., Morellato, P.C., Poloczanska, E.S., Ruoppolo, V., Vanstreels, R.E.T., Woehler, E.J. & Wolfaardt, A.C. (2013) Phenological Changes in the Southern Hemisphere. *PLoS One* 8(10):e75514. *IF 3.73*

Cherel, Y., Jaeger, A., Alderman, R., Jaquemet, S., Richard, P., **Wanless, R.M.**, Phillips, R.A. & Thompson, D.R. (2013) A comprehensive isotopic investigation of habitat preferences in nonbreeding albatrosses from the southern ocean. *Ecography* 36:277-286. *IF 5.124*

Cook, T.R., Lescroël, A., Cherel, Y., Kato, A. & Bost, C.-A. (2013) Can foraging ecology drive the evolution of body size in a diving endotherm? *Plos One* 8:356297. *IF 3.73*

Corfield, J.R., Birkhead, T.R., **Spottiswoode, C.N.**, Iwaniuk, A.N., Boogert, N.J., Gutiérrez-Ibáñez, C., Overington, S.E., Wylie, D.R. & Lefebvre, L. (2013) Brain Size and Morphology of the Brood-Parasitic and Cerophagous Honeyguides *(Aves: Piciformes) Brain, Behavior and Evolution* 81:170-186. *IF 2.885*

Crookes, D.J., Blignaut, J.N., de Wit, M.P., Esler, K.J., Le Maitre, D.C., **Milton, S.J.**, Mitchell, S.A., Cloete, J., **de Abreu, P**., Fourie, H., Gull, K., Marx, D., Mugido, W., Ndhlovu, T., Nowell, M., Pauw, M. & Rebelo, A. (2013) System dynamic modelling to assess economic viability and risk trade-offs for ecological restoration in South Africa. *Journal of Environmental Management* 120:138-147. *IF 3.057*

Croxall, J., Small, C., Sullivan, B., **Wanless, R.**, Frere, E., Lascelles, B., Ramirez, I., Sato, M. & Yates, O. (2013) Appropriate scales and data to manage seabird-fishery interactions: comment on Torres et al. (2013) *Marine Ecology Progress Series* 493:297-300. *IF 2.546*

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