Percy FitzPatrick Institute

DST/NRF Centre of Excellence

Annual Report
January – December 2009

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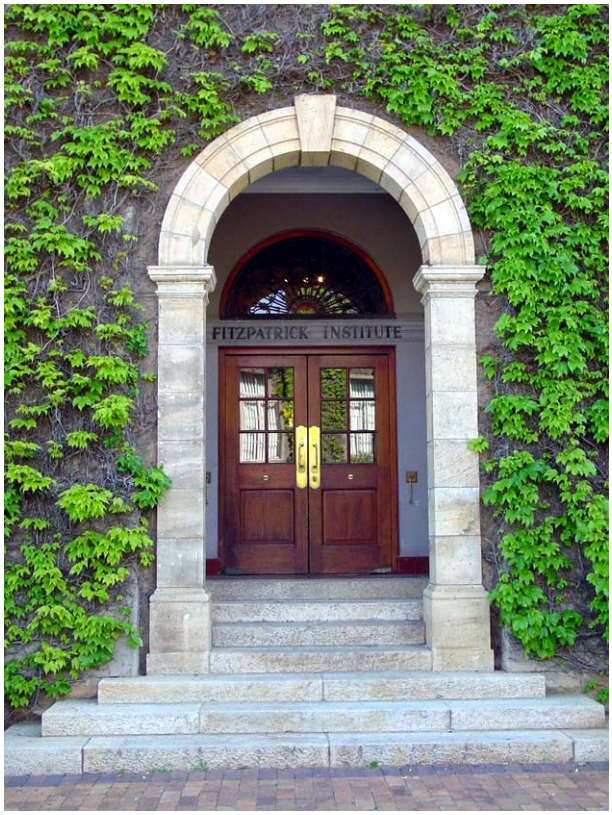

Board Members:

Mr M. Anderson (BirdLife SA)
Mr H. Amoore (UCT, Registrar)
Dr G. Avery (Wildlife and Environment Society of Southern Africa)
Prof. K. Driver (UCT, Dean of Science, Chairman)
Prof. P.A.R. Hockey (UCT, Director, PFIAO)
Assoc. Prof. J. Hoffmann (UCT, HoD, Zoology)
Mr P.G. Johnson (co-opted)
Dr J. McNamara (UCT, Development & Alumni Dept)
Prof. M.E. Meadows (UCT, HoD, ENGEO)
Mr C.A.F. Niven (FitzPatrick Memorial Trust)
Mr J.D.F. Niven (FitzPatrick Memorial Trust)
Mr P.N.F. Niven (FitzPatrick Memorial Trust)
Mr F. van der Merwe (co-opted)
Prof. D. Visser (UCT, Chairman, URC)

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The Annual Report may also be viewed on the Percy FitzPatrick Institute's website: **http://www.fitzpatrick.uct.ac.za**

Director's Report

To say that 2009 was a busy and eventful year would be an understatement! Early in January, Doug Loewenthal, Graeme Oatley and I participated in the Biodiversity Academy at De Hoop Nature Reserve. This is a week-long event we hold annually in conjunction with the Centre for Invasion Biology at Stellenbosch University. It is funded by the Department of Science and Technology and is designed for undergraduate students from Historically Black Universities with the aim of enthusing them about following a career in the biological sciences. The students are exposed to both theoretical and practical work, and the Academy has had some success in recruiting these students into postgraduate studies. No sooner had the Academy finished than the new cohort of CB students arrived to take up residence in their sparkling new lab – but more about that later.

January also saw us stepping up the pace in the search for a replacement for Penn Lloyd as Manager of the Centre of Excellence (CoE). By March, we were able to announce the appointment of Dr Rob Little. Rob obtained his PhD from the Fitztitute for a study of the sustainability of wing-shooting in the highlands of the Eastern Cape but, for the last 11 years, had been the Director of Conservation at WWF-SA. We are extremely lucky to have secured Rob for the Manager position and, during the year, he has repeatedly confirmed the confidence we had in making the appointment.

Also early in the year, we took on the three new post-docs mentioned in last year's report as being the recipients of new fellowships awarded to us by the NRF. Timotheé Cook (France) is studying cormorant diving ecology; Rowan Martin (UK) is part of our climate-change team; and Felix Nchu (Cameroon) is studying avian diseases and their conservation implications.

In March, the CoE five-year review took place over a three-day period. The international review panel was chaired by Professor Stuart Pimm (USA) and included Professors Kevin Gaston (UK) and Andrew Cockburn (Australia). This was a very intense review, with a detailed mandate from the DST/NRF designed to explore the true extent to which we had performed as a National Centre of Excellence in Science and Technology. I am happy to report that the Fitztitute fared very well in this process, not least with the panel concluding that the staff and senior students, in terms of quality and quantity of research output, were at least on a par with the Cornell Laboratory of Ornithology and the Edward Grey Institute (Oxford): the panel thus put us alongside the best in the world. The panel had two very significant recommendations: firstly, that we increase the terrestrial bird conservation component of our research; and secondly, that the NRF upgrade our CoE to fully funded status (at present we are only 50% funded). In terms of the former, by the end of 2009 we had already initiated three new, large projects – power-line collisions by large, arid-zone birds such as bustards and cranes; a Cape Parrot conservation project; and a project on the effects of climate change on desert birds. We also upgraded our ground-hornbill project to a fully fledged conservation project. In terms of finances, we were informed by the NRF towards the end of the year that we would be asked to prepare a management document explaining the additional benefits that would be derived were we to receive full funding (fingers crossed on that one!).

Soon after the panel review, we interviewed candidates to fill my (long vacant) post as Senior Lecturer. This was seemingly highly successful – an offer made to an Ethiopian lady currently at the Max Planck Institute in Germany was accepted, but we agreed to defer her taking up the post until May 2010. Unfortunately, shortly before she was due to take up the position, she withdrew her acceptance, leaving us back at the starting gate.

With the year more than a third gone, the threatened eviction from our office and laboratory space in the P.D. Hahn Building became a reality. This required a revamp of almost every office in the main Fitztitute and caused major student disruption, with squatting students spread all over the place (and providing a true reflection of why a 'laptop' computer is so named!). The moves and alterations were largely overseen by Chris Tobler, with help from Lionel Mansfield and Petra Muller (Zoology). We had been steadily 'accumulating' students in the P.D. Hahn building for many years, so the reshuffle was very far from being a trivial exercise. However, every cloud has a silver lining – in this case several. Offices in the main Fitztitute that were designed in the early 1980s and had remained largely untouched (and unpainted) since then were redesigned with modern research needs in mind. Refurnished, refurbished and painted, they now look very smart

and are functioning well. Some offices that had been used as library overflow storage space were now urgently needed for student accommodation. The only way this could be achieved was by increasing the storage space in the library. This was successfully executed by annexing laboratory space in the Zoology building adjacent to the Niven Library, knocking down a dividing wall and installing a state-of-the-art compact storage facility. The library holdings are almost in one space and Margaret Koopman and her team must be congratulated on effecting this metamorphosis with minimal disruption to library users. We also gained some additional office space in the Zoology Building, which allowed us to bring all staff and students, bar the CB students, under a single roof (effectively curing the 'isolation syndrome' felt by some students housed in the P.D. Hahn Building). Overall, the move took almost one third of the year, but the end result was well worth the hiatus.

Amidst the dust, noise and paint fumes, plans were well on their way for the 50th Anniversary in 2010, ranging from fund raising to public events and a major upgrade of the website. The upshots of all these activities will, however be reported in the 50th Anniversary annual report of 2010.

At the time of the move, however, there was one cloud that did not have a silver lining. Patrick Niven (Cecily's son), a staunch supporter of the Fitztitute and member of the Advisory Board since its inception, passed away on 3 July. On 8 July, I attended Patrick's funeral in Port Elizabeth on behalf of the Fitztitute staff and students. Over almost 50 years, Patrick's belief in the Fitztitute and its products was unstinting. It is a great pity that he did not live to see our 50th year, but we are working on establishing a fitting memorial to his efforts and dedication. The Niven family and the Fitztitute are inextricably linked, and always have been. It gives me pleasure, therefore, to report that Rory Niven (Patrick's nephew) has accepted a unanimously supported nomination to the Fitztitute Advisory Board.

On the subject of Boards (of which we have two), it also gives me pleasure to report that two new members have agreed to join the CoE Board in a scientific advisory capacity. These are Dr Guy Midgley (SANBI) and Professor William Bond (UCT).

In September, we started the time-consuming exercise of selecting the CB class of 2010. This year it was a challenging task because not only were applicants of a high standard, but the NARIC criteria (see last year's report) were being strictly applied by UCT's Science Faculty. The upshot of the latter is that the 2010 cohort will not be as demographically representative as has been the case in the past. On the up side, however, and on paper at least, they may prove to be the most academically high-flying class that we have seen in many years. Not only will the class of 2010 have a brand-new teaching space (long overdue), but they will also have a brand-new computer lab donated by The Nature Conservation Corporation as a contribution to our 50th Anniversary celebrations: a big thank you to the NCC.

In addition to having seen a considerable turnover in the student corpus of the Fitztitute, we also saw some staff turnover. When I first visited the Fitztitute as an undergraduate student in 1976, Lionel Mansfield was already well entrenched in the Institute, having been there since 1975 when he joined the Institute after five years working in the Chemistry Department. For my entire working life in the Fitztitute, Lionel has been there – all the way from when I was a PhD student to my appointment as Director. At the end of 2009, after 39 years of service at UCT, Lionel retired. However, I am happy to report that Lionel agreed to stay on for the first three months of 2010 to help ease his successor, Ms Anthea Links, into the job. Lionel – many thanks for everything that you have done over the years to make the Fitztitute a better and happier place.

Jane Turpie also left us as a part-time staff member at the end of 2009, now devoting most of her time to the mushrooming consulting company that she and her husband Barry Clark run. Like Rob Little, Jane also obtained her PhD at the Fitztitute. Subsequently she developed considerable expertise in the field of Resource Economics, and will be returning to teach this module of the CB course in 2010.

Despite the ups and downs of 2009, I would like to believe that the Fitztitute now enjoys greater *corps d'esprit* than has been the case at any time in its history – even though we are now larger than at any time in the past. The student body is well balanced in terms of seniority, and regular student/postdoc meetings have greatly increased the flow of information as well as the mentoring of postgraduate students by postdoctoral fellows. When we once again achieve a full academic staffing complement, I can only see this synergy going from strength to strength. Our national and international liaisons are also working well, and several of our past postdoctoral fellows still work in close liaison with the Fitztitute.

This happy state of affairs does not come about without effort. In 2009, everyone deserves mention for their tolerance to the disruptions caused by the move from P.D. Hahn. Despite all the inconvenience, I did not hear one moan: everyone realised what had to be done and bent over backwards to ensure that the transition was as seamless and painless as possible. The primary oil lubricating the mechanics of the operation was Chris Tobler. There were days when I tried to gauge the point at which Chris was going to lose the plot – but it didn't happen, despite the fact that Chris also has to keep an eagle eye on the Institute's ever-more-complex finances. In the absence of a CoE Manager for the first three months of the year, Chris also had to work with Tania Jansen to ensure that the financial reporting on the CoE's activities went off without a hitch. With nearly 60 students and fellows under our wing in 2009, special thanks also have to go to Hilary Buchanan. She is not only the model of efficient student management, she is the 'mother away from home' for many foreign students and has a knowledge second to none of international, national and university bureaucratic hurdles. Margaret Koopman coped with the library upheavals with laudable calm, and Lionel was always there to help with everything. Rob Little arrived in his office in April and literally had to hit the deck running, not least because of the accelerating speed with which plans for 2010 were developing and the need to respond to the recommendations of the international review panel. All are proof of the adage that the whole is greater than the sum of its parts. Finally, I would like to thank Associate Professor John Hoffmann (Head of Department, Zoology), Professor Kathy Driver (Dean of Science) and Professor Danie Visser (Deputy Vice-Chancellor, Research) for their help, support and advice throughout the year.

Phil Hockey
Director

Staff:

Dr Penn Lloyd *emigrated to Australia with his family at the end of January.* ***Dr Rob Little*** *replaced him as Manager of the DST/NRF Centre of Excellence at the beginning of April.*
Lionel Mansfield *retired from the Fitz at the end of December 2009 after 38 years of service to UCT.* ***Mrs Anthea Links*** *will replace him from January 2010.*
Postdoctoral fellow, ***Dr Mandy Ridley*** *took up a research fellowship at Macquarie University in Sydney, Australia at the beginning of July, but has retained her association with the Fitztitute as an Honorary Research Associate.*

Graduates:

MSc: Anja Teroerde *(Dec 2009)*

Conservation Biology MSc: *The entire 2008/9 cohort graduated at the June 2009 ceremony:* ***Aphiwe Bewana, Justine Cordingley, Tsholofelo Ditlhobolo, Simon Dures, Maike Hamman, Clifton Meek, Alexander Menayas, Tendai Musvuugwa, Tiwonge Mzumara, Tarryn Quayle*** *and* ***Jessica Shaw.***

BSc Hons: Dominic Henry, Gina Louw, Jason Mingo *(Dec 2009)*

New students:

Postdoctoral Fellows: Steve Boyes *(Phil Hockey),* ***Timotheé Cook*** *(Peter Ryan),* ***Rowan Martin*** *(Phil Hockey) and* ***Felix Nchu*** *(Graeme Cumming)*

PhD: Sharon Okanga *(supervised by Graeme Cumming)*

MSc: Alex Thompson *(supervised by Phil Hockey)*

Conservation Biology (CB) MSc: *Eleven students began the CB MSc in January 2009.*

Staff

Director
Hockey, P.A.R. PhD (Cape Town) Professor *

Academic and Research Staff
Crowe, T.M. PhD (Cape Town) Professor *
Cumming, D.H.M. PhD (Rhodes) Honorary Professor
Cumming, G.S. PhD (Oxford) Professor *
Lloyd, P. PhD (Cape Town) Manager, Centre of Excellence, Jan
Milton, S.J. PhD (Cape Town) Honorary Professor
Ryan, P.G. PhD (Cape Town) Associate Professor*
Turpie, J.K. PhD (Cape Town) Senior Lecturer

External CoE Team Members
Bloomer, P. PhD (Pretoria) - University of Pretoria
Bowie, R.C.K. PhD (Cape Town) - University of California, Berkeley
Mandiwana, T. MSc (Cape Town) - Botany Dept, University of Cape Town
McKechnie, A.E. PhD (Natal) - University of Witwatersrand

Research Associates
Barnard, P.E. PhD (Uppsala)
Dean, W.J.R. PhD (Cape Town)
Jenkins, A.R. PhD (Cape Town)
Kemp, A. PhD (Rhodes)
Milewski, A. PhD (Murdoch University, W. Australia)
Ridley, A.R. PhD (Cambridge, England), Jul-Dec
Simmons, R.E. PhD (Wits)
Spottiswoode, C. PhD (Cambridge, England)
Wanless, R. PhD (Cape Town) July-Dec

Visiting Scientists
Bodin, O. PhD, Stockholm University, Sweden
Covas, R. PhD, CBIO University of Porto, Portugal
Gonzalez-Solis, J. PhD, Barcelona University, Spain
Gremillet, D. PhD, CNRS, Montpellier, France
Hansson, B. PhD, University of Lund, Sweden
Hole, D. PhD, Conservation International/Durham University
Homburger, D.G. PhD, Louisana State University, USA
Huntley, B. PhD, Durham University, UK
Maron, M. PhD, University of Queensland, Australia
Peters, J. PhD, Wright State University, USA
Ronconi, R. PhD, Dalhousie University, Canada
Sullivan, M, PhD, University of Ohio, USA
Willis, S. PhD, Durham University, UK

Support Staff

Manager, DST/NRF Centre of Excellence
Little, R.M. PhD (Cape Town) Manager, Centre of Excellence, Apr-Dec

Principal Technical Officer
Tobler, C.J. *

Administrative Assistant
Buchanan, H.J. *

Senior Secretary, DST/NRF Centre of Excellence
Jansen, T.

Departmental/Accounts Assistant
Mansfield, L.F. *

Library Staff
Sandwith, M. * (Librarian)
Dalgliesh, S. (Volunteer)
Hans, P. Jan-Dec

Webmaster
Stander, M.J.

Research Assistants
Aronson, J.
da Silva, J.
Fyfe, A.
Hagens, Q.
Haley, C.
Mabuza, A.
Mollat, C.
Nkosi, D.
Owen, C-S.
Scholtz, R.
Stanway, R.

* Denotes permanent member of the UCT staff establishment. All other personnel are contractual or *ad hoc* appointees held against posts supported by grants in aid of research.

Students

Post-doctoral Fellows
Boyes, R.S. PhD (KwaZulu-Natal), Aug-Dec
Cook, T. PhD (CNRS, France), Mar-Dec
Fuchs, J. PhD (MNHN, France)
Loewenthal, D. PhD (Cape Town)
Martin, R. PhD (Sheffield), Apr-Dec
Melo, M. PhD (Edinburgh, Scotland)
Nchu, F. PhD (Pretoria), Feb-Dec
Pichegru, L. PhD (Strasbourg, France)
Ridley, A.R. PhD (Cambridge, England), Jan-Jun
Rondon, X.J. PhD (Miami University, Oxford, Ohio, USA)
Techow, N.M. PhD (Cape Town)

Doctoral
Barquete Costa, V.B. MSc (Furd, Rio Grande)
Braby, J. BSc, PG. Dip Law (Cape Town)
Chaskda, A. MSc (Jos, Nigeria)
Cohen, C. BSc (Hons) (Cape Town)
De Ponte, M. MSc (Cape Town)
Jones, G. MSc (Cape Town)
Kaliba, P. MSc (Cape Town)
Little, I.T. MSc (Cape Town)
Mandiwana -Neudani, T.G. MSc (Cape Town)
Nelson-Flower, M. MSc (Vancouver, Canada)
Ngoma, P. MSc (Malawi)
Nupen, L. MSc (Cape Town)
Oatley, G. BSc (Hons) (Cape Town)
Okanga, S. MSc (Nairobi, Kenya)
Ribeiro, A. MSc (Porto, Portugal)
Shaw, J. MSc (Cape Town), Jul-Dec

Masters by Dissertation
Davies, O. BSc (Hons) (Cape Town)
Mutumi, G. BSc (Hons) (NUST, Zimbabwe)
Ndlovu, M. BSc (Hons) (NUST, Zimbabwe)
Teroerde, A. BSc (Hons) (Rhodes)
Thompson, A. BSc (Hons) (Cambridge), Sep-Dec

Masters in Conservation Biology 2009
George, S. BSc (Hons) (Zambia)
Gichohi, N. BSc (Hons) (Moi, Kenya)
Githiora, Y. BSc (Hons) (Western Cape)
Heermans, B. BSc (Hons) (Montana)
Kissoon, I. BSc (Hons) (Guyana)
Kujirakwinja, D. BSc (Hons) (Bukavu)
Marais, M. BSc (Hons) (Pretoria)
Moseley, C. BSc (Hons) (Cape Town)
Skidmore, A. BSc (Hons) (Colorado)
Tuyisingize, D. BSc (Hons) (Rwanda)
Wilson, G. BSc (Hons) (Cape Town)

Masters in Conservation Biology 2008
Bewana, A. BSc (Hons) (Cape Town), Jan-Jun
Cordingley, J. BSc (Hons) (Newcastle, England), Jan-Jun
Ditlhobolo, T. BSc (Hons) (Oklahoma, USA.), Jan-Jun
Dures, S. BSc (Hons) (Edinburgh, Scotland), Jan-Jun
Hamman, M. BSc (Hons) (Cape Town), Jan-Jun
Meek, C. BSc (Hons) (New York, USA), Jan-Jun
Menayas, A. BSc (Hons) (Arizona, USA), Jan-Jun
Musvuugwa, T. BSc (Hons) (NUST, Zimbabwe), Jan-Jun
Mzumara, T. BSc (Hons) (Malawi), Jan-Jun
Quayle, T. BSc (Hons) (Aberdeen, Scotland), Jan-Jun
Shaw, J. BSc (Hons) (Edinburgh, Scotland), Jan-Jun

Zoology (Hons)
Henry, D. BSc (Cape Town)
Louw, G. BSc (Cape Town)
Mingo, J. BSc (Cape Town)

Externally registered students

Doctoral
Flower, T. MSc (Pretoria) - registered at U. Cambridge
Golabek, K. MSc (Bristol, England) - registered at U. Bristol
Hermann, L. MSc (Pretoria) - registered at U. Pretoria
Smit, B. MSc (Wits) - registered at Wits

Masters
Deville, A-S. - registered at U. Montpellier
Jansen van Rensburg, A. BSc (Hons) (Pretoria) - registered at U. Pretoria

B.Tech
Mabihi, K. - registered at CPUT

MISSION STATEMENT
To promote and undertake scientific studies involving birds, and contribute to the practice affecting the maintenance of biological diversity and the sustained use of biological resources.

Prof. Tim Crowe
is an Elected Fellow of the Willi Hennig Society of Systematic Biology and the University of Cape Town; a member of the International Ornithological Congress Committee and the Board of the South African Biological Information Facility, and a research associate at the American Museum of Natural History in New York. He is past-president of the Southern African Wildlife Management Association and the Southern African Society for Systematic Biology and past-chairperson of the South African Biosystematics Initiative. He acted as external examiner for undergraduate courses in conservation biology at the University of Venda.

Tim co-ordinates the module Characterizing Biodiversity in the Fitztitute's Postgraduate Programme in Conservation Biology. In the year under review he supervised or co-supervised one MSc and four PhD students. He taught a module on systematics to the third-year Botany/Zoology/ Molecular and Cell Biology students. He was author or co-author of two scientific papers. He gave talks to two membership-based societies. He refereed 12 scientific papers for five different journals and reviewed one application for a research grant.

Assoc. Prof. Peter Ryan
also leads the ***Island Conservation Programme*** *and the* ***Seabird Research Programme****.*

Systematics and Biogeography

Programme leaders
Prof. Tim Crowe
Prof. Paulette Bloomer (University of Pretoria)
Assoc. Prof. Peter Ryan
Asst Prof. Rauri Bowie (University of California, Berkeley)

Research team:
Dr John Bates (Field Museum of Natural History, Chicago)
Dr Tim Bray (Postdoctoral Fellow, University of Pretoria)
Prof. Michael Bruford (Cardiff University)
Prof. Terry Burke (University of Sheffield)
Prof. Adrian Craig (Rhodes University)
Dr Michael Double (Australian National University)
Dr Christine Dranzoa (Makerere University, Uganda)
Dr Gareth Dyke (University College, Dublin)
Dr J. Steven Farris (Swedish Museum of Natural History, Stockholm)
Prof. Jon Fjeldså (Zoological Museum, University of Copenhagen)
Dr Jérôme Fuchs (Postdoctoral Fellow, PFIAO)
Dr Pablo Goloboff (Instituto Superior de Entomología, Argentina)
Dr Shannon Hackett (Field Museum of Natural History, Chicago)
Prof. Bengt Hansson (Lund University, Sweden)
Prof. Martine Hausberger (University of Rennes, France)
Prof. Terry Hedderson (Department of Botany, UCT)
Charles Kahindo (Makerere University of Kampala, Uganda)
Cecilia Kopuchian (Tucuman University)
Prof. Graham Louw (UCT Medical School)
Tshifhiwa Mandiwana-Neudani (Department of Botany, UCT)
Dr Martim Melo (Postdoctoral Fellow, PFIAO, and CIBIO, Portugal)
Michael Mills (Birding Africa; former PFIAO student)
Rick Nuttall (National Museum, Bloemfontein)
Dr Colleen O'Ryan (Department of Molecular and Cell Biology, UCT)
Asst Prof. Bret Payseur (University of Wisconsin)
Dr Eric Sande (Makerere University, Uganda)
Prof. Jon Slate (University of Sheffield)
Dr Hanneline Smit (Postdoctoral Fellow, University of Stellenbosch)
Prof. Mike Sorenson (Boston University)
Martin Stervander (MSc student, University of Lund)
Alex van Rensburg (MSc student, University of Pretoria)
Dr Bettine van Vuuren (University of Stellenbosch)
Dr Gary Voelker (Texas A. & M. University of Memphis)

Overview
Systematics is the branch of biology most closely associated with characterizing biodiversity. It has three major scientific 'twigs': taxonomy, phylogenetics and biogeography. Taxonomy involves the description, naming and classifying of species and higher taxa (genera, families, orders, etc.). Phylogenetics involves placing these taxa on to the evolutionary tree of life or (in the case of phylogeography) understanding within-species evolutionary connectivity. Biogeography involves the discovery and explanation of patterns of the distribution and diversity of taxa. There is a common misconception that the systematics of birds is well understood. For example, recent phylogenetic research by Fitztitute researchers and their collaborators has shown that Darwin's finches are not finches, but tanagers, and hawks and falcons are not closely related to one another, but evolved their predatory life styles independently. Bird systematics is a vibrant field of research thanks to recent developments in molecular genetics, combining genetic data with rigorous

analysis of more traditional lines of evidence, such as morphology, behaviour and ecology. In particular, rapid advances are being made in understanding the phylogenetic relationships among bird taxa, and we are only just starting to infer the biogeographical factors that have promoted the evolutionary diversification of birds.

Members of this programme tackle a range of projects to determine the origin and taxonomic status of species, to infer their phylogeographic or phylogenetic relationships, and to identify and explain patterns of species distributions and diversity.

Genetics of ecological speciation in birds

Understanding the genetic bases of adaptive divergence and speciation is a major challenge in evolutionary biology. We are approaching this problem by using two cases of adaptive radiation in finches recently described by members of the research team: the *Nesospiza* buntings of the Tristan archipelago (Ryan et al 2007, *Science* 315: 1420-1423) and the *Serinus* seed-eaters of the Gulf of Guinea (Melo 2007, PhD thesis). The study models have been chosen for their simplicity and because molecular and ecological data indicate that selection has played a major role in these radiations. We will use a genomics approach to sample a large number of unlinked markers across the genome (including *ca* 40 microsatellite loci and a microarray able to analyse *ca* 18000 genes) in order to distinguish between neutral and selected loci. The former will be used to infer robust phylogenetic and demographic histories, whereas the latter will identify regions underlying phenotypic variation. As we are particularly interested in identifying regions underlying bill evolution, we shall assess if genes known to be responsible for bill development in other birds play the same role in these species.

This project makes use of advanced molecular tools, thanks to a broad collaborative network established between the Fitztitute, the Genetics Department of the University of Pretoria and three European institutions at the forefront of genomic research: CIBIO (Portugal), the Molecular Population Biology Laboratory at Lund University (Sweden), and the Molecular Ecology Laboratory at Sheffield University (UK). This collaboration will both ensure a very high level of expertise at all stages and will allow cost-effective use of some of the very best laboratory facilities available. Bengt Hansson secured an EU IRSES grant (2009-2010) allowing exchanges of scientists and students between Lund, University of Pretoria (UP), UCT and Sheffield, as well as a three-year bilateral SA/Sweden grant (2009-2011) to cover running costs. Martim Melo was successful with an application to the Portuguese Foundation for Science & Technology, being awarded a three-year grant in August 2009. This will constitute the bulk of the funding required to lead this project through its completion.

The collaborative programme was launched with a two-week meeting at UCT in January 2009 which set the framework for the project. Two MSc students were able to attend the workshop: Martin Stervander based at Lund (supervised by Bengt Hansson and Martim Melo) will work on inferring the evolutionary history of the Gulf of Guinea seed-eater radiation with nuclear sequence data, whereas Alex Jansen van Rensburg from Pretoria (supervised by Paulette Bloomer, Bengt Hansson and Peter Ryan) will continue work on the radiation of the Tristan buntings. Alex spent five months in Bengt's lab at Lund University to investigate MHC variation and to genotype samples collected in 1999-2004 at additional microsatellite loci. Preliminary analyses of these data support previous results suggesting that ecological speciation took place *within* islands. She used a candidate gene approach to amplify several genes underlying body size and bill shape (Bmp2, Bmp4, MC1R, MC3R, MC4R), but found no variation among her test panel individuals which represented all the taxa from our study system. She will complete her analyses and MSc dissertation in 2010. Martin Stervander designed 48 new primer pairs and tested in total 84 primer pairs for introns and exons, amassing a dataset of over 20000 base pairs. Using this he was able to confirm the sympatric pattern of speciation in the Gulf of Guinea seed-eaters previously inferred by Martim Melo based on mitochondrial DNA and microsatellite data. The population of *Serinus rufobrunneus* from São Tomé Island is more closely related to the distinct *Neospiza [=Serinus] concolor*, endemic to São Tomé, than to its conspecific populations of the islands of Príncipe and Boné. Martin

Nesospiza *buntings exhibit a wide range of body size, with the small Nightingale Bunting* N. questi *(left) weighing barely half that of the large Wilkins' Bunting* N. wilkinsi *(right). Morphological differences are driven mainly by differences in bill size, linked to dietary specialisations. Birds on Inaccessible Island exhibit the full range of phenotypes, although fully intermediate hybrids (centre) are relatively rare. Photos: Peter Ryan.*

Prof. Paulette Bloomer
is based at the Department of Genetics, University of Pretoria. During 2009, she was promoted to full professor and elected as head of department for the period 2010-2013. She continued to serve on the IUCN Specialist Group on Afrotheria; the Yellowfish Working Group Scientific Advisory Panel and on the South African Biosystematics Initiative steering committee. She is president of the Southern African Society for Systematic Biology (2009-2011). Paulette and her students presented talks at the Zoological Society of Southern Africa and Southern African Society for Systematic Biology conferences. She supervised one CoE part-time PhD student and one full time MSc student. Her group was also joined by a UP postdoctoral researcher Dr Tim Bray (2009-2010) who contributes to one CoE project.

Asst Prof. Rauri Bowie
is based at the Museum of Vertebrate Zoology and Department of Integrative Biology at the University of California, Berkeley. He is an editor of the bird journal Ibis *and an associate editor of* BMC Evolutionary Biology *and* Ostrich*. During the review period he supervised or co-supervised two MSc students, 15 PhD students and three postdoctoral fellows. Four of his students presented papers of which he was co-author at international and local conferences. Rauri gave several talks to different interest groups, reviewed 57 papers for 11 journals and his lab published 13 papers.*

completed his MSc in early 2010 and is continuing to work on the project for his PhD.

Peter returned to the Tristan islands in 2009 to assess whether the phenotypes of buntings have changed since previous surveys in 1989 and 1999. He joined the annual relief expedition to Gough Island on the *SA Agulhas* in September 2009, then spent two months on Inaccessible Island with Canadian post-doc Rob Ronconi (Dalhousie University). They left the island on the *MV Edinburgh* with the assistance of Norman Glass from Tristan's Conservation Department and spent a week aboard the *Edinburgh*, conducting further research at Inaccessible, Nightingale, Middle and Stoltenhoff Islands, before returning to Cape Town in mid-December. More than 380 buntings were caught at the islands, including the first samples from Stoltenhoff and Middle Islands off Nightingale. Tissue samples were obtained from five large- and five small-billed buntings (all adult males) from Inaccessible Island for extensive genetic screening to ascertain the genetic basis of bill-size differences. Some 350 blood samples were collected for population genetic analysis. Feather samples and representative samples of key prey items were obtained for stable isotope analysis to test how phenotype affects diet. Feathers were collected from 150 buntings across the full range of phenotypes present on both Inaccessible and Nightingale Islands. In November 2009, Bengt Hansson again visited the Fitztitute for two months to work primarily with Martim Melo, and also visited Paulette Bloomer at U.Pretoria.

Comparative phylogeography of southern African birds

This collaborative project involving Rauri Bowie, Tim Crowe, Gary Voelker, Jérôme Fuchs, Hanneline Smith, Bettine van Vuuren, Ângela Ribeiro and Graeme Oatley aims to describe the phylogeographic pattern of 11 co-distributed southern African bird lineages and to use the resulting data to understand how populations responded (by fragmenting or merging, shrinking or expanding) to landscape changes resulting from the climatic oscillations of the Plio-Pleistocene (3.6 m.y.a. until present). The project is designed to 1) assess whether currently recognized subspecies represent distinct evolutionary lineages; 2) infer the number and location of potential evolutionary refugia that allowed populations to persist during climatic oscillations and independently evaluate their placement using a climate-based model of habitat stability; 3) determine if population fluctuations were synchronised across taxa and correspond to periods with marked climatic change; and 4) characterize the genetic structure of suture zones (i.e. whether distinct gene pools exist on each side of a contact zone). If such contact zones are detected, we shall assess whether alleles are moving freely across zones (i.e. genetic introgression) or whether the movement of alleles is restricted to a narrow zone.

Studying the genetic structure within each lineage takes advantage of the development of novel molecular markers and high-throughput molecular techniques (e.g. genotyping SNPs). The spatially specific data generated are used to test specific hypotheses in a coalescent framework. The team currently is using up to 20 independent loci from mitochondrial, autosomal and Z-chromosome-linked DNA to determine the phylogeographic history of each species.

Preliminary results indicate that the species studied do not share a common genetic structure across South Africa. Some taxa are highly structured (e.g. Fork-tailed Drongo *Dicrurus adsimilis* and Karoo Scrub-Robin *Erythropygia coryphoeus*), whereas others are genetically homogeneous across the country (e.g. Common Fiscal *Lanius collaris* – although this changes if one expands the scale to the whole of Africa, with two well-defined taxa emerging, Fig. 1 on page 8). Even where strong genetic structure is observed, there appear to be no consistent barriers to gene flow between populations. It thus seems that species responded differently to the Plio-Pleistocene climatic oscillations. These results are mostly based on one mitochondrial marker and incomplete geographic sampling. A more complete picture will emerge during the course of 2010 as nuclear markers are analyzed and taxon coverage is extended.

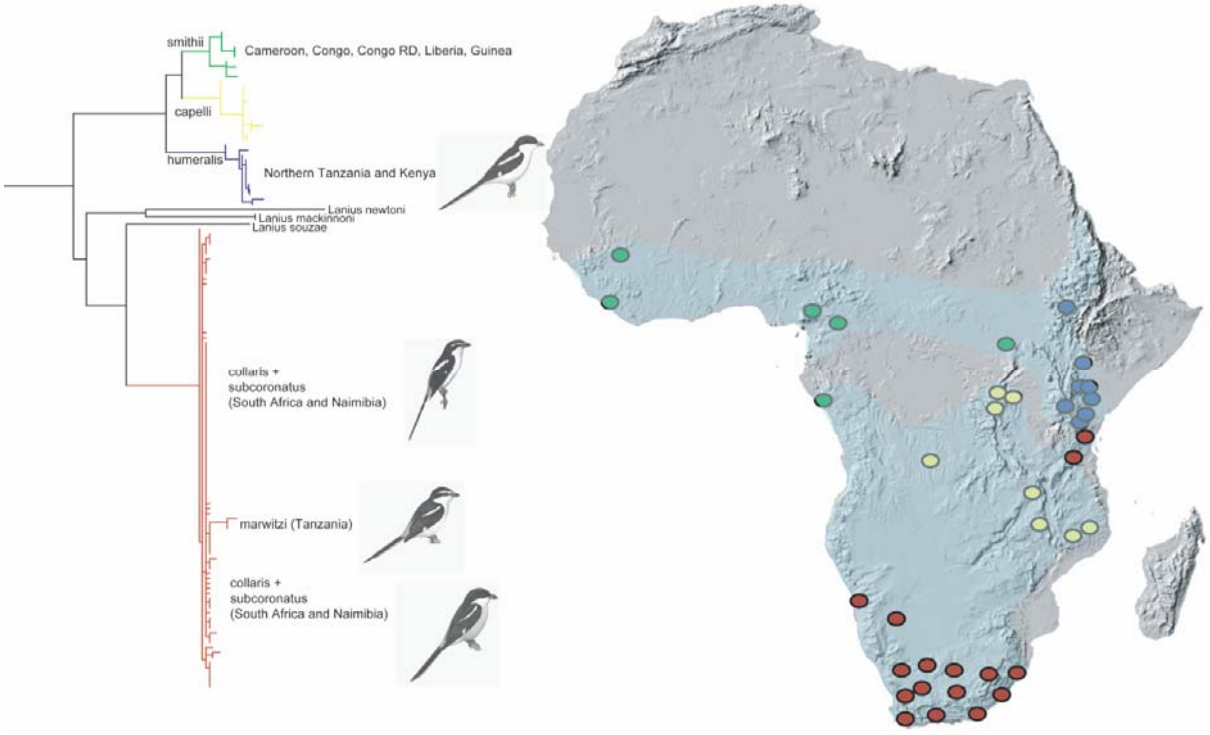


Figure 1. Distribution of the Fiscal Shrike Lanius collaris *complex in Africa, with the dots representing the sampling localities. There is a strong genetic differentiation between a northern (green, blue and yellow dots) and southern group (red dots), with the occurrence of intervening species* (L. souzae, L. mackinonni) *in the tree. Our data suggest that the northern and southern group may best be recognized as distinct species,* L. smithii *and* L. collaris*, as suggested by Harris and Franklin (2000), based on morphology and vocalizations, with the localised Uhehe Fiscal* L. marwitzi *from the Tanznian highlands nested within the southern group. The phylogenetic tree was obtained by maximum likelihood analyses of 250 individuals.*

Molecular biogeography and conservation of Africa's highland forest birds

Highland forests are arguably the most diverse and threatened habitats in Africa, at risk due to their restricted areas, nested within regions with large human population densities, and their predicted susceptibility to climate change. The similarities and differences in these highland avifaunas have long fascinated ornithologists, but the development of biogeographic hypotheses has been hindered by the lack of phylogenetic information for the avifaunas of several important centres. Recent research has discovered numerous new species among the relatively well-studied East African montane forest birds, but important areas such as the Angolan Scarp and northern Mozambique highlands have been largely ignored, due in part to recent political instability.

This project aims to provide novel insights into the biogeography of birds found in the highlands of tropical Africa by inferring the evolutionary links between highland regions. In parallel with this, we aim to provide clear guidelines for conservation planning and to launch specific conservation actions in the most threatened areas. The initial phase of the project focuses on the Angolan highlands. This important centre of bird endemism is of particular interest because it includes the most isolated 'islands' of the Afromontane 'archipelago'. In November 2008, Martim Melo and Michael Mills visited the central scarp and the Afromontane forests of Mount Moco, the highest mountain of Angola. This resulted in the launch in 2009 of a research and conservation programme for the Mount Moco forests, where the best remnants of Afromontane forest persist. An expedition to Mount Moco in July-August 2009 conducted bird surveys in the remaining forest patches, including mist-netting birds to obtain genetic samples. It also explored human impacts on the forests, including surveys of resource use and mapping of surrounding communities. Mount Moco is the single most important site in Angola for bird conservation. We estimate its meagre 80 ha of forest represents more than half of the remaining Afromontane forest in Angola, and supports most of the surviving Swierstra's Francolins *Pternistis swierstrai*, a species that should be regarded as *Critically Endangered* or at least *Endangered*.

The Mount Moco initiative was funded in part by the A.P. Leventis Foundation and assisted by close collaboration with ISCED (Tertiary Institute for Education Sciences) in Lubango, resulting in the enrolment of two Angolan MSc students in the project. In December 2009 a third MSc student from the University of Oporto, Portugal was recruited to conduct a viability study on eco-tourism as a conservation tool at Mount Moco. The project has strengthened the relationship with BirdLife International and BirdLife Africa, which will use this conservation initiative as the seed for a BirdLife Angola

programme. A similar project is planned for the forests of the central scarp, where the bulk of the endemic bird species are confined, commencing in 2010. Funding for this work has already been secured from the A.P. Leventis Foundation, the Rufford Small Grants Foundation and the P.A. Clancey Trust (administered by the PFIAO).

Mount Moco, Angola's highest mountain, supports more than half of the country's Afromontane forest, yet barely 80 ha survives. Photo: Martim Melo.

Studies of birds and mammals throughout the Malawi Rift

Potiphar Kaliba's PhD research investigaties the biogeography, phylogeography and genetic diversity among several bird and small mammal taxa distributed throughout the Malawi Rift. The resulting data will be used in combination with morphological evidence to determine species boundaries and relationships across the geographical region from southern Tanzania (Rungwe Mountains) through Malawi (Misuku Hills, Nyika Plateau, Ntchisi Highlands, Mount Zomba and Mount Mulanje) to northern Mozambique (Mount Namuli). Potiphar has completed his fieldwork and is current collecting the remainder of the molecular DNA data for his thesis at the Museum of Vertebrate Zoology at the University of California – Berkeley.

Preliminary results suggest that a phylogeographic break occurs between populations in the northern and southern Malawi Rift for several species including the Soft-furred Rat *Mastomys natalensis*, Stripe-cheeked Greenbul *Andropadus striifacies* and Malawi Batis *Batis dimorpha*. Potiphar is currently adding data from another small mammal, as well as four additional bird species that include two rainforest specialists and two broadleafed woodland species.

Bird speciation in the Gulf of Guinea

The Gulf of Guinea island system off West Africa constitutes a spectacular centre of bird endemism, with 33 species unique to the region. It comprises three oceanic islands (Annobón, São Tomé, Príncipe), one land-bridge island (Bioko) and one ecological island (Mount Cameroon), all part of the Cameroon line of volcanoes. A long-term project with the objective of inferring the causes behind such high endemism levels started in 2002. This project works as an umbrella for several independent projects on well-defined questions that focus on specific groups. Martim Melo has used molecular data to infer the evolutionary history of all endemic groups. The genetic data is then combined with morphological, behavioural and field experiments (mate choice) to investigate: 1) the importance of isolation for the speciation process; 2) the applicability of the current 'ecological model' of speciation, which was developed in parapatric and sympatric situations (presence of gene flow), to allopatric situations (no gene flow), and 3) the link between character divergence at the population level and the evolution of reproductive isolation.

Molecular phylogenies have revealed that previous systematic assessments based on phenotypic characters were often incorrect. High levels of phenotypic differentiation of island taxa are not related to time since origin, often evolving within very short periods. Species that diverged the most in phenotype were those that speciated after establishing sympatry with related populations, providing strong evidence for the importance of secondary contacts in promoting phenotypic diversification and speciation. Although most species originated by diverging in isolation from their mainland source populations (allospeciation), two cases of archipelago radiation have been described for five white-eye taxa (Zosteropidae) and for two seed-eater species (Fringillidae). Remarkably, molecular evidence strongly suggests that the two seedeater species (Príncipe Seed-eater *Serinus rufobrunneus* and the São Tomé Grosbeak *Neospiza concolor*) may have speciated in sympatry (see project on Genetics of ecological speciation). The year 2009 was one of paper writing rather than data collection, with six papers published or in press.

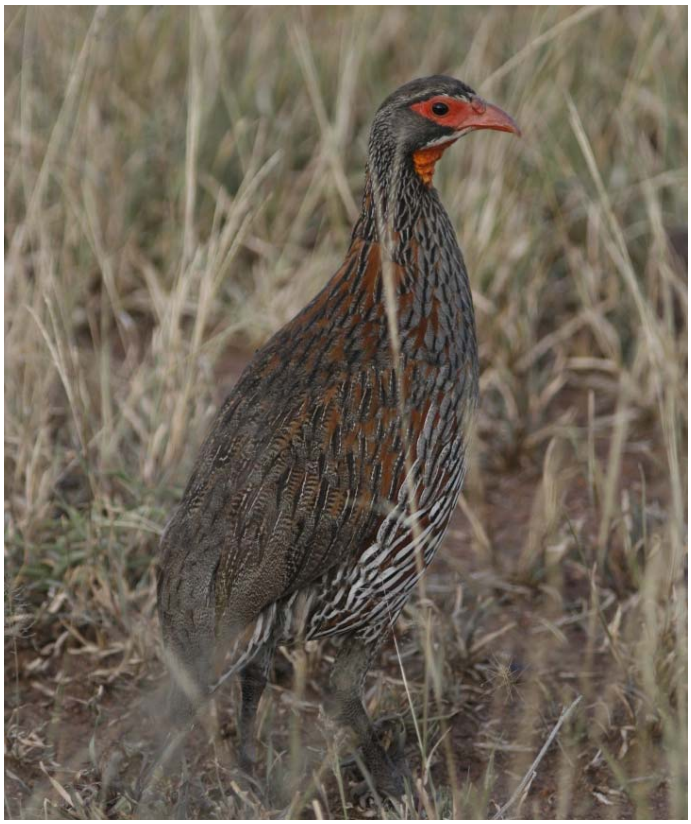
Recent work by Martim Melo combining molecular, vocal and morphometric data, has shown that the Príncipe Thrush Turdus xanthorhynchus *is quite distinct from its more common congener on Sao Tomé. Photo: Martim Melo*.

Gamebird evolution

Francolins and spurfowls are traditionally placed in one of the largest genera of birds. However, building on earlier molecular research conducted by Paulette and Tim, Tshifhiwa Mandiwana-Neudani has confirmed from her research on their anatomy, behaviour and molecular biology that they form at least two evolutionarily distinct groups, the 'true' francolins

(*Francolinus sensu stricto, Dendroperdix, Peliperdix* and *Scleroptila* spp.) and Spurfowls (*Pternistis* spp.). During the period under review, she finished the molecular research necessary for her PhD and worked with collaborators Martine Hausberger, Cecilia Kopuchian and Graham Louw to demonstrate that francolins and spurfowls also have consistent differences (and within-group similarities) in their calls and the anatomy of their syrinxes (avian voice-boxes).

In April, Tim worked with Gareth Dyke at the British Natural History Museum in Tring, England, to review the research of Dan Ksepka on the Eocene gamebird fossils *Paraortygoides messelensis* and *Gallinuloides wyomingensis*. Placing these fossils on the gamebird evolutionary tree is important in dating the branches of this tree and testing the hypothesis that their evolution was influenced by the break-up of the ancient mega-continent Gondwana. Tim and Gareth have independently concluded that *Gallinuloides* is related to phasianoid gamebirds (guineafowls, New World quails and pheasant-like birds, relatively high in the tree). Dan's more recent research based on more complete evidence places them at the very base of the gamebird tree, linking them to their closest living relatives, duck/goose-like birds (Anseriformes). Tim and Gareth now believe that Dan is correct. However, later that month, Tim's investigations of another Eocene fossil, *Telecrex grangeri* from Mongolia, held by the American Museum of Natural History, seem to confirm that phasianoid birds existed in the Northern Hemisphere early enough to support very ancient origins of evolutionarily basal gamebirds.



Tshifhiwa Mandiwana-Neudani's PhD work has confirmed the distinctness of the spurfowls, such as this Red-necked Spurfowl Pternistis afer*, from the other francolins. Photo: Callan Cohen.*

African White-eyes

The primary aims of Graeme Oatley's PhD research on southern African white-eyes *Zosterops* spp. are to use a combination of morphological, vocal, molecular and geo-bioclimatic evidence to: 1) discover Evolutionarily Significant Units (ESUs) of white-eyes from southern Africa (at both the species and subspecies levels); 2) resolve phylogenetic relationships between them; and 3) elucidate the processes (e.g. vicariance *versus* disruptive selection) that promoted their evolution. Morphological analyses support recognition of four ESUs determined primarily by the coloration of their ventral plumage. The Orange River White-eye *Zosterops pallidus* from arid parts of north-western South Africa has peachy flanks. The Cape White-eye *Z c. capensis* from the Western Cape and Eastern Cape Provinces has a grey belly, whereas *Z. c. virens* from the more mesic areas of the eastern Eastern Cape northwards through KwaZulu-Natal extending marginally into Zimbabwe and Mozambique has a greenish belly. Finally, the African Yellow White-eye *Z. senegalensis*, distributed broadly in Africa northwards, has mainly yellow underparts. Comparisons of sonograms of contact calls revealed significant differences between the Orange River White-eye (3-4 syllables) and both forms of the Cape White-eye (only a single syllable).

A preliminary phylogeny of white-eyes based on analyses of mitochondrial DNA confirms an evolutionary break between the Orange River White-eye and both forms of the Cape White-eye. Interestingly, a few individuals of the Cape White-eyes appear to hybridize with the Orange River White-eye where their distributions meet (Vanderbijlpark, Bronkhorstfontein and Aliwal North). There is no such mitochondrial break between the two Cape white-eyes, although grey-bellied birds from the southern and western Cape seem to group together. This supports recognition of a possible subspecies in the Cape White-eye restricted to the southern and western Cape. There does not seem to be any molecular difference between grey-bellied birds from the Eastern Cape and green-bellied birds from eastern and northern South Africa, suggesting that diversification in plumage has occurred relatively recently.

Ongoing research at UC Berkeley involves the addition of more samples to the mitochondrial DNA dataset, as well as amplifying and analysing various nuclear DNA markers, including microsatellites. The addition of microsatellites will provide a fine-scale perspective on the population structure between the grey- and green-bellied forms of the Cape White-eye, which will provide information on the subspecies status of these two taxa, as well as determining where the split between the two taxa occurs. These results will be linked to bioclimatic models in an attempt to understand the underlying processes that may have promoted diversification in fynbos birds: fynbos has relatively few endemic bird species despite its high botanical diversity.

Cisticolas

The systematics of the cisticolas *Cisticola* spp. is particularly challenging due to their remarkably uniform anatomy. MSc student Owen Davies has expanded on the research initiated by

Lisa Nupen using multiple independent sources of evidence (morphology, molecules, behaviour, life-history and ecology) to delineate the taxonomic boundaries within and between species of southern African cisticolas. He is employing a multifaceted approach to understand the phylogeny, taxonomy and biogeography of 11 currently recognized species that occur in southern Africa. Traditionally, many cisticolas have been placed into eight groups in order to reflect hypothesized relatedness, whereas others were left ungrouped because their evolutionary affinities are unclear. Owen has selected representatives of three of these traditional groups, each comprising of three species, and two unplaced species. These include: the '*textrix*' or cloud-scraper group, comprising *C. textrix, C. ayresii* and *C. cinnamomeus*; the '*galactotes*' or marsh cisticola group, comprising *C. galactotes,, C. laupula* and *C. pipiens*; and the '*subruficapilla*' or wailing cisticola group, comprising *C. subruficapilla, C. lais* and *C. rufilatus*. The two 'unplaced' species *C. tinniens* and *C. chiniana* will be key species of interest. Additionally, in order to clarify the potential existence of cryptic species of *C. juncidis* identified by Lisa, more molecular work will be done on material collected from sampling gaps and locations suggested by her research. The first step in Owen's research will be to re-investigate data used to date to determine the extent that they confirm the currently employed systematics. Additional detail will involve the comparison of data obtained from syringeal (voice-box) morphology and from detailed analysis of vocalizations. Molecular data, including nuclear and mitochondrial markers, will then be combined with these phenotypic data in order to get an accurate understanding of the diversity of the taxa.

Bustards, sandgrouse, coursers and enigmatic gamebirds

Callan Cohen is in the final stages of completing his PhD dissertation on the systematics of bustards (Otididae), sandgrouse (Ptericlididae), coursers (Glariolidae) and two phylogenetically enigmatic gamebirds - the Stone Partridge *Ptilopachus petrosus* and Nahan's 'Francolin' *Francolinus nahani*. His investigations, based on a range of anatomical, behavioural and molecular evidence have demonstrated that: 1) polygyny has evolved more than once in the bustards, and that a new generic taxonomy is required for the family; 2) the long-established sandgrouse genus *Pterocles* is not monophyletic; 3) the recognition of two subfamilies of coursers may not be warranted; and 4) the Stone Partridge, a small gamebird confined to the semi-arid Guinea savannas, and Nahan's Francolin, a bird of pristine tropical rainforest, have remarkably similar behaviour, confirming the results of molecular research carried out by other team members.

Bar-throated Apalis

The Bar-throated Apalis *Apalis thoracica* is a complex of 21 recognized subspecies that occur widely in southern Africa, becoming increasingly localised in montane forests towards the Equator. One of the aims of Lucille Hermann's PhD research under the supervision of Paulette Bloomer and Peter Ryan is to elucidate the intra-specific patterns of genetic diversity in this complex. A clear genetic divergence has been identified between the northern subspecies and six southern subspecies, with a contact zone in KwaZulu-Natal. However, more thorough sampling is still urgently needed in KwaZulu-Natal, firstly to determine accurately the geographic position of the contact zone between the northern and southern phylogroups, and secondly to determine the processes present within this contact zone. There are strong indications of an ancient northerly migration along the Afromontane archipelago progressively giving rise to the more northerly subspecies. Five nuclear markers that have previously proven to be useful in passerines have been tested, but none has shown significant genetic divergence in *Apalis thoracica*. One nuclear locus is yielding some resolution. Lucille presented her current findings at the SASSB conference. In early 2010 Lucille will complete her first manuscript and then extend the search for nuclear loci to add resolution to the phylogeographic analysis.

Conservation genetics of Benguela seabirds

Lisa Nupen is using genetic markers to assess the phylogeography of three species of threatened seabirds endemic to the Benguela upwelling region of Namibia and South Africa - Cape Cormorant *Phalacrocorax capensis*, Cape Gannet *Morus capensis* and African Penguin *Spheniscus demersus*. Populations of all three species have been impacted by historical and ongoing anthropogenic factors ranging from guano and egg collecting, through pollution, disturbance and competition with commercial fisheries. Following the collapse of pelagic fish stocks off Namibia, the bulk of these birds' populations are found in South Africa. However, the last decade has seen a south and eastward shift in the distribution of pelagic fish (sardines and anchovies) off South Africa. This has increased the foraging effort required to find enough food to breed successfully, especially for birds at colonies off the west coast. Seabirds are capable of covering large distances, suggesting a high frequency of gene flow between colonies, but strong breeding site fidelity (philopatry) results in significant levels of population genetic structure in many seabird species.

The primary aim of this study is to test whether geographic isolation and adult philopatry has led to genetic differentiation between island subpopulations. Lisa is examining the genetic diversity within and between different sub-populations of seabirds to quantify the extent to which gene flow occurs between colonies. The degree of structure within populations has important implications for management. It also will be interesting to see how closely the migration estimates based on molecular data approximate those based on ringing data. Preliminary results suggest low levels of genetic diversity in the African Penguin and Cape Gannet. Lisa also will test whether this low diversity is partly the result of the recent large population declines in these long-lived seabirds.

Oystercatchers

Dr Tim Bray took over the previous genetic work on the African Black Oystercatcher *Haematopus moquini* and used new 454 sequencing technology to identify more loci for microsatellite

marker development. The oystercatchers are proving a challenge in this regard as they have very few alleles per locus, limiting resolution in population genetic analyses. Preliminary results appear to support demographic data suggesting a range expansion to the Eastern Cape over recent times. Tim presented his preliminary findings at the ZSSA symposium. Tim will continue with further marker development in early 2010, followed by analyses of population structure using mitochondrial DNA coalescent-based theory.

Other ongoing research

Paulette Bloomer is wrapping up research on phylogenetic relationships among Helmeted Guineafowl *Numida meleagris* in collaboration with Tim Crowe and Tshifhiwa Mandiwana-Neudani. Paulette and Peter Ryan will also complete lark analyses in 2010 to publish several papers from Keith Barnes' PhD and to complete former research on clapper larks.

Martim Melo assists an Angolan student weighing a bird during the Mount Moco survey in 2009. Photo: Pedro Rocha.

Highlights

- We established a firm collaborative linkage with researchers at Lund and Sheffield Universities to investigate bird speciation.
- A project was launched to conserve the Afromontane forests of Mount Moco, Angola (see www.mountmoco.org).
- Paulette Bloomer was promoted *ad hominem* to full professor and elected as head of department.
- Tim presented a paper on the phylogenetic utility of retroposed elements ("jumping genes") at the annual conference of the Willi Hennig Society of Systematic Biology in Singapore.
- Several team members attended the joint conference of the Zoological Society of Southern Africa (ZSSA) and the Southern African Society for Systematic Biology (SASSB) at Illovo Beach (KwaZulu-Natal), and Owen Davies won the award for best student poster at the ZSSA meeting.
- Tshifhiwa Mandiwana-Neudani organized the South African Biosystematics Initiative (SABI) postgraduate student workshop at the SASSB conference. In September, she visited the University of Rennes and worked with Martine Hausberger to complete her research on the evolution of francolin/spurfowl vocalizations.

Students (supervised by PFIAO staff)

Callan Cohen (PhD, supervisors Tim Crowe and Rauri Bowie) *The evolution of the bustards, coursers and sandgrouse and two enigmatic gamebirds: implications for African biogeography, evolution of display and conservation*.

Lucille Hermann (PhD, Univeristy of Pretoria, supervisors Paulette Bloomer and Peter Ryan) *Comparative phylo-geography of forest avifauna.*

Potiphar Kaliba (PhD, supervisors Rauri Bowie and Tim Crowe) *Faunal turnover between east and southern African birds and small mammals: is Malawi the geographical break?*

Tshifhiwa Mandiwana-Neudani (PhD, supervisors Tim Crowe and Rauri Bowie) *Taxonomy, phylogenetics and biogeography of francolins and spurfowls.*

Lisa Nupen (PhD, supervisors Peter Ryan, Rauri Bowie and Jacqui Bishop) *Comparative conservation genetics and evolutionary history of threatened, endemic southern African seabirds in the Benguela Current Upwelling Ecosystem: Range-wide phylogeography, gene flow and population genetics based on nuclear and mitochondrial DNA*.

Graeme Oatley (PhD, supervisors Tim Crowe and Rauri Bowie) *Exploring species boundaries within the Cape White-eye* Zosterops virens *and Orange River White-eye* Z. pallidus *complex using organismal and molecular evidence*.

Ângela Ribeiro (PhD, supervisors Rauri Bowie and Phil Hockey) *Comparative phylogeography of southern African birds.*

Owen Davies (MSc, supervisors Tim Crowe and Rauri Bowie) *Taxonomy, phylogeny and biogeography of African cisticolas.*

Alexandra Jansen van Rensburg (MSc, Univeristy of Pretoria, supervisors Paulette Bloomer, Bengt Hansson and Peter Ryan) *Landscape genetics and adaptive radiation of* Neospiza *buntings.*

Acknowledgement

The National Research Foundation, Department of Science and Technology and French Centre National de la Recherche Scientifique (National Centre for Scientific Research) for financial support. The American Museum of Natural History (New York), Field Museum (Chicago), University College (Dublin) University of Pretoria and Boston University for access to facilities, specimens and logistical support.

Dr Mandy Ridley

left the PFIAO during 2009 to take up a position as a Postdoctoral Research Fellow at Macquarie University in Australia. However, she remains an Honorary Research Associate of UCT and retains close links with the Fitz and its students in terms of both project development and student supervision.

In 2009, Mandy reviewed two scientific grant applications, and peer-reviewed 22 manuscripts for six international journals. She was also involved in the supervision of two MSc students, one PhD student and assisted in advising several Honours students.

Prof. Phil Hockey

is also leader of the Rarity and Conservation of African Birds Programme.

Cooperation and Sociality in birds

Programme leaders

Dr Mandy Ridley (UCT Honorary Research Associate and Macquarie University)
Prof. Phil Hockey (PFIAO)

Research team:

Dr Res Altwegg (SANBI)
Dr Matthew Bell (Postdoctoral Fellow, Cambridge University)
Dr Rita Covas (CIBIO, University of Porto, Portugal and PFIAO Research Associate)
Dr Claire Douletrant (CEFE-CNRS, Montpellier, France)
Fiona Finch (Field Assistant)
Prof. Ben Hatchwell (Sheffield University)
Dr Colleen O'Ryan (Molecular and Cell Biology, UCT)

Overview

Cooperative breeding describes a social system in which animals live in groups, most often of closely related individuals. Within a group, usually only the dominant pair breed, but the other group members (subordinates/helpers) assist in rearing the offspring, despite not being the parents. This creates an apparent conundrum in terms of Darwinian precepts and the search for a unifying theory that explains the evolution of cooperative breeding remains one of the most tantalising holy grails of behavioural ecology. Globally, it is a rare social system – only about 3% of the world's birds are thought to breed cooperatively (although most of these species are capable, at least under some conditions, of breeding successfully without helpers). Some of these cooperative breeders have been the focus of intense study, often concentrating on the extent to which helpers contribute to group reproductive success. Results of these studies have proved inconclusive in terms of developing a unifying theory to explain the behaviour. In some species, helpers are beneficial to group reproductive performance, yet in others they seemingly confer no benefit or may even be detrimental. The Fitztitute has embarked on four major studies of cooperative breeding – in Green Wood-Hoopoes *Phoeniculus purpureus* and Karoo Scrub-Robins *Cercotrichas coryphoeus* (both recently concluded), and Sociable Weavers *Philetairus socius* and Southern Pied Babblers *Turdoides bicolor* (both ongoing). The two ongoing projects have, in the last few years, highlighted a key issue about studies of cooperative breeding and its origins – have we been asking the right questions in the right way? As the scientific tool kit grows ever larger and more sophisticated, the answer to that question increasingly seems to be 'perhaps not'. If the unifying theory is within grasp, history tells us that it might be uncovered only by modifying the search pattern. This is something that recent research at the Fitztitute has attempted to do by using a diversity of research approaches.

The Southern Pied Babbler Project

The Southern Pied Babbler Project is a long-term study conducting behavioural research on these cooperatively breeding birds in the southern Kalahari, based at the Kuruman River Reserve near Vanzylsrus. The Southern Pied Babbler is a medium-sized passerine that lives in groups of 3-15 adults, who all help to raise the young produced by a single dominant pair. The study population is habituated to close observation, and most birds carry unique ring combinations allowing researchers to collect detailed information on many aspects of their daily lives. The project is currently involved in several areas of research including the causes and costs of cooperation, reproductive conflict, parent-offspring conflict, foraging theory, sexual selection, kin recognition and the genetic identity of parentage.

The current population stands at 12 fully habituated groups and four peripheral groups, with group sizes ranging from 2-7 adults. The early part of the 2009/2010 breeding season was a poor one for the pied babblers, with the lowest breeding success ever recorded in seven years of research. Nest predation has been heavy,

The 14-month period that Mandy Ridley spent habituating groups of Southern Pied Babblers Turdoides bicolor *in the Kalahari has paid off with some very significant findings, including the first demonstration of Pavlovian teaching in a non-primate. Photo: Alex Thompson.*

with only 22% fledging success up to the end of 2009, compared to an annual average of 65%. Predator populations currently are large following several wet years, and their impacts on the pied babblers have been exacerbated by the very dry conditions. The seasonal rains did, however, arrive early in 2010 and there has been a resurgence in (successful) nesting activity.

Causes and costs of cooperation

Mandy Ridley continues to investigate the causes and costs of variation in contributions to cooperation, and will complete several experiments during the course of the 2009/10 breeding season. The purpose is to show that once the foraging success of an individual is taken into account, young (subordinate) group members actually provide more help than both older helpers and parents. The reason for this lies in their relatively low foraging proficiency. Youngsters give away a greater proportion of the food that they catch than do other group members, something that could not be inferred simply by monitoring chick-feeding activity. The habituation of the Pied Babblers has allowed Mandy to obtain weekly foraging observations on all group members. These data, combined with feeding experiments and body mass changes, will aim to show that the contribution of subordinates, in terms of the physical cost of help, is higher than previously thought from studies of other cooperatively breeding birds.

Mandy's primary focus of the season is to begin an entirely new area of research on sexual selection. This research is based on observations of a strong preference shown by females for heavy-bodied males. Data from the current breeding season have revealed the following:

Female reproductive conflict

- Females compete strongly for a 'sexy' male. There have been 10 cases where females divorced their mates for another male. These are significant events, because only one male and female in each group breed, resulting in strong competition for limited breeding vacancies. Dispersing females often fight resident females for access to a breeding vacancy, so evidence of females voluntarily vacating their dominant breeding position to fight for the breeding position in another group is a significant behavioural discovery. This behaviour occurs in a highly predictable fashion: females always divorce their mates for a heavier male.
- When females fight for access to males, this carries a high cost in terms of lost body condition. Fighting can be very physical and last for many days. In several cases, females collapsed from exhaustion after continuous bouts of fighting. During these extended fights, females can lose up to 25% of their body mass. This is extremely costly, because females do not lay eggs when they are in poor body condition (average egg-laying weight is 79-83 g, average weight following extended bouts of fighting is 66-70 g). Fights for access to males thus delay the onset of reproduction.
- Roving females that visit other groups outside their natal group assess their chances of winning a fight by means of vocal challenges directed at the resident, dominant female. We term this behaviour 'vocal rallying': a roving female calls when approaching the group, inciting the dominant female to give a defensive call that rallies the group in defensive mode. This vocal exchange informs the

roving female (a) whether there is a breeding vacancy in the group, and (b) the strength of the dominant female. We are conducting experimental playbacks to show this effect: by playing the calls of rovers of different weights (lighter or heavier than the dominant female), we can determine whether the dominant female can assess the strength of her rival based on vocal cues alone. Results to date suggest that females respond more strongly to the calls of heavy rovers than light ones (the latter posing little risk to her status as the dominant female). This suggests that information encoded in the call allows females to assess the relative risks posed by the interlopers. The ability to assess body mass is likely to be important because the heavier female wins more than 90% of dominance fights.

Habituated babblers have been trained to jump onto a balance so that changes in their body condition can be monitored over time. Photo: Mandy Ridley.

- Roving females that visit other groups outside their natal group assess their chances of winning a fight by means of vocal challenges directed at the resident, dominant female. We term this behaviour 'vocal rallying': a roving female calls when approaching the group, inciting the dominant female to give a defensive call that rallies the group in defensive mode. This vocal exchange informs the roving female (a) whether there is a breeding vacancy in the group, and (b) the strength of the dominant female. We are conducting experimental playbacks to show this effect: by playing the calls of rovers of different weights (lighter or heavier than the dominant female), we can determine whether the dominant female can assess the strength of her rival based on vocal cues alone. Results to date suggest that females respond more strongly to the calls of heavy rovers than light ones (the latter posing little risk to her status as the dominant female). This suggests that information encoded in the call allows females to assess the relative risks posed by the interlopers. The ability to assess body mass is likely to be important because the heavier female wins more than 90% of dominance fights.

Male quality, honest signals, and advertising 'sexiness'

- Males vary widely in the structure of their 'long call'. This call fulfils several functions. It is used during duets or courtship with the dominant female; to advertise a vacancy (i.e. when the dominant female has left or died); to locate missing group members; to declare a territory border; and during border conflicts. Heavier males are able to sustain the call for longer, and their calls have greater structural symmetry (visible on a sonograph) than do those of lighter males. The lightest males have wavering, disjointed calls and appear unable to maintain a constant pitch. Playback experiments suggest that both males and females are able to assess the body masses of calling males through the call structure. Light males will either not respond to, or fly away from the playback of a heavier male. By contrast, males that are heavier than the playback respond strongly by flying towards the source of the call and calling back. Such calls (indicating dominance) always last for longer than the playback. When the calls of light males are played to females looking for a breeding position, the latter show little interest. However, when the calls of heavy males are played to females, they tend to fly towards the call, call back, and may even go roving in response (presumably in search of the high-quality male they have heard calling).
- Following the death of a dominant female, her partner advertises the vacancy by constantly giving long calls on the territory borders. The speed with which such vacancies are filled correlates strongly with male body mass. The heaviest males fill their vacancies very quickly, typically within 1-7 days of the dominant female's death. While females do occasionally visit light males, they often leave the group within a few minutes. One light male advertised for 221 days before finding a female and some of the lightest males may never fill their vacancies. For example, one previously dominant light male never filled his breeding vacancy, the remainder of the group abandoned him and he subsequently joined a neighbouring group as a subordinate male.

Parentage and reproductive skew

Martha Nelson-Flower identified the polymorphic loci and conducted parentage analysis for the entire Southern Pied Babbler population for the full six years that the project has been running. Her findings confirmed what behavioural observations suggest, namely that reproductive skew is very high in this species. The dominant pair gain more than 97% of

parentage and subordinate reproduction, on the rare occasions it does occur, is highly predictable. Subordinate reproduction occurs when a new (unrelated) dominant immigrates into the group, freeing subordinates from incestuous matings (other group members being immediate relatives). In these cases, older subordinates - particularly when also unrelated to the same-sex dominant - will attempt to mate with the new immigrant. Describing the mating system genetically is an extremely important aspect of the Southern Pied Babbler Project: it helps us to understand what benefits subordinates gain from group membership, why reproductive conflict exists and what drives dispersal patterns. Other highlights of Martha's research include:

- An investigation into physical and genetic patterns of sex-biased dispersal, showing that Southern Pied Babblers have no sex biases in dispersal. This is unusual among cooperative breeders, most of which show a strong bias towards female dispersal.
- An investigation into the benefits that subordinates accrue from group membership, including an investigation into the current applicability of reproductive skew models.
- No evidence for inbreeding in this species. Given the close relatedness within most groups, this indicates that the babblers actively practise inbreeding avoidance.
- No evidence that there is preferential care of kin (suggesting that kin selection is not driving the evolution of cooperation in this species).
- Identifying predictable patterns of reproductive conflict and the mechanisms that dominants can use to suppress subordinates (aggression and eviction), and how subordinates can respond (e.g. egg-eating).
- Measurement of the cost of reproductive conflict (including delayed onset of reproduction and smaller group sizes).

Solo dispersal by Southern Pied Babblers is a risky and potentially life-threatening game. Photo: Alex Thompson

Parent-offspring conflict

Alex Thompson has recently started his research on parent-offspring conflict (POC) and its resolution in Southern Pied Babblers. Although POC is a theory whose origins are several decades old, research has to date been conducted almost exclusively on species with uni- or bi-parental care. However, cooperative species are particularly tractable for POC work because the presence of helpers results in significant brood overlap, with multiple broods of dependent young being raised simultaneously. This sets the scene to investigate how investment in one brood affects investment in subsequent broods, without any time delay. In addition, cooperatively breeding species typically have a prolonged post-fledging dependence period, making it possible to measure how POC changes over several stages of development.

Specifically, Alex will be looking at how and why maternal investment strategies vary between broods, the effect of brood overlap on the preferential care of particular young, and how offspring behaviour (such as begging strategies) changes as the number of competing offspring increases. He will also be conducting experiments on begging strategies, including begging as an honest signal *versus* dishonest or competitive begging among young as they try to manipulate an unequal share of resources from parents.

The addition of nest cameras this year for Alex's research has provided some interesting and unexpected insights into nest activity, including several cases of infanticide through female-female competition and egg-tossing by other bird species, presumably as a result of competition for resources (which were scarce during the early, dry period of the breeding season). We have also accumulated evidence for significant predation by hornbills, an effect not seen in previous years, but possibly also precipitated by extremely dry conditions at the start of the 2009/2010 summer. A colleague working on Southern Yellow-billed Hornbills *Tockus leucomelas* at the study site simultaneously documented severe food stress at hornbill nests, resulting in the partial or complete abandonment of some broods. This food stress has coincided with evidence for hornbill predation at babbler nests, including babbler eggshells beneath hornbill nests, and hornbills carrying dead babbler chicks.

Cooperation and population dynamics in the Sociable Weaver *Philetairus socius*

The Sociable Weaver *Philetairus socius* is endemic to southern Africa. This species has been the subject of a long-term Fitztitute study initiated in 1993 and is based at Benfontein Game Farm near Kimberley in the Northern Cape. The study was initially set up by Mark Anderson (then at Northern Cape Nature Conservation) and Morné du Plessis (PFIAO) as a means of involving amateur ornithologists in bird ringing while at the same time contributing to our knowledge of the species. The study has been continued by Fitztitute students and researchers since 1998 and is now one of the few long-term studies in Africa (along with Fitztitute studies of sub-Antarctic seabirds, African Black Oystercatchers *Haematopus moquini*, Peregrine Falcons *Falco peregrinus*, Green Wood-Hoopoes *Phoeniculus purpureus* and Southern Pied Babblers *Turdoides bicolor*) that is based on a population of individually colour-ringed birds. The main focus of the study has been to understand the evolution of cooperative breeding and helping behaviour, and over the last ten years the programme has

produced two PhD and three MSc theses, and more than 15 scientific publications. In addition, the long-term data set is now been used to address questions related to demography and population dynamics.

During the 2009 breeding season we focused on two different aspects of Sociable Weaver biology. One project continues the long-term study of the adaptive hypotheses for helping behaviour in this species. Specifically, we are investigating whether the presence of helpers has benefits for females by allowing them to reduce their investment in eggs and thereby increase their own survivorship. The other project focuses on factors affecting the population dynamics of the weavers at Benfontein using the long-term data set (1993-2009).

Recent analyses have found that the survival of breeding female Sociable Weavers Philetairus socius*, but not that of males, is enhanced by having helpers at the nest. Photo: Martim Melo.*

The evolution of helping behaviour in Sociable Weavers

In cooperative breeders, mature helpers assist in raising the young of dominant breeders. These helpers are often related to the breeders and hence are expected to have a positive effect on the breeders' reproductive output, thereby indirectly increasing the production of their own kin. However, several studies have failed to demonstrate this effect, raising a currently unresolved paradox. One possible explanation for this is that, in the presence of helpers, females reduce their reproductive effort by laying smaller eggs or decreasing the amount of food they bring to the brood. This could result in similar reproductive success whether helpers are present or absent. Helping behaviour would, nonetheless, benefit females who could enjoy enhanced survival or fecundity in subsequent reproductive attempts. Our study is investigating the effect of helpers on females' reproductive investment in eggs and on female (and male) survival. This study formed the core of an MSc thesis at the University of Montpellier II, France, by Anne-Sophie Deville. The MSc was co-supervised by Rita Covas (PFIAO) and Claire Doutrelant (CEFE-CNRS).

Anne-Sophie found that females, but not males, have enhanced survival when breeding with the assistance of helpers. Because both females and males reduce their feeding effort in the presence of helpers, this result suggests that females may be cutting their reproductive costs in some other way(s). A primary hypothesis tested was that females reduce their investment in eggs when breeding in the presence of helpers because the additional food brought by the helpers will compensate for the smaller or poorer quality eggs produced. However, initial analyses of egg size and content failed to support this hypothesis. Nevertheless, due to the different factors potentially affecting female investment in eggs and the interactions between these factors, we will be increasing the sample size to ensure that the hypothesis is tested rigorously before it is rejected.

The second interesting result stemming from this study concerns the effect of helpers on the juveniles they assist in raising. Because helpers are expected to have a beneficial effect on reproduction, we predicted a positive effect of helper presence on juvenile survival. However, exactly the opposite turned out to be true: helpers had a significant negative effect on juvenile survival. This unexpected result could be due to a higher propensity for dispersal among juveniles raised in part by helpers. Young that fledge from nests with helpers might be forced to disperse because of competition with older, dominant helpers (who are usually siblings from previous broods). If such dispersal happens regularly, we would be unable to distinguish it from juvenile mortality, because both result in the 'disappearance' of young. This result has been submitted for publication, but the work on juvenile dispersal will continue.

Sociable Weaver population dynamics

This project is investigating the environmental, demographic and behavioural factors affecting the dynamics of the Sociable Weaver population at Benfontein. In particular, we are investigating causes of colony decline and extinction, and factors affecting dispersal. This involves modelling survival and reproduction. For this we use both the existing long-term data-set plus additional field data collected in 2009. This study is being conducted by CB student Michael Marais and is co-supervised by Rita Covas (PFIAO) and Res Altwegg (SANBI).

Future work

In 2010 we will continue the work that investigates the evolutionary basis of cooperation on the weavers, as well as the research on the weavers' demography and population dynamics.

Maternal investment and helping behaviour

In 2010 a new PhD student will continue one of the central themes of the study, namely understanding the adaptive basis of cooperative breeding in this species, as well the consequences it has in terms of life-history and population dynamics. Specifically, the new study will investigate the hypothesis that breeders reduce reproductive effort when assisted by helpers, which could explain why many studies of cooperative breeding find little or no effect of helpers on reproductive output. We will use a long-term dataset combined with field experiments to investigate the effects of helpers on survival and test the novel hypothesis that females assisted by helpers decrease investment in eggs. Finally, we will

investigate the consequences of cooperative breeding for juvenile dispersal and population dynamics. The thesis will be co-supervised by Rita Covas and Claire Doutrelant. The project will be partly funded by a Research and Development grant from the Portuguese Science and Technology foundation to Rita Covas.

Nest building in Sociable Weavers: how is a tragedy of the commons averted?

Individuals cooperating in joint tasks share the benefits of investment in public goods, while the costs are borne individually, making cooperation vulnerable to exploitation. This social dilemma is termed the 'tragedy of the commons'. The objective of this project is to determine how such a 'tragedy' is averted in a colonial system with substantial cooperative investment in public goods, namely the weavers' communal nest structure. Specific objectives are 1) to quantify individual variation in cooperative investment in public goods; 2) to test the assumption that investment in cooperative behaviour is costly; 3) to quantify the function of public goods in a colonial breeding system; and 4) to test alternative hypotheses for resolution of the tragedy of the commons. The latter will be investigated by determining whether individual investment in cooperative work is a) related to kinship with other colony members; b) enforced by other colony members; or c) a signal to other colony members of individual quality. This project, to be carried out at the Fitztitute's long-term weaver study site at Benfontein, will be a joint venture between the PFIAO and the University of Sheffield and will be funded by a NERC (UK) grant to Ben Hatchwell (University of Sheffield).

Demography and population dynamics

We will continue the capture-mark-recapture program and monitoring weaver reproduction to increase the long-term database that has been allowing us to study the factors affecting survival, reproduction and hence population dynamics. Such long-term data sets are an invaluable tool to understand how populations may respond to environmental changes, including climate change. This study will be pursued in collaboration with Res Altwegg. It is envisaged that a second PhD student may become involved in this part of the project.

Highlights

- In 2009, the Southern Pied Babbler project had four papers published in international journals (*Proceedings of the Royal Society* x 2; *Journal of Animal Ecology*; *Behavioral Ecology & Sociobiology*). Four manuscripts are currently in review.
- Mandy received a grant from the National Geographic Society to help launch her new research on sexual selection strategies in Southern Pied Babblers
- Alex received a grant from the British Ecological Society to help fund some of his fieldwork costs for research on parent-offspring conflict
- In November, Martha Nelson-Flower submitted her PhD thesis.

Students

Anne-Sophie Deville (MSc, U. Montpellier, supervisors Rita Covas, Claire Doutrelant and Arnaud Gregoire) *Conséquences de la reproduction coopérative sur la survie et l'investissement reproducteur maternel chez le Tisserin social* (Philetairus socius).

Michael Marais (MSc CB, supervisors Rita Covas and Res Altwegg) *The effects of colony dynamics and climate on a declining population of Sociable Weavers* Philetairus socius.

Martha Nelson-Flower (PhD, supervisors Phil Hockey, Colleen O'Ryan and Mandy Ridley) *Kinship and its consequences in the cooperatively breeding Southern Pied Babbler* Turdoides bicolor.

Alex Thompson (MSc, supervisors Phil Hockey and Mandy Ridley) *Maternal investment and its effects on parent-offspring conflict in the cooperatively breeding Southern Pied Babbler* Turdoides bicolor.

The nest of the Sociable Weaver Philetairus socius *is the largest of any bird in the world: many hundreds of birds may be involved in the construction of a single nest. Whilst individual birds benefit from the large nest structure, each individual incurs a cost in its construction, opening the doors for individuals to cheat by not pulling their weight. A new research project is investigating how this potential 'tragedy of the commons' is or is not avoided. Photo: Peter Ryan.*

Acknowledgements

Southern Pied Babblers: Mr & Mrs Kotze, Mr & Mrs de Bruin and the Kuruman River Reserve for land access. We also thank the Centre for Research & Exploration (National Geographic Society), the British Ecological Society, the DST/NRF Centre of Excellence at the Percy FitzPatrick Institute, the South African National Research Foundation (Core Programmes) and Macquarie University for financial support.

Sociable Weavers: Portuguese Science Foundation (FCT); Marie Curie Fellowships; Eric Herrmann; and ringers Alan Brooks, Pat Cochran, Karen Dixon, Graham Grieve and Karin Nelson.

Prof. Phil Hockey
is Director of the Percy FitzPatrick Institute and its associated DST/NRF Centre of Excellence. He is a member of the Editorial Board of the journal Biological Conservation *and of the International Advisory Group for the* Public Library of Science *(PLoS). He is a Council member of BirdLife South Africa and a member of three of their committees. During the review period he supervised the work of one Honours student, eight MSc students, six PhD students and five post-doctoral fellows.*

Rarity and Conservation of African birds

Programme leader
Prof. Phil Hockey

Research team
Dr Steve Boyes (PFIAO Postdoctoral Fellow)
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Overview
The forces that have driven birds towards extinction have changed over the past 400 years from direct persecution to habitat loss and degradation, invasion of alien taxa, disease and climate change. For several years, researchers at the PFIAO have used a diversity of model taxa to investigate the reasons underlying avian rarity. In most cases, the search has been for the life-history stages at which demographic bottlenecks occur, and identifying the root causes of such bottlenecks.

Underpinning these studies is the philosophy that conservation action is only likely to be effective if the root cause of the problem *can* be identified. Practical examples of this include managing the successful re-introduction of the Aldabra Rail *Dryolimnas [cuvieri] aldabranus* to Picard Island, and effecting a marked increase in African Black Oystercatcher *Haematopus ostralegus* numbers after identifying the key, two-week-long demographic bottleneck and promoting conservation strategies to reduce mortality rates during this period. The Institute's considerable expertise in the field of linking life-history studies with remedial action for threatened taxa has been applied in locations as disparate as sub-Antarctic and tropical islands, grasslands, forests and highland wetlands. As increasing numbers of species are added to Red Data Lists, continued development of this expertise will become ever more essential. Indeed, following the recommendations of the Centre of Excellence international review panel in 2009, we have started three new terrestrial bird conservation projects, in addition to a new conservation project targeting responses of birds in hot deserts to climate change (described in the 'climate change' section of this report).

Cape Parrot conservation
Cape Parrots *Poicephalus robustus* are endemic to South Africa and *Critically Endangered* by the historical degradation of the Afromontane mistbelt forest patches, illegal capture for the wild-caught bird trade, and disease (especially Psittacine Beak and Feather Disease [PBFD]). The wild population of Cape Parrots now stands somewhere between 1000 and 1500 individuals and it is one of the four most endangered bird species in South Africa. The core study areas for the Cape Parrot project are the Amathole and former Transkei regions of the Eastern Cape, South Africa, which have the largest remaining Cape Parrot populations (*ca* 800 birds). These populations were last studied by Jack Skead of the PFIAO in the early 1960s.

In KwaZulu-Natal, Cape Parrots are recognized as habitat and dietary specialists dependent on the seed kernels of *Podocarpus* trees that grow in Afromontane mistbelt forest patches. They also have been identified as nest-tree specialists,

utilizing almost exclusively *Podocarpus* snags (standing dead trees) for nesting. The findings of Skead (in the Eastern Cape) and preliminary findings from this study challenge conclusions drawn by the KwaZulu-Natal studies. In our study area the diets of the birds are more catholic and they use a wider diversity of tree species for nesting.

Our project, spearheaded by postdoc Steve Boyes and supervised by Phil Hockey, is run in partnership with the World Parrot Trust, BirdLife South Africa, the Eastern Cape provincial government, the Department of Agriculture, Forestry and Fisheries (DAFF), Eastern Cape Parks, and local businesses. The project has the following aims: 1) to study how Cape Parrot breeding and feeding ecology is linked to forest condition and resource abundance in relict Afromontane mixed *Podocarpus* mistbelt forest patches; 2) to determine whether the recent observations of advanced symptoms and death due to PBFD in wild Cape Parrots are due to a new, more virulent genotype of PBFD that has entered the wild population or are exacerbated by malnutrition resulting from continued degradation of the birds' natural habitat; 3) to develop a rapid, aerial, forest health assessment technique using low-altitude, high-definition photography of forest patches for use in monitoring long-term impacts of human disturbance to Afromontane forest patches; 4) to determine whether nest boxes can promote breeding success by increasing nest-cavity availability at the landscape level; 5) to investigate the importance of vocalizations and visual signals to the flocking behaviour of Cape Parrots (i.e. understand whether playback recordings can be used to influence Cape Parrot movements); and 6) to continue DNA-archiving and gathering data on illegal capture and trade to support an application to upgrade Cape Parrots to CITES Appendix I, thereby banning all international trade in the species.

Central to the Cape Parrot Project are public participation and community-based conservation action (e.g. community nest-box manufacture and establishment of a yellowwood nursery). We have also launched the Cape Parrot Forum in the Amathole region, comprising participants in the annual Cape arrot counts, local community members, and BirdLife South Africa members that reside within the study area. Over the next 36 months, the forum aims to gather data on Cape Parrot sightings, nesting activity, roost sites, illegal trade, and evidence of disease throughout the study area.

We have been handed over management of the 35-year old pecan orchard on the experimental farm at the University of Fort Hare, Alice. While use of other pecan orchards in the Amathole region is diminishing, more than 200 Cape Parrots utilize this orchard on daily basis between April and June. We aim to ensure that this food resource remains available to Cape Parrots for many years to come and, with support from corporate sponsors, will post a security guard on night duty and erect a fence to protect the orchard from further vandalism and/or theft. Over time this community-based venture will achieve self-sufficiency through pecan sales and tourism. As many Cape Parrots as possible will be captured in this orchard, forming the fulcrum of our research. Blood samples will be taken from each captured parrot for disease testing, blood screening, and DNA-archiving.

Cape Parrots are reported to embark on medium- to long-range foraging flights from roosts and nest cavities in high-altitude Afromontane forest patches to feeding sites in low-lying and coastal forests. To understand how Cape Parrots utilize the landscape mosaic, we will track their local and regional movements using VHF telemetry from road transects and forest trails, as well as light fixed-wing aircraft.

An important component of our study is the 72 (300 x 20 m) forest transects distributed in 24 Afromontane forest patches used to determine relative and seasonal resource abundance, forest condition, and forest structure for comparison with utilization of these forest patches by Cape Parrots.

Population recovery necessitates a significant increase in breeding success at population level. We will locate and monitor as many Cape Parrot nest cavities in the region as possible, ensuring their safety from nest poaching and developing a conservation action plan to support future breeding successes. Every effort will be made to identify a supplementary source of animal protein for breeding birds similar to the bruchid beetle larvae (Coleoptera, Bruchidae) discovered by Steve in the breeding season diet of Meyer's Parrots *Poicephalus meyeri*.

We aim to erect over 300 nest boxes in tall *Podocarpus* and *Eucalyptus* trees in at least 12 different forest patches. Nest boxes will be constructed at a facility run by BirdLife South Africa using equipment and building supplies donated by corporate sponsors. All nest boxes will be monitored monthly for breeding activity.

A Cape Parrot Poicephalus robustus *in the Eastern Cape with advanced symptoms of Psittacine Beak and Feather Disease. This disease may be threatening the species' global population. Photo: Steve Boyes.*

The extinction risk posed by disease (primarily PBFD) is unclear. Researchers at UCT have, however, discovered a unique genotype of PBFD virus in wild Cape Parrots in KwaZulu-Natal. Since March 2009, we have received several reports and photographs of wild Cape Parrots in our study area showing advanced symptoms of PBFD or death due to the

disease. Symptoms of or death due to PFBD have not previously been recorded in the wild. Blood smears will be stored for disease testing and the development of a vaccine at the University of the Free State. Blood screening will be used to estimate seasonal fluctuations in relative body condition to explore correlations between the incidence of PBFD, age class (from visual assessment), and sex (determined using DNA analysis).

Since the launch of the Cape Parrot Project in May 2009, we have started the forest assessments in collaboration with DAFF senior scientists. Rance Timber and Amathole Forestry Company have taken on the nest-box project. We are also in discussions with landowners in Hogsback to secure land for offices and a flight aviary for quarantine and reintroductions. The Prins Bernhard Natuurfonds has provided funding for radio transmitters, a quad bike, and rental of an additional cottage for volunteers and students working on the project.

An important component of the Cape Parrot Project is publicising the plight of Cape Parrots in popular media. In 2009, we published two magazine articles (including the cover of Farmer's Weekly) and captured HD footage of Cape Parrots in the wild that has lead to a television special and a documentary (both due to be aired in 2010). Yellowwood Brand Architects and TBWA/Hunt Lascaris have agreed to assist us in developing a Cape Parrot brand and marketing campaign aimed at bringing this ambassador for our last-remaining Afromontane mistbelt forests to all South Africans.

Power-line collisions and large terrestrial birds

The negative impact of electricity distribution infrastructure on birds is a well-recognised conservation problem. Because they lack manoeuvrability in flight, many large terrestrial birds are prone to being killed when they collide with power lines. The problem is exacerbated for birds that fly in flocks and those that fly to roost in low light conditions. It is an especially important problem in South Africa, given the combination of globally important crane and bustard populations and a rapidly expanding power grid.

Early in 2009, Jessica Shaw completed her CB MSc project investigating power-line mortality of Blue Cranes *Anthropoides paradiseus* in the Overberg of the Western Cape. The main aim of the study was test a simple GIS model that had been developed at Stellenbosch University to identify high collision-risk power lines for Eskom to use for proactive mitigation. In the event, the model proved to have very little predictive power. However, Jessica's study showed that an estimated 12% of the Overberg Blue Crane population die annually in collisions with power lines. This is an extremely high and possibly unsustainable level of mortality, especially in light of possible changes to wheat farming in the region, on which Blue Cranes are heavily reliant. As a result of these findings, we have established a long-term, three-monthly monitoring program to record mortalities along approximately 45 km of power lines in the Overberg.

In July, and supervised by Peter Ryan and Andrew Jenkins, Jessica registered for a PhD exploring the causes and effects of, and possible solutions to, power-line mortality among Ludwig's Bustards *Neotis ludwigii*. This species is thought to be decreasing in numbers because of estimated collision rates in excess of 1 bustard.km^{-1}.yr^{-1} on the nearly 8000 km of transmission power lines that criss-cross the Karoo. The project will re-assess the numbers of Ludwig's Bustards in South Africa, repeating the surveys made by former Fitztitute student David Allan for his MSc 20 years ago. We shall use satellite transmitters to track the birds' movements – as yet it is unclear whether they are migratory or nomadic. Jessica will also expand power-line surveys throughout the Karoo to assess bustard mortality rates. The ultimate aim of the project is to develop effective mitigation measures that will reduce collision rates. An experiment has been designed to test the efficacy of devices currently used to increase line visibility (both static 'pigtails' and 'flappers') on reducing bustard collision rates. A power analysis suggests that this experiment should detect an effect of 50% or more; we decided that if the devices were less than 50% effective, another solution would have to be found.

The low manoeuvrability and restricted visual field of Ludwig's Bustards Neotis ludwigii *make them particularly prone to collisions with overhead power lines. PhD student Jessica Shaw is tackling the questions of why mortality is greater in some areas than others and how this mortality could be reduced. Photo: Koos de Goede.*

In September, Jessica worked with Graham Martin to assess visual fields in Blue Cranes, White Storks *Ciconia ciconia* and Kori Bustards *Ardeotis kori,* using captive birds at Tygerberg Zoo and the Johannesburg Zoological Park. These three species are visually guided ground feeders which live in open habitats and often collide with power lines. Whilst their frontal visual fields proved to be similar, the three species differed markedly in the vertical extent of their binocular fields and the size of their blind spots above the horizontal directly in front of the birds. In practical terms, this means that small head movements below the horizontal, such as might occur if a bird is looking down, render bustards and cranes blind in the direction of travel during flight. This makes them particularly susceptible to collisions with obstacles such as power lines, with important implications for effective mitigation. It might be that making the lines more visible has little effect on collision rates, and consideration should be given to other strategies to alert bustards and cranes to the proximity of power lines (e.g.

ground marking or audible cues). Jessica gave presentations on her work at the BirdLife South Africa Bustard & Korhaan Conservation Workshop in May 2009, and at the European Ornithological Union Conference, in Zurich in August 2009.

Southern Ground-Hornbill conservation

During the course of the 20th Century the range and population size of Southern Ground-Hornbills *Bucorvus leadbeateri* in South Africa decreased by some two thirds, with the birds disappearing from much of their historical range. Such a rapid decrease in the population of a long-lived, slow-reproducing animal is of great conservation concern and, based on IUCN criteria, the official conservation status of Southern Ground-Hornbills in South Africa should probably be elevated from *Vulnerable* to *Endangered*. In many cases, however, the drivers of local extinctions are known (e.g. persecution and incidental poisoning), and in some instances these are no longer operative (e.g. poisoning). Because of the ground-hornbills' complex social structure, self-reintroduction would, at best, be very slow. This means that reintroduction programmes need to be considered in an attempt to improve the species' precarious conservation status.

Based on eight years of monitoring data from the Lowveld, CB student Gwyneth Wilson was able to show that artificial nest-boxes significantly improve the breeding performance of Southern Ground-Hornbills Bucorvus leadbeateri*. Photo: Phil Hockey.*

Since 2000, the PFIAO has been monitoring the breeding performance of a population of Southern Ground-Hornbills at the Associated Private Nature Reserves, a 180 000 ha conservation area adjoining Kruger National Park. In 2009, we started our ninth season of monitoring. Also in 2009, CB student Gwyneth Wilson analysed the first eight seasons of monitoring data with to the aim of identifying social and environmental correlates of breeding success. For some time, we have been planning a satellite-tracking study of habitat use by these birds. The reason for this is that even when fitted with radio transmitters (something we have done in the past) these birds are impossible to follow on the ground without changing their behaviour. Thanks to a donation from the Hans Hoheisen Charitable Trust, we were able to purchase four additional transmitters in 2009, bringing our total to seven. We spent substantial time during the year testing different harness designs on free-flying captive birds. We also completed and distributed of a 10-minute DVD about the ground-hornbill project, to be used in part for the leverage of future funding for the project.

Gwyneth's analysis found major differences in reproductive success amongst the 23 ground-hornbill groups monitored in the APNR. Over the period 2001-2008 there were some highly successful groups that bred and fledged a chick almost every year, whereas other groups either did not breed or did not rear a single chick over the same period. During 2001–2008 (184 possible group breeding years) there were a total of 67 breeding attempts by 17 of the 23 groups. Six groups did not attempt to breed at all. Of the 67 breeding attempts, 51 (76%) were successful, with seven of the groups (30%) collectively raising 60% of chicks. These seven groups all bred in artificial nests: only 5 of the 23 groups bred in natural cavities. Of these latter groups, three did not fledge a single chick over the eight years.

Reproductive success was influenced primarily by rainfall, the amount of open woodland in the vicinity of the nest, availability of an artificial nest and group size. Groups breeding in natural nests were successful only when the proportion of open woodland surrounding the nest site was high. Those that bred in artificial nests, where overall breeding success was higher, were less dependent on the amount of open woodland available to them. High rainfall (>500 mm) over the breeding season resulted in a decrease in reproductive success, with groups being most successful in years when rainfall ranged from 300-500 mm. Large groups (>3 birds) bred more successfully than groups comprising only 2-3 individuals. Group size, helper effects and rainfall cannot be managed to increase the productivity of ground-hornbills. However, the fact that the availability of artificial nest sites and the amount of open woodland around the nest site both contribute positively to breeding performance identify possible management options for increasing the reproductive output of ground-hornbill populations in South Africa.

From these findings arose the challenge of understanding how the ground-hornbills use their large home ranges (some perhaps as large as 100 km^2). This is where the satellite tracking comes into play – the nature of the terrain in the APNR (coupled with unwelcome interference from lions, elephants, buffalos, etc!) makes it impossible to follow groups for protracted periods on foot. Towards the end of 2009 we managed to deploy our first satellite transmitters: this has never been done before with ground-hornbills. Positional data

are transmitted once an hour, starting before sunrise and ending after birds have entered their night-time roosts. These data are then overlaid on a detailed geo-referenced vegetation map of the study area. This will allow us to see a) whether they favour certain habitats over others; b) how habitat use changes with time of day and season; and c) determine the genuine extent and overlap of the groups' home ranges.

Towards the end of 2009, we started discussions with a ground-hornbill reintroduction programme based to the west of the APNR at Mabula Private Game Reserve. To date, the reintroduction programme has learned many lessons (some hard) and has had limited success, with there now being one wild-living group of semi-habituated birds. Given the knowledge that we are rapidly acquiring from the APNR, we are in discussions about taking over the scientific oversight for the Mabula project. Hopefully there will be progress to report on in our upcoming 50th anniversary year.

Population biology of African Black Oystercatchers

The global population of African Black Oystercatchers *Haematopus moquini* has increased by *ca* 45% over the past 25 years, from an estimated 4800 birds in the early 1980s to 6780 birds today. Given current trends it may well be possible in the near future to downgrade the species' IUCN status from *Near-threatened* to *Least Concern*. Both the presence of the alien mussel *Mytilus galloprovincialis* and improved protection have benefited the species. The primary way in which local breeding oystercatcher populations have increased (as a response to the improvements in habitat quality) is due to territory shrinkage of breeding pairs and a resultant influx of previously excluded, but sexually mature birds. However, it is improved reproductive success that is likely to explain the increase in the global population. There are numerous reasons for this improvement. However, one additional factor, which has now been confirmed, is an increase in the average clutch size of African Black Oystercatchers. As recently as the 1980s, 3-egg clutches were extremely rare – they are now commonplace. We cannot yet prove that pairs laying larger clutches have a higher breeding success. However, the substantial increase in the proportion of three-egg clutches appears to be occurring largely in areas invaded by the alien mussel, *Mytilus galloprovincialis*. This strongly suggests that the improved food supply for oystercatchers has driven the observed increase in clutch size.

Despite the global increase in the oystercatcher population, estimates of breeding success of local populations (obtained from ongoing monitoring at our long-term study sites) indicates that in many of these areas breeding success is still below that required to maintain stable population numbers. The reasons for breeding failure in unprotected areas are now well understood (see previous annual reports) and are supported by findings based on more than 54 site-years of nest-monitoring data. What is required to improve the situation for breeding oystercatchers in these areas is improved management, especially control of dogs during the breeding season. Additional colour-ring resighting data (buttressed by genetic evidence) continue to support the conclusion that even on the mainland of South Africa, young birds are highly site faithful to natal areas. From a conservation perspective, therefore, we have to continue to assume that movement of juvenile birds from areas producing a surplus of young, are unlikely to buffer populations achieving marginal reproductive rates.

Damara Terns Sterna balaenarum *lay only a single egg. In Namibia they are under threat from mining in the south and from off-road vehicles in the central coastal regions. Photo: Justine Braby.*

Biology and conservation of the Damara Tern *Sterna balaenarum*

The Damara Tern project encompasses three main sections: 1) demography and breeding biology; 2) growth and energetics; and 3) conservation. Justine Braby's study encompasses the full cross-section of the Damara Tern's ecology and will collate all information collected over almost three decades along the desert coastline of Namibia. Justine spent three years in the restricted diamond area to assess little-known breeding populations in southern Namibia, has travelled to Nigeria to observe Damara Tern migration, and to northern Chile to study the ecologically equivalent Peruvian Tern *Sterna lorata*. By accounting for all known Damara Tern breeding colonies in South Africa, Namibia and Angola, threats can be identified and conservation measures can be put in place to protect key colonies. Conservation issues have been focused on off-road-vehicle disturbance to breeding sites in central Namibia, and the effect of diamond mining on breeding populations in southern Namibia.

Conserving Blue Swallows

The Blue Swallow *Hirundo atrocaerulea* is in imminent danger of extinction in South Africa due to ongoing transformation of its mistbelt grassland habitat. Very little of its local range is formally conserved. A complicating factor is that the swallow is an intra-African migrant that spends part of the year in central Africa. Conservation efforts thus need to be coordinated across the areas that birds occupy at different times of the year, but

we currently have little knowledge of the migratory connections between non-breeding populations in central Africa and breeding populations in southern Africa. In a project spearheaded by Andrew McKechnie and in collaboration with the late James Wakelin (Ezemvelo KZN Wildlife) and Stephan Woodborne (CSIR), we have been using biochemical signatures in the swallows' feathers to infer links between the breeding and non-breeding ranges of these birds. The technique relies on natural variation in the ratios of stable isotopes of elements such as hydrogen. The feathers of swallows from the eastern highlands of Zimbabwe, for example, contain significantly less of the heavy isotope of hydrogen than do birds from the South African breeding grounds. Early in 2009, we travelled to Nyika National Park in northern Malawi and collected feathers from the largest Blue Swallow breeding population. Analyses of these feathers, together with those from the Zimbabwean and South African populations, have allowed us to identify a unique isotopic "featherprint" for each breeding population. We also analysed feathers from eight non-breeding birds caught on the shores of Lake Victoria in Uganda, and were able to establish the origins of these individuals. This study has provided the key for unlocking the secrets of the swallows' migration patterns, and in 2010 we shall travel to Uganda to collect feathers from birds in other parts of the non-breeding range. 2009 also saw the start of an exciting project on Blue Swallows in the eastern highlands of Zimbabwe. Fadzai Matsvimbo from BirdLife Zimbabwe will compare breeding success, stress hormone levels and other parameters in Blue Swallow populations within and outside protected areas, most notably Nyanga National Park. This study will provide new insights into the factors responsible for the species' decreasing numbers outside protected areas, and should provide information vital for bringing the South African population back from the brink of extinction.

Stable isotopes in the feathers of Blue Swallows Hirundo atrocaerulea *are being used to track their movements from southern Africa to the East African non-breeding grounds. Photo: Andrew McKechnie.*

Bird reproduction and highland grassland management

South African grasslands have high conservation value because they house many threatened and endemic plant and bird species. However, *ca* 60% of the biome has been irreversibly transformed and only 2.2% is formally conserved. Many of the endemic bird species are centred in the moist highland grasslands (MHGs) of north-eastern South Africa, of which only 1.5% is conserved. Livestock farming is the only potentially 'environmentally friendly' land-use, yet farmers lack guidelines about the biodiversity impacts of differing burning and stocking regimes. Most burn annually and stock at very high densities. Ian Little's PhD study, supervised by Phil Hockey, John Donaldson and Raymond Jansen, is investigating diversity and reproductive success of grassland-restricted birds across a range of land-management practices in the MHGs of north-eastern South Africa to assess what pastoral practices can be considered 'conservation friendly'. Reproductive performance is considered the most apposite measure of conservation value because it provides a more honest biological signal than do measures of diversity and abundance alone. The study is testing the following hypotheses: 1) plant species composition and structure as well as arthropod abundance are detrimentally affected by high stocking rates and too-frequent burning; 2) time since burning does not influence nest survival or nestling growth rate in conservation areas; and 3) chick survival and growth rate are influenced by the addition of livestock because of reduced phytomass. In summary, the ultimate aim of this project is to identify, using process-orientated data, the degree of compatibility between grassland land-use practices and biodiversity conservation.

The study started in late 2007 and has progressed well: field work was completed in 2009 with more than 400 breeding attempts having been monitored in land-use types ranging from a fully protected nature reserve across the spectrum to communal grazing lands. The study also involved monthly bird-count transects and almost 100 000 invertebrate samples per season. Vegetation structure was also quantified on a monthly basis (>100 000 samples/season!). Vegetation biomass (kg/ha), along with vegetation architecture close to the ground, proved critical for nesting success and acted as surrogates for nest concealment.

Bird transect and reproductive effort/success data strongly suggest that there is an upper acceptable limit to stocking rate. This is true even for indigenous vertebrates. Interestingly, the lowest breeding success was recorded in a nature reserve where indigenous herbivores are fenced, but at high density. However, it is apparent that the burning regime is the over-arching driver of habitat structure and functioning. In addition, species such as the endemic and globally *Vulnerable* Yellow-breasted Pipit *Anthus chloris* may be effective indicators of biodiversity-unfriendly land management.

The presence of large numbers of grasshoppers in burnt areas may lead to these sites acting as sink populations for grassland-nesting insectivorous passerines: they provide good feeding opportunities but present few breeding opportunities. This finding supports our contention that bird counts alone are flawed as a means of assessing bird diversity responses to grassland management. Grassland specialists were restricted

to biennially burnt areas with low stocking rates: repeated annual burning has strong negative impacts on these grassland specialists. Second to fire frequency, vegetation structure is the most important (measured) covariate of breeding performance, specifically standing stock of vegetation, bearing in mind that fire frequency influences vegetation standing stock. Other factors considered as potentially important drivers of reproductive success, such as food availability, grazing intensity, type of grazing animal, vegetation patchiness etc, have little if any effect on the nesting success of grassland passerines.

This study clearly shows that the future conservation of endemic species such as Yellow-breasted Pipit, Buff-streaked Chat *Campicoloides bifasciata* and Sentinel Rock-Thrush *Monticola explorator* requires a large-scale change in farming management, focusing primarily on a broad-scale shift from annual to biennial burning.

The results of this study have already been used in a management context. Following the submission of a report to Mpumalanga Parks Board illustrating the detrimental impacts of high Blesbok *Damaliscus dorcas* numbers on the vegetation (and hence birds) of Verloren Valei Nature Reserve, action has been undertaken to remove excess animals and to manage the reserve under a new regime of reduced grazing pressure.

Re-assessing the status of Malawi's 'Endangered' Yellow-throated Apalis *Apalis flavigularis*

The forest-associated Yellow-throated Apalis *Apalis flavigularis* is the only bird endemic to Malawi. The species is confined to three mountain massifs in the south of the country and is classified as globally *Endangered*. This study re-evaluated its conservation status by assessing its population size and habitat preferences on Mount Mulanje, where forest patches are threatened by illegal logging and an increasing frequency of uncontrolled fires. These latter also cause a proliferation of invasive plant species, especially the Himalayan Yellow Raspberry *Rubus ellipticus*. Yellow-throated Apalises favoured forest edge habitat and occurred in forest patches as small as 0.01 ha. Their occurrence was positively correlated with the presence of *R. ellipticus*, although this relationship may be driven primarily by canopy architecture and the existence of an understorey shrub layer. More than 10500 apalises were calculated to be present in cedar forest habitat alone on Mount Mulanje, exceeding the IUCN's most optimistic estimate of the global population. As yet, there is no compelling evidence that forest degradation on Mount Mulanje has negatively impacted the apalis population to the point where the species should be classified as *Endangered*: *Near-threatened* is probably a more appropriate classification.

Students

Justine Braby (PhD, supervisors Les Underhill, Rob Simmons and Jean-Paul Roux) *The influence of mining disturbance on the breeding productivity and population dynamics of the Damara Tern* Sterna balaenarum: *causative factors and rehabilitation measures.*

Nathan Gichoi (MSc CB, supervisor Phil Hockey) *Ecological impacts of biological invasions on native birds in Africa.*

Yvonne Githiora (MSc CB, supervisor Phil Hockey) *A comparative analysis of patterns of recent extinction in birds and mammals.*

Ian Little (PhD, supervisors Phil Hockey, John Donaldson and Raymond Jansen) *Reproductive success as a tool for understanding the impacts of land-use management on birds in moist highland grasslands*.

Tiwonge Mzumara (MSc CB, supervisor Phil Hockey) *Status and prospects of Malawi's Yellow-throated Apalis* Apalis flavigularis. Graduated June 2009.

Jessica Shaw (PhD, supervisors Peter Ryan and Andrew Jenkins) *Conservation of Ludwig's Bustard.*

Gwyneth Wilson (MSc CB, supervisor Phil Hockey) *What causes variation in the reproductive performance of groups of Southern Ground-Hornbills* Bucorvus leadbeateri?

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Assoc. Prof. Peter Ryan *is on the Editorial Board of* Bird Conservation International*, editorial assistant for* Antarctic Science *and was invited to join the conservation section of the* Faculty of 1000 *in 2009. He is the South African representative on ACAP's Taxonomy Working Group and a member of the IMAF Working Group of CCAMLR and the South Atlantic Island Plant Specialist Group, which is part of the IUCN Species Survival Commission. He is a Tristan da Cunha Conservation Officer as well as a member of the Tristan Biodiversity Advisory Group.*

Peter is the academic co-ordinator of the Conservation Biology MSc course. He supervised three PhD and one MSc student, with two CB MSc students completing their theses in the review period. Publications in 2009 include one book, 23 scientific papers, one book chapter and seven popular articles. In addition to his editorial duties for Antarctic Science *and* Bird Conservation International*, Peter reviewed 10 manuscripts for six scientific journals.*

Assoc. Prof. Peter Ryan *is also leader of the* ***Seabird Research Programme****, and together with* ***Prof. Tim Crowe****, leads the* ***Systematics & Biogeography Programme.***

Island Conservation

Programme leader
Assoc. Prof. Peter Ryan

Research team
John Cooper (Avian Demography Unit, UCT)
Dr Rob Crawford (Marine and Coastal Management)
Dr Richard Cuthbert (Royal Society for the Protection of Birds, UK)

A highlight of the 2009 visit to Tristan da Cunha was the first scientific landing on Stoltenhoff since 1973. Photo: Peter Ryan.

Overview
Oceanic islands – those that have never been connected to a continental landmass – are among the most sensitive of terrestrial ecosystems. Large surrounding stretches of open sea prevent many elements typical of continental biotas from colonising islands. The few terrestrial species that do manage to reach the islands often evolve into endemic species, many of which lack appropriate defences against introduced predators, or are unable to cope with introduced competitors. Colonisation of these environments by man and his commensals has had catastrophic results – more than 90% of avian extinctions since 1600 have been of island taxa. Even where species persist, they are often at greatly reduced population sizes, and are thus prone to extinction from chance events such as environmental variability and catastrophes. Land-bridge islands are less susceptible to disturbance, but off southern Africa all are small, and support large numbers of breeding seabirds, many of which are endemic to the region and are globally threatened. Conservation of these breeding sites is thus of considerable importance. This programme dovetails with the Seabird Research Programme, but covers the broader issues of island conservation, including controlling alien organisms and conserving land birds on islands.

Impacts and eradication of House Mice
Henk Louw and Paul Visser had a very productive year on Gough Island, being replaced in September 2009 by Graeme Parker and Kalinka Rexer-Huber. In addition to monitoring breeding bird populations and conducting regular control measures against the invasive alien plant *Sagina procumbens*, Henk and Paul were mainly involved in preparing for the proposed attempt to eradicate introduced House Mice *Mus musculus* from Gough Island. Trials on captive mice confirmed the efficacy of toxic bait to be used in the eradication attempt, and use of dyed bait showed all mice consumed some bait in field trials, including mice in caves (without the need to place bait into the caves). During September a large-scale bait trial was conducted over 20 ha and again all mice consumed dyed bait. These results support the feasibility of an eradication attempt. In 2010 the focus shifts to the feasibility of maintaining captive populations of land birds that may otherwise be


The introduced Cape Gooseberry Physalis peruviana *was overlooked on Inaccessible Island from the 1930s until 2009, when several plants were found near the seldom used East Road. Rob Ronconi contemplates the plants (left) and then celebrates their removal (right). Photos: Peter Ryan.*

poisoned. Graeme and Kalinka will be keeping Gough Moorhens *Gallinula comeri* and Gough Buntings *Rowettia goughensis* in mouse-proof cages for several weeks to ensure that we can keep captive populations successfully during an eradication attempt.

On Marion Island, mouse attacks have been implicated in the deaths of several Wandering Albatross *Diomedea exulans* chicks as well as stripping skin from the heads of Sooty Albatross *Phoebetria fusca* chicks. These attacks appear to have commenced following the eradication of cats from the island in the early 1990s, supporting the hypothesis that mice are more likely to impact seabirds at islands where they are the only introduced mammal (Wanless et al. 2007, *Biology Letters* 3: 241-244).

Monitoring and eradicating other invasive species

Efforts to eradicate *Sagina procumbens* from Gough Island continued throughout 2009, and funds have been secured to ensure that work will continue until at least 2011. Dalton Gibbs, an expert in alien plant control, visited Gough in September 2009 to audit the programme, and to assist with installation of a high-pressure hose system to aid stripping affected soil into the sea. Follow-ups to eradicate New Zealand Flax *Phormium tenax* from Inaccessible and Nightingale Islands took place in October-December. Much of Inaccessible Island's summit was not checked during the initial round of follow-up in 2007, and there had been considerable regrowth from cut material. These plants were all removed in 2009. The good news is that checks of areas cleared in 2007 found virtually no regeneration or new plants. The only area not tackled was the main cliffs, which require much greater investment in terms of equipment. Approximately 40 plants remain visible on the cliffs. It is hoped that these will be tackled in 2010. Only one small plant was found on Nightingale Island.

A comprehensive survey of the distribution and abundance of alien plants was conducted at Inaccessible Island. This repeated earlier surveys conducted in 1989 and 1999, and found little change in the ranges of most species. Several new aliens were found, but almost certainly had been overlooked in the past. The Cape Gooseberry or Goldenberry *Physalis peruviana* was discovered at several sites along the East Road on Inaccessible Island; all plants were removed. A single plant of *Agrostis* cf. *tenuis* also was found on the East Road. Several large plants of Jointed Rush *Juncus effusus* were found near the hut at Blenden Hall; its identification was thanks to Niek Gremmen's guide to the alien plants of the main island on Tristan. One plant was removed and burnt, but others were too large to dig up, so were sprayed twice with herbicide. Follow-up will be required to assess the efficacy of this measure. Eradication efforts continued for other localised introduced plants. *Brassica rapa* has virtually disappeared from Inaccessible Island; only three plants were found in 2009, and the patch of *Cynodon dactylon* has decreased following repeated spraying with herbicide in 2004 and 2007. Weeding of *Cotula australe* away from the hut area on Nightingale was conducted in early December. I also managed to land on Stoltenhoff and Middle Islands, islets off the north coast of Nightingale Island, and found only a single alien species on the islets.

Highlights

- Trials on Gough Island indicate that an aerial drop of poison bait should be effective to eradicate mice.
- Landing on Stoltenhoff and Middle Islands to survey their floras as well as bird populations.

Lectures, Workshops and Symposia

We presented a poster on the *Sagina* eradication programme at the International Conference on Ecology and Management of Alien Plant Invasions held at Stellenbosch University in October.

Visitors

Dalton Gibbs, Cape City Council, joined the annual relief voyage to Gough Island to advise on alien plant control and eradication initiatives.

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Assoc. Prof. Peter Ryan
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Seabird Research

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Dr Mareile Techow (PFIAO Postdoctoral Fellow)
Dr David Thompson (NIWA, Wellington, New Zealand)
Prof. Les Underhill (ADU, Zoology, UCT)
Dr Ross Wanless (BirdLife South Africa)
Prof. Rory Wilson (University of Swansea, Wales)

Quentin Hagens and Genevieve Jones weigh an adult Wandering Albatross Diomedea exulans *on Marion Island. By weighing the albatrosses when they first return to the island each year to breed, we obtain a measure of their body condition. Photo: Marion Burger.*

Overview
As a group, seabirds are among the most threatened birds in the world, with almost one third of all species included on the global Red List. Seabirds also dominate the list of globally threatened species at a regional level in southern Africa. They are vulnerable to human activities both at sea and at their breeding sites. Consequently, the Seabird Research Programme has a strong applied focus, assessing the magnitude of threats faced by various seabird species, and attempting to provide

practical management solutions to reduce these threats. However, because many seabirds are easily observed and caught at their breeding colonies, they also provide excellent models for testing ecological and evolutionary theories. The programme thus includes several studies of a more academic nature. It forms the bulk of Peter Ryan's research activities, and overlaps to some extent with the Island Conservation Programme.

Albatross demography and individual variation in reproductive success

Ben Dilley replaced PhD student Genevieve Jones and field assistant Edith Mertz on Marion Island in April 2009 to start the final year of this five-year research programme funded through SANAP. In addition to following the final cohort of Wandering Albatross *Diomedea exulans* chicks being studied intensively as part of this project, Ben conducted the routine annual monitoring of selected surface-nesting seabirds and completed a census of White-chinned Petrels *Procellaria aequinoctialis* started at Marion Island during the April relief trip. Together with mapping of White-chinned Petrel burrows on Prince Edward at the end of 2008, this will provide the final estimate needed to obtain a global population estimate for the nominate subspecies of this *Vulnerable* species. This is crucial for the management of White-chinned Petrels, which are the species most often killed on longlines in the Southern Ocean. Meanwhile Graham Parker and Kalinka Rexer-Huber replaced Paul Visser and Henk Louw as RSPB-funded field assistants on Gough Island in September 2009, where their work included monitoring of seabird populations and deployment of geolocator loggers as well as work on various island conservation projects.

The status of SANAP is currently under review, so there was no call for new projects in 2009, but fortunately the opportunity was made for bridging projects to allow long-term studies to continue at the islands. As a result, a two-year project has been approved to allow the current joint MCM and Fitztitute research and monitoring activities to continue. The value of this work was again highlighted by a special section in the *African Journal of Marine Science*, which saw six papers with a Fitztitute address summarising the conservation status of seabirds and seals at the Prince Edward Islands. Sarah Converse also published a paper on survival of Marion Island Grey-headed Albatrosses *Thalassarche chrysostoma* using novel mark-recapture analyses.

The core study of individual variation in reproductive success among albatrosses entered the final analysis stage, with PhD student Genevieve Jones returning from Marion Island in May 2009. After a well-deserved break, during which she kept up her fitness with a gentle stroll up Kilimanjaro, Gen knuckled down to analysing the vast amount of data collected over the last four years. Preliminary results show few marked differences between birds with 'good' and 'bad' breeding histories, but sex of offspring is a surprisingly important factor. Male chicks are larger and require greater parental investment. Birds with good breeding histories tend to produce female chicks, so their better performance may be in part a result of a lighter work load. Postdoc Mareile Techow finally completed genetic 'finger-printing' to assess the levels of extra-pair paternity among Wandering Albatrosses *Diomedea exulans*, and in 2010 she will complete paternity testing for Grey-headed Albatrosses. She also made encouraging progress in the use of MHC markers to study the relationship between genetic diversity and mate choice in Wandering Albatrosses.

Lorien Pichegru and David Nkosi fit a GPS-TD logger to an adult African Penguin Sphensicus demersus*. The loggers provide detailed information on when and where penguins feed. By comparing the foraging effort of penguins from two islands, Lorien was able to show that stopping fishing for sardines and anchovies within 20 km of breeding islands significantly reduced the foraging effort of breeding penguins. Photo: Ralf Mullers.*

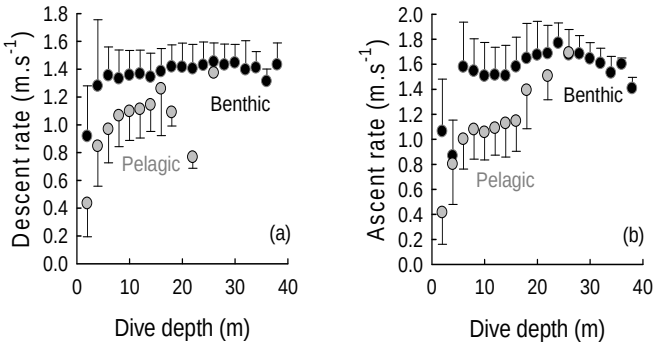
Foraging ecology of African Penguins, Cape Gannets and Cape Cormorants

Over the last five years the South African breeding population of African Penguins *Spheniscus demersus* has decreased at an average rate of 17% per year. Given that South Africa supports more than 80% of the global population, the penguin's conservation status is currently under review for uplisting from *Vulnerable* to *Endangered*. The most likely cause of this dramatic decrease is competition with the purse-seine fishery for food. As an experimental measure, fishing closures took place within 20 km of key penguin colonies on Dassen and St Croix Island. Postdoc Lorien Pichegru used GPS and depth loggers to compare the foraging ecology of penguins at St Croix and adjacent Bird Island before and after fishing was banned around St Croix. After the closure, birds from St Croix reduced their foraging effort and foraging range, whereas those on Bird Island increased their foraging effort. Although this was only a single year, the results are encouraging, and garnered much attention when published in *Biology Letters* in early 2010. Fishing closures should now be extended as a precautionary measure to other major penguin colonies, notably Dyer Island, where penguin numbers

continue to dwindle despite the south- and eastward shift in pelagic fish stocks from the west coast, which should have benefited this population. Unfortunately, in recent years more than half the commercial catches of pelagic fish have occurred close to Dyer Island, making the fishing industry reluctant to accept such a closure. Fortunately, Lorien's continued involvement in this programme has been ensured through a generous grant from the Charl van der Merwe Foundation negotiated by Ross Wanless, a former Fitztitute student who now works for BirdLife South Africa as seabird research officer for Africa.

2009 was the eighth consecutive year of monitoring the at-sea behaviour of Cape Gannets *Morus capensis* from the Malgas Island colony on the west coast. Guided by long-time collaborator David Grémillet, CB student Christina Moseley compared the foraging ecology and body condition of Malgas birds with those from Bird Island in Algoa Bay. The expectation was that Bird Island gannets would be in better condition, because they haven't suffered as a result of the south- and eastward shift in pelagic fish stocks from the west coast. By contrast, Malgas Island birds have become increasingly reliant on low-quality offal and discards from the hake trawl fleet. Interestingly, there were few differences in body condition between birds from the two islands. This might be due in part to the larger population size in Algoa Bay leading to greater intra-specific competition. However, the experiment was confounded by the reappearance of sardines off the west coast for the first time in several years. Despite the fish being present in relatively small numbers, gannets were able to find the sardines quite efficiently. David was able to capture the some of the action with a miniature bird-mounted camera, which combined with a GPS logger showed exactly how and where the birds were feeding. The sardines were too far offshore to benefit the other key predators of small pelagic fish in the Benguela ecosystem, African Penguins and Cape Cormorants *Phalacrocorax capensis*, and the camera images showed no other birds sharing the bounty.

A pilot study on the foraging ecology of Cape Cormorants in 2008 by CB student Maike Hamann, in collaboration with David Grémillet, Francesco Bonadonna and Lorien Pichegru, deployed GPS loggers and depth recorders to assess where the birds foraged. Postdoc Tim Cooke has taken the data from this study further, comparing how the fine-scale structure of foraging dives changes depending on whether they target pelagic or benthic prey. This was possible thanks to the very fine-scale information on where birds were diving from the GPS data. By combining the positional data with a map of bathymetry and dive-depth data, Tim could tell when birds were feeding close to the bottom, and when they fed in water much deeper than the dive depth, thus targetting pelagic prey. By comparing the extremes, he was able to define characteristics of the two dive types and derive a discriminant function that allowed 'uncertain' dives (where dive depth was close to the seabed, but perhaps not actually benthic due to uncertainty caused by the coarse accuracy of the bathymetry data) to be categorised with a high degree of confidence. Not surprisingly, pelagic dives are characterised by slower dive rates, allowing more time to encounter prey in the water column, than benthic dives, where birds want to commute to the feeding area as efficiently as possible. Tim also gathered additional data on Cape Cormorant foraging ranges and ecology from birds breeding on Dyer Island in 2009, and will start work on *Endangered* Bank Cormorants *P. neglectus* in 2010.

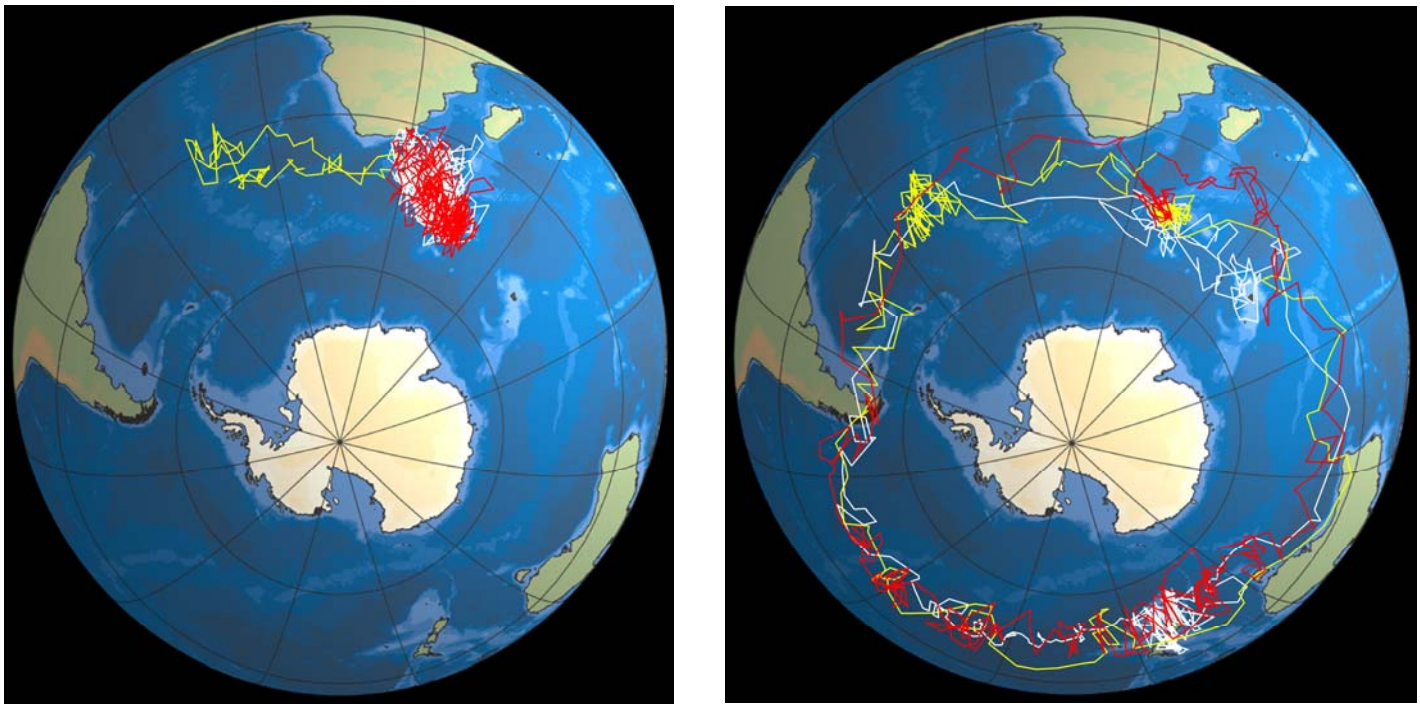


(a) Descent and (b) ascent rates of benthically and pelagically diving Cape Cormorants Phalacrocorzx capensis *Transit rates of benthic dives are faster, because birds commute quickly from the surface to the sea floor, where demersal anchovy shoals are found. Transit rates are slower for pelagic dives, birds taking time to explore the water column for midwater anchovy shoals. Figures: Timotheé Cook.*

Foraging ecology of other seabirds

Frances Taylor visited Marion Island in April-May 2009 to gather additional data on the foraging ranges and behaviour of Wandering Albatrosses, and also made dual deployments of 'daily diary' loggers with GPS loggers to assess the accuracy of their dead-reckoning tracking system on a dynamic soaring bird. Probably the most exciting result was the finding that the albatrosses often spent protracted periods swimming in tight circles at night, apparently foraging. Former Fitztitute researcher John Cooper worked with Rory Wilson in the 1990s to show that although Wandering Albatrosses obtain most of their food during the day, apparently scavenging dead or moribund squid, they also catch about a third of their food at night: until now we didn't know how they did this. We now suspect they behave like giant phalaropes, creating localised vortices that attract live squid. Frances's progress has been temporarily slowed thanks to the birth of her second child in early 2010.

A new collaboration with Jacob Gonzales-Solis from Barcelona University, Spain, and Rob Ronconi, a postdoc at Dalhousie University in Canada, will greatly increase our understanding of seabird movements from Gough and the Tristan da Cunha islands. Both Jacob and Rob joined the annual relief voyage to Gough in 2009, where they worked hard to recover GLS loggers deployed on Great Shearwaters *Puffinus gravis* the previous year in a collaborative project with Rich Cuthbert from the RSPB. The results show exactly how Great Shearwaters structure their trans-Equatorial migration to the North Atlantic each year, augmenting comparative data that Jacob has collected on other trans-Equatorial migrant shearwaters breeding in the North Atlantic and South Pacific.



Tiny geolocator loggers, first devised by former Fitz student Rory Wilson, provide crude tracking of coarse-scale movements of birds for up to three years. These tracks, prepared by Frances Taylor, contrast the sabattical year movements of two Wandering Albatrosses Diomedea exulans *from Marion Island. Many birds (left) remained mostly within the south-west Indian Ocean, but one male (right) travelled around the Southern Ocean three times. Images: Frances Taylor.*

We also recovered GLS loggers deployed on Southern Giant-Petrels *Macronectes giganteus* breeding at Gough Island, the species' most northerly breeding site. The petrels remain in the central South Atlantic year round, but show fascinating latitudinal differences in foraging areas seasonally. Jacob brought more than 100 GLS loggers to deploy on a range of seabirds at Gough that will be recovered from 2010.

For the last few years, Rob Ronconi has been tracking the southward migration of Great Shearwaters caught off Newfoundland using satellite transmitters. He was keen to track their northward migration by deploying transmitters on birds at the breeding grounds. Having received a thumbs-up from Fitztitute old boy Alan Burger, who supervised Rob's PhD, Peter invited Rob to join an expedition to Inaccessible Island after the Gough relief. They spent two months on the island from October to early December, conducting a variety of research and conservation management projects. Peter helped Rob to deploy 22 satellite tags on Great Shearwaters (six on Gough and 16 on Inaccessible), while he assisted with the deployment of satellite tags on eight Spectacled Petrels *Procellaria conspicillata* and eight Sooty Albatrosses *Phoebetria fusca* on Inaccessible Island. Most of these tags were made available by a special grant from BirdLife International.

Finally, Ross Wanless secured funding for a postdoc to start work on identifying marine Important Bird Areas (IBAs) off South Africa. Tim Reid, a vastly experienced Australian seabird biologist has accepted the position and will be commencing work at the Fitztitute in 2010. His work will be assisted by a grant from SABIF to digitise seabird-at-sea data from the Fitztitute's large collection of 10-minute cards.

Incidental mortality of seabirds and other studies

Unfortunately, relaxation in 2009 of boat-specific limits on seabird bycatch that were so successful in curtailing bycatch in 2008 saw an increase in seabird mortality in the South African tuna fishery. We are lobbying to reinstate the 2008 regulations. In the meantime, Ed Melvin from the University of Washington conducted a simultaneous trial of different tori line designs and line-weighting regimes aboard two tuna boats off the Cape, and we collaborated by providing data on the ages and sexes of birds killed. Samantha Petersen published a suite of papers from her PhD in the *African Journal of Marine Science*. Marta de Ponte completed her PhD on the impacts of Great White Pelicans *Pelecanus onocrotalus* on breeding seabirds and will graduate in June 2010.

Marine debris and its impacts on seabirds

The last few years have seen a marked resurgence in interest in the abundance and impacts of plastic debris at sea. Peter led a review paper on monitoring plastics in marine environments for a special issue on plastics in the environment published by the *Philosophical Transactions of the Royal Society, London.* Data on plastic ingestion by seabirds on Inaccessible Island were obtained by examining Subantarctic Skua *Catharacta antarctica* pellets during October-November 2009. There was a marked increase in both the incidence of plastic and in the size of plastic loads in all species, after relatively constant levels from the late 1980s to 2004. We also surveyed beach debris on the west coast of Inaccessible

Island, which showed large increases in most types of artefacts since the late 1980s.

Highlights

- Nineteen papers were published as well as one book chapter, five semi-popular articles and a UNEP report summarising the abundance and impacts of plastic debris in South Africa.
- Six papers on population status and trends of seabirds and seals were published in a special issue of the *African Journal of Marine Science.*
- Samantha Petersen published four papers on the impacts of various southern African fisheries on seabirds, turtles and sharks in the *African Journal of Marine Science.*
- Maike Hamann obtained her MSc with distinction for her work on the foraging ecology of Cape Cormorants.
- Lorien Pichegru demonstrated the benefits of closing areas around penguin breeding colonies to purse-seine fishing and had a paper accepted in the prestigious journal *Biology Letters*.
- Ross Wanless raised funds to continue Lorien Pichegru's work with African Penguins for a further three years as well as to employ a postdoc to work on marine IBAs from 2010.

Students

Viviane Barquete (PhD, supervisors Peter Ryan and Ross Wanless) *Using stable isotopes as a tool to understand the trophic relationships of seabirds off southern Africa.*

Marta de Ponte (PhD, supervisors Les Underhill and Peter Ryan) *Food supplementation, population growth and impacts of Great White Pelicans on breeding seabirds.*

Maike Hamann (MSc CB, supervisors David Grémillet, Lorien Pichegru and Peter Ryan) *Foraging ecology of breeding Cape Cormorants.* Graduated June 2009.

Genevieve Jones (PhD, supervisor Peter Ryan) *Individual variation in albatross reproductive success: Wandering and Grey-headed Albatrosses at Marion Island.*

Christina Moseley (MSc CB, supervisors David Grémillet, Lorien Pichegru and Peter Ryan) *Comparing body condition and foraging ecology of two populations of Cape Gannets on Bird and Malgas Islands.*

Lisa Nupen (PhD, supervisors Peter Ryan, Rauri Bowie and Jacqui Bishop) *Comparative conservation genetics and evolutionary history of threatened, endemic southern African seabirds in the Benguela Current Upwelling Ecosystem: range-wide phylogeography, gene flow and population genetics based on nuclear and mitochondrial DNA.*

Visits and visitors

Jacob Gonzalez-Solis (Barcelona, Spain) visited in Aug-Oct to accompany the seabird monitoring team to Gough Island. Rob Ronconi (Dalhousie, Canada) also joined the trip, but stayed on at Inaccessible Island with Peter Ryan until early December. David Grémillet (CNRS, France) visited Cape Town again in Oct-Nov to compare the body condition of gannets from west and south coast colonies with Lorien Pichegru and MSc student Christina Moseley.

An oiled Northern Rockhopper Penguin Eudyptes moseleyi *on Inaccessible Island. Despite lying well off the main shipping routes, small numbers of these penguins are oiled each year. Fortunately a survey in 2009 found that the population in the Tristan group had not decreased as much over the last few decades as was originally feared. Photo: Peter Ryan.*

Acknowledgements

Seabird research in the Southern Ocean is supported financially and logistically by the Directorate: Antarctica and Islands, Department of Environmental Affairs and Tourism. Bird research on Gough Island is co-funded by the Royal Society for the Protection of Birds, assisted in part through grants from the UK Overseas Territory Environment Programme. Studies on the foraging ecology of Cape Gannets were initiated as part of a collaborative NRF-French programme but are now supported by the CNRS and a grant from the European Union to David Grémillet as well as CoE funds. Colleagues both at UCT and in the field are thanked for their assistance. SANParks and CapeNature kindly granted permits to work on guano islands off South Africa, and often assisted with transport, accommodation and occasional assistance in the field. Raggycharters Whale Watching also offered free transport to the islands in Nelson Mandela Bay. This programme is truly a collaborative effort.

Dr Andrew Jenkins
heads the Raptor Research Programme with long-term studies of Peregrine Falcons, Black Harriers, Taita Falcons and African Fish-Eagles. He has co-supervised several students and invests much time in interpreting research results for the lay public. He has assessed bird-power line interactions as a research co-ordinator with the Wildlife & Energy Interaction Group of the Endangered Wildlife Trust, and currently investigates the impact of wind and solar power on birds throughout South Africa.

Dr Rob Simmons
is a UCT Research Associate, a co-founder of the Fitztitute's Climate Change Programme and co-leader of its Raptor Research Programme. He combines evolutionary and population ecology with practical conservation issues such as the impact of domestic cats on native wildlife and persistence of small populations, and the responses of endemic, wetland and raptorial species to climate change. Rob also works on behavioural ecology issues including factors favouring siblicide in birds of prey. Rob reviews manuscripts for 22 journals, is an Associate Editor of Ibis, was NRF rated in 2006 and funded in 2007 and has published two books. During the review period, Rob supervised three students – at technikon, CB Masters and PhD level, continued a BIOTA transect study of climate change in Namibia, and added to the 10-year Black Harrier data set. He co-authored three papers, two book chapters, and eight semi-popular articles and contributed to a film on Black Harriers and several press articles on cats.

Raptor Research

Program leaders
Dr Andrew Jenkins
Dr Rob Simmons

Research team
David Allan (Durban Museum)
Mark Anderson (Executive Director, Birdlife South Africa)
Dr Pat Benson (Wits University)
Dr Keith Bildstein (Hawk Mountain)
Andre Botha, Adri Barkhuysen (Birds of Prey Working Group, EWT)
Odette Curtis (Overberg Conservancy Programme)
Dr Jerome Fuchs (PFIAO Postdoctoral Fellow)
Prof Phil Hockey (PFIAO)
Leo Legra (University of Papua New Guinea)
Zanne Macdonald, Lucia Rodrigues, Carrots Doyle, Ann Koeslag and Colleen Rust (Western Cape naturalists, seconded to the research team)
Dr Athol Marchant, Dr Sonja Krueger (KZN conservation officers)
Kirsten Retief (UCT student)
Drs Ruth Tingay and Mike McGrady (Natural Research, UK)
Anthony van Zyl (PFIAO Associate)
Anne Williams, Riette Griesel, Kate Webster (Eastern Cape naturalists, seconded to the research team)
Prof Michael Wink (University of Heidelberg, Denmark)

Satellite-tagging of Black Harriers Circus maurus *has revolutionized our understanding of their movements both during breeding and post-breeding movements. Photo: Mark Anderson.*

Overview
There are two core aims of the Fitztitute's Raptors Research Programme. The first is the monitoring of populations of rare species (e.g. Taita Falcon *Falco fasciinucha*) or those of conservation concern (e.g. Black Harrier *Circus maurus* and Cape Vulture *Gyps coprotheres*) to provide up-to-date information for effective management decisions. In these cases we liaise closely with regional and national conservation organizations to facilitate the transfer of results. The second aim is to provide long-term data on population ecology and dynamics (Peregrine Falcon *Falco peregrinus* and Black Sparrowhawk *Accipiter melanoleucus*), the effects of pesticides (e.g. African Fish-Eagle *Haliaeetus vocifer*), responses to climate and other systemic environmental changes (peregrines, sparrowhawks and vultures) or migratory species whose world populations visit the subregion (kestrels).

A new direction has been to consider the effects of climate change on some of these species, both in South Africa and as far afield as Papua-New Guinea. Raptors are good indicators of biodiversity, and are sensitive to changing food levels in the environment and to changing weather patterns. So for example, why peregrines are getting smaller, why

migratory kestrels are arriving later in southern Africa, and how Papuan Harriers *Circus spilothorax* can avoid annual grass fires have become key questions.

Black Harrier conservation

The Black Harrier is among southern Africa's rarest endemic species, with the global population numbering less than 2000 birds. Moreover, recent preliminary evidence suggests a lack of genetic diversity in this species (J Fuchs pers. comm.), adding to its woes. Found in arid grasslands and fynbos, this species is globally *Vulnerable*. The present study, in its tenth year, investigates the breeding ecology and resources required by Black Harriers with a view to improving management strategies to meet their conservation needs. There are three major components to this project:

(1) An overview of the life history of the species in different regions of South Africa. Results from over 150 nest sites and over 300 nesting attempts indicate that in the Northern and Western Cape Provinces i) clutches are smaller and fledging success lower in inland sites (mountains and Overberg habitats) relative to coastal areas where prey (mice) are more numerous; ii) breeding in the Northern and Eastern Cape Provinces is sporadic, occurring in approximately two out of every three years; iii) polygyny occurs at a low level only in the mountains; and iv) Reversed Size Dimorphism (females larger than males) levels are high, as predicted.

(2) An investigation will be initiated this year of the influence of climate change on behaviour and breeding to determine if the higher breeding success apparent at the coast is a result of cooler, more equable temperatures relative to hotter inland environments.

(3) A new and exciting development is the addition of satellite-tagging technology to follow harriers through a breeding season and then determine where they spend the non-breeding season. Tagging began in 2008 with two birds carrying tiny solar-powered satellite transmitters weighing a mere 9.5 g each. Funds and collaboration were forged with Hawk Mountain (USA), and Natural Research (UK) in order to effect this research.

Results from two harriers breeding in the west coast area showed similar, local movements within the west coast region. The West Coast National Park male spent most time within 40 km of his breeding area, while the female from Koeberg moved to Cape Columbine, before both returned to their breeding areas. However, the third bird from Niewoudtville headed south for the coast after breeding and then turned abruptly east and headed 1 000 km across the Karoo and into the Drakensberg foothills in four days! Her journey continued up through the Lesotho plateau from where she emerged into the grasslands of the Free State. Her record-breaking journey was cut short when she was found dead and emaciated near power lines in the northern Free State in mid February. She had travelled the entire width of the known global range of Black Harriers in about two weeks and shown the widespread wandering of which these birds are capable.

Mystery "Red" buzzards breeding in the Western Cape

Over the past few years there have been reports of buzzards breeding in the Western Cape that do not conform to the standard Forest Buzzard *Buteo trizonatus* phenotype which breeds in our forests. These buzzards are either red or very dark brown in appearance and reports from Elgin suggest that they are replacing the typical Forest Buzzards in some areas. This raises the question of whether these new red buzzards are driving the Forest Buzzards out, or hybridizing with them. More intriguing was the discovery by Andrew Jenkins of dark buzzards breeding successfully on rocky cliffs on Table Mountain, behaviour unheard of in Forest Buzzards. To determine why, Ann Koeslag and others sampled blood from chicks from active nests in 2008 and tissue from two others was collected for DNA analysis. Adult birds are particularly difficult to trap and Ann has been working on various ways of doing so to gain further DNA samples. She was able to confirm however, that a typical Forest Buzzard male paired with a deep red buzzard in 2008. This project will undertake genetic analysis of the blood samples and will register a PhD student in 2010 who will find and capture as many "Red" and Forest Buzzards as possible. The research will compare the behaviour, morphology and DNA between these "Red Buzzards" and all other buzzards in southern Africa to determine their identity, relatedness to other buzzards and geographic origin.

Papuan Harriers – updates on an elusive raptor

During a visit the tropical island of Papua-New Guinea in 2007 to secure DNA from the world's most elusive harrier, native ecologist Leo Legra and Rob Simmons located two of the first nests known in a 3-week trip. Funded by Natural Research, Hawk Mountain and University of Heidelberg, two papers have now emerged giving the first estimate of the small population size of this island endemic (*ca* 3600 birds or 740 pairs). However, they recommended the bird be designated as a globally *Vulnerable* species given that a major threat is the high frequency of fire; this is both a blessing and curse for these uncommon harriers. On the one hand it opens up forest to provide suitable grassland for nesting and foraging, but on the other the timing of fires (most occur as the dry season begins) destroys nests with eggs and chicks. Both nests we discovered were destroyed in this manner. A second paper provides first details of the diet, and nest contents of this poorly studied species, highlighting the large egg size that suggests this may be among the largest of the world's harriers.

Breede River Fish-Eagle Project – looking for chemical connections

Research on the value of African Fish-Eagles as indicators of chemical pollution of freshwater systems continued this year, under the auspices of the Birds of Prey Working Group, Endangered Wildlife Trust, the practical management of Adam Welz, and with significant input from Bill Bowerman of Clemson University, Michigan, USA and his colleagues in the US Fish & Wildlife Service. The eagles on the Breede experienced a relatively poor breeding season, with heavy spring rain resulting in extensive flooding along the length of the catchment. Conditions also prevented sampling at several nests which were rendered inaccessible by the floodwaters. However, blood samples were obtained from nestlings at a reasonable number of sites on the river, and more broadly across the Western Cape Province. These have been added to the growing body of material from this study. A sister study of fish-eagles breeding along the Vaal River has been conducted by Mark Anderson (Northern Cape Nature Conservation, now BirdLife South Africa), and these samples are awaiting analysis in the USA.

A four week-old Peregrine nestling at ringing time. Photo: Andrew Jenkins.

Peninsula Peregrine Project

Now in its 21st year, this project has seen the Peregrine population of the Cape Peninsula grow at >5% per annum, from 8-10 pairs in 1989, to 47 pairs in 2009. For the last 12 years, Andrew Jenkins has focused on individually colour-ringing as many birds in the population as possible and following their fortunes: the project is now starting to reap the benefits of this investment. With nearly 500 birds marked to date, some fascinating demographic secrets are starting to emerge as Res Altwegg, SANBI's biostatistics and modelling wizard, puts the data through their paces. We're hoping that 2010 will see some published results, with planned papers on basic demography, the relative influence of climate and urbanization/human subsidy on breeding success, and the source/sink relationship between urban and remote components of the population.

Long-term road-side and atlas surveys, combined with a study of breeding pairs along the Orange River in Namibia have resulted in the first published assessment of the Namibian Peregrine population. Published in a global re-evaluation of the Peregrine's status, the review shows that less 100 pairs occur in Namibia, where they breed in the arid west, exploiting sandgrouse, larks and coastal shorebirds. Global temperature increases in these regions are likely to reduce the population of this *Near-Threatened* species by 2050.

Peninsula sparrowhawk project

The Black Sparrowhawk project, spearheaded by volunteer researchers led by Ann Koeslag and funded by the Fitztitute, has now been running since 2000. The Black Sparrowhawk is a recent colonist (or recolonist) of the Peninsula, with the first nest being found only in 1994. Fifteen years later the population exceeds 50 pairs, with 50 territories being monitored as part of our study in 2009. To date, more than 170 individuals have been colour-ringed and our understanding of the demographics of the population is growing rapidly. We have expanding databases on mate and territory faithfulness, breeding productivity, movements and dispersal, and the causes of breeding failure. These data will form the basis for understanding the consequences of an experiment on a scale we could never have hoped to emulate. Policy decisions about the management of the Table Mountain National Park have deemed that the majority of the Peninsula's pine plantations will be felled within the next few years: some of the felling has already started. Most of the sparrowhawk population breeds in these plantations. Although as yet there is no evidence that breeding numbers (or success) have decreased, we might expect to see such decreases as the species' favoured breeding habitat becomes increasingly rare. Habitat loss should set the scene for strong competitive interactions and a redistribution of the birds. Knowing the reproductive histories of many individuals will allow us to test theories related to 'despotic' behaviour and territoriality. Theory predicts that the 'best of the best' should monopolise the dwindling patches of pine, and that the frequency of divorce should increase as the best females compete with increasing vigour for access to the best males.

Highlights

- A paper on the Papuan Harrier was published in Bird Conservation International highlighting its precarious existence and climate-change threats from wild fire.
- Rob Simmons, Andrew Jenkins and Chris Brown co-authored a chapter entitled "A review of the population status and threats to Peregrine Falcons throughout Namibia" in Silieki J & Mizera T (eds). Peregrine Falcon Populations – Status and Perspectives in the 21st Century.

Students

Kego Mabihi (B.Tech, CPUT, supervisor Rob Simmons and Charline McKie) *Ecological importance of the Black Harrier* Circus maurus *at Witsand Aquifer Conservation Area.*

Acknowledgements

The Black Harrier study is partially supported by the NRF. Thanks to Anthony van Zyl (Head: Migrating Kestrel Project, Birds of Prey Working Group, EWT) for access to data and global interpretation of the results. The Papua-New Guinea odyssey would not have happened without financial support from Natural Research (UK), Hawk Mountain (USA), and University of Heidelberg (Germany) and field support from Don Scott, John and Michael Simmons, and particularly Leo Legra. The Breede River Fish-Eagle Project is funded by Distell and Flight of the Fish Eagle Brandy and is now managed by the Birds of Prey Working Group, EWT, while the long-term study of Peregrine Falcons on the Cape Peninsula is supported by Steve Phelps and Peregrine Properties. The Taita Falcon survey was funded by The Peregrine Fund, BirdLife South Africa, and Pick 'n Pay. Several raptor projects have been supported by many committed volunteers, notably Lucia Rodrigues, Zanne Macdonald, Colleen Rust, Ann Koeslag, Anne Williams, Carrots Doyle and Dr Athol Marchant.

Spatial Parasitology and Epidemiology

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Dr Michael Kock (WCS)
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Innocent Magunje (BirdLife Zimbabwe)
Dr Felix Nchu (PFIAO Post-doc)
David Nkosi (PFIAO field assistant)

Greater Flamingos Phoenicopterus ruber *trot the water as they take off from a wastewater treatment pond at Strandfontein. Photo: Graeme Cumming.*

Overview

Pathogens have a high relevance for conservation, particularly in small protected areas, small or endangered populations, or localities in which anthropogenic influences are strong. Conservation areas in Africa often occur in close proximity to agricultural systems and, in many countries, areas that have high conservation significance are also used for grazing by cattle, donkeys and goats. Many important pathogens of mammals and birds are carried by ectoparasites (such as ticks, fleas, tsetse flies and mosquitoes).

The community dynamics of most pathogens and parasites are dependent on both their host communities and on their immediate biophysical environment. The close proximity of wild animals, domestic animals and humans in Africa raises many interesting questions from both theoretical and applied perspectives. For example: does environmental modification (tree felling, heavy grazing, controlled burning, etc.) affect ectoparasite numbers or the prevalence of pathogens in avian populations? Do more diverse host communities harbour more diverse pathogen communities, and what would be the implications of this for the management of disease in wild populations? Are there thresholds in ectoparasite or pathogen abundance that dictate the likelihood of disease outbreaks occurring? Are there thresholds in host numbers that dictate the abundance of ectoparasites? And how would such thresholds be influenced by changes in stocking densities and the species composition of large mammals and birds?

Prof. Graeme Cumming
*holds the Pola Pasvolsky Chair in Conservation Biology. During 2009, Graeme supervised two PhD students, two thesis MSc students, four CB MSc students and two postdocs. Graeme published five peer-reviewed articles in 2009 and has another four publications currently in press. He taught the 4-week landscape ecology module and a week-long module on complexity theory on the CB MSc course. In 2009 he also served as external examiner for Walter Sisulu University; as an associate editor for three journals (*Diversity and Distributions, Ecology and Society*, and* Landscape Ecology); *as a special feature editor for* Ecology and Society; *and as a member of the local organising committee for the international DIVERSITAS meeting (Cape Town, October 2009) at which he also gave an oral presentation. He reviewed and/or edited ten papers for different international journals.*
Graeme will be taking a sabbatical year in 2010.

Prof. Graeme Cumming
is also leader of the ***Pattern-Process Linkages in Landscape Ecology*** *programme.*

It is only recently that ecologists have started to develop a food web and community ecology perspective on host-parasite-pathogen relationships, and even more recently that the field of veterinary conservation science has started to gain recognition. Within this general area, we are working from a food web and community ecology perspective (but with links to other agendas and approaches) to understand the relationships between landscape heterogeneity, wetland dynamics, the movements of water birds, and avian influenza and malaria.

Water bird movements and avian pathogens

The Institute, in partnership with the Onderstepoort Veterinary Institute and the Wildlife Conservation Society, led the implementation of the southern African component of the USAID-funded GAINS initiative. We undertook a regional study of the distributions and movements of ducks and the prevalence of avian influenza viruses in wild duck populations in five sites spread across South Africa (Strandfontein in the Cape and Barberspan in the Northern Province), Botswana (Makgadikgadi Pans and Lake Ngami), Mozambique (Lake Chuali) and Zimbabwe (Lakes Chivero and Manyame, near Harare). The primary aims of the project were twofold: first, to document the prevalence of influenza viruses (including but not limited to H5 strains) and malaria parasites in wild duck populations in southern Africa; and second to obtain a better understanding of the regional movement patterns of wild water birds.

The primary field component of the project ended in May 2009, although Mduduzi Ndlovu is still completing bird counts at Strandfontein and Barberspan as part of his PhD study. The project as a whole yielded influenza samples and other data from over 4,000 wild birds. Laboratory analysis has yielded over 100 positive records of avian influenza, most of which come from Zimbabwe. Our capture data were supplemented by standardized duck counts, measures of water quality and quantity, and a range of satellite image-derived measures of habitat type and quality. Twenty-two individuals of each of two species, Red-billed Teal *Anas erythrorhyncha* and Egyptian Goose *Alopochen aegyptiaca*, have been tracked in three focal locations using GPS satellite telemetry. At the time of writing, we are still getting regular data from 15 birds (all bar one of which are Egyptian Geese). Some of these birds have now been tracked for over two years. The results look to be extremely interesting, but we are holding our tongues until publication – watch this space!

With the intense period of GAINS field work completed, we are now shifting more into writing and analysis mode, with a number of publications in various stages of preparation, submission, and review. Graeme is planning to spend part of his sabbatical year working with collaborators in France on writing up shared data sets and pooling our data with other data from sub-Saharan Africa. The results of the study will contribute to a regional and global understanding of the potential role of wild birds in the epidemiology of avian pathogens, as well as shedding light on patterns of duck movements through the year and the causes of nomadism in duck populations in semi-arid areas.

Interestingly, our water quality data have indicated a major problem at Barberspan, where dissolved oxygen levels in the water have plummeted over the last year. Barberspan water quality now appears to be similar to that at Strandfontein, which is a wastewater treatment works. We have communicated our results to the Northwest Parks Board and they are attempting to remedy the situation, which appears to have been caused by (1) inputs of sewage from processing plants upstream during flood periods; and (2) destruction of reed beds at Barberspan and the Harts River for boating and fishing convenience, as well as quelea control.

PhD student Mduduzi Ndlovu holds a Blacksmith Lapwing Vanellus armatus *at Lake Chuali, Mozambique. Photo: Graeme Cumming.*

Student projects on waterbirds proceed apace. Mduduzi Ndlovu has made good progress on several chapters of his PhD thesis and has an article on moult patterns in Egpytian Geese currently under review with the *Journal of Avian Biology*. Sharon Okanga has started field work on avian malaria; Sharon will be looking at the impact of land use on mosquito densities and avian malaria in communities of passerines using areas adjacent to wetlands. Postdoctoral Fellow Felix Nchu is focusing on avian malaria in waterbirds, both analysing some of our samples from the GAINS project and collecting new samples at a wider range of wetlands.

Gregory Mutumi should complete his MSc thesis on the potential use of stable isotopes in duck feathers to track duck movements by the end of July 2010; we anticipate three solid publications coming out of that analysis. Dominic Henry completed an honours thesis on waterbird movements using some of the count data from the project and found that a high proportion of variation in waterbird abundances could be explained by a relatively simple measure of dispersal ability. Dominic is currently revising his project write-up, under Graeme's supervision, for submission to a peer-reviewed journal.

Highlights

- Mduduzi successfully upgraded to PhD status at the end of 2009; and new PhD student Sharon Okanga successfully defended her proposal in July.
- Mduduzi and Greg presented posters at the International DIVERSITAS OSC2 Conference in Cape Town in October 2009.
- Graeme is in the process of wrapping up a special feature on 'Risk mapping for avian influenza' for the peer-reviewed journal *Ecology & Society*. The primary Fitztitute contribution to the special feature is already in print, but will be followed by an editorial and a further joint publication with CIRAD.
- Our collaborators at OVI led an analysis of influenza A viruses from the subregion: Abolnik, C., G.H. Gerdes, M. Sinclair, B.W. Ganzevoort, J.P. Kitching, C.E. Burger, M. Romito, M. Dreyer, S. Swanepoel, G.S. Cumming, and A.J. Olivier. (In press). Phylogenetic analysis of influenza A viruses (H6N8, H1N8, H4N2, H9N2, H10N7) isolated from wild birds, ducks and ostriches in South Africa from 2007 to 2009. Avian Diseases.

Students

Dominic Henry (Hons, Zoology, UCT, supervisor Graeme Cumming) *Ecological traits as predictors of cross-scale temporal abundance in waterbird communities.* Graduated December 2009.

Gregory Mutumi (MSc, PFIAO, supervisor Graeme Cumming) *Stable isotope analysis as a tool for understanding movements of nomadic ducks.*

Mduduzi Ndlovu (MSc upgraded to PhD at the end of 2009, PFIAO, supervisors Graeme Cumming and Phil Hockey) *Understanding moult, condition, and the movements of Egyptian Geese in southern Africa.*

Sharon Okanga (PhD, PFIAO, supervisor Graeme Cumming) *The influence of host community, urbanization and pollution on avian parasite ecology.*

Acknowledgements

This programme was initiated with funding from USAID through the Wildlife Conservation Society's GAINS program and is currently receiving support from the DST/NRF Centre of Excellence at the Percy FitzPatrick Institute. We are also grateful to our collaborators in each country and to the many volunteers who have helped out in the field.

A Grey Heron Ardea cinerea *stands watch in a bed of invasive* Typha *reeds at Strandfontein. Photo: Graeme Cumming.*

Prof. Graeme Cumming
is also the leader of the ***Spatial Parasitology and Epidemiology Programme.***

Pattern-Process Linkages in Landscape Ecology

Programme leader
Prof. Graeme Cumming

Research Team:
Assoc. Prof. Grenville Barnes (University of Florida)
Matthew Child (CB MSc graduate)
Prof. David Cumming (PFIAO and Tropical Resource Ecology Programme)
Dr Grant Joseph (CB MSc graduate)
Milton Makumbe (University of Zimbabwe MSc student)
Zaccheus Mhlanga (now retired, formerly Zimbabwe National Parks)
Assoc. Prof. Stephen Perz (University of Florida)
Assoc. Prof. Jane Southworth (University of Florida)
Dr Xanic Rondon (Postdoctoral Fellow, PFIAO)
Dr Colleen Seymour (SANBI)

The setting sun highlights an elephant-carved hole in the side of a large termite mound in Chizarira National Park. Photo: Grant Joseph.

Overview
The earth is currently entering an age that has been termed the Anthropocene, when human influences dominate natural processes. Most individual anthropogenic impacts occur at relatively small scales, but the combined effects of many people making small-scale changes to ecosystems can compound to cause large-scale changes. Humans and other organisms respond to landscape change across a range of scales. The central theme of this research programme is to unite fine-scale and broad-scale perspectives in landscape ecology and conservation biology through exploring the connections between landscape pattern and landscape process at multiple scales. We are also interested in the resilience of linked social-ecological systems and the ways in which management and landscape-level changes in ecosystems interact to determine social-ecological resilience to such events as climate change, disease outbreaks, and species loss.

This programme area is one in which both theoretical and practical developments are of prime importance. We have identified several focal areas in which research into specific cases will provide ways of developing the necessary theory and should provide insights of broader relevance. These currently include 1) the role of nutrient hotspots in the landscape, and their contribution to community composition and resilience; 2) the spatial relationships between functional and taxonomic diversity; and 3) the influence of connectivity and other spatially explicit variables on the resilience of linked social-ecological systems. This research will feed usefully into attempts to develop more effective, better-informed approaches to ecosystem management and biodiversity conservation.

Nutrient hotspots and community composition

This focal area has made significant progress over the last year, with Grant Joseph and Colleen Seymour taking the lead on field data collection at our Chizarira study site in Zimbabwe, under the expert guidance of local botanist Zaccheus Mhlanga. Grant is in the process of applying for PhD candidacy and plans to focus on the contributions that termitaria make to ecosystem resilience in the face of pressure from fire and elephants. Preliminary results indicate many fascinating connections and differences between termitaria and the landscape matrix in which they sit. In particular, results suggest that 1) large termitaria are providing important refugia for large trees, which in turn provide the deadwood needed by cavity-nesting birds; 2) termitaria provide a refuge from fire; 3) the composition of tree and ant species on termitaria differs from the surrounding matrix; 4) although reptile communities do not appear to differ between mound and matrix, they are heavily influenced by fire; and 5) termite mound communities undergo a set of predictable developmental stages as mounds age. In addition to these results from Chizarira, Milton and Zaccheus collected data at Lake Chivero, Zimbabwe, which demonstrated that vegetation communities on termitaria are influenced by land use and management.

Data on wetlands and their ecological influence on duck communities (currently being collected through the water bird project described under the spatial parasitology and epidemiology programme) will also contribute to this project theme.

Spatial relationships between functional and taxonomic diversity

This focal area has benefitted from some excellent inputs from CB students. Matthew Child completed an honours project in 2006 and an MSc project in 2007 that compared spatial patterns of functional and taxonomic bird diversity. Matt and Graeme have published two peer-reviewed papers (*Philosophical Transactions of the Royal Society* and *Biological Conservation*) together and are currently mid-way through a third analysis, which will focus on looking at variation in functional volumes associated with decreasing trait-space. One of the central findings of this research has been that South African protected areas are acting as key reservoirs for populations of raptors and scavengers.

Simon Dures followed up on Matt's research with a project in 2008/2009 on avian communities in protected areas in lowland fynbos in and around Cape Town, with the goal of testing how landscape connectivity and patch characteristics influence both the taxonomic and functional composition of avian communities in a largely urban matrix. Simon was able to show that the primary determinant of avian community composition in green spaces in Cape Town was the overwhelming impact of an invasive shrub, Port Jackson Willow *Acacia saligna*. Simon's research is now published in *Biological Conservation*.

A new twist on functional and taxonomic spatial patterns, and an exciting new development, is the analysis of functional differences between plants growing on and off termite mounds. This work will constitute part of Grant Joseph's PhD project.

Spatial influences on resilience

This project was supported until February 2010 by an NSF grant that was awarded to Steve Perz, Grenville Barnes, Graeme Cumming and Jane Southworth. We have been exploring the influence of the (currently under construction) trans-Amazon highway on the MAP (Madre de Dios, Accre, and Pando) area of the Amazon basin, where Bolivia, Brazil and Peru meet. MAP is an intriguing case study because it includes three areas with similar biophysical templates and vastly different institutions and political systems. We predicted in 2005 that resilience of Amazonian social-ecological systems will be greatest when their physical connectivity is intermediate, because the system receives new inputs from outside but is not overwhelmed by them. As connectivity changes with the construction of the Trans-Amazon highway, we are tracking changes in social systems, household economies and plant communities. These data will be integrated with time series of land-cover change, initially using space for time substitutions, to test whether system resilience changes as connectivity changes. A conceptual framework for the project was published in *Ecosystems* in 2005 (Cumming et al., 2005). Dr Xanic Rondon spent the first year of her postdoc in Cape Town working with Graeme on the development of spatial models to simulate economic decisions made by loggers in relation to infrastructure. Xanic and Graeme, together with several other collaborators on the project, have also completed an analysis of patterns of edge formation and their potential impacts on fire dynamics in the Amazon. This work is currently under review at *Landscape Ecology*.

Highlights

- Ten peer-reviewed articles were published or accepted for publication as part of this programme in 2009:
- Xanic Rondon and Graeme Cumming presented papers at the International DIVERSITAS Conference in October.

Students

Tsholofelo Dithlobolo (MSc CB, supervisors Graeme Cumming and Sue Milton) *Does protection from grazing alter the species composition and improve grazing value of the semi-arid Karoo rangeland?* Graduated June 2009.

Simon Dures (MSc CB, supervisor Graeme Cumming) *Connectivity and avian function in urban protected areas in Cape Town.* Graduated June 2009.

Ben Heermans (MSc CB, supervisors Graeme Cumming, David Cumming and Colleen Seymour) *Large vegetated termitaria, fire and elephant impacts on a reptilian community in a Miombo woodland system in Chizarira National Park, Zimbabwe.*

Allison Skidmore (MSc CB, supervisors Graeme Cumming, David Cumming and Colleen Seymour) *Landscape heterogeneity facilitated by termitaria and its effect on ant community composition in the miombo woodlands of Chizarira National Park, Zimbabwe.*

Acknowldegements

We are grateful to Zimbabwe's Wildlife Management Authority for allowing us to work in Chizarira; to the NRF for funding research on termitaria through a SARC grant to Graeme and David Cumming; and to the NSF (USA) for supporting the MAP programme.

Dr Jane Turpie

Jane is a part-time academic staff member responsible for teaching the Resource Economics module of the Conservation Biology MSc Course. Jane's research and consulting interests incorporate resource economics, conservation planning and estuarine ecology. Jane is a member of the European Association of Environmental Economics and a Research Fellow of the Environmental Economics Policy Research Centre, a Swedish-funded Environment-for-Development Centre based at UCT's School of Economics. She is on the editorial board of the African Journal of Marine Science*. She sits on the steering committees of Water Research Commission projects concerning estuarine ecology, management and economic evaluation. During the review period Jane supervised or co-supervised two PhDs and one MSc mini-thesis in environmental economics.*

Environmental and Resource Economics

Project leader
Dr Jane Turpie

Research team:
Dr Jon Barnes (Windhoek, Namibia)
Dr Christophe Bene (Worldfish Centre, Penang, Malaysia)
Dr Liz Day (Freshwater Consulting Group, Cape Town)
Dr Heather Malan (Zoology Dept., University of Cape Town)
Dr Guy Midgley (SANBI, Cape Town)
Dr Peter Tarr (Southern African Institute of Environmental Impact Assessment, Namibia)

Dug-out canoes used by fishers in the Lower Shire floodplain, Malawi. Photo: Jane Turpie.

Overview

This programme is multidisciplinary, integrating ecological, social and economic research in order to inform policy and decision making relating to the conservation of biodiversity and socio-economic development. The programme has particular emphasis on water and aquatic ecosystems. Projects initiated, ongoing or completed during the review period included a study of the water quality amelioration services provided by wetlands; development of tools and protocols for assessing the socio-economic (livelihood) importance and economic value of wetlands; a study of the social value of small-scale inland African fisheries; a study of the economic implications of climate change-related changes in biodiversity in Namibia, including an adaptation strategy for the protected area system; and a study of the implications of carbon markets for the heavily forested state of Guyana in South America.

Water quality amelioration value of wetlands

Wetlands are commonly understood to have the capacity to reduce the loads of excess nutrients, pathogens, sediments, and other contaminants generated by various activities in their catchment areas. However, quantifying these 'services' is difficult and most research in this field has concentrated on artificial treatment wetlands. Understanding the value of their water treatment characteristics, as well as the other services they provide, is increasingly recognized as essential to achieving a balance between conservation and activities that degrade or replace wetlands. The aim of this study was to estimate the water treatment capacity of wetlands on a landscape scale in the south-western Cape of South Africa and estimate the economic value of the service performed. We collected samples at the outflow points of 100 subcatchment areas and measured the loads of nitrogen, dissolved phosphorus, and suspended solids, which were analysed with respect

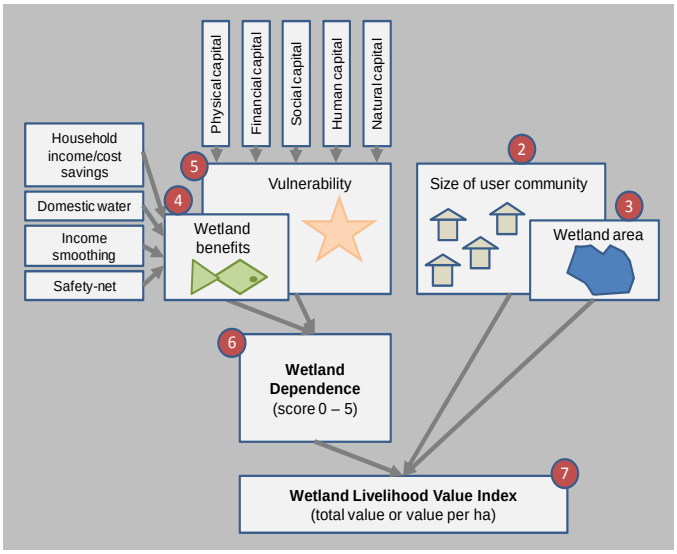
to detailed spatial data on land cover and wetlands area. Wetlands play a significant role in the reduction of nitrates, nitrites, and ammonium, but not dissolved phosphorus or suspended solids. Estimated removal rates ranged from 307 to 9,505 kg N.ha^{-1}.year^{-1}, with an average of 1594 ± 1375 kg.N.ha^{-1}.year^{-1}. Data from a number of water treatment works suggest that the cost of removal of ammonium nitrogen is in the order of ZAR 26 per kilogram. Applied to the wetlands in the study area, this suggests that the average value of the water treatment service provided by wetlands in the study area is about ZAR 14350 ± 12385 ha^{-1}.year^{-1}. These values are high enough to compete with the alternative land uses that threaten their existence. The results suggest that wetlands should be given considerably more attention in land-use planning and regulation.

The livelihood value of small-scale inland fisheries

The study assessed the welfare value of fisheries in reducing income poverty and economic vulnerability in the Kafue floodplain, Zambia and the Lower Shire floodplain, Malawi. Data were collected through literature reviews, key informant interviews, focus group discussions and monthly household surveys. A total of over 1900 household interviews were analysed. Both fisheries are only weakly managed, but the Lower Shire fishery has more control over access than Kafue due to co-management arrangements. Both floodplains are heavily populated, but agricultural activities differ. Inhabitants of the Kafue floodplain were traditionally pastoralists, whereas those of the Lower Shire floodplain have always engaged in both cropping and livestock. Fishers in the Kafue floodplain tended to be immigrant economic refugees, and have also brought cropping to the area. Kafue fishers had fewer livestock than the rest of the community, but their livestock holdings increased with years spent fishing, suggesting that fishing was able to help them climb out of poverty. In the Lower Shire floodplain, fishers had smaller fields than other households, suggesting this activity was used as a risk-spreading strategy by poorer households. Fishing income reduced the poverty head count by 6% in both floodplains, and reduced economic vulnerability by 52% in the Kafue floodplain and 4% in the Lower Shire floodplain. Fishing effectively performs a safety-net function in the Kafue floodplain for disenfranchised households that have immigrated into the area due to the *de facto* open access and weaker management regime while it performs a risk spreading function in the Lower Shire floodplain where households are comparatively well-off in terms of their asset base and access is restricted through informal mechanisms and stronger management regime.

A tool for assessing the livelihood value of wetlands

Millions of South Africans are directly dependent to some extent on natural systems to sustain their livelihoods, and wetlands are considered particularly valuable in terms of the variety and abundance of services they provide. Understanding the degree to which wetlands contribute to people's livelihoods may be vital in steering decisions that minimize negative impacts or enhance the benefits that wetlands have for communities, such as their contribution to household income. The aim of this study was to develop a simple index for the assessment of a wetland's importance to people's livelihoods through understanding of the level of dependence of surrounding communities on the wetland. The tool outlines the way in which the index parameters are estimated at a rapid, intermediate, or comprehensive level, depending on the budgetary constraints or the level of confidence required. Since the index produces a result which is in comparable units, the results can be used to assess the relative importance of a wetland compared to others in the catchment or even nationally, and to rank, or prioritize, different wetlands in terms of management priorities. It would also be possible to apply the index when investigating the implications of different future scenarios (e.g. changes in wetland property rights, climate, and population density). The index developed can be used in conjunction with existing South African indices such as WET-Health, WET-EcoServices and WET-SustainableUse. The components of the index are shown in the figure below:



Structure of the livelihood index developed for wetlands.

Using tropical forests to combat global climate change without compromising local livelihoods in Guyana

Tropical forests provide benefits to local and national economies through the provision of environmental goods and services. In the fight against climate change, the Guyanese President has proposed placing almost the entire state-owned forest under an avoided deforestation programme if the right economic incentives are created to compensate for the economic benefits that the country would have to forego. The opportunity cost which includes standing timber value, post-harvest land use value, avoided protection cost, and loss of local ecosystem services was estimated at US$580 million annually. With avoided emissions estimated at 343 tons of carbon per hectare and the abatement cost of carbon at US$2-11 per ton, this proposal seems financially viable and important for this developing nation. However, such a programme would affect the local communities that depend on the use and conversion of forest resources for their livelihoods. This study showed that a third of the state forest can be allocated to meet the needs of local communities without compromising the potential income from the avoided deforestation programme. The continued use of a third of the state forest would not only benefit the local communities and maintain their traditional way of life but would also benefit the government who would otherwise have to spend at least US$396 million annually to supplement those resources that the forests provide free of cost.

Recreational value of the Kogelberg coast and potential impacts of management

The Kogelberg Biosphere Reserve ("KBR"), South Africa's first biosphere reserve, covers a land area of some 103 000 ha and includes a marine portion of 24 500 ha along its 79km of coastline. This study investigated the value of the coast, its spatial distribution and the impacts of environmental changes on this value. The study was based on existing statistics, aerial surveys and questionnaire surveys of over 700 users. Analytical methods included Contingent Valuation, Conjoint Rating and Hedonic Pricing. In addition to the permanent population of about 13 000, there are an estimated 28 - 34 000 visitors on any one day in December. Visitors spent an estimated total of 4.3 to 5.3 million visitor days per year, of which holiday home owners, other overnight visitors and day visitors accounted for about 22%, 56% and 21%, respectively. Coastal activities contributed 71% to all users' enjoyment of the Kogelberg coast, with beach activities (26%) and coastal nature (27%) contributing the bulk of this, and fishing (13%) and water sports (5%) making a smaller contribution. Non-coastal activities such as relaxing at the home base and shopping make up the balance. Visitors spend an average of 70% of their leisure time at the coast. Visitors were categorised, based on multivariate analysis. Two-thirds of visitors in summer are beach-oriented visitors and the remainder are fishing and water sport-oriented. Going to the Kogelberg area was a bigger reason for their trip away for South Africans (average 90%) who tend to be on single destination trips, than for foreign visitors (59%) who tended to be visiting as part of a larger sight-seeing trip. The MPA and its penguin colony were not major influences in attracting visitors to the area. The recreational expenditure by land-based visitors attributable to the Kogelberg coast was estimated to be about R191 to 235 million per annum. Coastal property in the area is estimated to be worth approximately R7.3 billion. Of this, the coastal premium was estimated to be just over R1 billion, translating to an annual value attributed to the coast of R59 million. Thus the recreational value of the coast is estimated to be in the order of R272 million. Survey data suggested that the value of the coast could be increased by some R126 million by eradicating crime. Expanding the MPA system would generate an additional R37 million, as long as fishing catches in surrounding areas increase, and by R34 with better enforcement of environmental laws. Litter, doubling of house numbers and halving of cetaceans could reduce value by R107, R77 and R77 million, respectively.

Impacts of climate change on tourism demand in Namibia

Namibia is projected to experience considerable changes in landscape productivity and distributions of plants and wildlife by 2080 as a result of climate change. This will affect the density and types of species seen by visitors to Namibia's protected areas. This study, carried out by the Conservation Biology MSc class as part of their Resource Economics module, investigated whether visitors would be sensitive to such changes, and the degree to which overall tourism expenditure might be affected. Over 500 holiday makers were interviewed in several Namibian National Parks and at Hosea Kutako International Airport in Windhoek, during June–July 2009. The study, which was based on a composite of conjoint and contingent valuation methods, showed that tourism would be relatively resilient to losses in biodiversity because of the high contribution of landscapes to the visitor experience, and the fact that these would not be significantly impacted by climate change. Without any change in tourism strategy, predicted changes in biodiversity could reduce nature-based tourism demand by up to 15% for the worst-case scenario.

Conference presentations

- "Estimating social and economic trade-offs in allocating environmental flows for the Pangani River Basin, Tanzania". Implementing Environmental Water Allocations, Port Elizabeth, 23-26 Feb 2009.
- "The nature, distribution and value of ecosystem services in South Africa". CAPE Environmental and Resource Economics Conference, 21-22 May 2009.
- "Estimation of the water quality amelioration value of wetlands: a case study of the Western Cape, South Africa" The 3rd Annual Meeting of the Environment for Development (EfD) Initiative, Naivasha, Kenya, 3-7 Nov 2009.

Students

Peter Ngoma (PhD student, supervisor Jane Turpie) *Valuation of inland fisheries in the Zambezi Basin: The case of Lower Shire and Kafue floodplain fisheries.*

Ian Kissoon (CB MSc student, supervisor Jane Turpie) *Using tropical forests to combat global climate change without compromising local livelihoods.*

How resilient will tourism be to changes in biodiversity: the CB students investigated. Photos: Jane Turpie.

Climate Change: Vulnerability and Adaptation

Programme leaders
Dr Rob Simmons (PFIAO)
Dr Phoebe Barnard (Birds & Environmental Change Partnership, SANBI)

Research team:
Dr Res Altwegg (SANBI)
Mark Anderson (BirdLife South Africa)
Dr Niels Blaum (BIOTA, University Potsdam, Germany)
Dr Lynda Chambers (Bureau of Meteorology, Australia)
Bernard Coetzee (Stellenbosch University)
Dr Yvonne Collingham (Durham University, UK)
Dr Richard Dean (Research Associate, PFIAO)
Dr Lesley Gibson (Department of Environment & Conservation, Western Australia)
Dr Danni Guo (SANBI)
Prof. Phil Hockey (PFIAO)
Dr Dave Hole (Conservation International and Durham University, UK)
Prof. Brian Huntley (Durham University, UK)
Dr Rowan Martin (Postdoctoral fellow, PFIAO)
Assoc. Prof. Andrew McKechnie (University of Pretoria)
Dr Guy Midgley (SANBI)
Dr Mark Robertson (University of Pretoria)
Dr Frank Schurr (University of Potsdam, Germany)
Dr Colleen Seymour (SANBI)
Dr Clélia Sirami (Postdoctoral fellow, SANBI)
Dr Wilfried Thuiller (Université Joseph Fourier, Grenoble, France)
Ross Turner (University of KwaZulu-Natal)
Prof. Les Underhill (Animal Demography Unit, UCT)
Dr Steve Willis (Durham University, UK)
Prof. Blair Wolf (University of New Mexico, USA)

Overview
Climate change has been a fact of life on the African continent, as elsewhere, for millennia. Yet for many birds, most of which evolved in cooler conditions, accelerated climate change may prove to be the straw that breaks the camel's back. It does not operate in isolation, but may compound the already serious effects of land-use change, biotic invasion and disease in complex ways. Climate-change impacts on southern African biodiversity will likely be significant, given our high levels of endemism and our position in the mid-latitudes of the continent. The magnitude and pace of these problems demands a concerted research response, coupled to the development of tools for conservation planners, policy makers and habitat managers.

In 2005-06, the Fitztitute and SANBI's Birds and Environmental Change Partnership established this joint programme to focus attention on the vulnerability and adaptation of southern Africa's birds to climate change and other environmental change drivers. Research work is done collaboratively by SANBI, the Fitztitute, and the Animal Demography Unit, with international partners. The policy and planning translation is undertaken mainly by SANBI with partners' inputs. SANBI, the Fitztitute, the ADU and partners at Durham University are developing second-generation modelling tools, focused on climate-change vulnerability, to inform conservation adaptation strategies.

Key themes and questions
Conservation-management responses to climate change need to be focused, well-informed by solid research, achievable and cost-efficient. Our approach therefore relies on a hierarchy of questions, from basic to applied.

Dr Phoebe Barnard
is a UCT Honorary Research Associate. She founded and runs the Birds and Environmental Change Partnership at the South African National Biodiversity Institute (SANBI), which focuses on bird research, monitoring and conservation activities in relation to global change. Phoebe mentors young scientists across Africa through UCT, Stellenbosch University and the Society for Conservation Biology, and in 2009 supervised two PhD students, an MSc student and a postdoc. She runs the climate change module of the Conservation Biology MSc course, and during 2009 published three scientific papers, a chapter in a conservation management manual, a booklet on birds and environmental change, and nine popular articles, with five further papers in press. She serves on the editorial boards of Biology Letters, Animal Conservation *and the* African Journal of Ecology*, and screens and reviews about 30 manuscripts per year for these and other journals. She is interested in applying insights from behavioural, population and evolutionary ecology to understand how species cope with global change in human-altered landscapes. Phoebe writes and speaks widely to specialist and public audiences on global change and society's transformation to sustainability.*

Dr Rob Simmons
is also co-leader of the Raptor Research Programme.

Which species are most vulnerable, and why?
Which traits – ecological, behavioural, life-history or genetic – influence birds' vulnerability to changing climates? An early bioclimatic envelope analysis of six potentially vulnerable species (Simmons et al. 2004, *Ostrich 75:* 295-308) predicted range losses of 22-69%, with an average of 40%. Only one of these species (Blue Swallow *Hirundo atrocaerulea*) was then on South Africa's Red Data List. Since then, Brian Huntley, Phoebe Barnard, Res Altwegg, and other team members have been developing integrated bioclimatic envelope and demographic modelling techniques, to be published in *Ecography* in 2010 and applied in a series of papers exploring the relationship between abundance, range changes and climate. This series will look in turn at projected range shifts of Karoo, fynbos, grassland, Afromontane forest and other birds, including species of conservation concern, and interpret some intriguing similarities in pattern.

The long-term population and community study of fynbos endemic birds by Phoebe Barnard and Rob Simmons, initiated in 2008, uses colour-marked individuals of both endemic and more widespread birds to study how behavioural and ecological traits and genetic history influence vulnerability at species and population levels. This new study, focusing on Cape Sugarbirds *Promerops cafer*, Orange-breasted Sunbirds *Anthobaphes violacea*, and Cape Rockjumpers *Chaetops frenatus,* will over time provide insights into the roles of behavioural ecology, demography and past gene flow in influencing species' vulnerabilities.

Victorin's Warbler Cryptillas victorini *is endemic to rank fynbos vegetation, which is often found along water-courses. It may be influenced by climate-induced changes in hydrology. Photo: Paula Pebsworth.*

What are the risks for threatened, small and peripheral populations?
In a series of current and planned analyses, we are looking at the potential impacts of climate change on threatened and range-restricted species of southern Africa, including montane endemics, plant pollinators, and Red Data species. Phoebe Barnard, Rob Simmons, Ross Turner and a team led by Frank Schurr of Potsdam University are designing a basis for investigating plant-pollinator interactions, and how each may be affected by climate change. Protea – Cape Sugarbird *Promerops cafer* interactions are a flagship example, as are Orange-breasted Sunbirds *Anthobaphes violacea* and *Erica* species previously thought to be pollinated by insects.

Mountain-dwelling vultures have among the most isolated and peripheral populations of any southern African bird. Surveys of two such vultures, Bearded *Gypaetus barbatus* and Cape Vulture *Gyps coprotheres*, had earlier suggested that factors other than poisons and habitat change may drive population declines (Simmons & Jenkins 2007). A study by 2008 CB student Jamshed Chaudhry found that Cape Vulture heat-stress behaviours were significantly temperature-dependent at three colonies differing in their exposure to direct sunlight, with the northernmost colonies in this species' recent range now extinct. Following on from this study, two new PhD studies will assess vulture habitat preferences. The Bearded Vulture PhD project will assess which pothole nests have been abandoned in the last 30 years and how temperature affects success and timing of breeding in this declining species. Simultaneously, White-backed Vulture *Gyps africanus* vulnerability will be assessed by following birds' habitat choices over several years using GPS trackers.

How do birds move across human-altered landscapes?
In recent decades, a number of South African bird species have undergone substantial range changes. The majority of these involve range expansions to the west and south. In 2009, Phil Hockey and Guy Midgley published a paper analysing patterns of bird colonisation of the Cape Peninsula since the 1960s. Most of the colonising species have been associated either with wetlands or woodlands, both naturally rare in the west of the country. They interpreted the patterns of colonisation as better explained by human-introduced landscape elements (dams and alien trees) than by climate change.

A subsequent analysis of more than 400 terrestrial species being prepared for publication by Phil Hockey, Clélia Sirami and Guy Midgley supports the notion that climate change is not an overarching explanation for recent range changes. For example, westward range expanders are closely linked to human-altered landscapes. A similar conclusion had been reached for wetland birds in a 2008 study by Nicola Okes, Phil Hockey and Graeme Cumming. This study showed that wetland species that had expanded westwards were generalists, whereas those whose ranges had contracted eastwards were specialists closely tied to vegetated wetlands (habitats regularly lost to drainage and agriculture).

It is highly unlikely that climate change is *not* having an impact on the distribution of South Africa's birds. However, the last three studies point to the difficulty in separating out the effects of climate and altered landscapes. In Europe, it has been argued that the latter are no longer an explanation for currently changing species' distributions because the landscape changes are so old that bird populations had reached new equilibria before climate change started to have

an effect. In South Africa, however, this is not the case: the country's population doubled between 1981 and 2003, with parallel changes in land use.

In the search for a 'pioneer climate-change indicator species', in 2009 Gina Louw, Phil Hockey and Danni Guo analysed range changes of Common Swifts *Apus apus* from the 1960s to the present. When in South Africa, this migratory species never comes to ground, so does not need terrestrial habitats (human altered or not) in which to forage, nest or roost -- it eats, drinks and sleeps and on the wing. The species' range in South Africa has more than doubled in the past 50 years, spreading towards the west and south. Using a combination of predictive and retrodictive approaches, it was possible to show that the pattern of colonisation of the west and south of South Africa accorded closely with patterns of environmental warming. This is the first compelling evidence for a South African bird's range having changed in direct response to climate change.

How do differences in vulnerability affect populations?

Analysis of large-scale range shifts is a very incomplete and belated way of understanding impacts. By the time ranges shift, major population-scale impacts are already underway and local populations may have gone extinct. We need to establish how populations are affected in detail, and why – which individuals or age classes suffer most; how breeding, migration and feeding are affected; and whether normal activities carry increased costs (e.g. energetics) and risks (e.g. predation) for individuals as the climate changes. This work requires long-term demographic datasets, unfortunately very rare in southern Africa. Yet integrated global change models, strengthened by the demographic insights these datasets present, were highlighted as a strategic priority globally by Phoebe Barnard and Wilfried Thuiller in an earlier (2008) *Biology Letters* overview. The paper by Brian Huntley *et al.* above, submitted in 2009, outlines the components of integrated spatial and demographic models which more accurately predict vulnerability to climate change, and has shaped the team's current work in this area.

The fynbos endemics study by Phoebe Barnard and Rob Simmons is providing detailed insights into the population and behavioural mechanisms underlying range changes, as well as the painfully rare field data to validate demographic and spatial models. In addition, at a community level, the work is gaining insights into the mutualisms between fynbos endemic plants and birds which may be strained by the impacts of climate change. Furthermore, genetic data are being collected from birds in several study sites throughout the fynbos biome, to understand better the degree of population gene flow in past climates.

How do birds in hot deserts cope with warming?

Many animals face specific bottlenecks in energy and or water demand, and the impacts of climate change on these species can be predicted through physiological research. One such group is desert birds, which inhabit areas that experience extremely hot weather in summer. In deserts of the south-western United States, North Africa, the Middle East and Australia, temperatures may exceed 50°C. Climate change is predicted to cause more intense and frequent heat waves in many regions, including hot deserts. Very high air temperatures pose significant physiological challenges to birds, as they must evaporate sufficient water to maintain body temperatures below that of their environment. In very small species, rates of evaporative water loss required to keep cool increase rapidly with increasing air temperatures, and may exceed 5% of body mass per hour in extremely hot weather. Birds are thought to be able to tolerate dehydration levels of 10-20 % of body mass, but during very hot weather they can rapidly reach these limits and become fatally dehydrated. These challenges are compounded in deserts, where water demands are high, but where water resources are scarce and highly unpredictable. Catastrophic mortality events among desert birds during extreme heat waves have been recorded in the past, particularly in Australian deserts. In January 2009 and January 2010, two such events were reported in Australia: the first involved thousands of Budgerigars *Melopsittacus undulates* and Zebra Finches *Taeniopygia guttata* near Carnarvon, and the second more than 100 endangered cockatoos near Hopetoun. These events highlight the vulnerability of desert birds to more intense and frequent heat waves, which have also recently caused large-scale die-offs of flying foxes in New South Wales.

Our research into the impacts of climate change on desert birds uses several complementary approaches. The physiological component is supervised by Andrew McKechnie, and the behavioural component by Phil Hockey. We have modelled avian evaporative water demands at various environmental temperatures, and used this model to predict increases in water requirements that birds will experience on very hot days under future climate scenarios. We are currently expanding this analysis to include a spatial component, where we map avian evaporative water requirements under current and future climates for different regions. The other major component of this study involves behavioural and physiological studies of birds inhabiting southern Africa's hottest desert, the Kalahari. PhD student Ben Smit is spending the summer of 2009-2010 in Tswalu Kalahari Reserve, where he is examining how birds' activity patterns, drinking behaviour and rates of water turnover vary with increasing temperature. Preliminary data show that several medium-sized species start showing heat dissipation behaviours at air temperatures as low as 31°C, whereas small (e.g. Yellow Canary *Crithagra flaviventris*) and large species (e.g. Red-crested Korhaan *Lophotis ruficrista*) show very limited or no heat dissipation behaviour, even at much higher temperatures. Heat dissipation behaviour seems related to activity levels and perhaps different microsites, for instance foraging at high temperatures or remaining sedentary in the shade or wind (while singing, preening or resting). Ecological differences such as dietary guild or drinking dependency might explain interspecific differences in activity budgets and risk of heat stress. Ben also

uses video cameras to monitor drinking patterns at waterholes, and how these change with temperature. So far, except for Namaqua Doves *Oena capensis* which tend to drink during the middle of the day, most species visit waterholes in large numbers during the early hours of the morning, with smaller numbers visiting again in the late afternoon. These drinking patterns do not seem to vary greatly between mild and hot days, although days over 37°C were rare during the first few months of the study. Small- to medium-sized insectivorous species rarely drink.

Microsite use by a desert bird community

Many birds make use of microclimates generated by landscape features, such as trees, to regulate body temperature. These microsites can buffer macroclimatic conditions, allowing species to persist in otherwise unfavourable areas. Predicting how climate change will affect bird communities requires understanding of the availability of specific microsites and the way in which different birds use them under different environmental conditions. This research is being carried out by Rowan Martin, together with Phil Hockey.

From the perspective of an organism trying to maintain its body temperature within tolerable limits, climatic conditions vary in four key respects: air temperature, wind speed, solar radiation and humidity. The extent to which each influences an organism's body temperature depends on its size and shape, the properties of its feathers, and the degree to which it can use evaporative cooling to dissipate heat. Different species can experience climate in very different ways - a favourable microsite for one may be intolerable for another. A pilot study carried out in the Kgalagadi Transfrontier Park in 2008/09 by CB student Justine Cordingley highlighted these interspecific differences. One part of her study analysed the ambient temperatures at which birds of different sizes started to exhibit stress as temperatures rose. Based on the assumption that evaporative cooling would be the main form of thermo-regulation used by birds, we predicted that small birds would suffer first due to their high surface area:volume ratios, with relatively large areas available to absorb heat and yet relatively small amounts of body water to use for evaporative cooling. Unexpectedly, but excitingly, the study showed exactly the opposite – large birds took strain in the heat first. The current study will identify which species use which microsites as temperatures rise, and, as the frequency and intensity of heat wave conditions increase, which species may be the first to disappear. This study is also based at the Tswalu Kalahari Reserve in the Northern Cape.

We are currently developing research protocols to produce an accurate 'thermal map' of a Kalahari landscape. This requires the application of different measurement techniques to develop a model for how air temperature, wind speed, solar radiation, and humidity vary as function of vegetation structure. Preliminary data show that wind speed varies dramatically within and between trees, depending on the density and structure of tree canopies. Locations shaded from the sun also tend to be sheltered from the wind, forcing birds to trade off the beneficial cooling effects of shade and wind. Mathematical models of heat transfer in birds predict that some species will experience this trade-off more acutely than others. The second component of this work involves a 'shotgun' approach to amass large amounts of data on patterns of microsite selection across a range of air temperatures and species. Preliminary results suggest that there are distinct differences between species. For example large, perch-and-sally foragers such as migrant Lesser Grey Shrikes *Lanius minor* switch from using exposed high perches to more shaded, less windy locations at relatively low air temperatures, while nomadic Namaqua Doves *Oena capensis* continue to use the windiest, sunniest spots even in the heat of the day.

Postdoc Rowan Martin measures light and heat penetration in different microsites within a small Boscia albitrunca *in the southern Kalahari. Photo: Caroline Martin.*

Bird community changes across a steep aridity gradient

Studies by Rob Simmons across Africa's steepest rainfall gradient, in Namibia, funded by the BIOTA programme, are designed to determine how bird communities may change as arid lands experience increased temperatures and reduced rains under climate change.

Work over the last three years in bush-encroached and open grasslands in five study sites, with an annual rainfall differential of over 250 mm, shows that resident birds undergo predictable decreases in species richness with decreasing rainfall. However, species richness in dry riverbeds showed no such decreases, independent of any surface water. Analyses by Colleen Seymour (SANBI) showed that bird community structure changes little across this aridity gradient, except at the driest site; there, community structure within each of three habitats is more similar to each other than to any other site/habitat. Both results suggest that increasing aridity will have significant effects on bird communities, but not in a straightforward way. The results are summarized in a multi-authored book currently in preparation.

Etosha's flamingos and climate change

The flamingos of Etosha National Park, Namibia, continue to be monitored for breeding by Wilferd Versfeld (Namibian

Ministry of Environment & Tourism) in a long-term collaboration with Rob Simmons and the PFIAO. More than 50 years of breeding data show that flamingo breeding is strongly related to annual rainfall on the pan, with a breeding rainfall threshold of 419 mm below which reproduction always fails. Over the last 50 years, mean annual rainfall has fallen by 11% from exactly 419 mm to about 385 mm. Thus, if rainfall continues to decline, we expect both less frequent and less successful breeding in future by both Greater *Phoenicopterus ruber* and Lesser Flamingos *P. minor*. This is not good news for flamingo conservation. These data are among the first to show that long-term climate patterns affect wetland birds negatively.

Declining Lesser Flamingo Phoenicopterus minor *populations in southern Africa can be partly attributed to climate change and the long-term reduction in rainfall on which they depend in Etosha National Park, Namibia. Photo: Mark Anderson.*

How can conservation planning, policy and management respond to these challenges?

Finally, in work led by SANBI and the ADU with PFIAO inputs, results of climate change research are increasingly fed into the science-policy interface through, for example, State of the Environment (SoE) reports and a 2009 special booklet. Long-term datasets and large-scale projects (such as the 2nd Southern African Bird Atlas Project and its successors) which can inform public policy are being secured financially by SANBI. The goal is to track southern Africa's bird species over time and space and provide baselines and snapshots of environmental change to inform sound planning, policy and conservation management. Given the difficulties and uncertainties that have arisen in analyses based on poor-quality historical data, such work is urgently needed to shape and strengthen appropriate conservation strategies for the future.

Highlights

- Four scientific articles, five semi-popular articles, and one semi-popular chapter in a handbook for West African parks managers (in French) were published.
- Phoebe Barnard, Rob Simmons, Phil Hockey and Les Underhill participated in the Royal Society- and Leverhulme Foundation-funded climate-change collaboration with Durham University climate-change group and Australian climate scientists.
- The long-term flamingo work is featured in several editions of Richard Primack's *Essentials of Conservation Biology, Sinauer Associates,* including the 2009 update.
- Publication of the booklet, *Birds and Environmental Change: Building an Early Warning System in South Africa* to inform negotiations at the UNFCCC conference of parties in Copenhagen.

Students

Justine Cordingley (CB MSc, supervisors Phil Hockey and Guy Midgley) *Hot, hotter, gone? Predicting climate-induced species losses from hot African ecosystems.* Graduated June 2009.

Gina Louw (Hons, supervisor Phil Hockey) *Evidence for range changes of Common Swifts Apus apus in South Africa being driven by climate change.* Graduated Dec 2009.

Ben Smit (PhD, U. Pretoria, supervisors Andrew McKechnie and Phil Hockey) *Taking the heat: integrating physiological and behavioural variables to predict avian responses to climate change in the Kalahari Desert..*

Visitors

Prof. Brian Huntley, Durham University, UK.
Dr Steve Willis, Durham University, UK.
Dr Dave Hole, Conservation International/ Durham University.

Acknowledgements

We thank Dr Colleen Seymour (SANBI), Lisa Nupen (PFIAO) and Namibian farmers on the BIOTA transect for hospitality and forbearance; Wilferd Versfeld (Namibia) for his long-term commitment to flamingo research and conservation and SANBI, SANParks, CapeNature, Rooi Els Conservancy Association members and the Wild Cape Nature Trust for permission to carry out the fynbos endemics study. We would also like to thank the Tswalu Foundation for their considerable financial and logistical support during 2009. We would further like to extend our gratitude to the staff of Tswalu Kalahari Reserve for not only helping to make the initial field season a success but also thoroughly enjoyable. Thanks also to Yellotec for the kind loan of a thermal imaging camera.

And a Miscellany

There are always some projects on the go that do not fit neatly into one of the main, current research themes. This does not mean they are any less important or exciting scientifically, just that they are different. In this annual report, for the first time, we have chosen to report on this 'miscellany' separately.

Coevolutionary arms races: hosts and parasites at war

Dr Claire Spottiswoode (Cambridge University, PFIAO Associate)

Coevolution is the process by which two or more species reciprocally influence each other's evolution, and can escalate to produce startlingly refined adaptations. Postdoctoral Associate Claire Spottiswoode (Cambridge University) uses brood-parasitic birds, which exploit other species to bear the costs of raising their young, as a model system better to understand this process. Parasitic birds such as cuckoos are locked in co-evolutionary struggle with their hosts, each trying to stay one step ahead of the other. As parasites evolve ever better manipulation of their hosts, the same hosts respond by evolving ever more refined defences to evade being parasitised.

Brood parasitism is not confined to cuckoos. Claire's field research in Zambia focuses on two other independent and ancient events where a parasitic lifestyle has evolved in birds - in the honeyguides and the parasitic finches. Her work uses a combination of approaches including experiments made at host nests in the wild, sensory analyses of bird vision, and genetic techniques. In Cuckoo Finches *Anomalospiza imberbis* and their hosts, Claire is studying a coevolutionary 'arms race' through bird colour space, whereby hosts are evolving an ever more extreme diversity of egg colours to evade mimicry by their pursuing parasites. She has carried out field experiments designed to estimate the intensity of natural selection through host rejection behaviour and, using historical data from the same locality, is analysing and modelling the evolutionary dynamics of this interaction through time. Preliminary results indicate that the arms race between Cuckoo Finches and Tawny-flanked Prinias *Prinia subflava* has progressed remarkably rapidly, with changes in egg colours being detectable on the time scale of a human lifetime. In parasitic Greater Honeyguides *Indicator indicator*, Claire has been using field experiments to study how host-specific adaptations might be maintained by competition with fellow parasites, as well as studying the evolutionary history of these interactions using genetic approaches. Together with Prof Michael Sorenson and Katie Faust at Boston University (USA) she is testing the idea that host-specific adaptations within a single parasitic species can be maintained by female-only inheritance. Preliminary results from Greater Honeyguides show that not only does this seem highly likely to be true, but in evolutionary terms, that this specialisation can be remarkably ancient.

Overall, Claire's research aims to add to our understanding not only of brood-parasitic adaptations, but also of broader coevolutionary dynamics involving one parasite and multiple hosts or host genetic strains. There are interesting parallels, for example, with the interactions between ourselves and the pathogens that cause human diseases.

Claire Spottiswoode has been studying how Tawny-flanked Prinias Prinia subflava *attempt to avoid their nests being parasitised by Cuckoo Finches* Anomalospiza imberbis *by evolving ever more elaborate egg colours and patterning. However, the Cuckoo Finches are faring well in the race. The eggs on the right below are from four different prinia clutches; the eggs on the left are Cuckoo Finch eggs from the same nests. Photos: Peter Ryan (top) and Claire Spottiswoode.*

Messages in the breast bands of Bar-throated Apalises

Prof Phil Hockey (PFIAO)

Model of optimum territoriality propose that high-quality individuals occupy high-quality territories and derive substantial fitness benefits as a result. PFIAO PhD student Adams Chaskda been investigating the extent to which this is true for the socially monogamous Bar-throated Apalis *Apalis thoracica*. The study has been carried out at Koeberg Nature Reserve, just to the north of Cape Town. A first step was to measure territory sizes, which vary substantially. This was done using the behaviour of the birds themselves. Based on observations of foraging birds, it soon became clear that despite the rich diversity of plant species at the study site, the apalises confined themselves to gleaning food from only three plant species. Armed with this information, it was possible to sample the density of food on these plant species in different territories. From surveys designed to estimate the number of these favoured plant species in each territory, it was then possible to calculate the relative food density (biomass per unit area) in each territory. This showed very clearly that there was an inverse relationship between territory size and food density, with the smallest territories being the most food rich. Once this had been established, the stage was set for testing the hypothesis that these small territories (the 'best' territories) should be occupied by high-quality birds.

The breast bands of male Bar-throated Apalises Apalis thoracica *(on the left) vary in size. Adams Chaskda's PhD research was able to show that this variability carries honest signals about the quality of both individual males and the territories that they defend. Photo: Adams Chaskda.*

Reproductive data collected over four breeding seasons showed very clearly that pairs on large territories almost never succeeded in rearing chicks. But is this because they are poor-quality territories, poor-quality birds, or both? To answer this, territorial birds from across the study site (males and females) were captured and measured. One feature that was of particular interest to us was the black breast band – both sexes have the breast band, but it is larger and more intense in males. We suspected that the breast band of the males may be a means of signalling male or territory quality. We found that males with the largest breast bands were indeed the birds in the best body condition. Not only this, but these males also occupied the best-quality territories (small and food rich). Over and above this, they also attracted the best mates and had the highest breeding success (i.e. they achieved the greatest direct fitness). Multiple recaptures of the same males over time showed that breast bands became gradually larger with age. Thus, the male breast band carries signals about male age and condition and about territory quality. Whether females respond to one or more of these messages we don't know, but given that all three attributes are auto-correlated, perhaps it's not that important.

We also discovered that the apalises had high year-to-year survivorship and that many remain mate- and territory-faithful between breeding seasons. Part of the reason for this stability (and the extreme rarity of territorial fights), may also lie in the messages carried in the breast bands. Black 'badges' such as these are usually thought to function in resolving male-male competitive issues. That the breast band is such an honest signal of male quality gives 'rival' males a message about the likelihood of winning a fight. If you know before you start that you are likely to lose a fight, there is little point in engaging in that fight in the first place.

By the end of 2009, Adams was well on his way to completing his PhD. Hopefully in 2010 we will be able to report that he is now Dr Chaskda.

Students

Adams Chaskda (PhD, supervisors Phil Hockey and Penn Lloyd) *Determinants and consequences of territory quality in the Bar-throated Apalis* Apalis thoracica.

Torpor and hibernation in southern African birds

A/Prof Andrew McKechnie (University of Pretoria, PFIAO Associate)
Dr Justin Boyles (University of Pretoria)
Ben Smit (PhD student, University of Pretoria)

Many birds employ torpor, a physiological state in which metabolic rate is suppressed far below normal levels, to offset the energetic costs of maintaining a high, constant body temperature. During 2009, Ben Smit and Justin Boyles (U. Pretoria) attached temperature-sensitive transmitters to three Freckled Nightjars *Caprimulgus tristigma* in Namaqualand, and monitored the birds' body temperatures over a period of one month. The nightjars exhibited an intriguing pattern of torpor, with body temperature cycles being closely synchronized with phases of the moon. When moonlight was available, the birds were active and foraging, but as soon as the moon set, they returned to their roost sites and entered torpor, with a lowest recorded body temperature of 23°C. The depth of torpor bouts followed a clear rhythm related to lunar phase, with shallow bouts around full moon and much deeper bouts around new moon, when the lack of moonlight meant that foraging opportunities were limited.

Ben Smit setting up a video camera at a waterhole in Tswalu Kalahari Private Game Reserve. As part of his PhD, Ben Smit is analysing the temperature-dependence of drinking behaviour among Kalahari bird communities. Photo: Andrew McKechnie.

These data are particularly interesting when compared to data from Freckled Nightjars near Rustenburg, collected during 2006 by Andrew McKechnie, Robert Ashdown and Mark Brigham (University of Regina, Canada). Unlike the Namaqualand birds, nightjars at the more mesic eastern site used torpor less regularly, but did reduce their body temperatures to much lower levels (around 13°C). These data provide the first comparison of torpor patterns among two populations of a southern African bird.

Phenotypic plasticity in avian metabolic rates

Assoc. Prof. Andrew McKechnie (University of Pretoria, PFIAO Associate)

Dr Nomakwezi Mzilikazi (Nelson Mandela Metropolitan University)

Many birds reversibly adjust their metabolic machinery over short time scales in response to changes in energy supply and/or demand. For instance, many species that are year-round residents in temperate latitudes in the Northern Hemisphere show impressive seasonal changes in metabolic rate, with metabolism generally up-regulated in winter. Ben Smit's data from five species occurring in Molopo Nature Reserve, however, revealed that some Southern Hemisphere species do the opposite, with basal metabolic rates reduced by as much as 35% in winter. Ben also analysed global patterns in the magnitude and direction of these seasonal adjustments, and found that there is a continuum from large winter increases in metabolic capacity in birds that live in bitterly cold environments at high latitudes in the Northern Hemisphere, to winter decreases in species that live in subtropical regions. We suspect that this continuum reflects two different selective pressures acting on avian metabolic machinery, with winter increases in heat production capacity among species that have to face severely cold winters, and winter energy conservation in species that inhabit regions where winters are milder. The year 2009 also saw the start of a collaborative laboratory-based project examining how the capacity for phenotypic adjustment varies among species of different sizes. Dr Nomakwezi Mzilikazi (Nelson Mandela Metropolitan University) and her PhD student, Sonnette Calitz, (co-supervised by Andrew McKechnie) are examining the metabolic responses of species covering a range of body masses to thermal acclimation under laboratory conditions. They are measuring both basal metabolic rate, or minimal energy requirements, and summit metabolic rate, or the maximum metabolic rate achieved in cold conditions in the absence of activity. These data will provide a key link in understanding metabolic changes in wild birds, because they will allow us to account for differences in body mass when comparing the magnitude and/or rapidity of metabolic adjustments among species.

The impact of domestic cats on Cape Town's biodiversity

Dr Rob Simmons

An exciting and somewhat contentious project was begun in 2009 with CB student Sharon George tackling the question of how much of a threat domestic cats pose to biodiversity around Cape Town.

Cats have variously been responsible for numerous extinctions of bird on islands around the world including South African islands, yet their impact in mainland Africa has remained unstudied until now. With the knowledge that cats show astonishing adaptability and huge impacts from Australian deserts to Antarctic islands, Sharon's pilot project determined 1) what prey are being taken; 2) the rate of predation and 3) how far domestic cats wandered from their homes in and around Cape Town.

By tracking Cape Town cats and determining their rate of prey capture, Masters student Sharon George calculated that they take up to 5.9 million prey per year: upwards of half a million of these prey are birds. Photo: Susan Fitchat.

Miniature GPS loggers carried on the animals allowed cats from both urban and peri-urban settings to be followed day and night. These showed that individual cats wandered up to 18 km a day, travelling up to 800 m from their homes. Their prey was

made up mostly of native mammals (shrews, mice and vlei rats) and reptiles, with about 15% being birds. The impact of Cape Town's estimated population of 270 000 cats was found to be 3.9 to 5.9 million vertebrates per annum – a conservative estimate. Of these prey, between 585 000 and 885 000 will have been birds.

Students

Sharon George (MSc CB, supervisors Rob Simmons and Justin O'Riain) *Cape Town cats: predation impacts and movements*.

Invasion of the southern African coast by the alien mussel Mytilus galloprovincialis *has contributed to an increase in the global population of African Black Oystercatchers* Haematopus moquini. *Also in recent years there has been a significant increase in the proportion of oystercatcher pairs that are laying three, rather than one or two, eggs in a clutch. The spatial correlation between large clutches and the alien mussel suggest that it is an increase in the food supply that is bringing about this change in clutch size. Photo: Jessie Walton*.

African Black Oystercatcher movements

Prof. Phil Hockey (PFIAO)
Dr Douglas Loewenthal (Postdoctoral Fellow, PFIAO)

Our ongoing colour-ringing programme continues to document large-scale movements of African Black Oystercatchers *Haematopus moquini*. Despite the large size of the data set, there is still virtually no evidence to indicate that birds reared at natal sites pair up and hold territories in areas away from where they were reared. Resightings of colour-ringed juveniles from Possession Island (a recent addition to the colour-ringing programme), supports the finding that juveniles born on the west coast mostly move north when they leave the parental territories. There have been no resightings of young born on Possession south of Possession, although birds have been recorded as moving north.

On islands off the west coast of South Africa, retrapping of metal-ringed adult birds (as well as observations of individually identifiable colour-ringed birds) continues to support the finding that although young birds may move large distances from 'home' (rarely more than 2000 km), they are close to 100% site faithful, returning to breed where they were born. Recent ring-retrap data have indicated that a large proportion (>22%) of breeding birds on west coast islands are more than 20 years old, with the oldest known-age, breeding adult estimated to be at least 31 years old. Ongoing colour-ring resighting data has extended the known age of some pre-breeders from 8 to 10 years (even though oystercatchers are physiologically able to breed at 3-4 years of age).

Island population continue to remain stable. Theoretical models (based on the so-called evolutionary stable strategy) suggest that this scenario is unlikely to change unless there is a significant change in habitat quality. Given the survival rates of juveniles and adults, for island-reared birds, simulated populations will reach stability long before it pays a juvenile bird to leave a queue (for a high-quality territory on an island) and opt for a lower quality mainland territory.

While we have a fair understanding of where young oystercatchers go after fledging, the extent to which juvenile movements are genetically *vs* environmentally determined remains unclear. Observations of non-breeding adult oystercatchers and juvenile birds at roosts indicate that age-based dominance hierarchies probably exist (with younger birds occurring more frequently on the fringes of roosts, which are presumably less desirable areas). Currently, however, the data are too few to subject to robust statistical analysis. Nevertheless, the data to hand do suggest that there may at least partly be an ecological component to the movement patterns of juvenile and non-breeding adult birds (with younger birds being forced to roost sites further away from natal sites, due to competitive exclusion by older birds). Currently we are developing a model for west coast birds which assumes an entirely ecologically determined dispersal pattern for young oystercatchers. Because the population size and number of all known oystercatcher roost sites on the west coast of South Africa and Namibia are known, the output from the 'ecological dispersal model' can be compared with these data to assess whether an entirely ecological explanation (based on competitive exclusion from roost sites) may be adequate to explain dispersal patterns of young oystercatchers.

If funds for satellite tags materialise, this will allow us to track the movement patterns of young oystercatchers at very high spatial and temporal resolutions over the entire non-breeding range. Critically, data from tagged birds will allow us to assess whether young oystercatchers bypass areas of suitable (feeding and roosting) habitat – suggesting a genetically determined component to their movements (and one which is an essential component of the definition of true migration).

The question of whether movement patterns of young oystercatchers are environmentally, rather than genetically driven, is not only of substantial scientific value, but has important implications in assessing the impact of habitat changes (driven, amongst other things, by climate change) on the spatial dynamics of oystercatcher populations. Such a study will also make an important contribution to our understanding of the effects of climate change on migratory shorebirds in general.

External/Contractual lecturers

A/Prof. Colin Attwood
(Zoology Department, UCT)

Dr Phoebe Barnard
(SANBI)

Dr Jacqui Bishop
(Zoology Department, UCT)

Prof. David Cumming
(TREP)

Assoc. Prof. John Hoffmann
(Zoology Department, UCT)

Assoc. Prof. Astrid Jarre
(Zoology Department, UCT)

Dr Jackie King
(Zoology Department, UCT)

Dr Guy Midgley
(SANBI)

Prof. Sue Milton
(PFIAO and University of Stellenbosch)

Prof. Norman Myers
(Oxford University)

Prof. Dave Richardson
(University of Stellenbosch)

Dr Sheona Shackleton
(Rhodes University)

Dr Michael Schoon
(Arizona State University)

Conservation Biology Masters Programme

Course co-ordinators
Prof. Graeme Cumming
Assoc. Prof. Peter Ryan

Members of the 2009/10 CB class on a field trip to Silvermine Reserve during the Climate Change and Conservation module. Photo: Phoebe Barnard.

The 17th cohort of Conservation Biology students completed their projects early in 2009, with all 11 of the students graduating in June 2009. Five students obtained their degrees with distinction: Justine Cordingley, Simon Dures, Maike Hamann, Alex Menayas and Jessica Shaw.

The 18th cohort started in January 2009, comprising 11 students from seven countries: the Democratic Republic of Congo, Guyana, Kenya, Rwanda, South Africa, the United States of America and Zambia. All 11 survived the coursework component of the programme and 10 will graduate in June 2010. The remaining student completed her individual research project too late for June graduation.

This was the second year of the newly restructured CB course, and it ran remarkably smoothly. Feedback on the revised curriculum remains positive. 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 the Fitztitute – listed on the left of this page – for their willingness to teach on the course and the consistently high academic standards that they have maintained. Many other people have contributed through guest lectures, field trips, or practical sessions. The programme is also strengthened by the dedication of the Fitztitute support staff, especially Hilary Buchanan, who administers the project examination process and generally assists the settling-in process for the newly arrived foreign students. Meg Ledeboer retired from UCT at the end of 2009 and Hilary will take over the processing of CB applications from 2010. Meg played a crucial role in managing student applications and we wish her all the best in her new career at Save our Seas.

Conservation Biology projects: 2009/10

George, Sharon: *Cape Town cats: predation impacts and movements*. Supervisors: Rob Simmons and Justin O'Riain.

Gichohi, Nathan: *Ecological impacts of biological invasions on native birds in Africa.* Supervisor: Phil Hockey.

Githiora, Yvonne: *A comparative analysis of patterns of recent extinction in birds and mammals.* Supervisor: Phil Hockey.

Heermans, Ben: *Large vegetated termitaria, fire and elephant impacts on reptilian abundance and community assemblage in a miombo woodland system at Chizarira National Park, Zimbabwe.* Supervisors: Graeme Cumming, David Cumming and Colleen Seymour.

Kissoon, Ian: *Using tropical forests to combat climate change without compromising local livelihoods.* Supervisor: Jane Turpie.

Kujirakwinja, Deo: *The status and conservation of common hippopotamuses in Virunga National Park, Democratic Republic of Congo.* Supervisors: Peter Ryan and Andrew Plumptre.

Deo Kujirakwinja's project explored the calamitous decline in hippo numbers in Virunga National Park, Democratic Republic of Congo. Photo: Deo Kujirakwinja.

Kujirakwinja, Deo: *The status and conservation of common hippopotamuses in Virunga National Park, Democratic Republic of Congo.* Supervisors: Peter Ryan and Andrew Plumptre.

Marais, Michael: *The effects of colony dynamics and climate on a declining population of Sociable Weavers* Philetairus socius. Supervisors: Rita Covas, Res Altwegg and Peter Ryan.

Moseley, Christina: *Comparing body condition and foraging ecology of two populations of Cape Gannets on Bird and Malgas Islands.* Supervisors: David Grémillet, Lorien Pichegru and Peter Ryan.

Skidmore, Allison: *Landscape heterogeneity facilitated by termitaria and its effect on ant community composition in the miombo woodlands of Chizarira National Park, Zimbabwe.* Supervisors: Graeme Cumming and David Cumming.

Tuyisingize, Deo: *Small terrestrial mammal community composition in the Volcanoes National Park, Rwanda.* Supervisors: Gary Bronner, Julian Kerbis Peterhans and Katie Fawcett.

Gwyneth Wilson's study of ground-hornbills in our 180 000 ha lowveld study site required eyes for more than just birds! Photo: Phil Hockey.

Wilson, Gwyneth: *What causes variation in the reproductive performance of groups of Southern Ground-Hornbills* Bucorvus leadbeateri? Supervisor: Phil Hockey.

Graduating students from the 2008/9 class pose proudly outside UCT's Jameson Hall after the June 2009 graduation ceremony. From left: Tarryn Quayle, Aphiwe Bewana, Jessica Shaw, Simon Dures, Maike Hamann and Clifton Meek.

Librarian
Margaret Koopman

Contract Staff
Phelisa Hans

Volunteers
Sally Dalgliesh (retired Aug 2009)

Niven Library

Overview

The library underwent building operations, in the form of an additional stack area, during 2009. This resulting area, which included compact storage, soon proved to be more suitable than the two storage areas which had to be relinquished by the library to be used for much needed office space.

On the completion of the building operations the Victorian bird display was moved to a focal position in the library. The Niven crest, which had to be moved because of the demolition of the wall, was repositioned outside the library next to the FitzPatrick crest. A glass-fronted display case housing the Fitztitute Scientific papers is now located at the base of the stairs.

A stock-take and weeding exercise was completed during the latter half of the year and the entire collection was re-distributed, re-shelved, re-labelled and the catalogue entries changed to match the new location of material.

The library continues to be a constantly used resource on campus and beyond, particularly by conservation NGOs and ornithologists throughout South Africa and internationally.

Staff and staff development

Margaret Koopman

The Librarian contributed articles to 2 semi-popular publications during the year. In addition 5 book reviews for *Ostrich: journal of African ornithology* were coordinated and one review contributed. All review books are returned to the Niven Library for the reference use of the ornithological community.

The Librarian attended a Taylor & Francis workshop on academic publishing in September 2009. This turned out to be fortuitous as NISC, the publishers of *Ostrich*, also attended and the librarian learnt that NISC have entered into a contract with Taylor & Francis to launch an electronic archive of *Ostrich* back to volume 1, 1930. The librarian was subsequently able to organise for the Fitztitute to have complimentary access to this archive through collaborating with NISC to provide archival copies of *Ostrich*.

The Zoology department publication count continues to be coordinated by the Niven Librarian. As this is such a time-consuming task, a time sheet has been kept for the 2009 cycle. At the time of writing 62 hours or 8 eight-hour days have already been spent on this task by the librarian and the process is not yet complete. Natalie Jodamus in the Zoology Department has assisted with the inputting of Zoology Department scientific papers for 2009 into the Irma database.

Phelisa Hans was once again employed on a contract basis for 9 hours per week. Her help in the moving and integration of 3 collections into the library, after the installation of new shelving and the compact storage, was invaluable. Her patience in moving journals, which she had packed and moved to the 2nd floor during 2008, back into the library in 2009, was greatly appreciated. She was also responsible for all the new labels for the journal collection and the labelling of the compact storage shelves. In addition she was responsible for all shelving of books, journals and newsletters during the year. An additional task for 2009 was to populate a duplicate books database which will be used to ascertain which books can be sold or auctioned for library funds in the future.

Sally Dalgleish retired from her long-term volunteer work in the Niven Library in August 2009. Sally gave freely of her time to manage the reprint collection for 27 years! Her dedication to the Niven Library is sincerely appreciated and her cheerful personality will be missed.

Library liaison

During February 2009 the Niven Librarian hosted Muyoyeta Simui, Librarian and her colleague Fasil Yilma from the Pan African Parliament in Midrand, Johannesburg. The Pan African Parliament is in the process of setting up an actual and virtual library and came to see the UNESCO application used in the Niven Library. The Niven Librarian gave them copies of two practical articles written for the recent copy on 'Open Source Software and Libraries' in *Innovation: Journal of appropriate librarianship and information work in Southern Africa,* issue 36, 2008.

During May 2009 the Niven Librarian collaborated with UCT Librarians Jen Eidelman and Tanya Barben in the research and production of a display to celebrate Darwin 200. One of the display boards was subsequently used at the talk on Darwin's contribution to geology which was held as part of the City of Cape Town's Darwin celebrations. The boards were on display in UCT Library to the end of 2009.

In July 2009, at the request of UCT Library, the Niven Librarian met with the new Oceanography Librarian to offer advice on the operation of a departmental library.

Library development

Space management:

UCT space management requirements benefited the Niven Library in 2009. Fitztitute staff and students were required to vacate their long-term premises in the PD Hahn building where there have been Fitztitute offices since June 1985 to make way for a long-overdue toxic waste storage area planned for the vacated space. Two Niven Library offices were ear-marked for post-graduate offices – the 2nd floor storage room and the Richard Brooke office (nominally the librarian's office in the past). This meant that equivalent floor area, fitted with compact storage, was required to accommodate the material previously stored in these offices. An under-utilised Zoology Department storeroom adjacent to the Niven Library was identified as suitable space for compact storage and a doorway was created to link the two spaces with a short ramp to accommodate the height difference and enable a trolley to be moved between the areas. This, along with additional bays fitted into the journal and newsletter stack areas, has created about 5 years worth of growth for the library.

The new arrangement of housing all the Niven Library material on the same floor, in a continuous library space, has resulted in a much more efficient workflow and the opening up of two previously closed collections to library users.

The incorporation of the Animal Demography Unit into the John Day Zoology Building has resulted in the incorporation of the entire Afring library collection into the Niven Library.

Library maintenance:

There were no maintenance jobs required during 2009 other than the building operations and installation of new and additional shelving. These were handled without much dust and disruption to library users, although a dust curtain hung over the reading room for a couple of weeks while the doorway was broken through. Use of the library for meetings and seminars was curtailed during the building operations which took place mostly during the July vacation.

Collection management

Journals: The number of exchanges for ornithological journals which are generously subsidised by Africa Geographic, has increased to 22. This is running fairly smoothly, although some exchange partners have to be reminded to honour their side of the agreement. The exchange agreements represent a savings in 2009 subscriptions of R12,112.55.

During 2009 the Niven Library received 20 titles on the basis of subscriptions. The majority of the titles available through UCT Library electronic subscriptions are still available, although some vendor packages have changed resulting in 12 month embargoes on recent material. During 2009 UCT Library organised a trial of the BioOne suite of journals which would have significantly enhanced access to ornithological titles, but unfortunately this was not followed up with a subscription.

Reprints: The Niven Librarian continued to add to the reprint collection, focussing on articles in journals not held by the library.

Books: Between September and November 2009 a full stock-take of the Niven Library book collection was undertaken. The last comprehensive stock-take had been carried out in 2002. A total of 15 books have gone missing since the 2002 stock-take while a further 5 items missing in 2002 remain missing, bringing the total to 20 books. This represents 0.3% of the collection (6,324 volumes). An annual loss of between 1% - 3% is the international norm in ***libraries with security control***, so the percentage loss is extremely low - although the Niven Librarian would prefer the figure to be 0%!

204 books were withdrawn from the collection during the weeding exercise. During the stock-take the names of the donors of books were noted and added to the Niven Library catalogue in order to acknowledge the benefactors of the library over the past 50 years.

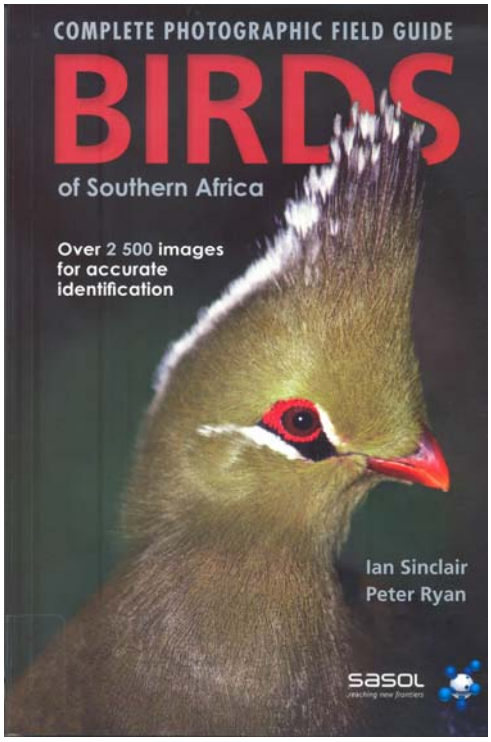
155 book titles were processed during 2009, 13 of these were purchased by the Fitztitute and the remainder were donations or book review copies for Ostrich. Lynx Edicions, Barcelona have been very generous in sending copies of *Handbook of the Birds of the World* for review and in 2009 also sent a copy of *Trogons, a natural history of the Trogonidae*. A few other significant titles include

- A guide to the birds of Thailand
- Handbook of avian hybrids
- Birds of Ethiopia & Eritrea
- Protecting birds from powerlines
- Parrots, guide to the parrots of the world
- A monograph of the Hirundinidae
- Boom & bust: bird stories for a dry country
- An atlas of wader populations in Africa and Western Eurasia

- Birds of St Helena and Ascension Island
- Effects of wind farms on birds

During 2009 the Niven Library was the beneficiary of the Estate Late Jim Enticott and, with the new storage area, the Librarian was finally able to unpack the donations received from the Estate of Walter Stanford and process many of these books for the library. Wayne Delport, a research associate from Pretoria University, donated all his ornithological books to the Niven Library when he moved to the University of California, San Diego.

The books on semi-permanent loan from UCT Library are due to be returned to the library on 31 December 2010. The Librarian has started to return material where these are duplicated by books received through donations. The new Zoology subject librarian, Jen Eidelman, is making every attempt to balance the Zoology book collection in UCT Library with books on subjects taught in the Department of Zoology including ornithology. Any recently purchased ornithological books held at UCT Library are included in the Niven Library catalogue.



Staff Books published during 2009

Sinclair, I., ***Ryan, P.*** Complete photographic field guide, Birds of southern Africa. Cape Town, Struik, 2009.

Databases:

Access to the *Afroropical Bird Database* (ATBD) through the EBSCO platform continues to be available to users of the Niven Library.

Niven Library Database

During 2008/9 ABCD, an upgraded version of the WinIsis software used by the Niven Library, was under development. The Niven Librarian contributed to this development by assisting with the translation many of the help files and sections of the ABCD Manual from French/Spanish into English. The Niven Librarian was requested to do the final overall edit of the English version of the ABCD Manual, but as this was a major commitment during a busy year, only parts of this were contributed. Once this software is fully developed the librarian is considering upgrading the current software to ABCD. This will provide the Niven Library with a fully integrated library system including a loans module. An informal enquiry to reopen negotiations to be included in the UCT Library Aleph system had not elicited a response by the end of 2009.

The Niven Library received a replacement OPAC PC and monitor during 2009 which has improved functionality and allows users to perform database searches, download to flash-drive as well as search the Niven Library catalogue.

Use of the Library

Table 1. Niven Library stock circulation over the past four years

	2009	2008	2007	2006
Monographs	228	300	376	410
Reprints	52	27	88	60
Theses	26	24	45	24
Journals	181	141	265	298
Audio Visual	3	5	5	15
Total	490	497	779	807

Document Delivery

Table 2. Niven Library inter-library loans over the past four years

	2009	2008	2007	2006
Items requested (by staff/students)	61	96	90	95
Items supplied	78	189	151	160
Requests not satisfied	14	15	8	9

Reprint requests

Table 3. Requests for PFIAO Reprints

Reporting Period	2009	2008	2007	2006
Number of reprint requests	238	243	258	165
Number of countries	23	35	36	29

The breakdown by countries is: Alaska 1, Argentina 8(10), Australia 11(11), Brazil 10(8), Cameroon 2, Canada 4(4), Chile 3(1), France 9(4, Germany 27(34), India 7(4), Israel 1, Japan 1, Marion Island 6, Netherlands 2, New Zealand 3(4), Poland 1(21), South Africa 72(58), Sweden 1(1), United Kingdom 27(9), United States of America 38(33), Venezuela 1(1). In (brackets) 2008 statistics.

Cash photocopying

The number of cash copies in 2009 was again reduced after the Fitztitute installed a new copier/scanner. The scanner facility allows the user to send scanned copies to an email address at no cost. 1146 [1716] cash copies amounting to R458.40 [R686.40] were made on the photocopier in the library during 2009. The charge for photocopying remained at 40c per page for 2009. Previous year's statistics in [brackets]

A further R1457.70 [R1194.70] was received for the supply of material requested from the Niven Library by users within South Africa and internationally as far a field as New Zealand and Romania.

Research requests

A total of 2168 [2717] requests for information were received during the period under review, with approximately 37% of these requests generated by staff and students of the Fitzstitite. 1560 [1022] pdf or jpg files were supplied by e-mail to users locally, nationally and internationally. The number of hard copy articles supplied 155 [298] has been significantly reduced as the new scanner enables pdfs to be created very easily and articles are then e-mailed. In addition 228 [31] literature searches were compiled and e-mailed to users. Other usage of the library was for verification of information, journal impact factors, calculation of H-indices, the supply of URL's and e-mail addresses and numerous other general queries. The Library received 803 [995] research requests from the staff and students of the PFIAO, 407 [257] from Zoology staff and students, and 62 [605] from ADU staff and students. 128 [617} requests for information were also received from elsewhere on the UCT campus, and both nationally and internationally (see figure 1), including the supply of Fitztitute reprints.

Requests for information

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

Bird NGOs:
Global Owl Project, Virginia, USA
Brian Marshall, Editor Honeyguide, BirdLife Zimbabwe

Conservation NGOs:
Hans Schinkel, Centre for Agriculture and Environment, Netherlands

Government affiliations:
Gilchrist Library, Marine and Coastal Management; Guy Preston, Working for Water; Theo Rossouw, DWaF; Craig Whittington-Jones, Ornithologist; Gauteng Directorate of Nature Conservation; Tambudzani Malaudzi, Principal Environmental Officer, Dept. Water & Environment Affairs, Pretoria; Carl D. Mitchell, Wildlife Biologist, U.S. Fish and Wildlife Service; Agreement on the Conservation of Albatrosses & Petrels; Khathu Sikhitha, City of Johannesburg

Publishers:
Vanessa Stephen, EarthTouch

Private Companies:
Janice Wormworth, freelance writer, Australia; Leonie Joubert, Science Journalist

South African Universities
David Woods, SA Scientific Society

Acquisitions and collection building

At the end of December 2009 the bibliographic records in the Niven Library database totalled 50625 [48967]. The numbers of individual items received in the Niven Library are shown below:

Table 4. Niven Library acquisitions over the last four years

	2009	2008	2007	2006
Monographs	155	113	102	206
Journals	530	351	530	597
Newsletters	328	296	272	294
Reprints	10	121	93	63
PDFs	1332	1300	1357	1482
AudioVisual	3	12	8	5

Books added to the collection were ordered by members of the Percy FitzPatrick Institute, donated books and review books for Ostrich. The Zoology Department, SAFRING, the Animal (previously Avian) Demography Unit and the African Seabird Group continued to donate their exchange journals. The Niven Library incorporated the entire SAFRING and ADU journal collection during June in preparation for the move of these units to the John Day Building.

Donations

We acknowledge with thanks donations from the following: Animal Demography Unit; John Cooper; Timothy Crowe; Wayne Delport; Dolly Maister; Endangered Wildlife Trust; Estate Late Jim Enticott (Cas Thomas); Jackie King; Lynx Edicions; Martim Melo; Patrick Morant; NISC; Dieter Oschadleus; T&AD Poyser and Roy Siegfried.

Scientific Publications

Angel, A., Wanless, R.M. & Cooper, J. 2009. Review of impacts of the introduced house mouse on islands in the Southern Ocean: are mice equivalent to rats? *Biological Invasions* 11:1743-1754. IF 2.788

Bell, M.B.V., Radford, A.N., Rose, R., Wade, H.M. & Ridley, A.R. 2009. The value of constant surveillance in a risky environment. *Proceedings of the Royal Society B-Biological Sciences* 276:2997-3005. IF 4.248

Best, P.B., Glass, J.P., Ryan, P.G. & Dalebout, M.L. 2009. Cetacean records from Tristan da Cunha, South Atlantic. *Journal of the Marine Biological Association of the United Kingdom* 89:1023-1032. IF 1.056

Bester, M.N., Ryan, P.G. and Visagie, J. 2009. Summer survey of fur seals at Prince Edward Island, southern Indian Ocean. *African Journal of Marine Science* 31: 451-455. IF 1.312

Biard,C., Gil,D., Karadaş,F., Saino,N., Spottiswoode,C.N., Surai,P.F. & Møller, A.P. 2009. Maternal effects mediated by antioxidants and the evolution of carotenoid-based signals in birds. *American Naturalist* 174:696-708. IF 4.67

Booth, V.R. & Cumming, D.H.M. 2009. The development of a recreational hunting industry and its relationship with conservation in southern Africa. In: *Recreational hunting, conservation and rural livelihoods: science and practice* edited by Barney Dickson, Jon Hutton & William M. Adams. London, Wiley-Blackwell, pp. 282-295.

Boyes, R.S. & Perrin, M.R . 2009. The feeding ecology of Meyer's Parrot Poicephalus meyeri in the Okavango Delta, Botswana. *Ostrich* 80: 153-164. IF 0.222

Boyes, R.S. & Perrin, M.R. 2009. Flocking dynamics and roosting behaviour of Meyer's parrot (Poicephalus meyeri) in the Okavango Delta, Botswana. *African Zoology* 44:181-193. IF 0.437

Braby, J., Braby, R.J., Braby, N., Simmons, R.E. 2009. Protecting Damara Terns Sterna balaenarum from recreational disturbance in the Namib Desert increases breeding density and overall success. *Ostrich* 80:71-75. IF 0.222

Brischoux, F. & Cook, T.R. 2009. Juniors seek an end to the Impact Factor race. *Bioscience* 59:638-639. IF 4.058

Child, M.F. 2009. The Thoreau Ideal as a unifying thread in the conservation movement. Conservation Biology 23:241-243. IF 4.705

Child, M.F., Cumming, G.S. & Amano, T. 2009. Assessing the broad-scale impact of agriculturally transformed and protected area landscapes on avian taxonomic and functional richness. *Biological Conservation* 142:2593-2601. IF 3.566

Colabuono, F.I., Barquete, V., Domingues, B.S., Montone, R.C. 2009. Plastic ingestion by Procellariiformes in Southern Brazil. *Marine Pollution Bulletin* 58: 93-96. IF 2.562

Cook, T.R. 2009. Book Review: Atlas des oiseaux nicheurs de la Grande Comore, de Mohéli et d'Anjouan by Michel Louette, Hachime Abdérémane, Ibrahim Yahaya and Danny Meirte. *Ostrich* 80: 205-207.

Cooper, J., Bester, M.N., Chown, S.L., Crawford, R.J.M., Daly, R., Heyns, E., Lamont, T., Ryan, P.G. & Shaw, J.D. 2009. Biological survey of the Prince Edward Islands, December 2008. *South African Journal of Science* 105:317-320. IF 0.604

Converse, S.J., Kendall, W.L., Doherty, P.F. Jr., & Ryan, P.G. 2009. Multistate Models for Estimation of Survival and Reproduction in the Grey-headed Albatross (*Thalassarche chrysostoma*). *The Auk* 126:77-88. IF 2.303

Crawford, R.J.M., Ryan, P.G., Dyer, B.M. and Upfold, L. 2009. Recent trends in numbers of Crozet shags breeding at the Prince Edward Islands. *African Journal of Marine Science* 31: 427-430. IF 1.312

Crawford, R.J.M., Whittington, P.A., Upfold, L., Ryan, P.G., Petersen, S.L., Dyer, B.M. & Cooper, J. 2009. Recent trends in numbers of four species of penguins at the Prince Edward Islands. *African Journal of Marine Science* 31: 419-426. IF 1.312

Crowe, T.M. 2009. Book Review: Reproductive biology and bird phylogeny. Miles to go before we sleep. *Cladistics* 25:105-106.

Crowe T. 2009. Management of southern african gamebirds: opportunities and threats. In: *Gamebird 2006: Quail VI and Perdix XII*. 31 May - 4 June 2006, edited by Sandrea B. Cederbaum, Brant C. Faircloth, Theron M. Terhune, Jeffrey J. Thompson & John P. Carroll. Athens, GA, USA, Warnell School of Forestry and Natural Resources, pp. 11-15.

Cumming, G.S. & Child, M.F. 2009. Contrasting spatial patterns of taxonomic and functional richness offer insights into potential loss of ecosystem services. *Philosophical Transactions of the Royal Society B-Biological Sciences* 364:1683-1692. IF 5.556

Cumming, G.S. & George, A. 2009. Historical influences dominate the composition of regenerating plant communities in abandoned citrus groves in north-central Florida. *Landscape Ecology* 24:957-970. IF 2.453

Cuthbert, R., Cooper, J., Burle, M.-H., Glass, C.J., Glass, J.P., Glass, S., Glass, T., Hilton, G.M., Sommer, E.S., Wanless, R.M. & Ryan, P.G. 2009. Population trends and conservation status of the Northern Rockhopper Penguin *Eudyptes moseleyi* at Tristan da Cunha and Gough Island. *Bird Conservation International* 19:109-120. IF 0.965

Dean, W.R.J. 2009. Gill Memorial Medal Address: What birds do and where they go in the Karoo. *Ostrich* 80:vii-ix.

Dean, W.R.J. 2009. Book Review: Lost land of the Dodo by Anthony Cheke and Julian Hume. T & AD Poyser, 2008. *Ostrich* 80:69-70.

Dean, W.R.J., Adams, M., Frahnert, S. & Milton, S.J. 2009. William John Ansorge's bird collections in Guinea-Bissau: an annotated list. *Malimbus* 31:75-108.

Dean, W.R.J., Barnard, P. & Anderson, M.D. 2009 When to stay, when to go: trade-offs for southern African arid-zone birds in times of drought. *South African Journal of Science* 105:24-28. IF 0.604

Downs, C., Boix-Hinzen, C. & Brown, M. 2009. Development and functional significance of dorsal air bags in nestlings of Monteiro's Hornbill *Tockus monteiri*. *Ostrich* 80:53-58. IF 0.222

Eising, C.M., Robles, R., Lasthuizen, M. and Groothuis, T.G.G. 2009. Lesser double-collared sunbirds *Nectarinia chalybea* do not compensate for hatching asynchrony by adjusting egg mass or yolk androgens. *Journal of Avian Biology* 40: 635-639. IF 2.327

Fischhoff, I.R., Dushoff, J., Sundaresan, S.R., Cordingley, J.E. & Rubenstein, D.I. 2009. Reproductive status influences group size and persistence of bonds in male plains zebra (*Equus burchelli*). *Behavioral Ecology and Sociobiology* 63:1035-1043. IF 2.917

Fort, J., Porter, W.P. & Grémillet, D. 2009. Thermodynamic modelling predicts energetic bottleneck for seabirds wintering in the northwest Atlantic. *Journal of Experimental Biology* 212:2483-2490. IF 2.981

Fuchs, J., Pasquet, E., Couloux, A., Fjeldså, J. & Bowie, R.C.K. 2009. A new Indo-Malayan member of the Stenostiridae (Aves: Passeriformes) revealed by multilocus sequence data: Biogeographical implications for a morphologically diverse clade of flycatchers. *Molecular Phylogenetics and Evolution* 53:384-393. IF 3.871

Geselbracht, L., Torres, R., Cumming, G.S., Dorfman, D., Beck, M. & Shaw, D. 2009. Identification of a spatially efficient portfolio of priority conservation sites in marine and estuarine areas of Florida. *Aquatic Conservation: Marine and Freshwater Ecosystems* 19:408-420. IF 1.619

Green, R.E., Barnes, K.N. & Brooke, M.de L. 2009. How the longspur won its spurs: a study of claw and toe length in ground-dwelling passerine birds. *Journal of Zoology* 277:126-133. IF 1.669

Hampton, S.L., Ryan, P.G. & Underhill, L.G. 2009. The effect of flipper banding on the breeding success of African Penguins *Spheniscus demersus* at Boulders Beach, South Africa. *Ostrich* 80:77-80. IF 0.222

Hockey, P.A.R. & Curtis, O. 2009. Use of basic biological information for rapid prediction of the response of species to habitat loss. *Conservation Biology* 23:64-71. IF 4.705

Hockey, P.A.R. & Midgley, G.F. 2009. Avian range changes and climate change: a cautionary tale from the Cape Peninsula. *Ostrich* 80: 29-34. IF 0.222

Kimball, R.T., Braun, E.L., Barker, F.K., Bowie, R.C.K., Braun, M.J., Chojnowski, J.L., Hackett, S.J., Han, K.-L., Harshman,

J., Heimer-Torres, V., Holznagel, W., Huddleston, C.J., Marks, B.D., Miglia, K.J., Moore, W.S., Reddy, S., Sheldon, F.H., Smith, J.V., Witt, C.C. & Yuri, T. 2009 A well-tested set of primers to amplify regions spread across the avian genome. *Molecular Phylogenetics and Evolution* 50:654-660. IF 3.871

Koopman, M.M. 2009. Book Review: Rare birds yearbook 2009 edited by Erik Hirschfeld, MagDig Media, 2008. *Ostrich* 80:126.

Lannas, K.S.M. & Turpie, J.K. 2009 Valuing the provisioning services of wetlands: contrasting a rural wetland in Lesotho with a peri-urban wetland in South Africa. *Ecology and Society* 14:article 18. IF 2.855

Little, I.T., Wellendorf, S.D., Palmer, W.E. & Carroll, J.P. 2009. Effects of timber volume on northern bobwhite autumn abundance. In: *Gamebird 2006: Quail VI and Perdix XII*. 31 May - 4 June 2006, edited by Sandrea B. Cederbaum, Brant C. Faircloth, Theron M. Terhune, Jeffrey J. Thompson & John P. Carroll. Athens, GA, USA, Warnell School of Forestry and Natural Resources, pp. 178-183.

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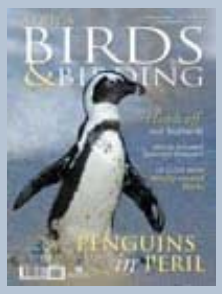

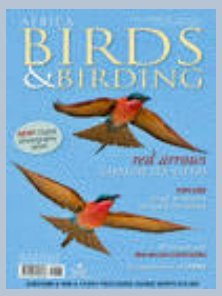

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Seminars 2009

9 Feb: Dr. Martine Maron, University of Queensland, Australia.
Agricultural intensification and resource availability for an endangered bird

23 Feb: Asst. Prof. Mazeika Sullivan, University of Ohio
Belted kingfishers in river systems in the US.

16 Apr: Dr Rita Covas, CBIO, University of Porto, Portugal
Cooperative breeding in the sociable weaver: why help?

28 Apr: Dr Martim Melo, Postdoctoral Fellow, PFIAO
Bird Speciation in the Gulf of Guinea

8 Jun: Lisa Nupen, PhD student, PFIAO
The evolution and conservation genetics of threatened southern African seabirds

4 Aug: Dr Timotheé Cook, Postdoctoral Fellow, PFIAO
The ecology of diving birds. Behavioural and sexual responses to environmental variability

17 Aug: Prof. Dominique G Homberger, Louisiana State University
The functional morphology of the avian integument: Implications for the evolutionary origin of bird flight.

Aug 18: Dr Rowan Martin, Postdoctoral Fellow, PFIAO
Long-term monogamy in a long-lived parrot

Sept 11: Sharon Okanga, PhD student, PFIAO
Influences of host community, urbanisation and pollution on South African avian parasite ecology

Sept 15: Ben Smit, PhD student, U. Pretoria
Taking the heat: integrating physiological and behavioural variables to predict avian responses to climate change in the Kalahari Desert

Sept 16: Alex Thompson, MSc student, PFIAO
Maternal investment and its effects on parent-offspring conflict in the cooperatively breeding Southern Pied Babbler (Turdoides bicolor)

23 Sept: Dr Lorien Pichegru, Postdoctoral Fellow, PFIAO
Can Marine Protected Areas benefit top predators?

10 Nov: Dr Jerome Fuchs, Postdoctoral Fellow, PFIAO
A molecular perspective on evolutionary processes and biodiversity in Africa: from Pan African phylogeograhy to diversification within the southern African arid zone

19 Nov: Dr. Jeffrey Peters, Wright State University, USA
Multilocus phylogeography: population structure, gene flow, and selection in /Anas ducks

20 Nov: Mduduzi Ndlovu, MSc student, PFIAO
The moult and movement ecology of African ducks

24 Nov: Dr. Orjan Bodin, Stockholm University, Sweden
Network based models of fragmented landscapes concepts, applicability, and predictability

30 Nov: Dr David Gremillet, CNRS, Montpellier, France
Winners & Losers: Rating the impact of climate change on seabirds in the North Atlantic

8 Dec: Asst. Prof. Bengt Hansson, University of Lund, Sweden
Evolutionary aspects of dispersal and migration in the great reed warbler