



Percy FitzPatrick

Institute of African Ornithology

DST/NRF CENTRE OF EXCELLENCE



50TH ANNIVERSARY ANNUAL REPORT

2010



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Cecily Niven
Founder of the Percy FitzPatrick Institute

The Percy FitzPatrick Institute of African Ornithology at the University of Cape Town was founded in 1960 through the vision and drive of Cecily Niven, daughter of Sir Percy FitzPatrick of *Jock of the Bushveld* fame, after whom the Institute is named. Cecily passed away in 1992, but her Institute continues to go from strength to strength. It is the only ornithological research institute in the southern hemisphere, and one of only a handful in the world.



Dr Max Price
Vice-Chancellor, University of Cape Town

The Percy FitzPatrick Institute is one of the jewels in the crown of the University of Cape Town. This is an accolade acknowledged both nationally and internationally, not only by the Institute's status as a National Centre of Excellence, but also by a recent report from an international review panel which places the Institute alongside its two global counterparts at Cornell and Oxford Universities. It gives me great pleasure to endorse the Institute's 50th Anniversary Report and to wish it success into the future.

Percy FitzPatrick Institute of African Ornithology

DST/NRF CENTRE OF EXCELLENCE

50TH ANNIVERSARY ANNUAL REPORT 2010



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FRONT COVER African Black Oystercatcher *Haematopus moquini*
(© Peter Chadwick. www.wildlife-expressions.co.za).

HALF TITLE PAGE Bennett's Woodpecker
Campethera bennettii. (© Peter Ryan)

OPPOSITE White-backed Duck
Thalassornis leuconotus.

BACK COVER Grey-headed Albatross *Thalassarche chrysoloma*
(© Peter Ryan)





© PETER RYAN

Director's Report



© HANNES LOCHNER

Welcome to our glossy, 50th Anniversary Annual Report. British theatre critic James Agate wrote that “the first nine commandments for a Director are ‘thou shalt not bore’”, hopefully I won’t and this report won’t.

Fifty years is a long time – longer than the life-span of many South African corporates. Elsewhere in the world, 1960 saw Joanne Woodward becoming the first star on Hollywood’s Walk of Fame; Hawaii being added as the 50th star on the American flag; the first Playboy Bunny being exposed; the Reserve Bank of Australia’s opening its door for the first time; and Penguin Books winning a court case against the banning of *Lady Chatterley’s Lover*.

Closer to home, however, 1960 - the year the Fitztite hatched - was a turbulent time in South Africa’s history. In February, Harold Macmillan delivered his “winds of change” speech to the South African parliament. The following month witnessed the Sharpeville Massacre and the declaration of a National State of Emergency. In April, the ANC and the PAC were banned and Hendrik Verwoerd was shot. The following year, South Africa declared itself a republic and severed its ties with Britain. This was hardly an auspicious backdrop against which to launch a new research institute, especially one with a mandate as seemingly esoteric as ornithology. However, the 1960s was a time of global economic boom: science was on the up and ornithology was growing as a discipline worldwide. But the Fitztite missed the bus. When the Institute opened its doors, there was no requirement for student supervision, and only four students graduated in the first decade, all supervised by a Zoology staff member. By the early 1970s there were fears that the fledgling Fitztite would have to close its doors. Happily, by the mid-1970s, and under the Directorship of Roy Siegfried, these fears were allayed and the Institute started its rapid rise to where it is today. By 1989, still during Roy Siegfried’s tenure as Director, ornithology was identified as the most internationally competitive science in South Africa, ranking third equal in the world. As I write today, the Fitztite is home to more than 60 postgraduate students and post-doctoral fellows.

The 1980s were tough years for South African science and scientists. Academic research, the stream of visiting scientists dried up and the future looked bleak. But the Fitztite has always prided itself on having 20/20 vision when peering into the crystal ball. By the late 1980s, we realised that a more academically liberalised, post-apartheid South Africa was in sight and that we needed to align ourselves to take advantage of the opportunities and challenges this would offer. We also realised that in terms of our African mandate, there was going to be a pressing need for human capacity in the field of Conservation Biology. This prediction proved ominously true.

The IUCN declared 2010 the “International Year of Biodiversity”, a recognition that came not a moment too soon. The conservation issues facing Africa have been steadily mounting, driven by unsustainable human population growth and societal expectations, with associated increasing demands on natural resources. resulting in habitat loss, degradation and climate change.

In 2010, in South Africa alone, 333 rhinos were killed by poachers. Also this year, Conservation International identified the ten most globally endangered forest hot-spot areas in the world. One of these is on our doorstep, in the coastal lowlands



AB&B 14(6):22



AB&B 15(1):20

TOP Black-bellied Storm-Petrel

of Mozambique and Tanzania, while another lies in the highlands of the Albertine Rift and Ethiopia. In May 2010, BirdLife International published a list of 132 bird species that have gone extinct in historical times: three of these were lost in the first decade of the 21st Century.

As our contribution to remedying the shortfall in trained conservation biologists, in 1992 we launched our MSc course in Conservation Biology. 2010 saw our 19th cohort of arriving students and our 200th graduate from the course. From humble beginnings, this course has proven to be one of the most successful of its kind in the world. In 2006, a generous and far-sighted private endowment enabled us to appoint Graeme Cumming as the Pola Pasvolsky Chair in Conservation Biology. By 2008, the impact of Conservation Biology research at UCT ranked top among Southern Hemisphere universities and equal with the fourth-rated university (of 314) in North America.

While the Institute's Conservation Biology Course was going from strength to strength, so too was the Institute. At the end of 2004, we received a very prestigious accolade when the South African Department of Science and Technology (DST) and the National Research Foundation (NRF) awarded us the status of one of only six National Centres of Excellence (CoEs) in Science and Technology. Even though we (along with the Forestry and Agricultural Biotechnology Institute at the University of Pretoria) were only 50% funded, this provided a very welcome boost to our coffers and saw a dramatic increase in the numbers of our students and the quality of our research outputs. Having the status of a Centre of Excellence also required us to enter a Service Level Agreement with the NRF, which sets targets for our numbers of graduands and publications. Since 2004, we have met and mostly well exceeded these targets, as recognised by an international review panel appointed by the NRF in 2009. In addition to lauding our achievements, this panel recommended that our funding be increased to full CoE level. The NRF invited a motivation for this upgrade, contingent in part on an explanation of how we would tackle the one panel criticism – that we should be doing more in the field of terrestrial bird conservation. Once again, we were a step ahead of the game. Aware of the fact that the NRF would ask us to address this criticism, in the second half on 2009, we started several new, land-based conservation projects (one of which already has more than 4 500 Facebook subscribers). Not only did we launch these projects within six months of the review, we also managed to raise more than R2.3 million in external funds to support them. In July 2010, the NRF and DST approved our upgrade which means that, retrospective to the beginning of 2010, the CoE income stream effectively doubled. The granting of this award was not in response to a carefully crafted motivation from the Director (although that did have to be written!), it was recognition of corporate success, and the reason for that success is the dedication and productivity of the Institute's students and staff (both academic and support). I believe that this ongoing high performance can be put down to five primary factors: careful student and project selection; promoting the post-doc culture (11 in 2010); setting targets; initiating productive collaborative research; and sound financial management.

So, after that abridged history, we have arrived in 2010! Although many of our anniversary activities are covered elsewhere in this report, a few events deserve mention here. Our anniversary AGM was held at Steenberg Golf Estate in Tokai – a scenic, rural setting below Silvermine Nature Reserve. Whilst this might appear rather ostentatious, we covered most of the costs by hosting a 'golf day' (a novel venture for the Fitz) at the same venue. Also as part of the Anniversary, we tried to ensure that as many of our students as possible had the opportunity to attend at least one international conference. All in all, we were represented at no fewer than 11 such conferences. Top of the list for most students, though, were the 25th International



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© IAN SINCLAIR

ABOVE Jack Winterbottom (top) directed the Fitztitute for the first decade of its existence. There have been only three subsequent directors, Roy Siegfried (above centre), Morné du Plessis (left) and Phil Hockey (right).



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ABOVE Phil Hockey and Dr Andrew Kaniki of the NRF seal the deal over the upgrade of the Fitztitute's Centre of Excellence to fully funded status.



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.

Ornithological Congress held at Campos do Jordão in Brazil in August and the First World Seabird Conference at Vancouver Island, Canada, in September.

In addition to being our anniversary year, 2010 was also a fairly stressful experience staff-wise. My old post was still not filled, Graeme Cumming was on sabbatical north of the Equator and Tim Crowe was poorly for much of the year. Academically, that left Peter Ryan and I shepherding some 60 postgraduate students and Post-doctoral Fellows through the year's hurdles. Without the Institute's amazing support staff, and the huge input made by Rob Little to the various anniversary activities, Peter and I would probably have ended the year as gibbering idiots (maybe we did, but people were too polite to tell us!).

In terms of staffing, specifically the filling of my old post, there was one significant upside to 2010. Following the disappointment of late 2009, when the newly appointed incumbent turned down the post at the last moment, we restarted the search in May 2010. Interviews took place in August and an offer was made to Dr Arjun Amar from the RSPB, Scotland. Arjun will take up his post at the beginning of February 2011, a development we await with stupefying grins! The three-year hiatus in staffing took its toll on our publication output in 2009, but I can happily report that 2010 saw the most papers published in high-quality journals in the Fitztstitute's history.

Finally, several discussions took place during the year between the Fitztstitute, the Zoology Department, UCT's DVC for Research, the Dean of Science, SANBI and the NRF about the future of the Animal Demography Unit (ADU) following Prof. Les Underhill's retirement at the end of 2011. Although the NRF was keen that the Fitztstitute take the ADU under its wing, the general feeling (and one endorsed by us) was that the optimal solution was that it remain as a unit within the Zoology Department at UCT, under the headship of A/Prof. John Hoffmann, and that it retain a mandate for biodiversity monitoring that extends beyond the narrow purview of birds alone.

Whilst an anniversary year such as this is an opportunity to reflect on the challenges and successes of the past, it is also a time to look forwards. We live in a rapidly changing world and have to ensure that we too can adapt. As the Greek philosopher Heraclitus observed, "You cannot cross the same river twice". The Institute has a vision to be the leading international research and postgraduate training institute in the fields of ornithology and conservation biology, with particular emphasis on African issues. In this regard, some issues are non-negotiable: Afro-centrism, excellence, education, research, relevance and outreach.

Just how one assesses excellence is a moot point, and one that numerous international metrics attempt to quantify. Whilst the Fitztstitute would like to consider itself a centre of excellence, as endorsed by our international review panel and the DST/NRF, we must never lose sight of the fact that we are a part of a broader university research community. What is good for us is good for the University, and *vice versa*. One of the well-respected international 'excellence' metrics is the Times Higher Education ranking. As a fitting end to a highly successful 2010, in December UCT was identified as the 45th best life-science university in the world: not too shabby. However, in terms of the impact of its life-science research, UCT was rated 12th in the world, less than 2% behind Oxford and Cambridge and ahead of some heavy punchers including Yale, Cornell, UCLA, Imperial College London and (my *alma mater*) Edinburgh. I would like to think that the Fitztstitute's contribution to UCT's research output has in no small way influenced this international measure of success. And for this reason, staff and students of the Fitztstitute – take a bow!

Phil Hockey



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© PHIL HOCKEY

ABOVE From the earliest days outreach has been an important part of the Fitztstitute's activities, but the nature of that outreach has changed over time!



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ABOVE The 4th Biodiversity Conservation Academy, a joint venture between the CoE for Invasion Biology (CIB) and the Fitztstitute CoE, was held at Potberg Environmental Education Centre in De Hoop Nature Reserve from 11 – 15 January 2010. The Academy was attended by 14 undergraduate students from across South African universities, four of whom were interns from the South African National Biodiversity Institute. Eleven students were from historically disadvantaged backgrounds and nine were women.



50th ANNIVERSARY 1960–2010



THE PERCY FITZPATRICK INSTITUTE OF AFRICAN ORNITHOLOGY

Profiling & media exposure during 2010

Whilst the 50th Anniversary was a time to reflect and celebrate a proud record of research, teaching and outreach built over 50 years of hard work and strategic planning, it was also a time to look to the future and plan for achieving even higher performance. During 2010, we took the opportunity to engage in a number of activities to increase our public profile and consolidate our financial security. What follows is a summary of the publicity and awareness exercises that we undertook in 2010.

The year started with a Vice-Chancellor's Open Lecture by Prof. Norman Myers, followed by a Fitztute 50th Golf Day and the Fitztute 50th Annual General Meeting, both of the latter held at the Steenberg Golf Estate. The 50th logo was featured on the front cover of 15 of the 20 issues of the UCT *Monday Paper* during 2010. We also saw eight Fitztute articles featured in the *Monday Paper* during 2010. The revamped Fitztute website was launched on the UCT website on 17 February 2010. Thereafter, 10 Fitztute news items appeared on the UCT website during the year, with three items featuring the Fitztute appearing in the last week of November alone – that is probably some sort of record for a single research unit at UCT.

All of this, and the generous assistance given by the UCT Communications and Marketing (C&M) team, with external media partners, helped make this 50th Anniversary year a wonderful exercise in marketing and profiling of the Institute. It gives us great pleasure therefore to extend our warmest appreciation and gratitude to the UCT C&M team for their unwavering support and assistance without which the achievements and celebrations of this year would not have been the same.

GENERAL PROFILING ACTIVITIES

- The 50th Anniversary logo was used on all Fitztute materials during 2010.
- Two 50th Anniversary banners were used at various events. Between events, and since, they are spanned above the Niven Library entrance and at the Fitztute reception.
- The UCT University Development Committee (UDC) and C&M Department featured the Fitztute as a UCT Strategic Project on the UCT website under environment & biodiversity; <http://www.uct.ac.za/dad/funddev/strategic/>.
- Embroidered 50th logos for use on clothing, etc., were and still are available for staff and students.
- 50th logo licence disk/bumper stickers were distributed to staff and students, and at strategic functions.

- A Fitztute 50th Golf Day was held on 26 July at the Steenberg Golf Club. A great day was had with 48 golfers participating. The proceeds of the golf day covered most of the costs of the Fitztute 50th AGM.
- The Science Faculty Marketing Committee invited Phil Hockey to present a Distinguished Alumnus lecture on Wednesday 22 September. This was pertinent as 2010 was also the International Year of Biodiversity.
- A 'flashy format' 2010 50th AGM was held at the Steenberg Golf Club on Wednesday 11 August. Over 100 Fitztute supporters, colleagues and students attended the presentation session and over 50 people enjoyed the special supporters' and conservation partners' dinner.

The Fitztute website

- The website received a new look early in 2010, celebrating the 50th Anniversary. The website also includes PDFs of all Fitztute articles published in *Africa Birds & Birding* since the magazine's inception in 1996 (more than 100 articles).
- The Fitztute's scientific publications section on the website is extended back to 1960, including a complete list of dissertation theses.
- A special Alumni feature on the Institute's website now acts as a virtual reunion template for past staff and students and a point of access to the whereabouts of Institute alumni.
- A 50th Anniversary fund-raising page focuses on donor opportunities and offers potential donors facilities to contribute to student bursaries, research projects and bequests.
- There is also now a 'donate online' link on the Fitztute home page to the UCT Strategic Projects URL facility.
- The new website contains details of 10 project fact sheets seeking sponsorship and identifying ways that donors can support Fitztute research (see "Support us" and "How you can contribute"). Several of these projects received substantial financial support during 2010.
- BirdLife South Africa put a prominent hotlink to the Fitztute site on the home page of their website.



ABOVE Winners of the golf day receive their copies of Roberts VII from Phil Hockey at the Steenberg Golf Estate.

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Internal UCT media

- An article on the Fitztitute's 50th was included in the *UCT Alumni Magazine* (page 42).
- A full-page Fitztitute 50th Anniversary feature was published on page 7 of the annual UCT Faculty of Science Newsletter *Contact*, Vol. 8, November 2010.
- The Fitztitute 50th AGM activities were included in the UCT milestones compiled for the *Alumni News 2010*.

UCT website

- The VC's Open Lecture by Prof. Norman Myers "SA the place to be, says environmental scientist" was posted as a podcast on Wednesday 10 February 2010.
- The "New website for Fitztitute" was launched on UCT's website on Wednesday 17 February.
- A Fitztitute 50th Anniversary seminar by Dr Claire Spottiswoode (*University of Cambridge & Research Associate of the Fitztitute*) was held on 7 April and received coverage in 'News & Highlights' on the UCT Home Page on 20 April.
- A Fitztitute feature "Celebrate International Day for Biological Diversity" was posted on Friday 21 May to link the Fitztitute's 50 years of biodiversity work with the International Year of Biodiversity.
- Celebrating the Fitztitute 50th golf day "Birdies galore at ornithology's golf day" was posted on Wednesday 4 August.
- The Fitztitute upgrade to a fully funded Centre of Excellence was posted on Tuesday 28 September.
- "The Fitztitute and Dow Southern Africa join forces for Ground-Hornbill conservation" was posted on Thursday 4 November.
- The new Southern Ocean Islands seabird book was featured "Birds on an island or two" on Tuesday 23 November.
- A media event hosted in the Niven Library and introduced by Phil Hockey "Airbus collaboration off to a flying start" was posted on Wednesday 24 November.
- A Fitztitute message of appreciation "UCT toasts the Mazda Wildlife Fund on its 20th Anniversary" was posted on Monday 29 November.

Monday Paper

- C&M agreed to put the 50th logo on the front page of each issue of the *Monday Paper* during 2010.
- A full page Fitztitute 50th article "Half-century milestone for the Fitztitute" appeared on page 5, Vol. 29 no. 1.
- C&M published a Fitztitute website launch on page 6, Vol. 29 no. 2.
- Claire Spottiswood's seminar received an editorial piece "Arms race in bird kingdom" on page 2, Vol. 29 no. 6.
- The Fitztitute 50th Golf Day received a Sports editorial "Birdies galore at ornithology golf day" on page 8, Vol. 29 no. 11.
- Prof. Phil Hockey's Distinguished Alumnus Lecture "Can birds survive another mass extinction?" was featured on page 2, Vol. 29 no. 14.
- The Fitztitute upgrade to a fully funded Centre of Excellence was announced on page 2, Vol. 29 no. 15.
- An Airbus press briefing held in the Niven Library on 22 November unveiled novel modeling studies that will be conducted by Prof. Redelinghuys of the UCT Aeronautical Research Group (Dept of Mechanical Engineering) and featured the Fitztitute in an article on page 3, Vol. 29 no. 19.

External media

- A full-colour 'one-pager', highlighting achievements (and looking for bursary money) was published in the Oct/Nov issue of *Africa Birds & Birding* (page 22) and in the Dec/Jan issue of *Africa Geographic* (Page 40). The publishing company waived charges (of >R30 000) for this.



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ABOVE Humphrey Le Grice of Mazda Wildlife Fund hands over a new vehicle for bustard research to PhD student Jessica Shaw.

- The Editor of *FullCircle* magazine (a South Peninsula monthly publication with a circulation of 25 500) placed a Fitztitute 50th banner (with logo & website address) as a footer to each Fitztitute article in each issue during 2010.
- A full-page Fitztitute 50th article was published in *FullCircle* in the January 2010 issue (page 10).
- Invitations to Norman Myers's VC Open Lecture were sent to Western Cape UCT Alumni and placed on the Fitztitute website. An overwhelming response meant that RSVPs were closed after one week. Select VIPs were invited to the VC's residence for a function after the lecture. For news snippets on the lecture see <http://www.uct.ac.za/dailynews/?id=7243> and <http://www.uct.ac.za/dailynews/?id=7253>.
- Independent Newspapers published a half-page 50th editorial in the *Cape Argus* on 26 February, page 16: supported with advertorials by ABAX Investments, *Africa Birds & Birding*, BirdLife SA, Mazda Wildlife Fund, Random House Struik, Western Cape Birding Forum & WWF-SA.
- A Fitztitute 50th Golf Day invitation appeared in the *FullCircle* (June 2010, page 4).
- A DVD and international, full-length documentary on the Fitztitute's ground-hornbill project were completed during 2010. A shorter documentary about this project was aired on 50/50 (SABC TV) on Sunday 15 August.
- A feature article "Fifty years of the Fitztitute: an interview with Phil Hockey" was published in the *WildCard* e-newsletter in the first week of May. see <https://www.wildcard.co.za/blog.htm?action=view-post&id=1351>.
- The Fitztitute participated with an exhibition in the Leslie Social Science Building for the UCT Africa Day celebration during 21–27 May.
- Once a month 50th Anniversary interviews with Phil Hockey and Peter Ryan were broadcast on John Maytham's afternoon show on Cape Talk Radio between July and December. The Nature Conservation Corporation sponsored the radio time (R3 600 per session).
- A full-page "The Hatching and Fledging of the FitzPatrick Institute" appeared on page 20 of the August (Vol.17 no8) issue of the *FullCircle* magazine.
- Following the Fitztitute 50th AGM day, journalist John Yeld wrote an editorial "Fitztitute marks 50 years of science" which was published on page 11, *Cape Argus* 26 August 2010.
- A five-page profile feature on the Fitztitute was published in *Quest* magazine (Vol. 6(2): 36-40).

Staff, Students & Associates

Staff

Anthea Links joined the Fitz as SAP purchaser in January 2010, replacing the long serving Lionel Mansfield.

Graeme Cumming was on sabbatical, spending the year in Zimbabwe, Sweden and Germany.

Graduates

PhD

Marta de Ponte Machado and Martha Nelson-Flower (June 2010); Peter Ngoma (Dec 2010)

Conservation Biology MSc

Nathan Gichohi, Yvonne Githiora, Ben Heermans, Ian Kisson, Deo Kujirakwinja, Michael Marais, Christina Moseley, Allison Skidmore, Deogratias Tuyisingize and Gwyneth Wilson (June 2010)

BSc Hons

Morgan Commins, Jeremy Dickens, Trevor Edwards and Kyran Wright (Dec 2010)

New students

Postdoctoral Fellows

Susie Cunningham (Phil Hockey), Tim Reid (Peter Ryan)

PhD

Grant Joseph (supervised by Graeme Cumming), Mduduzi Ndlovu (upgrade from MSc, supervised by Graeme Cumming)

MSc

Rowen van Eeden (supervised by Peter Ryan and Lorien Pichegru)

Conservation Biology (CB) MSc

Twelve students began the CB MSc in January 2010.



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ABOVE Hilary Buchanan, Phil Hockey and Rob Little from the FitzPatrick Institute, with Melissa Stander the Institute's webmaster (seated), led the way with the redevelopment of the institute's website.

Staff

Director

Prof. Phil Hockey, PhD (Cape Town)*

Academic and Research Staff

Prof. Tim Crowe, PhD (Cape Town)*

Prof. David Cumming, PhD (Rhodes)

Prof. Graeme Cumming, PhD (Oxford)*

Prof. Sue Milton, PhD (Cape Town)

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

External CoE Team Members

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

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

Ms Tshifhiwa Mandiwana-Neudani, MSc (Cape Town)

– Botany Dept, UCT

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

Honorary Research Associates

Dr Phoebe Barnard, PhD (Uppsala)

Dr David Grémillet, PhD (Kiel)

Dr Alan Kemp, PhD (Rhodes)

Dr Mandy Ridley, PhD (Cambridge)

Dr Rob Simmons, PhD (Wits)

Dr Ross Wanless, PhD (Cape Town)

Research Associates

Dr Rita Covas, PhD (Cape Town)

Dr Richard Dean, PhD (Cape Town)

Dr Andrew Jenkins, PhD (Cape Town)

Dr Martim Melo, PhD (Edinburgh)

Dr Antoni Milewski, PhD (Murdoch Univ.)

Dr Claire Spottiswoode, PhD (Cambridge)

Anthony van Zyl, MSc (Cape Town)

Support Staff

Manager, DST/NRF Centre of Excellence

Dr Rob Little, PhD (Cape Town)

Principal Technical Officer

Chris Tobler*

Administrative Assistant

Hilary Buchanan*

Senior Secretary, DST/NRF Centre of Excellence

Tania Jansen

Departmental/Accounts Assistant

Anthea Links*

Library Staff

Margaret Koopman, HDLS, MSc (KwaZulu-Natal) (Librarian)

Phelisa Hans

* 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.

Webmaster

Melissa Stander

Research Assistants

Charles Banda
Ben Dilley
Alistair Fyfe
Lazaro Hamusikili
Quentin Hagens
Tali Hoffman
Kiverness Moto
Collins Moya
Averd Munkombwe
Stanley Munkombwe
David Nkosi
Mduduzi Ndlovu
Kirsten Retief
Sieglinde Rode
Rheinhardt Scholtz
Kushmika Singh
Dunne Siyapolo

Students**Post-doctoral Fellows**

Dr Steve Boyes, PhD (KwaZulu-Natal)
Dr Timotheé Cook, PhD (La Rochelle)
Dr Susan Cunningham, PhD (Massey), May-Dec
Dr Doug Loewenthal, PhD (Cape Town)
Dr Rowan Martin PhD (Sheffield)
Dr Felix Nchu, F. PhD (Pretoria)
Dr Lorien Pichegru PhD (Strasbourg)
Dr Tim Reid, PhD (Tasmania) July-Dec
Dr Xanic Rondon, PhD (Miami Univ.), Jan-Oct
Dr Mareile Techow, PhD (Cape Town)

Doctoral

Viviane Barquete Costa, MSc (Furd, Rio Grande)
Justine Braby, BSc, PG. Dip Law (Cape Town)
Adams Chaskda, MSc (Jos, Nigeria)
Callan Cohen, BSc (Hons) (Cape Town)
Marta De Ponte Machado, MSc (Cape Town), Jan-Jun
Genevieve Jones, MSc (Cape Town)
Dr Grant Joseph, (MBCHB, MSc) (Cape Town)
Potiphar Kaliba, MSc (Cape Town)
Ian Little, MSc (Cape Town)
Tshifhiwa Mandiwana Neudani, MSc (Cape Town)
Martha Nelson-Flower, MSc (Vancouver), Jan-Jun
Mduduzi Ndlovu, BSc (Hons) (NUST, Zimbabwe)
Peter Ngoma, MSc (Malawi)
Lisa Nupen, MSc (Cape Town)
Graeme Oatley, BSc (Hons) (Cape Town)
Sharon Okanga, MSc (Nairobi)
Angela Ribeiro, MSc (Porto)
Jessica Shaw, MSc (Cape Town)

Masters by Dissertation

Owen Davies, BSc (Hons) (Cape Town)
Gregory Mutumi, BSc (Hons) (NUST, Zimbabwe)
Alex Thompson, BSc (Hons) (Cambridge)
Rowen van Eeden, BSc (Hons) (Cape Town)

Masters in Conservation Biology 2010

Petra De Abreu, BSc (Hons) (Cape Town)
Kate Du Plessis, BSc (Hons) (UC Santa Cruz)
Katherine England, BSc (Hons) (Western Ontario)
Masumi Gudka, BSc (Hons) (East Anglia)

Clova Jurk, BSc (Hons) (Edinburgh)
Andre Krahner, BSc (Hons) (Liebniz)
Sarah Lewis, BSc (Hons) (Nottingham)
Gina Louw, BSc (Hons) (Cape Town)
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*M*ANY BIRD SPECIES ARE RARE, SOME FOR NATURAL REASONS, OTHERS HAVING BEEN DRIVEN THERE BY HUMAN ACTIONS. THE LATTER GROUP ACCOUNT FOR THE MAJORITY OF THE WORLD'S THREATENED BIRDS, MANY OF WHICH ARE HOVERING PERILOUSLY CLOSE TO EXTINCTION. THE FITZTITUTE HAS A LONG HISTORY OF STUDYING THE BIOLOGY OF RARITY, TARGETING SPECIES RANGING FROM TINY



THREATENED BIRDS

FOREST WARBLERS ALL THE WAY UP TO THE PLANET'S LARGEST SEABIRDS. MOST OF THESE STUDIES SHARE THE COMMON RATIONALE OF UNDERSTANDING *WHY* A SPECIES IS RARE. ONLY IF WE UNDERSTAND THE CAUSE OF THE PROBLEM ARE WE ABLE TO OFFER PRACTICAL SOLUTIONS. INCREASINGLY WE ARE WORKING WITH CONSERVATION AGENCIES AND NGOs TO ENSURE THAT SOLUTIONS ARE IMPLEMENTED EFFECTIVELY, THUS IMPROVING THE CONSERVATION STATUS OF THE BIRDS WE STUDY.



Fitztute research and management recommendations have contributed to an increase of almost 50% in the global population size of the African Black Oystercatcher *Haematopus moquini*.

© PETER RYAN

Over-protected Peninsula forests

Bad news for Knysna Warblers?

THE KNYSNA WARBLER *BRADYPTERUS SYLVATICUS* IS ENDEMIC TO SOUTHERN SOUTH AFRICA AND IS GLOBALLY *VULNERABLE* BECAUSE OF ITS RESTRICTED AND DECREASING GEOGRAPHICAL RANGE, PATCHY DISTRIBUTION AND SMALL POPULATION SIZE (CA 2 500 BIRDS). THESE INSECTIVOROUS WARBLERS OCCUR ON THE FRINGES OF AFRO-TEMPERATE FORESTS AND ASSOCIATED STREAMSIDE THICKETS.

The most westerly population of Knysna Warblers occurs on the Cape Peninsula, isolated from populations farther east by extensive urbanisation. But all is not well on the Peninsula. Knysna Warblers have become increasingly rare in protected natural forests at higher elevations, where they occurred historically. In the 1970s, there were maybe 80-100 pairs of Knysna Warblers on the Peninsula; this number has at least halved since the late 1980s and today the population may be as small as 25-30 pairs.

Afro-temperate forests on the Cape Peninsula naturally exist as narrow belts in riverine ravines, where they are largely protected from the fires that drive the ecology of the adjacent Fynbos. Fire management in peri-urban areas is problematic, and fire has been excluded for almost 40 years from extensive areas in the core of the warbler's range, most notably in the National Botanical Gardens at Kirstenbosch. This results in lateral spread of the forests, accompanied by a thickening of the canopy and a concomitant reduction in streamside vegetation. This could affect the warblers by reducing food availability, reducing nesting habitat, or both. A Fitzpatrick study in the early 2000s demonstrated the birds' dependence on understorey vegetation and also, for the first time, documented their diet. What the early study did not do, however, was quantify the food available to the birds.

The natural forests of Table Mountain are important habitats for invertebrates, supporting many species endemic to the Cape Peninsula. Surface-active invertebrates are sensitive to environmental changes, but their low mobility affords them little opportunity to avoid disturbance. In view of the links between invertebrate loss and decreasing bird populations elsewhere, our



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study set out to establish whether a decrease in food could be driving the decrease in Knysna Warbler numbers. To do this, we compared prey abundance between habitats currently occupied by warblers and those now abandoned. Getting to the answer was time consuming, but the results were very straightforward: neither species richness, abundance, biomass or seasonal availability of arthropods eaten by the warblers (especially their favoured food items) differed between occupied and abandoned habitats. Yet, despite this, the warblers are disappearing from well-protected, food-rich native forests and retreating into narrow belts of fairly tall, riverine woodland in suburbia, which are heavily invaded by alien plant species.



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The birds' retreat into suburban, riverine woodland seemingly is best explained by vegetation structure rather than by food availability. In much of the bird's natural riverine forest range on the Cape Peninsula, the adjacent Fynbos areas have been protected from fire for so long that they have become invaded by forest. As the forest spreads laterally, light penetration along streams is reduced, resulting in the understorey vegetation becoming progressively more sparse and potential nest sites becoming increasingly rare.

The contrast with suburban woodlands is dramatic. Gardens adjacent to these woodlands, with their extensive open areas (such as manicured lawns), are creating conditions in the woodlands comparable to those that were present in natural, riverine forest when the adjacent Fynbos was allowed to burn. Gardens allow substantial lateral penetration of light into the woodlands, promoting the dense understorey that the birds need for nest sites. In this way, anthropogenic disturbance (gardening) mimics natural disturbance (fire) and, completely unintentionally, has proven an excellent management strategy to benefit Knysna Warblers.

Impact of the project

This project highlights very clearly one of the dangers of excluding fire from Fynbos. Even though the Knysna Warbler is a forest species, the impacts of enlarging the area of forest on the Peninsula are strongly negative for this species (even though the forests may be attractive

OPPOSITE Tangled, alien-infested, greenbelt strips are now the stronghold of Knysna Warblers *Bradypterus sylvaticus* on the Cape Peninsula.

ABOVE Lack of fires on the eastern slopes of Table Mountain have significantly impacted on the local population of Knysna Warblers.

to tourists). Whether the montane, riverine forest habitats of the eastern slopes of Table Mountain can now be returned to their natural state by controlled burning is equivocal, with lateral forest expansion now being extensive. Manual removal of the non-flammable forest component of the invaded Fynbos vegetation may be needed before the Fynbos itself can be burnt. What is certain, however, is that if the green belt woodlands are not managed to keep them in a structural state resembling the *status quo*, the future of the Knysna Warbler on the Cape Peninsula does not look good. The expanding forests have led to recent colonisation of the Peninsula by forest-dwelling birds such as Tambourine Dove *Turtur tympanistria* and Olive Bush-Shrike *Chlorophonius olivaceus*, but is this adequate compensation for the loss of a red-listed, national endemic?

Research team, 2010

Prof. Michael Samways (Univ. Stellenbosch)
 Dr James Pryke (Univ. Stellenbosch)
 Prof. Phil Hockey (PFIAO)

Cape Parrots heading for a fall?



MOST PEOPLE KNOW THE ICONIC AFRICAN GREY PARROT *PSITTACUS ERITHACUS* OF CENTRAL AND WESTERN AFRICA, BUT FEW PEOPLE KNOW ABOUT AFRICA'S MOST ENDANGERED PARROT, SOUTH AFRICA'S CAPE PARROT *POICEPHALUS ROBUSTUS*. IT IS LIKELY THAT THERE ARE NOW FEWER THAN 1000 CAPE PARROTS REMAINING IN THE WILD. THIS ICONIC, GREEN-AND-GOLD PARROT IS *CRITICALLY ENDANGERED* BY CONTINUED HABITAT LOSS, POOR NESTING SUCCESS DUE TO LACK OF NEST CAVITIES AND SUITABLE FOOD RESOURCES, BEAK AND FEATHER DISEASE OUTBREAKS, PERSECUTION AS A CROP PEST, AND THE ILLEGAL BIRD TRADE.

Over 350 years of intensive logging in their forest habitat, persecution as a crop pest (predominantly pecans), nest poaching and mist-netting adults for the wild-caught bird trade, and very little or no conservation intervention, has left the remaining Cape Parrot populations on unsure footing with ageing populations in declining physical condition. Stimulating positive change for Cape Parrots in the wild has become a high priority not only for the species itself but also for our remaining patches of Afromontane forest.

In late 2009, the FitzTittle initiated the Cape Parrot Project, led by Phil Hockey, to ensure that this endemic parrot persists in the wild. Dr Steve Boyes, a DST/NRF Innovations Post-doctoral Fellow at the FitzTittle's Centre of Excellence, is now based in Hogsback Village to undertake hands-on scientific research and ensure that the associated community-based conservation projects achieve long-term

benefits for both the forest patches and the surrounding local communities that have heritage rights to these forests. We are undertaking an in-depth study of the birds' diets relative to the threat posed by beak-and-feather disease outbreaks, and have engaged with the local communities in the re-planting and inter-generational rehabilitation of the Afromontane forest patches along the Amat-hole Mountains in the Eastern Cape. Together with senior scientists at the Department of Agriculture, Forestry and Fisheries (DAFF) and local timber companies, we aim to plant over 5000 yellowwood saplings in Afromontane forest patches where mature trees are missing due to past clear-felling for construction timber (e.g. railway sleepers and mine timbers). The Cape Parrot Project and the associated community conservation projects are a long-term commitment by the FitzTittle, the Wild Bird Trust, and BirdLife South Africa.

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When struggling to describe what we do for a living in halted Xhosa, a simple reference to "iziKhwenene" will result in a nod, a smile, and a story about a Cape Parrot that they caught or tried to catch when they were working for SAFCOL, or about the days when they saw hundreds of Cape Parrots above their village and feeding along the river. The local communities see them as icons of the forest that should be respected. If asked to catch a Cape Parrot many of the older men would be able to do so at short notice. Our community projects will invest in these communities by establishing better circumstances for themselves and Cape Parrots: the system can support two or three times the number of Cape Parrots currently in the area. Part of our longer term plan is visits to schools and agricultural colleges in the area to teach learners about the heritage value of the archipelago of Afromontane Forest patches scattered along the Amathole mountain range and to make sure that as many people as possible know that yellowwoods are our national tree and that these forest patches deserve to be rehabilitated to their former splendour.

Beak and Feather Disease ravages local populations: weakened parrots or killer virus?

Preliminary surveys established that the body condition of Cape Parrots in the southernmost part of their distribution has been worsening for at least five years. In March 2010, we received over 30 photographs of Cape Parrots with symptoms of advanced Psittacine Beak and Feather Disease (PBFDF) infection from concerned South Africans who had been photographing Cape Parrots feeding in their pecan trees for many years and never seen anything like this before. This news was shocking and it has been our focus ever since to understand the nature of this apparent threat to their persistence in the wild.

We caught Cape Parrots in mist nets at or near the pecan orchards where they feed for part of the year. Within a week we were catching wild parrots to take blood and feather samples for PBFDF testing. The results for our first eight samples came back confirming that five of the eight birds were infected. Of the next eight birds caught, half were infected. We were clearly dealing with an outbreak. The parrots we captured were all in very poor condition, with chronic weight loss, fleas, lesions on the beak, no down feathers, and widespread feather loss and abnormalities. To our heightening concern after the first two cold snaps of the season, we began finding carcasses under roost trees. By July 2010, we had seen the feeding flock reduced from 118 to 65, with an estimated 35 PBFDF-positive parrots thought to have perished. This means around 30% of



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ABOVE Cape Parrot *Poicephalus robustus* feeding on yellowwood.

RIGHT PBFDF-positive Cape Parrot.



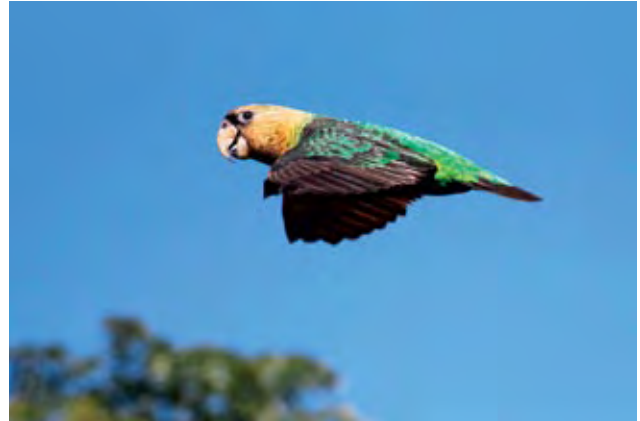
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a feeding flock which itself represents 10-15% of the global population may well have died in the space of a few months in 2010.

In 2011, we aim to capture Cape Parrots at six additional locations across their range to determine infection rates in other isolated populations: hopefully we will find a disease-free population. We are also currently using the blood samples to support the development of a vaccine and are networking with other,

international PBF D researchers. If we discover similar infection rates next year, we may have to start removing sick Cape Parrots from the wild for rehabilitation over winter in a quarantine facility, releasing them back into the wild in spring.

What caused this disease outbreak? There is no doubt that 300 years of logging has radically transformed the Afromontane yellowwood forests on which the Cape Parrots depend. Our research is increasingly revealing that Cape Parrots simply don't 'fit' into their natural habitat anymore. The forests have been altered to the point where they are simply not healthy enough to support the parrots. The birds are now forced or are choosing to (based on availability) feed on pecan nuts, plum and cherry kernels, pine nuts, acorns, apple seeds, Australian *Acacia* seeds, and several other exotic food sources that together may be far from nutritionally optimal. If they are poorly nourished (as we suspect), then they may not be strong enough to fight off the ravages of PBF D, which, similar to influenza in humans, has probably been in the wild Cape Parrot population for a very long time, but with much lower prevalence. As yet, the precise factors that precipitated the recent outbreak are unresolved. It may be that illegal traders captured Cape Parrots, kept them to produce eggs (which can be sold legally with the appropriate permits), and then released them back into the wild once they had lost condition due to poor diet and the resultant PBF D infection. It is also possible (and something we are



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exploring with molecular biologists at UCT) that the birds have been exposed to a new and more virulent strain of the PBF D virus.

Cape Parrot networking and collaboration – from local communities to Facebook

Steve Boyes and Nick Theron are currently launching the *iziKhwenene* Project, which aims to plant over 2500 indigenous tree saplings (predominantly yellowwoods) every year for the next two years and erect over 300 artificial nest boxes for parrots in suitable trees throughout the Hogsback area. We have injected much needed investment into a poorly managed, community-run indigenous tree nursery previously funded by the Danish government, by buying up their entire stock of 2000 indigenous tree saplings. We are also teaching local women to use "worm farms" to produce fertilizer and grow yellowwood saplings of their own in the potting bags provided. Teams of five local women will be supervised by our Community Liaison Officer (jointly employed by the Fitztute and BirdLife South Africa) planting up to 1000 saplings in a designated forest patch. They will then be trained how to take care of these indigenous tree saplings (which will be marked with special tape) and, following an audit by the Community Liaison Officer, will be paid R10 per sapling every six months (i.e. up to R50 000 each year). Linked to this, we have established a system whereby a sponsor can adopt an indigenous tree for five years by donating R100 to the *iziKhwenene* Project.

The *iziKhwenene* Project has also taken over the management of a pecan orchard in the grounds of the University of Fort Hare near Alice, where over 100 Cape Parrots feed daily for more than four months of the year. We have fenced this pecan orchard and have contracted women from the local community to gather the pecan nuts, de-schuck and package them. Revenue from this small business will be shared between the local women and the management of the pecan orchard.

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During 2010, the project launched a Cape Parrot Project Facebook page. Within a year, this became the largest parrot conservation group online anywhere in the world, with over 4 500 members and hundreds of photos, videos, links and posts. The group has already proven an important source of new regional collaboration, media contact, charitable donations, and new discoveries. We have discussed the role of carotenoid pigments in immune reactions, the causes of yellow feathers, and how a diet of pecan nuts could influence the health of wild parrots.

Impacts of the project

This project has only been running for a year, but the impacts it has made nationally and internationally have been very substantial. It already involves international decision makers, international funders, government agencies and their policy-makers, and local communities and their interactions with local resources. The project has garnered local support, facilitated employment and revenue, and has been well exposed in national and international media. At the time of writing, the Cape Parrot has just been adopted as the ‘emblem’ of Hogsback and will be depicted on a new arch to be built at the entrance to the village!

ABOVE Cape Parrots flocking to feed at the pecan orchard at Fort Hare.

OPPOSITE BELOW Yellowwood seedlings (mainly *Podocarpus falcatus*) ready for planting in indigenous forest patches that are lacking these iconic trees.

RIGHT Nest boxes used for Cape Parrot Project.



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Key co-sponsors

ABAX Foundation, African Bird Club, National Geographic, the National Research Foundation, Prins Bernhard Natuurfonds.

Research team 2010

Prof. Phil Hockey (PFAIO)
 Dr Steve Boyes (PFAIO Post-doctoral Fellow)
 Research assistants: Jordan-Laine Calder, Nick Theron, Kirsten Wimberger

Blue Swallows in South Africa

Here today, gone tomorrow?

THE BLUE SWALLOW *HIRUNDO ATROCAERULEA* HAS THE DUBIOUS DISTINCTION OF BEING THE BIRD MOST LIKELY TO GO EXTINCT IN SOUTH AFRICA IN THE NEAR FUTURE. HUMAN ACTIVITIES, MOST NOTABLY FORESTRY AND MINING, HAVE DRAMATICALLY REDUCED THE HABITAT AVAILABLE TO THIS MID- AND HIGH-ALTITUDE GRASSLAND SPECIALIST. THE SWALLOW'S UNUSUAL BEHAVIOUR OF BREEDING UNDERGROUND IN AARDVARK BURROWS, SINKHOLES AND ABANDONED MINESHAFTS ALSO MAKES THEM VULNERABLE TO DISTURBANCE. THE STATUS OF THE SOUTH AFRICAN POPULATION IS NOW SO TENUOUS THAT IT IS CURRENTLY THOUGHT TO INCLUDE NO MORE THAN 50 BREEDING PAIRS, DOWN FROM AROUND 80 JUST TWO YEARS AGO AND MORE THAN JUSTIFYING ITS RED-LISTING OF *CRITICALLY ENDANGERED*.

Despite concerted efforts to conserve the Blue Swallow, its decrease has continued unabated. The reasons for this are far from clear, and there are several distinctly puzzling aspects to the trend. In the summer of 2009/2010, for instance, the number of birds in Mpumalanga dropped precipitously, with no swallows breeding at well-known sites such as Kaapsehoop. Another recent, local extinction that is particularly difficult to explain involves the Blue Swallow population that formerly occurred in the Haenertsburg and Wolkberg region of Limpopo Province. Until the early 2000s, there was a small number of birds breeding in this area, but they vanished in the space of a few years. Ironically, the Wolkberg Wilderness Area is the largest conserved area in South Africa that, until recently, held the species: furthermore, the grasslands of this area have not been directly affected by human activities in any obvious way.

The South African Blue Swallow population has reached a critical point, and there is a depressingly high probability that it will disappear in the near future. A partnership involving the Fitztute and the Endangered Wildlife Trust (EWT) is currently employing cutting-edge, novel technologies in an effort to understand recent downward trends and identify ways to prevent this species' extinction in South Africa. One key challenge is that almost nothing is known about the swallows' movements between their breeding grounds (scattered from South Africa to Tanzania) and wintering areas in central Africa.

For instance, do swallows that breed in South Africa spend the winter in the same areas used by the swallows breeding in Zimbabwe and Malawi?

Traditional methods of studying bird movements have not yielded the necessary information: although more than 200 Blue Swallows have been ringed, not one has ever been recovered. Andrew McKechnie, a core team member of the Fitztute CoE based at the University of Pretoria, together with Stephan Woodborne (CSIR) and the late James Wakelin (Ezemvelo KZN Wildlife), have been investigating the use of biochemical



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techniques to infer movements between breeding and wintering grounds. The method relies on the fact that stable isotope ratios in birds' feathers reflect the geographical regions where those feathers were grown. In a paper published online in 2010 in the *Journal of Ornithology*, we showed that stable isotope ratios in feathers differ between Blue Swallows from each of the major breeding grounds (South Africa, Zimbabwe and Malawi/Tanzania), and these differences can be used to identify the origin of individual swallows on the wintering grounds in Uganda. In 2011, Ian Little (a Fitztute PhD student and now Manager of the EWT's Threatened Grassland Species Program) will be travelling to Uganda to collect feathers from wintering Blue Swallows; these feathers will provide the basis for a more detailed study of the swallows' migratory movements.

A related question concerns whether or not individual swallows return to the same breeding site each year. Although the regular use of particular nests suggests that the same breeding pairs are returning year after year, the lack of ring recoveries makes this difficult to confirm (and perhaps unlikely). Andrew McKechnie and Ian Little are exploring the use of passive integrated transponder (PIT) tags (more commonly used to "microchip" pets) as a means of identifying individual swallows. PIT tags are rice-grain sized transponders that are injected under an animal's skin, with each tag carrying a unique code that identifies an individual. This technique has proven highly successful in studies of Northern Hemisphere passerines such as Blue Tits *Parus caeruleus*, and has the advantage that returning birds can be detected without the need for recapture. In the case of the swallows, this can be achieved by positioning a receiver unit close to a nest. Any swallow carrying a PIT tag would be detected and identified by the receiver with no disturbance to the bird. Following the completion of a risk-assessment study, fledglings Blue Swallows in the KwaZulu-Natal midlands will likely be the first to receive PIT tags in early 2011.

Impact of the project

This is a species that conservation bodies have studied for many years, primarily in South Africa. However, the information gathered to date has not led to management interventions that have succeeded in halting the species' slide towards extinction. Hopefully, the insights from this new project will prove crucial in effectively conserving the swallows, because the birds' survival and breeding success may be influenced not only by conditions in breeding areas, but also by factors operating on the wintering grounds or along migration routes. The solution to their conservation may thus lie outside the borders of South Africa.



© WIM DE GROOT

OPPOSITE Grassland habitat of the Blue Swallow *Hirundo atrocaerulea*.

ABOVE AND BELOW Only a handful of Blue Swallow chicks are produced in South Africa each year.



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Key co-sponsors

Endangered Wildlife Trust Threatened Grassland Species Programme, University of Pretoria.

Research team 2010

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

Ian Little (EWT Threatened Grassland Species Program)

Dr Stephan Woodborne (CSIR)

Prof. Mathieu Rouget (Univ. Pretoria)

Southern Ground-Hornbill

Research and Conservation Project

THE SOUTHERN GROUND-HORNBILL *BUCORVUS LEADBEATERI* IS A CONSERVATION ICON OF SOUTH AFRICAN SAVANNAS. DURING THE COURSE OF THE 20TH CENTURY ITS RANGE AND POPULATION SIZE 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-HORNIBILLS IN SOUTH AFRICA HAS BEEN ELEVATED FROM *VULNERABLE* TO *CRITICALLY ENDANGERED*. IN MANY CASES, HOWEVER, THE DRIVERS OF LOCAL EXTINCTIONS ARE KNOWN, AND IN SOME INSTANCES THESE ARE NO LONGER OPERATIVE. BECAUSE OF THE GROUND-HORNIBILLS' 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.

The key questions being addressed are:

- What combination of environmental conditions promote the survival and successful reproduction of Southern Ground-Hornbills?
- How can this knowledge be used to identify areas previously occupied by ground-hornbills that are now suitable for their reintroduction?
- What scientific information is needed to guide reintroduction programmes such that their efficiency and efficacy are optimized?

OPPOSITE LEFT As dusk approaches, Southern Ground-Hornbills *Bucorvus leadbeateri* move into large trees to roost.

OPPOSITE RIGHT Most Southern Ground-Hornbills lay two eggs, but only one chick will survive. This paves the way for harvesting and captive-rearing of second chicks.

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What drives breeding success?

This study is based at the Associated Private Nature Reserves (APNR) in the South African lowveld adjacent to Kruger National Park. Covering 180 000 ha, this is one of the largest privately owned nature reserves in the world. We have been monitoring group distribution, composition and breeding performance of ground-hornbills at the APNR since the breeding season of 2001/2002. For most of the groups, we have erected artificial nests within their home ranges (mainly because evidence suggests that suitable, natural nest-cavities are few and far between). We now have reproductive data spanning nine breeding seasons and, by early 2011, will have completed 10 years of monitoring. Currently, two full-time field assistants are employed on the project – Quentin Hagens and Sieglinde Rode.

In 2009/2010, MSc CB student Gwyneth Wilson analysed the first eight years of data (2001-2008) from this long-term monitoring to determine the factors influencing differences in reproductive performance between groups. Over the period 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 accounting for 60% of all fledglings produced. These seven groups all bred in artificial nests: only five of the 23 groups bred in natural cavities. Of these latter groups, three groups did not fledge a single chick over the eight years.

Reproductive success was influenced primarily by rainfall, the interaction of nest type with the amount of open woodland in the vicinity of the nest, and group



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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 Gwyneth's findings arose the challenge of understanding how the ground-hornbills use their large home ranges (some perhaps as large as 100 km²). This is where satellite tracking comes into play – the nature of the terrain in the APNR (coupled with interference from elephants, rhinos, buffalos, lions, etc) makes it impossible to follow groups for protracted periods on foot. We currently have five groups transmitting data and efforts to catch a further two groups are ongoing.

No ground-hornbill has ever been satellite tracked previously (so this study represents a 'world first'). Satellite data will allow us to test the results of Gwyneth's *a posteriori* analysis of correlates of breeding success against how successful and unsuccessful ground-hornbill groups utilize the available habitats within their home ranges. Because of previous monitoring efforts, this can be done in a rigorous scientific manner involving true hypothesis testing.



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ABOVE AND RIGHT Catching ground-hornbills is a time-consuming business involving a large trap and life-sized decoys wired for sound to attract the wild birds.

BOTTOM Researchers at the APNR have to keep their eyes open for creatures other than ground-hornbills.



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Data are transmitted once an hour, starting before sunrise and ending after birds have entered their night-time roosts. The data come in the form of GPS fixes accurate to within a few metres – these are then overlaid on a detailed geo-referenced vegetation map of the study area. This in turn allows us to see a) whether (as predicted from Gwyneth’s analysis of breeding performance) they favour certain habitats over others; b) how, in terms of vegetation structure, the home ranges of successful groups differ from those of less successful groups; c) how habitat use changes with time of day (with birds predicted to use denser, more shady vegetation in the heat of the day, especially in summer); and d) how patterns of habitat use change with season (with birds predicted to travel further and perhaps expand their home-range sizes in the dry winter months when food may be scarce).

Receiving and analysing satellite data are ongoing elements of the project: we hope that the transmitters will continue to work for the next three years. The data are extremely valuable as they are the only means we have of knowing where the birds are and when. However, economics dictate that we do not receive data more than once an hour, which means that we do not have continuous coverage of the birds’ movements. To determine how much data we may be losing by having only hourly fixes, in 2010 we undertook a parallel project at Mabula Game Reserve (UCT Honours student Jeremy

Dickens), with the aim of ‘calibrating’ the satellite data. At present, the only group of ground-hornbills in the wild at Mabula is a habituated group of four birds, which contains one chick reared by the group in the wild (in the summer of 2008/09). Because the birds are habituated, an observer can follow the birds in the field without altering their behaviour. Jeremy followed the birds on foot, gathering real-time data (including GPS data, mimicking the satellite tags). He also recorded the birds’ activities as a function of time of day and ambient



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temperature. By comparing data from the Mabula birds at intervals of 5, 15, 30, 45 and 60 minutes we were able to determine how much information we 'lose' by only having hourly fixes from the APNR (e.g. how much further do the birds travel, and how many vegetation transitions do we miss?). This now allows us to place confidence limits on our interpretations of APNR data. We were also able to determine how many satellite hits are needed to obtain an accurate measure of home-range size (about 3000!).

We now have an extensive and ever-growing set of satellite-derived data, comprising literally thousands of 'hits'. These data will feed into three sets of management decisions. Firstly, identifying where bush clearance could be carried out within the APNR to provide maximum benefits to ground-hornbills; secondly, identifying optimal sites for the deployment of artificial nests within the APNR; and thirdly, identifying which areas of Mabula (and the adjacent 80 000 ha of conservancy to which we have access) contain optimal habitat configurations for the reintroduction of ground-hornbill groups.

Harvesting for reintroduction

Relative to the ground-hornbill population in the adjacent Kruger National Park, average reproductive success in the APNR is high (nearly double). Although ground-hornbills almost invariably lay two eggs, only one chick is reared to fledging (and in all but one instance at the APNR, this is the first-hatched chick). This provides the potential for 'harvesting' second chicks in the APNR that can be used to supplement the captive populations at Johannesburg Zoo and Loskop Dam which in turn will provide the birds for the reintroduction programme at Mabula (and, in time, elsewhere). The proposal for harvesting was approved by the Joint Committee of the APNR in mid-2010, and by the end of 2010 (at the start of the 2010/11 breeding season), three second chicks had been harvested at the APNR: we plan to harvest a further three in early 2011.

Impact of the project

In late 2009, we completed and distributed a 10-minute DVD about the ground-hornbill project, to be used in part for the leverage of future funding for the project. Subsequent to this, in 2010 Dow Southern Africa recommitted their sponsorship of the project at a generous level. In 2010, in conjunction with Wild Africa Productions we completed a 50/50 mini-documentary for SABC (screened in August). We also completed a

full-length documentary for international distribution (reviewed in the USA and France). Purchasing negotiations for the documentary are currently underway. In 2010, we signed an MoU with the Ground-Hornbill Reintroduction Programme currently operating at Mabula Private Game Reserve, with the aim of providing scientific input from our APNR study to optimize the efficiency and efficacy of the Mabula reintroduction programme. Rob Little serves on the Mabula Ground-Hornbill Project Advisory Board as the link between the Fitztitute and the Mabula project.



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Key co-sponsors

Dow Southern Africa (Pty) Ltd, Associated Private Nature Reserves, the Hans Hoheisen Charitable Trust, Senalala Game Lodge, Wild Africa Productions.

Research team 2010

Prof. Phil Hockey (PFIAO)
 Research Assistants: Quentin Hagens, Sieglinde Rode
 Students: Gwyneth Wilson (CB MSc), Jeremy Dickens (BSc Hons)

ABOVE AND RIGHT Large, artificial nests and a portable sound system are integral components of the ground-hornbill study.

Birds on a wire

The impacts of power line collisions on bustards and cranes



LARGE, OPEN COUNTRY BIRDS SUCH AS BUSTARDS AND CRANES ARE RELATIVELY CUMBERSOME IN FLIGHT, AND ARE UNABLE TO REACT RAPIDLY WHEN THEY ENCOUNTER AERIAL OBSTRUCTIONS. HISTORICALLY, THEY HAVE HAD THE FREEDOM OF OPEN SKIES, BUT THE PROLIFERATION OF POWER LINES AND OTHER AERIAL HAZARDS POSES A SIGNIFICANT THREAT TO THESE BIRDS. SOUTHERN AFRICA HAS A RICH HERITAGE OF BUSTARDS AND CRANES, WITH SEVERAL ENDEMIC SPECIES. THIS PROJECT INVESTIGATES THE CONSERVATION IMPLICATIONS OF POWER LINE COLLISIONS ON BUSTARDS AND CRANES IN THE KAROO AND OVERBERG REGIONS OF SOUTH AFRICA.

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The problem of large birds colliding with power lines and other man-made structures is not new, but it remains a significant problem and one that requires practical solutions as power grids and wind energy projects expand across the landscape. This project, run in conjunction with the Endangered Wildlife Trust's Wildlife and Energy Programme, assesses the population-level impacts of collision mortality on large birds and tests the effectiveness of possible mitigation measures. The main focus is on Ludwig's Bustards *Neotis ludwigii* and Blue Cranes *Anthropoides paradiseus*, but several other species also are of concern, particularly Kori Bustards *Ardeotis kori*.

PhD student Jess Shaw started working on power line collisions in the Overberg for her CB MSc project in 2008/09, so it was a fairly easy transition to extend her study into the Karoo, where Mark Anderson, now Director of BirdLife South Africa, has shown worryingly high rates of collision mortality among Ludwig's Bustards in the eastern Karoo. Subsequent surveys by Andrew Jenkins confirmed that Ludwig's Bustards are at risk throughout their large range, with a crude estimate

of around one bird killed per kilometre of high tension power line per year. Others die on distribution lines and even fences. Although we know very little about the population dynamics of the bustard, it is unlikely that this level of mortality is sustainable, and the species has been uplisted to *Endangered*, pending further study.

Jess spent most of 2010 criss-crossing the Karoo, checking beneath power lines for dead birds as well as repeating David Allan's road surveys of bustards conducted in the late 1980s. Preliminary results suggest that numbers of Ludwig's Bustards have decreased by as much as a half over the last two decades. The power line surveys continue to show high rates of mortality,



AB&B 14(2):34-39.

although this is quite patchy, linked to the bustards' seasonal and nomadic movements. For example, more than 30 Ludwig's Bustards were killed along 8 km of power line near Vanrhynsdorp over three months. To obtain a robust estimate of collision rates we still need to assess how long carcasses remain under the lines, especially given high densities of scavengers in the Karoo.

Understanding bustard movements and habitat use is crucial to tackling the problem, and GPS-logging satellite tags were deployed on three male bustards in Namaqualand during spring 2010. This required catching the bustards, which is no easy task given their flighty nature. Jess borrowed some leg noose traps, and after some experimentation, Ben Dilley set about mass production of a more robust model that allowed large areas to be seeded with traps. The trick is anticipating where the bustards will feed – and then it's just a matter of patience, waiting for a bustard to get caught. We also caught some sheep, but these we released without being tagged!

It has long been known that Ludwig's Bustards move into Namaqualand in winter, but it was unclear whence these birds came. David Allan's road counts couldn't detect a summer influx into the eastern Karoo, but all three tagged bustards moved east, in a series of long flights covering up to 250 km per day. Between these flights, they are reasonably sedentary, moving only a few kilometres each day. More transmitters will be deployed on Ludwig's Bustards in 2011.

In terms of mitigation, a large-scale experiment of line-marking devices has been designed centred on the EWT's long-term monitoring site near De Aar in the eastern Karoo. Unfortunately, we are still waiting for the lines to be marked by Eskom. However, making the lines more visible may not be particularly effective. Jess worked with Prof. Graham Martin from Birmingham University to assess the visual fields of affected birds. In a paper published in *Biological Conservation* in 2010 they reported that both bustards and cranes have limited forward vision in flight if they are scanning the ground.

Impact of the project

All the evidence suggests that current levels of collision mortality are unsustainable for Ludwig's Bustards, and possibly for Kori Bustards. Urgent action is needed to redress this problem, especially given the planned development of windfarms throughout large parts of the region. Additional studies also are needed in Namibia, where most of the Ludwig's Bustards outside South Africa occur. Jess attended a NamPower/Namibia Nature Foundation Workshop in Keetmanshoop in October 2010 to help set up monitoring of bird casualties along power lines in Namibia.



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ABOVE A Ludwig's Bustard takes to the air and towards potential danger.

BELOW Jess Shaw and Ross Wheeler fit a bustard with a GPS-satellite transmitter.



© DELIA DAVIES

Key co-sponsors

The Abax Foundation, Endangered Wildlife Trust, Eskom, Mazda Wildlife Fund and the Mohamed bin Zayed Species Conservation Fund.

Research team 2010

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Jon Smallie (Endangered Wildlife Trust)

Students: Jess Shaw (PhD)

Research assistants & volunteers: Lola Brookes, Ben Dilley, Maike Hamann, Conette Koorts, Ross Wheeler



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Coastal birds

Lessons for conservation

AFRICA'S SHORELINE RANGES FROM DESERT COASTS THROUGH ROCKY SHORES AND TEMPERATE SALT MARSHES TO LUSH MANGROVE ESTUARIES AND TROPICAL EMBAYMENTS. EARLY FITZ COASTAL RESEARCH EXAMINED THE ROLE OF SHOREBIRDS IN ENERGY FLOWS AT LANGEBAAN LAGOON (PROMPTED BY A PROPOSED DEVELOPMENT), AND, WITH THE WESTERN CAPE WADER STUDY GROUP, WE SURVEYED COASTAL BIRD NUMBERS ALONG ALMOST THE ENTIRE COASTLINE OF NAMIBIA AND SOUTH AFRICA. THESE SURVEYS PROVIDED BASELINE DATA AGAINST WHICH IT HAS BEEN POSSIBLE TO MONITOR AND EVALUATE SUBSEQUENT CHANGES IN SPECIES' POPULATION SIZES.

Since the early 1980s, our shorebird research has expanded to East Africa, Madagascar, other islands in the tropical Indian Ocean, and north to the Canary Islands and the Persian Gulf. The last three decades of research can be grouped into six themes: interactions between shorebirds and their invertebrate prey; how prey abundance and productivity influence the local and global distributions of migratory species; factors influencing shorebird population dynamics; conservation risks to migratory species; how artificial coastal wetlands can best be managed to improve the environment for shorebirds; and, what causes rare shorebirds to be rare.

The results of these studies have been exciting. Among other things, we found that densities of migratory shorebirds increased along the East Atlantic Flyway from Europe south to the Cape, with densities

being highest furthest from the breeding grounds. This counter-intuitive pattern could be explained in terms of regional differences in availability of food. As shorebirds travel farther south, the timing of the residency period increasingly coincides with the growth and reproductive season of their prey. Birds reaching the far south coincide perfectly with peaks in reproduction of their prey, allowing southern estuaries to support far higher densities of birds than their northern (or Equatorial) counterparts.

Oystercatchers, seabirds and people

Today, oystercatchers form the focus of our coastal bird research. The endemic African Black Oystercatcher *Haematopus moquini* is the only species of oystercatcher to breed in Africa, where it is confined to the coasts and offshore islands between Lüderitz

African Black Oystercatcher *Haematopus moquini*

and the Eastern Cape, with a handful of pairs in southern KwaZulu-Natal.

Our initial research concentrated on breeding and feeding ecology, roosting behaviour, and juvenile dispersal. It soon became clear that these birds have a major impact on the intertidal ecosystem, especially on islands where oystercatcher densities are an order of magnitude greater than on the adjacent mainland. In the early 1980s, together with George Branch of UCT's Zoology Department, we started to study this predator-prey interaction in earnest. Oystercatchers have a major impact as predators, especially of limpets, and influence the entire structure of the littoral communities – from the positioning of limpets on the shore to their reproductive output, persistence and even their shell shapes.

In 1983, Alison Bosman started a PhD examining how shorebirds influence intertidal community structure in South Africa. Not only did Alison investigate the top-down effects of predation, she also explored bottom-up effects that influence why mainland and island littoral communities looked so different (for example, the rich high- and mid-shore algal mats of the islands are absent on the mainland).

It transpired that the ultimate driver of high oystercatcher densities on islands was seabird guano. Wind and rain blow and wash guano-derived nutrients into the waters surrounding islands, forming a rich nutrient soup that stimulates littoral algal communities to grow ten times faster on islands than on the mainland. Algal spores and sporelings provide food for filter-feeding mussels and grazing limpets, allowing them to grow faster and reach larger sizes on islands than on the mainland. Of importance however, is that some of the invertebrates grow too large for the



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Crab Plover *Dromas ardeola*: a Fitzitute study species in both Kenya and the UAE.

oystercatchers to eat – these large individuals are responsible for most of the reproduction and are thus key to the persistence of the invertebrates. If mainland oystercatchers occurred at the same density as those on islands, Alison showed that they would exhaust their food supply. This proved to be seminal because it was one of the first marine demonstrations of how bottom-up and top-down forcing factors interact. Indeed, it is still used as a case study in at least one international text book.

This understanding of oystercatchers and their prey prompted two research expeditions to the Canary Islands, once home to Africa's only other oystercatcher – *H. meadewaldoi*. The first expedition concluded that the species was indeed extinct, while the second allowed us to explain the process that led to its extinction (published in *Biological Conservation*).



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ABOVE Invasive Mediterranean Mussels (the blue ones) have increased the food available to oystercatchers.



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RIGHT A student at the Biodiversity Academy quantifies the extent of alien mussel invasion at De Hoop Nature Reserve.



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As a spin-off from this study, we developed an interest in the interaction between human predators and the same intertidal prey. We studied predation of intertidal organisms by indigenous peoples in the former Transkei and showed, also for the first time, that regardless of the initial composition of a community, human exploitation drove all communities towards a common, degraded state. One of the best-cited papers from these studies was published in *Oikos* and the studies contributed to a Fitztute-edited book on human exploitation of the shore, published by Springer-Verlag.

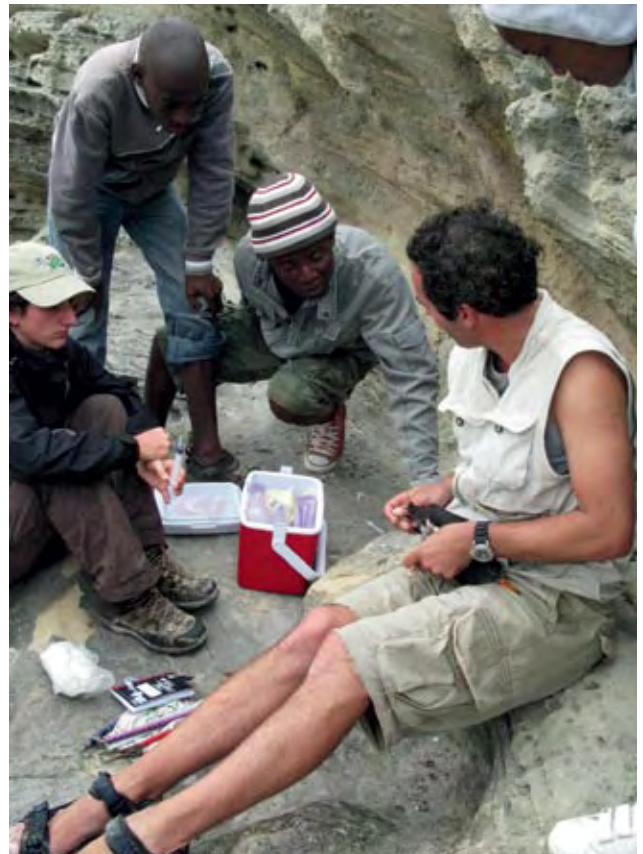
An alien aids a recovery plan

While these spin-off projects were underway, we continued to collect demographic data about oystercatchers on the west coast islands. This was auspicious in the extreme, because by the mid 1980s, we became aware that the shore was changing – blue mussels were appearing in the mid-intertidal zone. We were witnessing the start of a marine invasion by the alien Mediterranean Mussel *Mytilus galloprovincialis*. This invasion not only changed the shore – it also changed the diets, lives and prospects of oystercatchers. At the time, we had just completed an assessment of the global population size of African Black Oystercatchers. The total of only 4590 birds was cause for concern and precipitated the species' arrival in the *IUCN International Red Data Book*.

During the 1980s, *Mytilus* came to dominate the diets of west coast oystercatchers, and birds on the islands

started to produce an increasing proportion of two- as against one-chick broods: by the early 1990s, numbers of breeding birds started to increase.

However, elsewhere in their range, there was increasing concern about the impacts of burgeoning coastal developments, the use of off-road vehicles on the coast (especially during the birds' summer breeding season), and chick mortalities caused by uncontrolled dogs. In response, during January 1998, the Fitztute launched the Oystercatcher Conservation Programme (OCP) to develop a conservation strategy for the species that would also contribute to the conservation of other coastal species; and to promote awareness of the conservation needs of South Africa's coast. The OCP received massive support leading to many information boards around the coast, widespread distribution of newsletters, brochures and car stickers, talks to numerous interested bodies and the production of a 25-minute documentary for the television programme 50/50. We held a workshop in conjunction with Marine and Coastal Management (MCM) to determine how closely oystercatcher and fish priority conservation areas coincide and to prioritise coastal conservation areas for oystercatchers. Interestingly, of the 35 key sites for oystercatchers, eight were



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TOP Ritualised piping displays help maintain territory boundaries.

RIGHT Post-doctoral Fellow Doug Louwenthal explains the ringing and blood-sampling procedures.

OPPOSITE Invasion of an alien mussel has contributed to an increase in the global population size of African Black Oystercatchers.

already closed to shore angling and another 18 were considered priority areas for fish conservation. In 2000, vehicles were banned from South Africa's beaches – a move towards which the OCP had significant input (and today we still advise MCM on beach-driving permit applications).

While oystercatchers and coastal conservation were flying high in the public eye, behind the scenes we realised that long-term oystercatcher demographic data sets were a priority and the Fitz had been instrumental in setting some of these up as far back as the mid 1980s (before the *Mytilus* invasion took off). These data sets, involving more than 300 observers and spread between southern Namibia and East London, have given us unparalleled insights into the population dynamics of oystercatchers.

Back in the 1980s, when colour-ringing oystercatcher chicks, we concluded that most do not travel more than 150 km from home. How wrong we were!! In January 1999, Phil spent time at Swakopmund and Walvis Bay and found several ringed youngsters from as far away as Knysna, and subsequently one juvenile travelled 2500 km from East London to Walvis Bay. This changed our thinking about oystercatchers – not least because the birds that travel this far come back home to breed where they themselves were born. Unravelling the reasons behind these journeys has become a real challenge.

MSc student Antje Leseberg set out to investigate habitat use by oystercatchers at these Namibian nursery sites and the implications for their conservation. A few years later, in 2003, another MSc student (Anu Rao, from the University of Newfoundland) undertook a more extensive study of habitat use by young oystercatchers around the South African coast. We now know a great deal about where and when they go, the habitats they use and the proportions of youngsters that disperse different distances. Still largely unknown is how much of the behaviour is controlled by features of the environment and how much of it is a genetically inherited 'travel plan'. There is evidence for both, although preliminary findings suggest that ecological factors may be the primary driving force.

2005-2010: population dynamics, floaters and resilience

Oystercatchers sit well towards the 'k' end of the animal life-history spectrum (being long-lived and reproducing slowly). For *k*-selected animals, when a problem is detected (e.g. reduced numbers of breeders) the cause has been there for many years and may be irreversible. Also, if populations of *k*-selected species remain constant for long periods, it is difficult to understand their population dynamics. Oystercatchers have undergone marked changes in population sizes over the 30 years of the Fitztute's study. We have seen periods of





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ABOVE Lack of disturbance during the oystercatchers' summer breeding season is key to their success.

increase, rapid decreases, rapid recoveries and periods of stability. Overall, however, the news has been good. In 2007, Honours student Philip Haupt re-estimated the global population size to compare with the 1983 estimate. During 1980-2007, numbers rose from 4 590 to 6 670 birds. We can make sense of this by analysing age-related survival, reproductive output, age of first breeding etc. Thanks to an Honours project by Megan Laird in 2007, we can even factor in effects of climate change: oystercatchers breed more successfully in cool than in hot summers, raising a potential red flag.

Recently, models to explain past changes and to predict future scenarios have been developed by PhD student (now Post-doctoral Fellow) Doug Loewenthal. We can now show that both enhanced food (invasion by *Mytilus*) and increased protection (more Marine Protected Areas and coastal National Parks, as well as the vehicle ban) have benefited oystercatchers. But we have also entered the realm of

broader ecological/demographic studies. Animals that are territorial year-round can only increase breeding populations in two ways: the geographical range must increase and/or territories must become smaller. The oystercatcher's geographical range has expanded some 350 km to the east, but the small numbers of birds within this new section of the range cannot explain the overall 45% increase. The conclusion from this is that territories have shrunk – on some west coast islands, numbers of breeding birds have more than doubled in the past three decades.

This could happen either by young, sexually mature birds (floaters) pressuring their way into the population by 'ganging up' and forcing established adults to reduce territory size (a 'density-dependent effect'), or, in changing environments (e.g. more food and/or less disturbance), by adults 'voluntarily' reducing territory size, allowing new breeding pairs to establish (a 'density-independent effect'). Distinguishing between these two processes is not easy, but the implications of which process is operating are profound.

The density-dependent hypothesis is attractive – as the numbers of floaters build up, it seems obvious

that collectively they can influence breeding adults. However, even when models incorporate strong density dependence, 'model' breeding populations continue to increase, including in instances where we know that the real-world breeding population has stabilised. Density-dependent processes therefore cannot explain what is really happening. However, when models are driven by decisions of the breeding adults (rather than by war-like intentions of the floaters), the models mirror the real world very closely. Floaters must queue for a breeding position (some wait more than 10 years!) and these only arise when either a breeding adult dies (only 3-4% die per year) or when adults shrink their territories. The latter turns out to be the primary means by which floaters become breeders. Thus, when breeder numbers remain stable (assuming the production of chicks also remains stable), floater numbers will gradually increase. If there is a sudden mass mortality event – such as at Saldanha Bay in 1978 when an outbreak of Paralytic Shellfish Poisoning killed half the oystercatcher population – breeder numbers can recover rapidly, but floater numbers decrease, reducing the ability of floaters to buffer the breeder population should such mortality events happen in rapid succession.

Many species of territorial birds whose populations are much smaller than that of the African Black Oystercatcher are of sufficient international conservation concern that their populations are closely monitored – or are they? Such monitoring schemes typically target breeders and have no idea of how many floaters are sitting in the wings to buffer this breeding population. Should the breeder numbers fall, this means that the floaters have already been used up. We were able to demonstrate this effect for Aldabra Flightless Rails *Dryolimnas aldabranus* which are confined to four islets within the tropical atoll of Aldabra. Ross Wanless's MSc research was able to quantify the sizes of both the breeder population and the floater population. The rails are vulnerable to introduced terrestrial mammals, explaining their disappearance from other islands in the vicinity, as well as from the largest Aldabran islet of Grande Terre, where feral cats abound. Grande Terre adjoins Malabar Island, home to the majority of the remaining rails. We were able to model the impacts of cats arriving on Malabar. If 60 cats were present, the breeding



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population of the rails would remain unchanged for 11 years: thus, monitoring of *breeder* numbers would indicate no impact of cats for more than a decade. After 11 years, however, the floater population would have been used up and breeder numbers would fall rapidly. Eight years later, the Malabar rails would be extinct.

Doug, Ross and Phil presented a paper about the key role of floaters at the International Ornithological Congress in Brazil in August 2010. This was well received and we were invited by the Editor of *The Journal of Applied Ecology* to write a 'forum' article on the subject.

Impact of the oystercatcher project

Over the years, the oystercatcher project has had a significant public impact, being widely exposed in most media, from signage to newspaper and magazine articles (at least 14 semi-popular articles have appeared in magazines), and airing on radio and television. The project has also involved more than 300 members of the public in data collection in Namibia and South Africa and is used as a training ground for students from HBUs at our annual Biodiversity Academy at De Hoop. Our ability to identify the primary causes of human-induced oystercatcher mortality, and the life-history phase in which this threat is greatest (the first two weeks after hatching) has also influenced beach-use legislation at municipal, provincial and national level, receiving support from state bodies such as Marine and Coastal Management. Scientifically, the project and its immediate spin-offs have produced some 40 papers in international, peer-reviewed journals and chapters in international books. The project has further graduated two Honours, three MSc and three PhD students.

Key co-sponsors

The Cape Bird Club, CapeNature, Endangered Wildlife Trust, Marine and Coastal Management, Mazda Wildlife Fund, MTN, Namakwa Sands, Roger Jeffery, SANParks, South African Navy, the Tony and Lisette Lewis Foundation, Total Foundation and WWF-SA.

Research team 2010

Prof. Phil Hockey (PFIAO)
Dr Doug Loewenthal (PFIAO Post-doctoral Fellow)

Black Harrier research and conservation



THE BLACK HARRIER *CIRCUS MAURUS* IS AMONG SOUTHERN AFRICA'S RAREST ENDEMIC BIRDS, WITH THE GLOBAL POPULATION NUMBERING LESS THAN 2000 INDIVIDUALS.

MOREOVER, PRELIMINARY EVIDENCE SUGGESTS A LACK OF GENETIC DIVERSITY IN THIS SPECIES, POTENTIALLY 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.

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There are three major components to this project:

- An overview of the species' life history in different regions of South Africa. Results from more than 150 nest sites and 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) the species exhibits strong Reversed Size Dimorphism (females larger than males).
- An investigation of the influence of climate change on behaviour and breeding has recently been initiated to determine if the higher breeding success at the coast is a result of cooler, more equitable temperatures relative to hotter, inland environments.
- 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 12.5 g each.

Two tagged harriers breeding in the west coast area undertook local movements within the west coast region. After breeding, a male from the West Coast National Park spent most of his time within 40 km of his breeding area, while a female from Koeberg moved north to Cape Columbine, before both returned to their breeding areas. However, a third bird, a female that bred at Nieuwoudtville in Namaqualand headed south towards the coast before turning abruptly east and heading 1 000 km across the Karoo and into the Drakensberg foothills – all 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 of 1 600 km was cut short when she was found dead near power lines in the northern Free State in mid February. A journey of this magnitude was completely unpredicted – she had travelled the entire width of the known global range of Black Harriers in two weeks, highlighting the importance of modern technology in revealing aspects of behaviour that would otherwise go unrecorded.



© CAT SIMMONS

OPPOSITE A satellite-tagged male Black Harrier *Circus maurus* provisioning food for his young.

ABOVE RIGHT A female Black Harrier incubates quietly at her ground nest, sensitive to the slightest noises around her and at risk from terrestrial predators.

ABOVE Small hands are needed for those delicate knots: Black Harriers are among the first raptor species to be satellite tagged in Africa.



© MARK ANDERSON

Reporting of this journey to a wide network of harrier-helpers led to the proposal of film documentary on the life and movement of this enigmatic endemic raptor. The Home Brew film crew completed interviews and HD filming on the west coast in 2010, capturing new footage including hatching and cannibalism not previously recorded. Two short films and the documentary itself will be aired in 2011 and will help give publicity to the plight of the species and the trials and successes of studying such a rare bird.

Key co-sponsors

Hawk Mountain (USA), CapeNature, Jakkalsfontein Private Nature Reserve, Natural Research (UK), Rondeberg Nature Reserve and SANParks.

Project team 2010

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 Dr Jeremy Fuchs (Post-doctoral Fellow)
 Dr Mike McGrady (Natural Research, UK)
 Dr Keith Bildstein (Hawk Mountain Sanctuary, USA)
 Dr Phoebe Barnard (SANBI & Honorary Research Associate)
 Esme Beamish (MSc)
 Students: Kirsten Retief (BSc Hons)

Racing against time

Conserving western Angola's forests



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THE FORESTS OF WESTERN ANGOLA FORM THE HEART OF THE WESTERN ANGOLA ENDEMIC BIRD AREA, HOME TO FOURTEEN RANGE-RESTRICTED BIRD SPECIES, INCLUDING FIVE SPECIES LISTED AS *ENDANGERED*. UNFORTUNATELY, A BURGEONING RURAL POPULATION AND RAPID ECONOMIC GROWTH HAS PLACED THESE FORESTS AND THEIR BIOTAS UNDER SEVERE THREAT. A TEAM OF DEDICATED BIOLOGISTS IS STRIVING TO IDENTIFY THE REMAINING FOREST FRAGMENTS AND TO DOCUMENT THEIR BIODIVERSITY. AT THE SAME TIME, THEY ARE ESTABLISHING PROGRAMMES TO PROMOTE FOREST CONSERVATION AMONG LOCAL COMMUNITIES.

Political instability and civil war between 1974 and 2002 limited access to much of Angola, affecting researchers and local people alike. Following the cessation of hostilities, intrepid birders exploring areas last surveyed in the early 1970s found over-grown coffee estates teeming with birds. But since then, rural communities have mushroomed, re-commencing subsistence farming activities and placing increasing pressure on the already fragmented forest remnants. This project identifies remaining habitat patches, maps the distribution of key species, and assesses resource use among surrounding communities.

During 2010, the main focus of work was on the Afromontane forest patches of Mount Moco, Angola's highest mountain. A large team of 26 biologists,

sociologists and environmental educators spent a week working in the region in July, cataloguing the plants, butterflies, small mammals and birds. They also established a nursery to grow trees for forest restoration work, arranged an environmental art competition at the local primary school and produced a short documentary on the project. Regular follow-up visits have been made to promote forest conservation further among local communities. The main goals are to reduce human impacts through extractive use of forest resources, and restore forests through a tree-planting programme.

TOP The African Paradise Flycatcher *Tersiphone viridis* is one of the widespread species found in Angola's Afromontane forests.

BOTTOM Martim Melo searches for birds in a Mount Moco forest.



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Fuel-efficient stoves have been received enthusiastically, and four part-time jobs created to run the tree nursery.

A pilot project was also launched at Kumbira, one of the most important remaining patches of lower elevation escarpment forest. In September, Michael Mills, MSc student Aimy Cáceres and botanist Francisco Gonçalves spent three weeks in the field, conducting bird and vegetation structure surveys to establish the distribution, abundance and habitat requirements of threatened endemic birds. They also mapped the local communities, conducted preliminary resource-use surveys and held a meeting with the Administrator of Conda to discuss the possibility of acquiring land for a nature reserve in the Kumbira area.

In an exciting new discovery, extensive patches of Afromontane forest were found at the remote Mount Namba, making this site the most important in Angola for this scarce habitat type. The area contained healthy populations of *Endangered* Swierstra's Spurfowls *Pternistis swierstra*, as well as numerous other species including Angola Slaty Flycatcher *Dioptrornis brunneus* and Grey-striped Spurfowl *Pternistis griseostriatus*. Swierstra's Spurfowl has also been rediscovered at Tundavala near Lubango. Ranging further afield, Michael and Martim made important observations of the very poorly known Black-tailed Cisticola *Cisticola melanura*, making the first recordings of its vocalisations and capturing one bird for genetic samples.

Impact of the project

The alarming rates of forest loss in western Angola require urgent conservation action. This project uses

TOP Michael Mills looks over one of the small forest patches remaining on Mount Moco.

BOTTOM Martim and Michael work into the night processing birds

rapid biodiversity survey techniques to identify critical habitat fragments, works with local communities to reduce human impacts on the forests, and raises awareness about the importance of the region. During 2010, Michael Mills published a paper describing the conservation status of avian communities in the escarpment forests of central Angola in *Biodiversity & Conservation*, and a paper on the avifauna of Mt Moco was accepted by *Bird Conservation International*.



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Key co-sponsors

Tasso Leventis of the A.P. Leventis Ornithological Research Institute (Nigeria), Rufford Small Grants Foundation, the Conservation Leadership Programme, the Clancey Fund (PFIPO), the Conservation Fund of the African Bird Club, Julian Francis and the International Turaco Society.

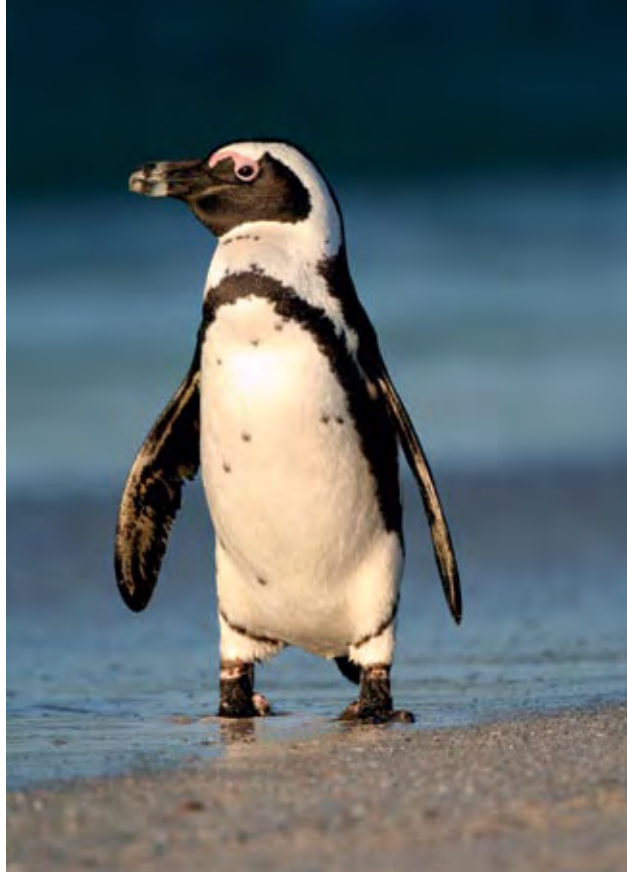
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Seabirds and fisheries

Managing competition and accidental mortality

SEABIRDS ARE AMONG THE MOST THREATENED GROUPS OF BIRDS, 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. THE FITZPATRICK'S 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. THIS SECTION REPORTS ON THREATS AT SEA, PRINCIPALLY THOSE LINKED TO INTERACTIONS WITH FISHERIES.



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The west coast of southern Africa is one of the world's major upwelling zones, the Benguela ecosystem. Southerly winds and Coriolis forces combine to push surface waters offshore, driving the upwelling of cold, nutrient-rich bottom water. As this water moves offshore, it warms, supporting blooms of large-celled phytoplankton that form the basis of a short, efficient food chain leading through zooplankton and small pelagic fish to a host of predators, including a range of commercial fisheries. Seabirds are well represented despite the paucity of safe breeding islands, with seven species endemic to the region, and many non-breeding migrants visiting from colonies in the Southern Ocean and Palearctic. The aggregation of large numbers of seabirds in waters with many fisheries inevitably leads to conflicts, including both competition and accidental mortality.

Competition with fisheries

Among the locally-breeding seabirds, three species dominate in terms of numbers and biomass: African Penguins *Spheniscus demersus*, Cape Gannets *Morus capensis* and Cape Cormorants *Phalacrocorax capensis*. All feed largely on small pelagic fish (mainly anchovies



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Engraulis encrasicolus and sardines *Sardinops sagax*), although the gannets are able to scavenge discards and offal from fishing boats, and Cape Cormorants can forage inshore on a range of small, benthic fish species. Numbers of all three of these seabirds have decreased over the last few decades, linked in part to increased predation by Cape Fur Seals *Arctocephalus pusillus* and other predators. However, the greatest problem for these species appears to be a reduction in food availability linked to changes in the distribution and abundance of small pelagic fish in the Benguela region. Since the mid-1990s, pelagic fish have shifted from the west coast to the south coast. The reasons for this shift appear to be linked to environmental change, but it is making life difficult for the seabirds and the purse-seine fishery alike, because the fish have moved away from their traditional fishing areas. The fishery has to contemplate making the costly decision to move their base of operations, whereas seabirds are stuck because there are no suitable breeding islands between Cape Agulhas and Port Elizabeth.

Penguins have suffered most, probably because of their relatively small foraging range when breeding

coupled with their almost total reliance on small pelagic fish. Over the last five years, the breeding population of African Penguins has more than halved, resulting in the species being uplisted to *Endangered*. To assess the impacts of competition with the purse-seine fishery for food, experimental fishing closures took place within 20 km of key penguin colonies on Dassen and St Croix Island. Post-doctoral Fellow 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. The closure had an immediate impact on the birds from St Croix, but subsequent study has shown that 20 km is probably too small a radius to meet the penguins' needs. The situation at St Croix was exacerbated in the second year of the closure by fishing vessels concentrating effort right along the edge of the closed area. Despite this, penguins still fared better than prior to the closure. Lorien's findings have caused some controversy with the fishing industry and the governmental managing agency, but have been instrumental in maintaining the closure around St Croix for at least another year.

The data on penguins are clear cut; their numbers are decreasing rapidly, and they are struggling to find enough to food to raise their chicks. The real gap in our understanding pertains to the behaviour and movement of pelagic fish. How mobile are the fish? If they move over large areas, then making small reserves around penguin colonies may have no benefit in the long run. And how do fish movements change in response to

OPPOSITE Numbers of African Penguins *Spheniscus demersus* have halved over the last decade due to a variety of threats, mainly occurring at sea.

ABOVE Cape Cormorants *Phalacrocorax capensis* are among the most aerial of cormorants, often spending hours in flight searching for schools of pelagic fish – especially as fish stocks move away from traditional breeding areas.

fishing pressure by humans and other predators such as penguins? Lorien is currently equipping a boat to be able to follow fish movements using hydroacoustics. The plan in 2011 is to track fish distributions in and around Nelson Mandela Bay while recording where penguins and the pelagic fishery operate. Meanwhile MSc student Rowen van Eeden has been examining where in the water column Bird Island penguins direct their foraging effort. The GPS-dive loggers Lorien uses to track foraging penguins also record water temperature. By taking the temperature data from the penguins' deepest dives, Rowen can show how the vertical structure of Nelson Mandela Bay varies over time, particularly with respect to the depth of the surface mixed layer. He can then relate how the penguins change their foraging depth in relation to the local oceanographic conditions.

Another interesting question is how penguins find their patchily distributed prey. At a fine scale, we know that penguins locate their prey by sight, as they only feed during the day, and their maximum dive depth changes with light levels. However, given their relatively slow commuting speed, penguins have a limited foraging range and clearly would benefit from an ability to detect prey over a scale of kilometres. A few years ago, Post-doctoral Fellow Greg Cunningham showed that African Penguins, like many petrels, can smell dimethyl sulphide (DMS), a compound released when phytoplankton is grazed. This might be a good cue for hungry penguins, because pelagic fish are likely to aggregate where zooplankton are feeding on phytoplankton. This year, honours student Kyran Wright tested whether penguins do actually respond to DMS at sea. Deploying small slicks of scented oil near to St Corix, he showed that penguins were indeed attracted to DMS.

We also continue to work on the other two major predators of pelagic fish in the Benguela system. Christina Moseley graduated with a CB MSc in June 2010 for her work comparing the foraging ecology, body condition and chick growth rates of Cape Gannets from Malgas Island on the west coast with those from Bird Island, Nelson Mandela Bay on the south coast. She expected Malgas Island birds to be in poorer condition because they have been largely reliant on poor-quality discards from the hake trawl fishery for at least the last five years, whereas the Bird Island birds still manage to feed on their preferred diet of pelagic fish. 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. Post-doctoral Fellow Emilie Tew Kai from the CNRS, France, continued the annual tracking of breeding gannets from Malgas Island in 2010 for the

ninth successive year, trying to assess the effects of age and experience on their foraging ecology by targeting ringed birds. Once again, there was encouraging evidence of pelagic fish biomass increasing on the west coast.

Post-doctoral Fellow Timoth e Cook has been working on the foraging ecology of Cape Cormorants, repeating Maik  Hamann's pioneering study comparing the foraging ranges and diving behaviour of birds from colonies around Saldanha Bay on the west coast with those of birds from Dyer Island on the south coast. Tim has added two further years of data to Maik 's study and has shown that Cape Cormorants are versatile predators, foraging from close inshore to offshore waters up to 150 m deep, diving to anything between a few metres to 40 m deep. They travel up to 50 km from the colony while provisioning small chicks. Tim has also completed a paper comparing the shape of benthic and pelagic dives in this species. Attempts to work on the foraging ecology of the *Endangered* Bank Cormorant *Phalacrocorax neglectus* at Robben Island have so far proved fruitless, but Tim has managed to obtain some additional diving information on the small, inshore-feeding Crowned Cormorant *Microcarbo coronatus*. Lorien Pichegru previously managed to deploy depth loggers onto three birds at Malgas Island, the first such deployments on a member of this, the smallest genus of cormorant. Although most dives are shallow, this species occasionally dives to more than 20 m.

Accidental mortality

Accidental mortality among seabirds occurs mainly in fisheries operating farther offshore than the purse-seine fishery, and largely affects non-breeding migrants to southern African waters. Two main fisheries are involved. The demersal trawl fisheries kill birds that get entangled on their warps or nets, whereas long-line fisheries kill birds that either swallow baited hooks or get entangled in the lines. Much of the work combating these problems is being conducted by NGOs, notably BirdLife International through its Albatross Task Force and WWF-South Africa through its Sustainable Seafood Initiative. In addition, Ed Melvin from Washington Sea Grant, Seattle, has been conducting dedicated trials of specific mitigation measures on Japanese pelagic long-line vessels. During 2010, the Fitztute's role in these initiatives has been to continue conducting autopsies on all dead birds returned to port, and to provide advice and support where needed.

In terms of trawlers, the large fishery for hakes *Merluccius* spp. is the main concern. Although the mandatory deployment of bird-scaring lines during all tows is largely adhered to, birds are still killed, especially during



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the shooting and hauling of nets. Additional measures, including better discard management, are needed, especially at these critical phases of the fishing operation. A novel problem also has been highlighted when warps are replaced on vessels. New warps come with a viscous grease layer that acts like fly-paper for small birds, fouling and drowning many Pintado Petrels *Daption capense*. Fortunately there are two solutions to the problem: fishing companies can schedule the replacement of warps in summer, when Pintado Petrels are absent from the region, and they can order warps to be packaged with a low-viscosity grease. This latter measure has already been implemented by at least one large fishing company.

Among long-liners, the pelagic fishery for tunas remains problematic. The marked reduction in bycatch in 2008, when measures restricting the number of birds that could be caught per vessel were enforced, has not been maintained. Bycatch rates have crept up again, above 0.1 birds per 1000 hooks, more than twice the interim target set by South Africa's National Plan of Action for reducing the incidental catch of seabirds in long-line fisheries (0.05 birds per 1 000 hooks). A worrying trend from a local perspective has been the increasing numbers of Cape Gannets caught by this fishery, which previously only caught migrant seabirds. Some good news is that Ed Melvin's mitigation trials

ABOVE Cape Gannets *Morus capensis* have suffered as pelagic fish stocks have moved south and east. We have been fortunate to track the spatial response of adults breeding on Malgas Island each year from 2002 to 2010.

continue to show considerable promise, with almost a 90% reduction in seabird bycatch rates when using weighted (0.04 birds per 1 000 hooks) rather than unweighted (0.35 birds per 1 000 hooks) branchlines. It seems from this work that setting only at night, using weighted branchlines and with two efficient bird-scaring lines deployed either side of the setting area should reduce seabird bycatch to acceptable levels in this fishery.

Tracking birds at sea

Managing seabird-fishery interactions requires an understanding of the at sea distribution of seabirds, resulting in numerous studies tracking seabird movements using satellite transmitters or cheaper archival geolocator (GLS) tags. We are using both approaches. Thanks to a generous donation from North Star Science and Technology, satellite tags were deployed on juvenile Tristan Albatrosses *Diomedea dabbenena* at Gough Island in 2010: this is the first time we have assessed



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post-fledging dispersal in a seabird. We also put satellite tags on adults of three species of seabird breeding at Inaccessible Island in 2009/2010, given that there was little chance of recovering tags from these birds. By comparison, GLS tags have been deployed on a suite of adult seabirds at Gough and Marion Islands, where we have field teams present year round to search for birds with loggers. GLS loggers also were deployed on adult Cape Gannets breeding at Bird Island, Nelson Mandela Bay, to track their post-breeding dispersal. Our capacity to analyse spatial data and to utilise it to designate important foraging areas for seabirds was enhanced in August 2010 with the arrival of Post-doctoral Fellow Tim Reid from Australia. Tim has a long pedigree of working on seabirds, and recently completed a PhD on the at sea ecology of Flesh-footed Shearwaters *Puffinus carneipes*. His post-doc, arranged by BirdLife South Africa and funded by the Plastics Federation of South Africa, will to use the available spatial use data to identify Marine Important Bird Areas (IBAs) around South Africa. This is a new departure for BirdLife; to date the IBA programme has only included breeding sites for seabirds.

Unfortunately, only a few species have been tracked intensively. Until very recently, only the larger species could carry tracking devices (new GLS loggers weigh as little as 1 g, making it feasible now to track birds as small as storm-petrels), and the costs of devices and satellite uplinks are considerable. Another source of information is direct observation. Seafarers have been recording the seabirds they encounter for centuries,

and the Fitz has a history of recording seabirds from vessels at sea dating back to the late 1970s. BirdLife's Ross Wanless has spearheaded a programme to capture historical data and augment it with current observations in an Atlas of Seabirds at Sea (AS@S). At the same time, PhD student Viviane Barquete is using a more novel approach, using the ratios of naturally occurring stable isotopes (SIs) to infer seabird movements. The SI ratios of carbon and nitrogen provide information on the diet and broad latitudinal position of marine organisms, integrated over varying temporal scales depending on the turnover rates of the tissue sampled. And among seabirds, feathers are particularly useful because they fix the SI ratios at the time the feather is grown. We can infer where a bird breeding at a given site was when it moulted, and by sampling multiple feathers, whether it moved significantly during its moult. Feathers from old museum skins act as time capsules, allowing us to investigate historical changes in seabird diets. Surprisingly, Viviane has found little evidence of dietary shifts in a suite of seabirds using the Benguela region prior to industrial fishing and today.

Other seabird studies

Given the ongoing debate about the relative costs and benefits of closing areas around seabird colonies to activities such as purse-seine fishing, CB MSc student Sarah Lewis conducted a valuation of the Boulders penguin colony as an ecotourism destination. The idea was to show that seabird colonies can have considerable economic value. Sarah's study was made 15 years after

a similar exercise by another CB student, Charlotte Morgan, who estimated the value of the Boulders colony while it was still under the control of Simonstown Municipality. Boulders is an important tourist attraction in Cape Town, currently drawing more than 500,000 visitors annually, generating gate revenues of R14.5 million, and supporting numerous jobs in the conservation and tourism sectors. Using willingness to pay and travel cost analyses, Sarah found that the current value of Boulders was close to R30 million, excluding multiplier effects on the local economy. However, despite the broad appeal of the penguins, most visitors to Boulders were quite ignorant of the African Penguin's parlous conservation status.

Finally, human disturbance is a potentially serious problem at some seabird breeding colonies. Honours student Trevor Edwards assessed differences in the susceptibility to disturbance between African Penguins from different colonies and at different stages of the breeding season. Penguins demonstrated some evidence of habituation to disturbance, with birds from colonies with regular exposure to human activity allowing closer approach before showing visible distress than birds at seldom-visited colonies. Unfortunately, attempts to test whether behaviour was a reliable indicator of stress using a remote heart rate monitor failed due to technical problems with the ECG device.

Impact of the project

The poor conservation status of many of the seabirds found off southern Africa requires urgent action. Our studies are designed to provide the insights to allow effective conservation of seabirds in terms of South Africa's Marine Living Resources Act, which calls for an ecosystem approach to ensure that fishing is sustainable. In particular, by understanding how seabirds feed, especially during the critical breeding period when they are constrained to remain close to their breeding colonies, we can advise on how best to manage spatial resource use. Lorien Pichegru's research is the first demonstration of the benefits of a mid-size, open water fishing closure on a top predator population. Viviane Barquete, Tim Cook and Lorien Pichegru presented research from this project at the First World Seabird Congress held in Victoria, Canada, in September 2010. Peter Ryan gave a popular lecture on seabirds and their conservation at the Save our Seabirds festival in Cape Town in October 2010.

OPPOSITE Although BirdLife's Albatross Task Force now leads the effort to reduce seabird bycatch on longlines, the Fitzitute remains involved, not least through processing all birds returned to port.



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ABOVE Ben and Delia Dilley deploy a geolocator tag on a White-chinned Petrel *Procellaria aequinoctialis* at Marion Island to track its year-round movement.

Key co-sponsors

BirdLife International, BirdLife South Africa, Charl van der Merwe Foundation, CapeNature, CNRS, European Union, Killam Trust, North Star Science and Technology, Plastics Federation of South Africa, Raggycharters Whale Watching, Royal Society for the Protection of Birds, South African National Antarctic Programme, SANParks and the UK Overseas Territory Environment Programme.

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Using seabirds and endemic landbirds as flagships to conserve oceanic islands



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ISLANDS, ESPECIALLY THOSE THAT HAVE NEVER BEEN CONNECTED TO A CONTINENTAL LANDMASS, HOLD A DISPROPORTIONATELY LARGE AMOUNT OF TERRESTRIAL BIODIVERSITY, YET THEY ARE AMONG THE MOST SENSITIVE OF TERRESTRIAL ECOSYSTEMS. THE ARRIVAL OF MAN AND HIS COMMENSALS HAS HAD CATASTROPHIC IMPACTS ON ISLAND BIOTAS; MORE THAN 90% OF MODERN AVIAN EXTINCTIONS HAVE BEEN OF ISLAND TAXA. WHERE ISLAND ECOSYSTEMS REMAIN REASONABLY INTACT, THEY ARE VULNERABLE TO NEW INTRODUCTIONS, REQUIRING STRICT CONTROL OF THE IMPORT OF PEOPLE AND MATERIALS. ISLANDS ARE KEY BREEDING SITES FOR SEABIRDS AND MANY ISLANDS SUPPORT ENDEMIC LANDBIRDS. THESE BIRDS CAN ACT AS FLAGSHIPS FOR THE CONSERVATION MANAGEMENT AND RESTORATION OF ISLAND ECOSYSTEMS.

The main focus of this research continues to be on Gough Island, a British island 380 km south-southeast of Tristan da Cunha in the mid-Atlantic Ocean. The study is driven largely by Richard Cuthbert from the UK's Royal Society for the Protection of Birds. Two significant restoration projects are underway at the island. The first involves the control and, hopefully, the eventual eradication of the invasive plant, Procumbent Pearlwort *Sagina procumbens*, whereas the second is an even more ambitious programme to eradicate introduced House Mice *Mus musculus* from the island. *Sagina* was discovered at Gough Island in 1998, probably after being transported there accidentally on cargo containers used to resupply the South African weather station on Gough. At that time, despite objections by the island's conservation advisory committee (spearheaded by John Cooper and Peter Ryan), the same containers were used at both Gough and Marion Islands. *Sagina* is an abundant, rapidly spreading invasive at Marion Island, which has self-colonised Prince Edward Island, becoming only the island's third alien plant.

At Gough Island, *Sagina* remains confined to approximately 400 m of coastal cliffs around the weather station, thanks to Herculean tasks over the last decade to halt its spread. Richard Cuthbert and John Cooper led the annual relief trip to Gough in September 2010, where Kalinka Rexer-Huber and Graham Parker had been based for the previous year. Two new field assistants, Jeroen Lurling and Ross Cowlin, accompanied Richard and John to continue work through 2011, but Jeroen had to return to South Africa in late 2010 after damaging his knee ligaments, and was replaced at very short notice by Nicolas le Maitre. Work on controlling *Sagina*, summarised in a 2010 paper by Cuthbert *et al.* in *Conservation Evidence*, was boosted by a team from Tristan's Conservation Department, who together with



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Richard and Erica Sommer, remained on the island for a few weeks after the annual relief to continue large-scale stripping of infected cliff face of all vegetation and soil. *Sagina*'s rapid maturity, high fecundity and long-lived seeds mean that frequent checking of the affected area is required to prevent new plants springing up in areas that have been cleared. This is complicated by the rugged nature of the coastal cliffs, which requires workers to have rope-access skills.

More relevant to birds is the work on introduced mice. A decade ago, Richard Cuthbert and Erica Sommer were the first ornithologists to spend a full year on Gough, and were puzzled at the end of their stay by the sudden deaths of many Tristan Albatross *Diomedea dabbenena* chicks. Once great albatross chicks survive the post-guard period, they typically

OPPOSITE An adult Gough Bunting *Rowettia goughensis* waits its turn, while a juvenile weighs itself during trials to ensure that a population of this single-island endemic can be held in captivity should a poison drop targetting mice go ahead.

ABOVE Thanks to ongoing eradication efforts, large plants of *Sagina procumbens* (left) are now seldom found on Gough Island, but even small plants (right) flower and set seed, requiring constant vigilance through the summer growing season.



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suffer very little subsequent mortality. However, on Gough, more than half of these chicks die. Richard suspected mice were to blame - a radical idea at the time. Ross Wanless and Andrea Angel subsequently confirmed this hypothesis, memorably filming about a dozen mice attacking a large albatross chick at night. Once the chick has been weakened by mice, it is killed by ever vigilant Southern Giant-Petrels *Macronectes giganteus*. Mice are now known to attack and kill the chicks of several birds at the island, and are responsible for Tristan Albatross and the endemic Gough Bunting *Rowettia goughensis* being listed as *Critically Endangered*, and Atlantic Petrel *Pterodroma incerta* as *Endangered*. Until recently it was thought that mice only threaten winter-breeding seabirds on Gough, because they mainly attack chicks in winter, when other food sources are scarce. However, anecdotal evidence of a marked decrease in a wide range of burrowing petrels over the last 25 years was published in 2010. This year also saw a paper appear in *Antarctic Science* summarising evidence of mouse attacks on albatross chicks at Marion Island, suggesting that mice are becoming more problematic for birds now they are the sole introduced mammal on Marion (following the removal of feral cats in the early 1990s). This finding supports an earlier conclusion from Ross Wanless's PhD that mice are most likely to threaten native birds when they are the only introduced mammal on an island.

The comprehensive publicity generated by the attacks by mice on Tristan Albatross chicks and other birds on Gough Island has stimulated serious consideration of the feasibility of attempting to eradicate mice from the island using poison bait dropped from helicopters. Two highly experienced New Zealand eradication consultants, Chris Golding and Nick Torr, accompanied the 2010 relief to draft an operational plan for removing mice from Gough Island. They consider the operation to be feasible, although acknowledge that success cannot be guaranteed, given that the island is much larger than any other island from which mice have been eradicated. At the same time, research has been underway to assess the feasibility of maintaining small captive populations of Gough Buntings and Gough Moorhens *Gallinula comeri* on the island during an eradication effort to ensure they survive the poison bait drop. The moorhens (and Sub-Antarctic Skuas *Catharacta antarctica*) are likely to be particularly susceptible to secondary poisoning, because they frequently scavenge dead mice. These findings were reported in a 2010 paper by Ross Wanless *et al.* in *Wildlife Research*, which also considered the risks of using poison bait on mice at Marion Island, where skuas and Lesser Sheathbills *Chionis minor* are most at risk.

In addition to the restoration programmes underway at Gough, we continue seabird monitoring on selected key species at the island, notably Tristan Albatross, Atlantic Yellow-nosed Albatross *Thalasarche chlororhynchos* and Atlantic Petrel, and novel research has commenced on the foraging ecology and diet of *Endangered* Northern Rockhopper Penguins *Eudyptes moseleyi*. Detailed demographic studies of the two albatrosses commenced in 1982 for the Yellow-nosed, and in 2007 for the Tristan Albatross. They have continued each year since without a gap, utilizing in most years volunteers from the South African weather station. During 2010, John Cooper established another long-term study colony, banding all Southern Giant-Petrels breeding in the island's largest colony. Although giant-petrels used to breed at the main island of Tristan, Gough is now their most northerly breeding site, and the birds here are smaller than populations farther south. Their numbers appear to be increasing, probably linked to the ongoing increase in Subantarctic Fur Seal *Arctocephalus tropicalis* numbers at Gough, but as yet we know little about their breeding biology or demography at Gough. The study area, below Low Hump, is a stiff 3-4 hour walk over the mountains from the weather station, and it is testament to John's commitment and fitness that he made numerous trips to the colony to ensure all breeding birds were banded with field-readable plastic bands.

Impact of the project

This is a largely applied project. If successful, the eradication of mice from Gough will have immense benefits for the long-term conservation status of the island and its biota, including two endemic landbirds and the once vast seabird populations. It will also set a significant precedent in the arena of island restoration, because Gough will be an order of magnitude larger than any other island from which mice have been removed. Our research over the last decade has been instrumental in changing the perception that mice are relatively innocuous to native bird faunas on oceanic islands. John Cooper and Richard Cuthbert attended the *Conference on Island Invasives: Eradication and Management* held in Auckland, New Zealand, in February 2010 to report on the ongoing work to eradicate *Sagina* and mice from Gough Island.

OPPOSITE Graham Parker checking the cliffs for *Sagina* near the South African weather station on Gough Island.

TOP RIGHT One of the mouse-proof cages used for holding endemic landbirds.

ABOVE RIGHT Gough Moorhens could successfully be kept in captivity for several weeks.



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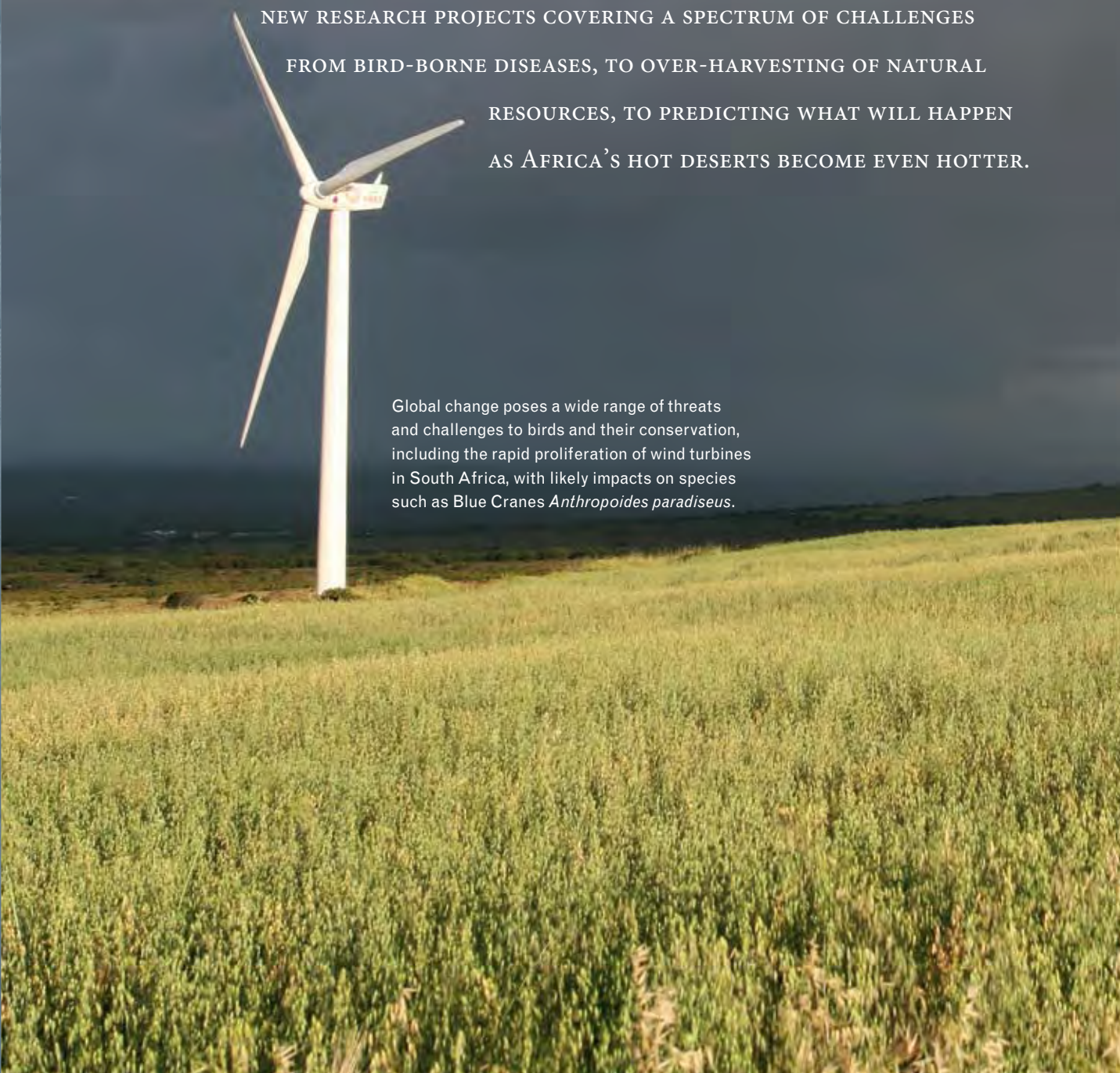
Key co-sponsors

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

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 Research assistants: Graham Parker (2009/10), Kalinka Rexter-Huber (2009/10), Erica Sommer (2010), Jeroen Lurling (2010), Ross Cowlin (2010/11), Nicolas le Maitre (2010/11)

THE EARTH IS ENTERING AN ERA OF UNPRECEDENTED GLOBAL CHANGE, DRIVEN BY HUMAN OVERPOPULATION, RESULTANT CLIMATE CHANGE AND ESCALATING DEMAND ON NATURAL RESOURCES. TERMED THE ANTHROPOCENE, THE COMING DECADES WILL PLACE HUGE DEMANDS ON THE COLLECTIVE SKILLS AND WILLS OF CONSERVATION SCIENTISTS. NOVEL PROBLEMS REQUIRE NOVEL SOLUTIONS AND, EQUALLY IMPORTANTLY, NOVEL SCIENTIFIC APPROACHES TO UNDERSTAND, RATHER THAN MERELY DOCUMENT THE CHANGES GOING ON AROUND US. THE FITZTITUTE HAS RISEN TO THE OCCASION WITH SEVERAL NEW RESEARCH PROJECTS COVERING A SPECTRUM OF CHALLENGES FROM BIRD-BORNE DISEASES, TO OVER-HARVESTING OF NATURAL RESOURCES, TO PREDICTING WHAT WILL HAPPEN AS AFRICA'S HOT DESERTS BECOME EVEN HOTTER.



Global change poses a wide range of threats and challenges to birds and their conservation, including the rapid proliferation of wind turbines in South Africa, with likely impacts on species such as Blue Cranes *Anthropoides paradiseus*.

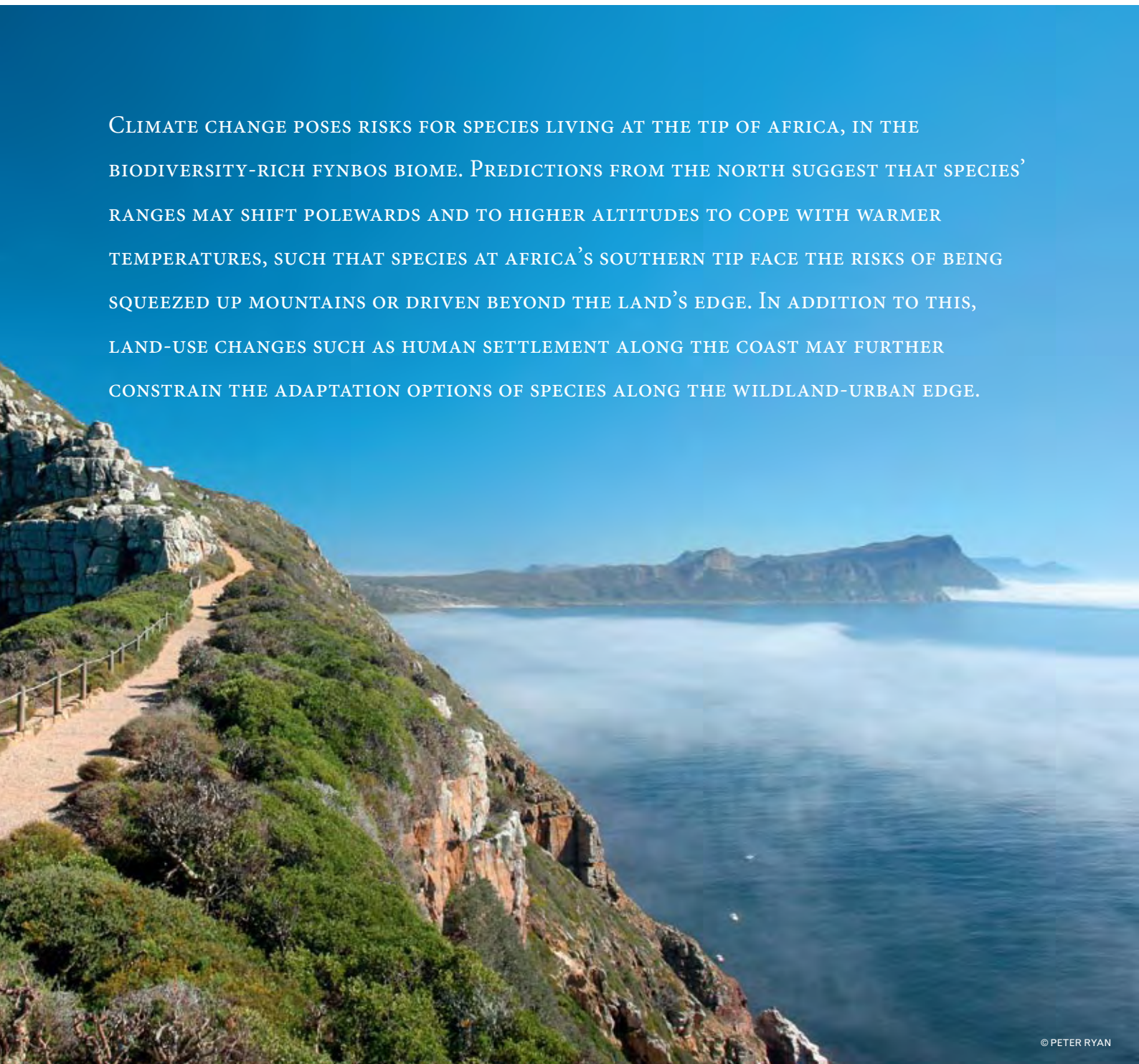
GLOBAL CHANGE



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Species' vulnerability to climate and land-use change in a biodiversity hotspot

CLIMATE CHANGE POSES RISKS FOR SPECIES LIVING AT THE TIP OF AFRICA, IN THE BIODIVERSITY-RICH FYNBOS BIOME. PREDICTIONS FROM THE NORTH SUGGEST THAT SPECIES' RANGES MAY SHIFT POLEWARDS AND TO HIGHER ALTITUDES TO COPE WITH WARMER TEMPERATURES, SUCH THAT SPECIES AT AFRICA'S SOUTHERN TIP FACE THE RISKS OF BEING SQUEEZED UP MOUNTAINS OR DRIVEN BEYOND THE LAND'S EDGE. IN ADDITION TO THIS, LAND-USE CHANGES SUCH AS HUMAN SETTLEMENT ALONG THE COAST MAY FURTHER CONSTRAIN THE ADAPTATION OPTIONS OF SPECIES ALONG THE WILDLAND-URBAN EDGE.



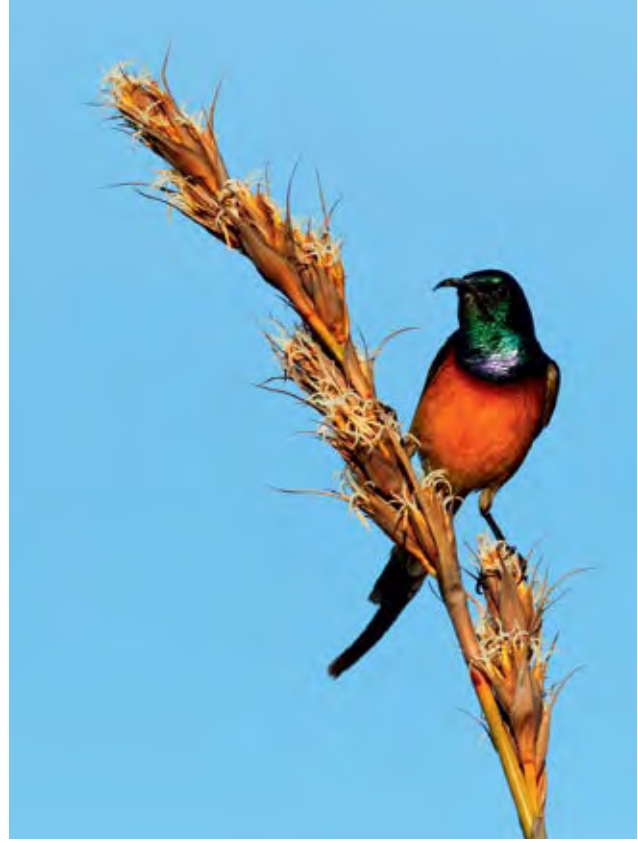
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South Africa's renowned biodiversity hotspot, the Cape Floral Kingdom or 'Fynbos biome,' is a captivatingly diverse shrubland with folded mountain ranges, Mediterranean-type winter rainfall, poor soil nutrients and subtle species mutualisms. The country's remarkable biodiversity is one of its strategic advantages for tourism, rural economic development and human well-being. So alterations to the Fynbos biome stemming from climate and land-use change are of importance not just for conservation biologists and academics, but for society at large.

The Fitz's first climate change field project, 'Fynbos Endemic Birds: Vulnerability and Adaptation to Land Use and Climate Change' started in early 2008. It forms part of the Fitz's Climate Vulnerability and Adaptation Programme, run in conjunction with the Climate Change and BioAdaptation Division of the South African National Biodiversity Institute (SANBI). The project explores how species on the edge of the continent and along urban edges are being squeezed by climate change, rampant urbanization, and associated ecological changes such as biological invasions and novel predators. For example, Fynbos endemic birds are potentially threatened by the unraveling of evolved plant-pollinator mutualisms, invasion by woody plants, predation by domestic cats, and novel diseases associated with urban encroachment.

To understand the vulnerability of species to the rapid environmental changes of the past century, and to the additive effects of environmental change drivers, it is necessary to look through different lenses. The Fynbos endemics research team is increasingly integrating the use of population and community ecology, behavioural ecology, phenology (timing of the life cycle), conservation genetics, stress ecology and landscape ecology to predict the likely impacts of rapid change on Fynbos endemic birds. The project works at sites in the Cape Peninsula, Kogelberg Biosphere Reserve, Hottentots Holland Mountains and Langeberg Mountains, with most effort to date concentrated at Elsie's Peak in the Table Mountain National Park.

Cape Sugarbirds *Promerops cafer*, Orange-breasted Sunbirds *Anthobaphes violacea*, Cape Rock-jumpers *Chaetops frenatus* and other endemics are focal species, with the first step to colour-mark accessible populations which can be tracked over time. The team includes ornithologists, a small network of volunteer observers and amateur bird-ringers, and the initial effort in establishing marked populations is already bearing considerable fruit in terms of resightings and recaptures. Once we know how long birds of different age classes and sexes survive, when they breed, moult and disperse, and where they disperse, we can start to



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build a detailed picture of their population ecology, behaviour and phenology.

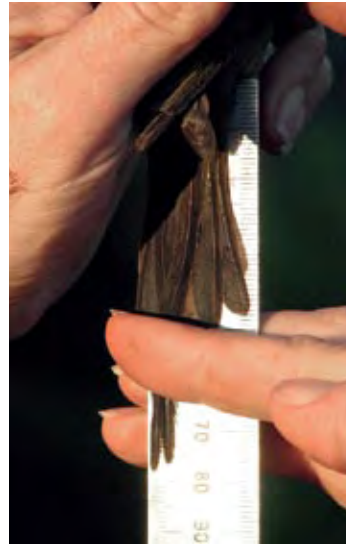
Detailed information like this is one of the key gaps in current scientific understanding of species' vulnerabilities. Improving the spatial models of range changes built by global change biologists using climate envelope concepts requires integrating demographic and spatial data in second-generation models, such as those now being developed in a collaboration between the Universities of Durham and Cambridge, SANBI, the Fitztitute and the Animal Demography Unit at UCT. The Fynbos endemics project is focusing on gathering survivorship, dispersal, clutch size and other reproductive data to generate parameters for, and validate, these integrated models. This will enable conservation biologists to identify populations in trouble before range changes and local extinctions occur.

From 2008 to 2010, the project was developed part-time by Phoebe Barnard and Rob Simmons, primarily in the Table Mountain National Park and at the Wildcliff Nature Reserve in the Langeberg, with the collaboration of bird ringers Margaret McCall, Mike Ford, the late Gordon Scholtz, Jo Johnson and Robyn Kadis. The availability of Fitz CoE funds and students from 2011, and the start of collaborative projects with Anton Pauw of Stellenbosch University, Jeremy Midgley of UCT's Botany Department, Frank Schurr of Potsdam University and Katrin Böhning-Gäse

ABOVE The Orange-breasted Sunbird *Anthobaphes violacea* pollinates at least 66 species of *Erica* in the Fynbos. It is just one of a suite of birds endemic to mountain Fynbos that might be at risk from climate change.



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FARLEFT Urbanization may bring both benefits and costs to Cape Sugarbirds *Promerops cafer*, including changes in the incidence of disease, such as this apparent avian pox-infected tarsus (top). A male Sugarbird wing, showing extensive wear (middle). Phoebe Barnard carefully removes a bird from a mist net (bottom).

LEFT The tail of a male Orange-breasted Sunbird showing some asymmetry in streamer length.



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and Matthias Schleuning of the Biodiversity and Climate Research Centre in Frankfurt will allow an acceleration of the project around several of its core research questions (see Box), as well as around some important protea- and erica-focused evolutionary and ecological questions.

The key questions of the Fynbos endemics project are:

- Do individuals at range edges have lower fitness/survival than in range cores?
- Are inland populations more heat-stressed than those at the coast?
- Is there significant current gene flow between sites, and what are the inferred past levels?
- Are nectarivores especially vulnerable to frequent fire?
- How does urbanization influence adaptation options for birds?
- Is survivorship (disease, predation, energetics) a function of urbanization?
- What phenotypic variables (if any) reliably indicate physiological stress?
- Are any range shifts and phenotypic changes consistent with predictions?
- How can conservation planning, policy and management respond?

The first two years of fieldwork at the Elsie's Peak and Wildcliff sites focused on the establishment of colour-marked populations and gathering of behaviour, phenology, stress ecology and genetic data to answer questions 2 through 8, but these (and questions 1 and 9) will involve

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more intense work in 2011-14. The work in 2011 by students Anina Heystek (BSc Hons) and Zingfa Wala and Ross Turner (both PhD) will involve experimentation, morphometric measurement, stress analysis and behavioural/evolutionary ecology observation.

Pollinators and pollinated

In 2009-2010, a collaboration with Ross Turner (UKZN) and Jeremy Midgley solved a puzzle about the unknown pollinator of *Erica halicacaba*, a large-flowered, high-altitude erica of rocky outcrops. Orange-breasted Sunbirds were clearly obtaining a 'high octane' fuel supply from somewhere in their home ranges to support a high level activity in conditions which appeared inhospitable to such a small bird. Ross's MSc work with the Fynbos Endemics team included pollinator exclusion experiments and confirmation of fresh pollen loads on visiting sunbirds: this work will expand during Ross' PhD. Michelle Malan, an MSc student in Jeremy's team, and Anina Heystek, a BSc (Hons) student in Anton Pauw's team, will explore sunbird pollination as a driving force in the radiation of the genus *Erica*.

Hunter and hunted

Sharon George's MSc CB thesis on the biodiversity impact of domestic cats tracked across a Fynbos/urban edge demonstrated that novel predators, introduced with accelerating urbanization, kill at least 3.9 million prey items per year (mostly small mammals and reptiles, and some 730 000 birds). These figures are highly conservative, as they do not include feral cats, and cannot account for prey consumed 'away from home'. Diseases affecting Fynbos birds may also be facilitated by urbanization, with the incidence of avian pox, a contagious, lesion-forming virus potentially facilitated by warm temperatures, birdbaths and bird feeders, now being monitored in Cape Sugarbirds.

Stress indicators

Contending with multiple and simultaneous environmental threats such as climate change, biotic invasion and urbanization may pose both threats and opportunities for endemic Fynbos birds. Is urbanization a net cost or a net benefit for birds, in terms of the balance between risks and opportunities? Do birds seek refuge in urban areas in times of fire, hot, dry winds, or rainstorms, and do the resources they acquire there help them cope? In the search for answers to these questions, the project is quantifying morphological and disease indicators of stress, including the incidence



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ABOVE Female Cape Sugarbird

of feather stress-barring, incidences of asymmetry in body size and feather growth, and diseases such as avian pox.

Impact of the project

While the Fynbos endemics, climate and land-use change project is well grounded in population, community, spatial, behavioural and evolutionary ecology, it will increasingly cast light on conservation planning, policy and land management, and even the seemingly prosaic matters of gardening and wildlife feeding. As so much national and global attention is paid to the future security of biodiversity (mainly plant diversity) in the Fynbos hotspot, this project will help guide landowners on both sides of the urban edge as well as those concerned with the future of biodiversity on the southern tip of Africa. Just as importantly, it will help make fine-scale, climate-range-shift modeling, on which conservation planning will be increasingly based, more accurate, more robust and more reliable for the species of this very special biodiversity hotspot.

Key co-sponsors

The South African National Biodiversity Institute (SANBI) and UCT Research Committee's Small Grants Programme.

Research Team 2010

Dr Phoebe Barnard (SANBI & Honorary Research Associate)
Prof. Jeremy Midgley (UCT Botany Dept)
Students: Ross Turner (PhD)

Hot, hotter, gone?



CLIMATE CHANGE, DRIVEN BY HUMAN-INDUCED INCREASES OF ATMOSPHERIC CARBON DIOXIDE AND OTHER GREENHOUSE GASES, IS AFFECTING BIOLOGICAL COMMUNITIES THROUGH SPECIES RANGE SHIFTS AND CHANGES IN THE TIMING OF EVENTS SUCH AS REPRODUCTION AND MIGRATION. THESE CHANGES, COUPLED WITH OTHER ANTHROPOGENIC THREATS TO THE BIOSPHERE, PROMPTED THE UNITED NATIONS TO DECLARE 2010 AS THE *INTERNATIONAL YEAR OF BIODIVERSITY*.

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Predicting the consequences of climate change in African desert ecosystems



AB&B 14(1):22.

Attempts to predict the responses of terrestrial organisms to climate change typically involve climate-envelope modelling, which assumes that the climatic conditions that define a species' range today can be used to predict its range under future climates. This approach ignores other drivers of global change such as habitat loss or degradation, as well as community interactions, and assumes that climate directly limits survival and/or reproduction. Such simplistic models have predicted climate-driven range shifts for several South African animals. However, recent analyses of range changes of birds carried out at the Fitzpatrick Institute are largely or wholly at variance with these predictions. These discrepancies highlight how predictions of species' responses to a changing climate are hampered by a lack of understanding of the links between climate and species' distributions. Unravelling these links, which are most evident in hot, dry regions, is a major challenge to physiologists, ecologists and geographers.

When ambient temperatures regularly exceed body temperature, survival and reproduction depend on an organism's ability to meet its needs for both energy and water over short time periods. As temperatures rise, this will become increasingly difficult for animals to achieve, pushing individuals ever closer to their physiological limits. Climate models predict that nearly all the world's hot, subtropical deserts will become significantly hotter during the 21st Century, with maximum air temperatures increasing by 3 to 5°C by the 2080s. The accompanying increase in the frequency and intensity of extreme heat waves potentially is one of the greatest short-term threats to biodiversity. Heat waves can lead to mass mortality events, such as those observed recently in the Western Australian desert when large numbers of parrots and finches died of heat stress and dehydration. Such events may well be harbingers of the effects of future climate change in Africa. We have already observed mass abandonment of breeding attempts by African Penguins *Spheniscus demersus*, Cape Gannets *Morus capensis* and African Black Oystercatchers *Haematopus moquini* during heat waves on the South African coast.



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ABOVE An Ant-eating Chat *Myrmecocichla formicivora* pants in the heat of a Kalahari afternoon.

Relative to other desert animals, birds are particularly sensitive to temperature increases due to their predominantly diurnal habits and limited use of underground refuges such as burrows. This vulnerability makes birds potentially sensitive indicators of climate change and is the reason why they have been selected as the target group for this study. The overarching aim of this project, supervised by Phil Hockey and Andrew McKechnie (Univ. Pretoria), is to develop a predictive framework for the consequences of climate change for birds in semi-arid areas based on understanding how high temperatures influence bird behaviour and physiology.

The key questions being addressed are:

1. What are the behavioural and physiological consequences of extreme temperatures for a diversity of birds in the semi-arid regions of southern Africa?
2. Which species are most vulnerable to increased temperatures and how is vulnerability related to inter-specific differences in morphology, physiology and ecology?
3. How are the bird communities in semi-arid areas of southern Africa predicted to change as a result of climate change and what will be the consequences of this for key ecosystem functions such as pollination and seed dispersal?

Data collection has concentrated on the bird community of the Kalahari Desert, one of the hottest regions of southern Africa.

Research Approaches

- Observe a wide range of bird species to investigate how their behaviour changes in relation to environmental conditions (e.g. air temperature, relative humidity, wind speed). Data collected include time-activity budgets, the frequency of heat dissipation behaviours (e.g. panting, wing spreading) and patterns of microsite use (e.g. shade seeking).
- Conduct focussed experiments on selected species to assess the impact of hot temperatures on their ability to meet daily energy budgets, particularly at times when energy demands peak (e.g. during breeding, moulting and pre-migratory fattening).
- Label water sources with isotopes to investigate how species differ in their reliance on drinking water and how rates of water and energy turnover vary in relation to temperature.
- Combine behavioural and physiological data to assess how climate change will affect energy and water balance across a range of species, and thereby model spatial variation in vulnerability.

Dealing with heat: issues of size

The 'hot-birds' project started with a pilot study by CB student Justine Cordingley in the Kgalagadi Transfrontier Park during the summer of 2008/09. She found a strong negative relationship between body mass and the temperature at which birds started to experience heat stress. The largest birds such as Common Ostriches *Struthio camelus* and Cape Crows *Corvus capensis* started to exhibit heat stress just above 30°C, whereas some of the smallest species, such as Black-chested Prinias *Prinia flavicans*, appeared to remain unstressed at temperatures above 40°C. This was somewhat unexpected, given the greater thermal inertia of large birds.

Further field work was conducted in 2009/10 by Post-doctoral Fellow, Rowan Martin at Tswalu Kalahari Reserve, a private reserve of more than 100 000 ha in the Northern Cape. Unfortunately, the summer of 2009/10 was cool and wet, with more than double the average annual rainfall and no days with temperatures exceeding 40°C. Nonetheless, Rowan and Ben were able to confirm that, on average, large birds start to show heat-dissipation behaviour at lower temperatures than do small birds. They also found that the rate at which stress increases with temperature is slower for large birds. Small birds first show signs of stress at higher temperatures, but once that critical temperature is exceeded, their stress levels increase rapidly. These differences probably reflect the interaction between body mass and rates of evaporative heat loss. Small birds have a relatively large surface area, and when faced with high environmental temperatures can rapidly lose heat by evaporating large amounts of water relative to their body mass. The smaller surface area to volume ratio of large birds slows the rate at which they can offload heat. The risk of dehydration is most significant for very small species, whereas the major hazard facing large species is overheating through not being able to offload heat rapidly enough.

Getting out of the heat

Birds can lose heat through physiological responses such as panting, but they can also reduce heat stress by reducing activity at high temperatures to generate less heat and/or seeking cool micro-habitats. Quantifying the thermal benefits of behavioural responses by birds is challenging. It is fairly easy to categorise habitat use, but it is much more difficult to measure what this means to a bird. To tackle this problem we needed some means of measuring the thermal landscape. We tried using thermal imaging cameras and i-Button temperature loggers suspended in black bulbs to develop three-dimensional thermal maps, but finally settled on a measure of shade intensity measured with an AcuPAR

Ceptometer. With this piece of hi-tech equipment, Rowan was able to quantify how the intensity of shade differs across trees of different species and sizes, and show that birds seem to respond to this pattern of shadiness. In the 2010/11 field season, Rowan is refining these measurements using specially designed models of birds which will allow us to record how birds gain heat in relation to their size, plumage and position in the landscape. This will give a meaningful picture of how birds perceive the thermal landscape and how they position themselves relative to the availability of microsites of different shade qualities.

Establishing a methodology for quantifying the thermal landscape and the refuges that exist within it will allow us to extend our research to other landscapes and hence refine our predictions of how birds might move around in the environment (or leave it completely) as temperatures rise. In November 2010, CB student Gina Louw spent time at Dregghorn, a hotter site than Tswalu in the southern Kalahari near the confluence of the Kuruman and Molopo Rivers. Like Justine, Gina is studying the relationship between ambient temperature and stress across a range of bird species to address two key questions: 1) are stress responses species-specific or do individuals of the same species show adaptation to heat, and 2) how are interpretations of stress influenced by the manner in which measurements of stress are made?

Trading off heat and water

While Rowan explored the vagaries of the thermal landscape, Ben Smit, a CoE-supported PhD student based at the University of Pretoria and supervised by Andrew McKechnie and Phil Hockey, tackled the key issue of water balance. Evaporative cooling is the main way birds can offload heat when ambient temperatures exceed their body temperature. Water losses must be balanced by gains through drinking and feeding if the bird is to avoid potentially fatal dehydration. Ben is measuring water turnover using doubly labelled water, which involves injecting a bird with a small dose of water containing heavy isotopes of hydrogen and oxygen. The rate of water turnover can be estimated by re-catching the bird after a known interval and measuring the concentration of labelled hydrogen in its blood. In extreme cases, such as some small passerines in the intensely hot Sonoran Desert, water turnover can exceed 100% of body water per day. By using doubly labelled water he will also be able to measure daily metabolic rate.

Ben is also using radio-labelling techniques to examine the sources of water used by different bird species. It is important to understand the degree to which birds depend on drinking water. By labelling a waterhole with a stable hydrogen isotope, then taking blood



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ABOVE Take the shade wherever you can find it.

samples from birds caught at various distances from the waterhole, Ben will be able to measure the importance of drinking water as a function of distance from a waterhole. We expect that the isotopic signature of a labelled waterhole will appear in many more species during extremely hot weather than in cooler periods.

At very high ambient temperatures, birds can reduce their water demand to some extent by allowing their body temperature to increase. Although this phenomenon (called facultative hyperthermia) has been well studied in captive birds, almost nothing is known about its prevalence in wild birds. Ben is examining facultative hyperthermia in Kalahari birds by implanting miniaturised data loggers to record body temperature fluctuations. Initially, this study is focusing on White-browed Sparrow-Weavers *Plocepasser mahali*, but we may expand it to include other species.



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ABOVE In parts of the Kalahari, shaded microsites where birds can escape from the heat of the day are few and far between.

LEFT Overall, it is large birds that are the first to show signs of heat stress as temperatures rise. Common Ostriches *Struthio camelus* show discomfort behaviour at the lowest temperatures.



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Focal bird studies

As temperatures rise, we expect that birds will increasingly be forced to trade off behaviours important for maintenance and reproduction (e.g. foraging and parental investment) for thermoregulation. For example, in turn they may be forced to stop foraging to seek shade. This may impact body condition, breeding success, or even survival. In late 2010, we started two projects to explore the extent to which this is happening. Susie Cunningham, another Fitz Post-doctoral Fellow, is exploring the possible trade-offs between foraging and thermoregulation in Common Fiscals *Lanius collaris* in Tswalu. These birds hunt from open perches exposed to the full force of the sun. Susie is using experimental arrays of perches that provide both shaded and exposed hunting opportunities in order to monitor the birds' foraging and shade-seeking behaviour. She will also use



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custom-designed perch balances to measure how trading off foraging for thermoregulation may affect body condition and the growth and survival rates of their chicks.

North-west of Tswalu, at the Kuruman River Reserve, CB student Katherine du Plessis is studying similar trade-offs in a habituated population of Southern Pied Babblers *Turdoides bicolor* (see p. 80). These birds are trained to weigh themselves twice a day, and it is easy to quantify their behaviour and energy gain under different environmental conditions. Kate's project is assessing how their foraging performance and decisions to abandon foraging to seek shade differ between hot and cooler days and whether this trade-off impacts body condition during periods of hot weather.

Many Kalahari birds breed at the hottest time of year, when summer rains increase the abundance of food. During hot periods, breeding birds are forced to trade off thermoregulation against the demands of breeding as well as their own maintenance. Starting in 2010, Susie and Rowan have begun working with a behavioural ecology research team from the University of Exeter, UK, who are investigating aspects of co-operative breeding in White-browed Sparrow-Weavers. This species is among the first to show signs of heat stress and reduced foraging activity on hot days: it is thus an ideal study species in which to explore the effects of high temperature on reproductive behaviour.

Impact of the project

By quantifying the key variables relating a bird's responses to climate change, this project will provide empirical support for models to predict the impacts of climate change. The need for such data has been highlighted during attempts to develop the next generation of climate-change-impact models by researchers from



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ABOVE LEFT Post-doctoral Fellows Rowan Martin and Susie Cunningham measure growth rates of Common Fiscals *Lanius collaris* as part of a study linking ambient temperature to breeding success.

ABOVE Rowan and Susie position mounted bird models equipped with i-buttons to measure the effects of temperature, wind and shadiness on body temperature.

UCT, SANBI and the Universities of Durham and Cambridge, UK (funded by the Leverhulme Trust). The project has great potential for training students not only in ecology and physiology, but also environmental science and conservation biology; it has already involved two Post-doctoral Fellows, one PhD student and three MSc students. The trick now is to convince funding agencies that climate-change models alone will not provide the answers we need – we need real data about how real birds and other organisms respond to actual environmental phenomena.

Key co-sponsors

The Tswalu Foundation.

Research team 2010

Prof. Phil Hockey (PFIAO)

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

Dr Susie Cunningham (PFIAO Post-doctoral Fellow)

Dr Rowan Martin (PFIAO Post-doctoral Fellow)

Students: Katherine du Plessis (CB MSc), Gina Louw (CB MSc), Ben Smit (PhD, Univ. Pretoria)

Research assistants: Laura Barclay, Craig Harding, David Nkosi, Robert Sutcliffe

Biodiversity-friendly farming in moist highland grasslands

SOUTH AFRICA'S GRASSLANDS ARE HOME TO OVER 3300 PLANT SPECIES, 15 OF THE COUNTRY'S 34 ENDEMIC MAMMALS, 12 OF THE 40 ENDEMIC BIRDS (FIVE OF WHICH ARE GLOBALLY THREATENED) AND FIVE RAMSAR WETLAND SITES.

Sixty percent of South Africa's grasslands have been irreversibly degraded. Moist Highland Grasslands in South Africa (of which only 1.5% are conserved) are naturally maintained by winter and spring fires and by summer grazing by migratory herds of small to medium-sized antelope. Prior to the advent of agriculture, these grasslands probably only burned at intervals of four years or more. Currently, most of the system is managed by livestock farmers (mostly farming cattle) who burn their land annually at the onset of the rainy season (in early summer). This coincides with the beginning of the breeding season for grassland-nesting birds. Currently, therefore, we face a situation in which the two major disturbance agents in these grasslands – fire and grazing – have been substantially altered. But this presents the opportunity to manage these disturbance agents to optimise ecosystem health within the economic constraints of food production. The overarching aim of this study, carried out by PhD student Ian Little, was a challenging one – to understand how fire and grazing interact to influence communities of plants, arthropods and, ultimately, birds.

The project design comprised eight management treatments, ranging from a nature reserve, through various farming practices with differing stocking rates and burn frequencies, to communal lands that lack a managed fire regime. In terms of vegetation quality, burn frequency has an over-riding effect. Both species diversity and vegetation structure are negatively impacted by annual burning (the norm), and a combination of frequent fires and the presence of livestock results in a dense, low, lawn-like sward. The same effect occurs in communal lands, even though fires are not managed, simply because the grazing pressure is so



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high. Frequent burning also impacts the diversity of arthropods, with diversity being lowest in annually burned areas. However, in terms of food for birds, the pattern is somewhat different. The arthropod fauna is dominated in terms of both numbers and biomass by grasshoppers (which are good food for insectivorous birds). Grasshoppers respond positively to burning, and reach highest biomass in sites that have been burned in spring, reaching peak abundance towards the end of the summer growing season.

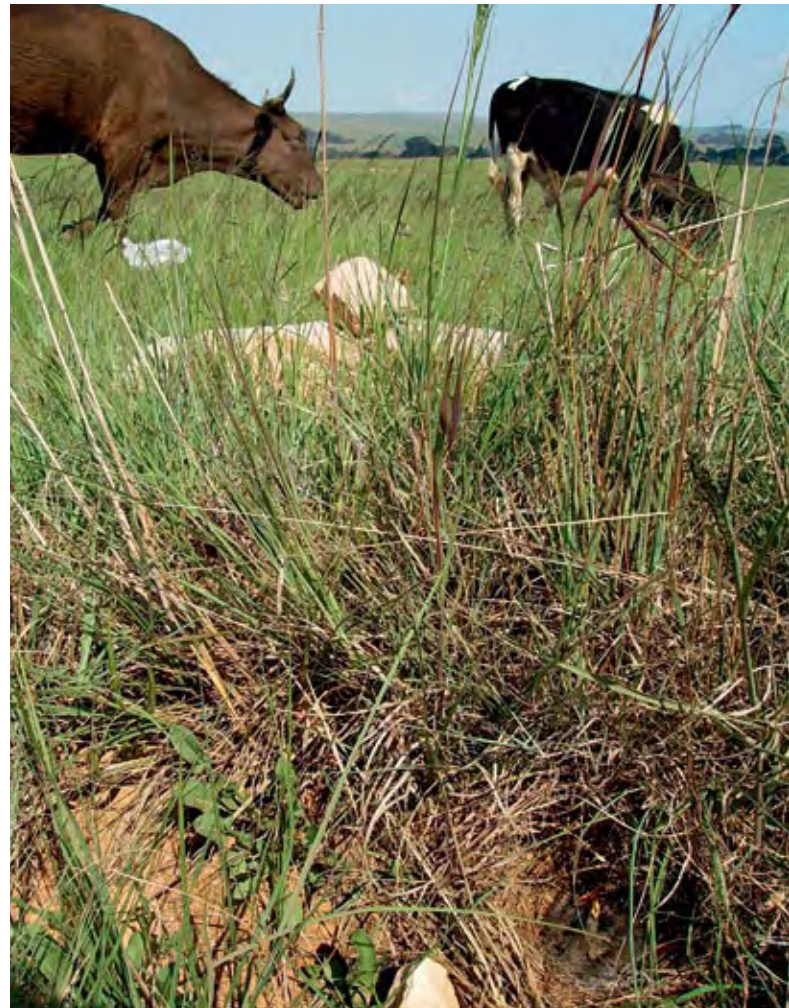
The different responses of vegetation and arthropods to management practices create an ecological conundrum for birds. These grasslands are rich in bird, mammal and snake predators (the latter being the main predators of eggs and chicks). Food is most abundant in areas burned in that breeding season, yet the lawn-like grass sward provides little concealment for nests. This also raises the possibility that bird density (if birds aggregate where food is abundant) may not mirror reproductive success (because nests in these sites are easily located by predators).

For this reason, Ian's research concentrated on process-oriented data in addition to inventory-type data. In particular, he was interested in quantifying reproductive success and how that related to management. After following the fates of more than 400 nests of grassland-specialist birds, Ian was able to model nest survival (from egg-laying to fledging) to assess how management practices influenced reproductive success. Results clearly indicate that both nest-site selection and nest success are driven primarily by vegetation structure, which itself is driven by habitat management. For birds that build cup nests on the ground, nest success rates increase through the season in response to decreasing predation rates as vegetation structural complexity increases. This finding is in direct contrast to Northern Hemisphere studies which have found that nest success decreases through the season, being driven primarily by lowered food availability rather than by predation pressure. One of the high-altitude grassland specialists is the Yellow-breasted Pipit *Hemimacronyx chloris* (a globally *Vulnerable* species). Nesting success and abundance of this species suggest that unconserved areas (farms) may house sink populations of this species: in some sites and treatments, the species was totally absent.

As an additional means of assessing the ecological integrity of farmed grasslands we used field metabolic rates (FMR) of birds and an adaptation of the Biodiversity Intactness Index (BII), which is a multi-taxon approach using plant, insect and bird diversity data. These analyses confirm the importance of conserved areas for birds in the moist highland grasslands. It is also clear that current farm management practices have significant negative impacts on bird abundance, species richness, nest density and fledgling output, highlighting the need for management in these 'matrix habitats' to be improved to make them more biodiversity friendly. Ian's research also showed that some simple changes to current management practices could translate into immediate and measurable biodiversity benefits without compromising the economics of livestock production. These revolve around fire management, fire being the most important driving force in these grasslands. If managers were to burn biennially or every three years, and to burn in a patchwork such that their farms contained grasslands of different 'ages', the benefits to biodiversity would be immediate and demonstrable.

Impact of the project

During 2009, an extensive report emanating from the project's preliminary findings was requested by the Mpumalanga Tourism and Parks Agency (MTPA) to inform them about appropriate stocking densities



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OPPOSITE The endemic, grassland specialist Yellow-breasted Pipit *Anthus chloris* is among the species most sensitive to injudicious land use.

ABOVE Unlike the specialised Yellow-breasted Pipit (opposite), the generalist African Pipit *Anthus cinnamomeus* (nest and brood shown here) is one of the few species to breed both regularly and successfully in communally grazed lands.



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of indigenous herbivores, specifically the Blesbok *Damaliscus dorcas*, on the Verloren Valei Nature Reserve. Following the recommendations of the report, Blesbok numbers were significantly reduced on the reserve during 2010. The findings of the study were presented at a symposium on Bird Conservation in Agricultural Lands as part of the 25th International Ornithological Congress, held in Brazil in August 2010. Even before submission of his PhD thesis, Ian Little was appointed as the Threatened Grasslands Species Programme Manager of The Endangered Wildlife Trust: he is currently co-developing a national grasslands management plan.

ABOVE Migratory Common Quails *Coturnix coturnix*, which breed in South Africa, were much more common in the nature reserve than they were in any of the farmed grasslands.

RIGHT PhD student Ian Little uses a large auger to make a hole that will be filled with a pitfall trap to catch arthropods as one means of measuring the abundance of food for grassland-nesting birds.



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Key co-sponsors

The South African National Biodiversity Institute (SANBI), the Rufford Small Grant Foundation, the National Research Foundation and Tshwane University of Technology.

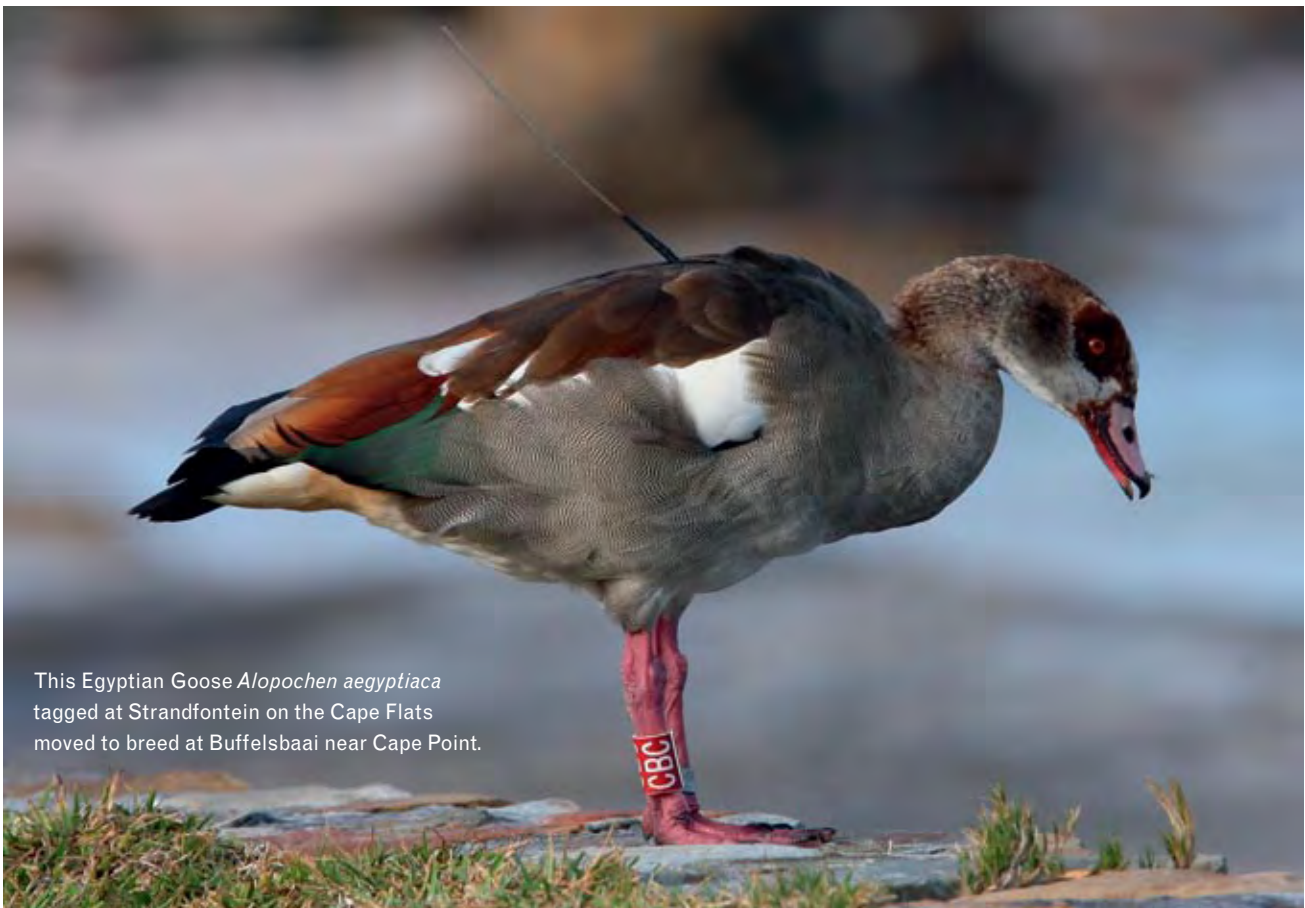
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Ducks, dispersal and disease

The movements and epidemiology of southern Africa's nomadic waterfowl and their pathogens

WATER IS AN ESSENTIAL RESOURCE FOR PEOPLE AND OTHER ANIMALS ALIKE. IN SUB-SAHARAN AFRICA'S ARID ENVIRONMENTS, WATER CAN BE A SCARCE AND FLEETING COMMODITY. THE SOUTHERN AFRICAN BIRDS THAT DEPEND HEAVILY ON SURFACE WATER CONSTITUTE A TOUGH AND MOBILE COMMUNITY WHOSE MEMBERS HAVE BEEN SELECTED OVER MILLENNIA FOR THEIR ABILITY TO FIND AND USE RESOURCES THAT VARY HUGELY IN BOTH SPACE AND TIME. THEY ARE GENERALLY THOUGHT TO MEET MANY OF THE BROAD EXPECTATIONS THAT ECOLOGISTS HAVE OF ANIMALS THAT USE PATCHY RESOURCES ON AN OPPORTUNISTIC BASIS: AMONGST OTHERS, HIGH POPULATION GROWTH RATES UNDER GOOD CONDITIONS, HIGH MOBILITY, AND A STRONG CAPACITY TO LOCATE RESOURCE-RICH LOCATIONS.



This Egyptian Goose *Alopochen aegyptiaca* tagged at Strandfontein on the Cape Flats moved to breed at Buffelsbaai near Cape Point.

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These same characteristics also make the movements of water-associated birds difficult to study. Despite decades of often intensive ringing and counting, relatively little is known about the long-distance movements of most southern African ducks. Red-billed Teal *Anas erythrorhyncha* ringed at Barberspan, in the North-West Province have been recaptured as far north as Tanzania and as far south as Cape Town. Equally intriguingly, anecdotal accounts from bird hunters and amateur ornithologists suggest that huge influxes of some of our most mobile ducks, including Comb Ducks *Sarkidiornis melanotos* and teal, may occur in certain places and at certain times of the year. However, it has been difficult to pin down these movements with any certainty. A telemetry study of White-faced Duck *Dendrocygna viduata* by Scott Petrie and Kevin Rogers found that birds from Nylsvlei moved only a few hundred kilometres.

The frequency and magnitude of large-scale population movements is impossible to quantify rigorously from amateur accounts, and the data obtained by more systematic protocols (such as the South African Bird Atlases and the CWAC count database) are surprisingly difficult to interpret in a consistent manner. Rigorous, peer-reviewed studies leave us with two contrasting views: ducks as lazy locals that move only a few tens

of kilometres per year, versus ducks as opportunistic migrants that may move thousands of kilometres to exploit ephemeral resources.

ABOVE Waterbirds are adept at exploiting ephemeral waterbodies, especially in areas where rainfall is often erratic. Their frequent movements make them potentially important vectors of a variety of diseases.

Uncertainties over the exact nature and frequency of waterbird movements create difficulties for their conservation and management, human health care, and veterinary scientists with an interest in the health of South Africa's poultry stocks. Many seemingly simple questions are currently unanswerable. For example: if populations of some of our ducks were decreasing (as has been proposed for African Pygmy-Goose *Nettapus auritus* and Maccoa Duck *Oxyura maccoa*), would we know, and would we be able to prove it? How strong a regional decline can we currently detect? What would be the impact on aquatic and riparian ecosystems if duck abundance greatly increased or decreased, or particular kinds of species were lost? And if a virulent pathogen such as highly pathogenic avian influenza (H5N1) were to enter southern Africa, how far and how fast could wild birds carry it? Were relatively recent outbreaks of the fatal H5N2 avian influenza

in ostrich farms in the Cape caused by inadequate precautions relating to the transport of domestic poultry, or by strains of the virus that were transported by wild Egyptian Geese *Alopochen aegyptiaca*? And just how worried should people be that H5N1 has made its way south as far as Kenya?

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

History of the research programme

The Institute, in partnership with the Onderstepoort Veterinary Institute (OVI), Cirad (the French Centre de Coopération Internationale en Recherche Agronomique pour le Développement) and the Wildlife Conservation Society, led the implementation of the southern African component of the USAID-funded GAINS (Global Avian Influenza Network for Surveillance) initiative. The field component of this intensive two-year project ran from 2007 to 2009. It included regional data collection on 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 (Lake Ngami), Mozambique (Lake Chuali and a single mission to Massingir Dam) and Zimbabwe (Lake Chivero and Manyame, both in the Manyame River catchment, near Harare). The primary aims of the project were 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 waterbirds.

During the two years of the project we conducted over 2,500 standardized point counts and collected samples from nearly 5,000 water-associated birds. Samples included blood, feathers, photographs, cloacal and tracheal swabs, and a full range of morphological data. We also measured water quality at each point count

site during each mission and attached a total of 44 satellite GPS transmitters to Red-billed Teal and Egyptian Geese at our three core sites (Strandfontein, Barberspan, and Manyame).

The avian influenza samples were divided into two equivalent batches. The first was analysed by OVI and the second in Italy at the FAO Reference Laboratory (IZVe) in Padua. Sample analysis for avian influenza was only completed in 2010 and we have spent much of the anniversary year analysing the results. From the original 44 transmitters, eight are still working and returning good data; some Egyptian Geese have now been tracked for over two years, with GPS fixes every 4 hours during the day yielding a rich and accurate account of their movements.

Student projects

The GAINS funding provided support for several Fitztute students, and the data and equipment obtained through the GAINS funds have provided a nucleus of resources that have contributed to ongoing projects supported mainly by the Centre of Excellence. Student involvement has proceeded in several complementary directions.

Zimbabwean students Gregory Mutumi and Mduduzi Ndlovu were both heavily involved in the field component of the GAINS project. Gregory's project (submitted as an MSc in 2010) focused on trying to understand and interpret the isotope signatures of feather samples from ducks collected at each of our five sites. Because ducks undergo a complete and synchronous moult of their wing feathers, Gregory was able to compare freshly grown feathers (which we could be sure were grown on site) with body feathers, which would have been grown at feeding and breeding sites. We were interested in learning (1) whether different study sites, each over a thousand kilometres apart, had different isotopic signatures; (2) what the level of variation in feather isotopes was between different seasons from the same site; and (3) whether we could detect any consistent evidence for dietary convergence or dietary differences from feather isotopes. In theory, grazing ducks such as Egyptian Geese should have different carbon and nitrogen signatures from dabbling ducks because of differences in the ratio of C3:C4 plants in their diets; and ducks which feed primarily on benthic invertebrates, and hence occur higher in the food chain, should have enhanced levels of heavy nitrogen. Gregory's results suggest that although consistent inferences about movement may be drawn from isotope ratios for some species, there is a considerable amount of variability by site, season and population within freshly grown wing feathers. The technique thus appears less useful

for movement analysis than we had hoped, although Gregory's results suggest that it may be possible to use nitrogen signatures to distinguish birds that forage in coastal areas (e.g. Strandfontein and Rietvlei) from birds that forage exclusively in freshwater systems.

Mduduzi upgraded his project from MSc to PhD at the start of 2010. His results suggest that Egyptian Geese show an unexpectedly high level of phenotypic plasticity, redistributing body mass between organs and flight muscles in a way that differs from the 'standard' Northern Hemisphere model. Our best guess as to why they should do this is that it probably permits them to fly earlier after wing feather moult, which would allow them to escape drying wetlands, return to foraging sooner, and more effectively avoid predation. Mduduzi has found different moult patterns in some other species (including the other local tadornid, the South African Shelduck *Tadorna cana*) and is currently working on the relationship between foraging style and moult physiology. He has also been exploring the influence of seasonality and rainfall on the timing of moult; and, more recently, resource use and moult patterns from satellite-tagged ducks in the Western Cape.

While Gregory and Mduduzi have both undertaken projects on the fundamentals of waterbird ecology, Sharon Okanga and Post-doctoral Fellow Felix Nchu have been working directly on pathogens. Sharon's project is focusing on avian malaria in the Western Cape, exploring the influence of landscape location (primarily in relation to an urban-rural gradient) on levels of avian influenza in passerines living near small wetlands. She sampled and counted birds at 25 different sites in 2010 and has screened over 400 blood smears from passerines, of which >50 appear to be positive. We thus anticipate finding a prevalence of avian malaria in passerines in the Western Cape of around 12%.

Felix's project is also focused on avian malaria. In 2009-2010 he captured 200 waterbirds from six different wetlands in the Western Cape and spent time screening >1 300 waterbird blood smears from the GAINS project for blood parasites. Preliminary analysis of the data suggests that parasite prevalence varies spatially and among avian hosts; and that parasite detection and prevalence varies significantly between screening methods (molecular or microscopy). Felix's work focuses on the prevalence of avian malaria parasites and the relationship between environmental variables and parasite abundance in the Western Cape. He has also been collecting samples for testing for West Nile Virus and the virus that causes Newcastle Disease and has found, together with OVI, that West Nile Virus can infect African Black Oystercatchers *Haematopus moquini*. However, further analyses are needed to confirm these results.

Main findings

Our main findings to date include the following:

- The prevalence of avian influenza in southern African waterbirds is relatively low, at around 2.5%. From around 5 000 samples we found just 125 birds with avian influenza. There is, however, considerable spatial and temporal variation in influenza prevalence, with highest levels in Zimbabwe, where prevalence reached 24% during one sampling mission.
- There is no detectable influence of the annual influx of Palearctic-breeding migrants on avian influenza prevalence in southern Africa. Influenza viruses appear to be in circulation within local waterbird populations throughout the year.
- The prevalence of avian influenza in passerines is considerably higher than in European birds, and we obtained unexpected positives from longclaws and sparrowlarks. Interestingly, recent results from passerines tested in the USA show a similar trend.
- Egyptian Geese may not be the lazy suburbanites that we often picture them as, with many of our satellite-tracked birds from Barberspan travelling around a thousand kilometres to and from their moulting site. One bird flew from Barberspan to a wetland near East London in two days. By contrast, birds in the Western Cape tend to stay in the winter rainfall region and Zimbabwean birds mainly moved from the Manyame catchment north to the Zambezi Valley and back.
- Egyptian Geese show substantial flexibility in moulting behaviour and physiology, but this flexibility is not mirrored in the closely related South African Shelduck.
- Many ducks appear to be highly faithful to their moulting site and very precise in the timing of their flightless moult. For instance, we recaptured one satellite-tagged bird at the same location in Strandfontein, 364 days after first tagging it.
- The prevalence of avian malaria in typical southern African populations of water-associated birds appears to be close to 12% in passerines and possibly higher in waterfowl (nearer to 16%). We currently have little idea whether or how avian malaria may influence bird behaviour and survivorship, nor whether synergies exist between malaria and infectious zoonoses such as influenza, Newcastle Disease, or West Nile Virus.

Collaborations and future directions

As the scope and depth of our research on waterbirds and their pathogens has expanded, the programme has developed several active and interesting collaborations. We have worked actively with OVI since the inception of the programme and Celia Abolnik at OVI has tested many of our samples for pathogens, as well as leading a paper on the phylogenetics of avian influenza viruses in southern Africa.

Graeme was on sabbatical in 2010 and spent three months based at Cirad (in Montpellier, France). During this time he worked intensively with the animal health and disease group (AGIR), particularly Alexandre Caron, Nicolas Gaidet, Daniel Corn elis, and Julien Cappelle. At least four joint papers are envisaged in the near future from this collaboration, and a number of longer term projects and collaborative papers were also initiated. Alexandre oversaw sampling efforts at the Zimbabwean site and has already either led or contributed to three co-authored papers on avian influenza. Nicolas has been coordinating Cirad's bird sampling programme for avian influenza in other areas of Africa and has included our data in a larger, synthetic analysis of environmental influences on avian influenza. Intriguingly, a consistent story emerges to explain the role of rainfall and other environmental drivers on influenza prevalence between sites as diverse as Senegal, Mali, Malawi, Zambia, Zimbabwe, and South Africa. Graeme worked with Daniel on developing and testing a new approach to comparing home-range metrics and acted as an external examiner for Julien Cappelle's PhD thesis. Julien is continuing with Cirad for his post-doc and plans to incorporate Fitzitute data in a pan-African analysis of the incidence of Newcastle Disease; we hope to host him at some point in Cape Town.

In the USA, we have been further developing a collaboration with Jeff Peters at Wright State University in Ohio. Jeff has been analysing the genetics of our duck blood samples as well as helping to test for, type, and do phylogenetic analyses of malaria parasites in the same samples. He spent a week in Cape Town in December 2009 and he and his students have been gradually processing our samples through 2010. Preliminary results are interesting, suggesting (1) that several species of southern African ducks may have passed through a genetic bottleneck in relatively recent times; and (2) that the prevalence of avian malaria in our samples will be high enough for us to explore some interesting hypotheses that will link our point-count data to the richness and abundance of malaria strains. We plan to further expand the genetic component of the study through collaboration with Staffan Bensch



  DAVID NKOSI

ABOVE Post-doctoral Fellow Felix Nchu inspects a Cape Shoveller *Anas smithii* for evidence of ectoparasites.

(Lund University, Sweden) on the analysis of wader and passerine samples.

Lastly, Graeme has been working with  rjan Bodin (Stockholm University, Sweden) on the possibility of developing a set of network-based approaches to quantifying multi-scale habitat use from satellite telemetry data.

Key co-sponsors

USAID-funded Global Avian Influenza Network for Surveillance (GAINS).

Research team 2010

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Social-ecological resilience and landscape dynamics

Exploring the relevance of scale and spatial pattern for the long-term sustainability of ecosystems and human wellbeing

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 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 PROCESSES SUCH AS CLIMATE CHANGE, DISEASE OUTBREAKS, AND SPECIES LOSS.

One of the more important intellectual developments in ecology over the last two decades has been the realization that ecosystems and ecological processes have a location. Differences between locations are described generically as 'landscape heterogeneity', or spatial variation. Spatial variation can have some interesting effects on ecological processes; the predictions of just about any ecological theory must be reconsidered when spatial variation is included in the analysis. For example, spatial variation in reproductive success and resource availability can create sources (areas that are net exporters of individuals) and sinks (areas that are

net importers of individuals) within the same management area. These effects may modify the predictions derived from classical models that assume homogeneity and random mixing within populations, and can be vitally important for understanding the dynamics of populations of threatened species such as lions.

Human impacts on ecosystems are hugely variable in both space and time. Processes within human societies also have some strong parallels to processes that occur within ecosystems. For example, urban sprawl can create a situation in which a city council must continually channel funds towards providing basic infrastructure



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to outlying suburbs, reducing their ability to maintain the tax-paying and more profitable central suburbs at an acceptable level. This kind of dynamic, with its spatial structuring and continual flow of resources from one location to another, has much in common with the source-sink dynamics found in nature.

Human society is strongly dependent on ecosystems for a range of goods and services; and the influence of humans now touches every corner of the world. We thus live in a linked system of people and nature, a social-ecological system, in which many of the supposedly internal dynamics of human society have strong relevance for ecosystems and for conservation. For example, the changes to our climate that will influence all of the earth's organisms can be blamed in part on the failure of social collective action processes to reduce CO₂ emissions.

Many of the most pressing problems of our time thus have both social and ecological elements, and exhibit a strong form of spatial structuring – whether by biomes and nation states, regional connections, or finer-scale processes of land use and land-cover change. For ecologists and conservation biologists, understanding the role of space and spatial variation in system processes is thus a deep and fundamental problem.

We have been exploring the influence of spatial

ABOVE Termitaria in heavily elephant-impacted systems support essential habitats for cavity nesting birds such as Green Wood-Hoopoes *Phoeniculus purpureus*.

variation on ecosystems and social-ecological systems in several distinct project areas. Although this programmatic theme is not as clearly bounded as our research on waterbirds, it overlaps with it and is gradually converging on a subset of questions relating to broad-scale variation in land use and avian communities. In particular, we are interested in understanding how spatial variation in land use and management decisions affects avian communities; whether protected areas offer a genuinely useful conservation solution for bird communities, particularly where birds are far-ranging; whether, and how, birds perform important ecological functions and/or influence ecosystem processes; and how spatial variation in social-ecological systems affects the resilience of bird communities.

Ongoing research

There have been several significant developments in this research theme in 2010. Graeme used part of his sabbatical year to write a 300-page monograph, 'Spatial Resilience in Social-Ecological Systems', which is to be published by Springer in March 2011. The new book

builds on an earlier edited volume, 'Complexity Theory for a Sustainable Future' (Norberg & Cumming 2008, Columbia University Press) and explores the role and relevance of spatial variation for the resilience of social-ecological systems. It lays out a theoretical framework for the analysis of spatial resilience, explores the development of spatial models and related concepts in ecology, economics and sociology. The book concludes with a set of case-study analyses that illustrate some of the principles discussed through the book.

During the writing of the book, Graeme spent six weeks in Sweden working with colleagues at the Stockholm Resilience Centre and Stockholm University's Department of Systems Ecology. This period, and the four weeks that he spent in Stockholm in 2009, gave rise to some other collaborative initiatives. The most notable of these is our ongoing research on applications of network analysis in conservation and complex systems research, which has already yielded a publication in *Diversity and Distributions*. Graeme presented some of this work during an invited keynote address on network analysis in conservation biogeography at the meeting of the German, Austrian and Swiss Ecological Societies in Giessen, Germany, in September 2010.

Graeme also spent a couple of weeks in Austria working with a Canadian colleague, Jeff Houlahan, on the relationships between spatial and temporal variation. Although still in the early stages, we are hopeful that exploration of a wide range of long-term ecological data sets may yield some interesting results with potentially profound implications for sampling design and statistical analyses in ecology.

Two Fitztute students, Post-doctoral Fellow Xanic Rondon and PhD student Grant Joseph, have contributed actively to this theme in 2010. Xanic has been modelling deforestation processes in the Amazon using a set of predator-prey equations adapted from ecology. The focus of her research has been understanding how different spatial patterns of forest harvesting (largely contingent on the trade-offs between the prices of high- and low-value timber) may impact forest regeneration times. She has also worked with Graeme on developing a deforestation model that considers the potential role of edge-driven feedbacks, via fire, in increasing rates of forest loss and resistance to reforestation efforts. Both Graeme and Xanic have been working with Jane Southworth, of the University of Florida, on land use and land-cover change in our study site.

Grant has continued his doctoral research on the ecological role of large termite mounds in miombo woodlands in Chizarira National Park, Zimbabwe. Chizarira has been through a number of significant

changes in recent years, with rapidly increasing elephant populations now coming under increasing threat from poachers and fire. Grant's doctoral thesis will focus on the influence of spatial heterogeneity on species and functional diversity in disturbed landscapes. Some of his main findings to date are as follows:

- Differences in the plant assemblages on termite mounds (relative to the matrix) occur on even very small mounds.
- A number of distinct woody plant communities exist on termite mounds, related to mound surface area.
- Matrix indicator species drop out from the mound community at predictable intervals relative to mound area, and mound-indicator species emerge in similar fashion.
- Woody plants on mounds experience less frequent fire, but more fire damage, than do plants in the matrix. Matrix species burn more frequently and more intensely, but resprout with greater vigour than mound species. The implication is not only that the matrix is fire adapted and that mounds act as refugia for fire-sensitive species, but that at the landscape level, the movement of savanna fires is influenced by the presence of termitaria.
- Mounds support more tall trees, with associated deadwood, and hence offer an important refuge for cavity-making and cavity-nesting birds. A paper presenting these results is now in press with *Landscape Ecology*.

Grant co-authored a paper on changes in grazing potential and palatability in Karoo rangelands, and a second paper on tree-grass coexistence, with other Fitztute members and collaborators (in particular Sue Milton and Richard Dean). His work on termite mounds has also involved collaboration with botanists Zaccheus Mahlangu (formerly with the Zimbabwe Parks Authority) and Colleen Seymour (SANBI, Cape Town). Colleen has contributed to soil and vegetation analyses, as well as leading the Karoo rangelands paper, and remains an active participant in the research programme.

David Cumming, Honorary Professor at the Fitztute, has been deeply involved in Grant's research and has been doing some additional analyses on erosion of termite mounds, as evidenced by rings of white soil that form around damaged and abandoned mounds. These rings are frequently visible on aerial photographs. David's analysis of aerial photographs dating back to the 1960s suggests that rates of mound erosion have increased in tandem with increases in Chizarira's elephant population. This in turn suggests that elephant

overstocking has negatively impacted not only the matrix of Chizarira (which has been transformed from closed-canopy woodland to scrub) but also the additional biodiversity of the mounds. It thus remains to be seen whether, and how successfully, the additional resilience that mounds appear to offer bird communities (through the maintenance of cavity-nesting birds in the system) can buffer elephant impacts on the broader ecosystem.

Future directions

This programme has so far been highly productive in terms of concrete and useful results, student training, and peer-reviewed publications. We anticipate that it will continue to grow and develop along a variety of interesting trajectories. In 2011 we plan to extend the programme to gain a better understanding of the ecological functions, or impacts, of one or more groups of birds. Some of our previous analyses of atlas data suggested that protected areas in South Africa provide key habitat for a distinct set of functional groups of birds, particularly raptors and scavengers. It would be intriguing to test whether this finding has important local consequences for the economic viability of agricultural areas. Are there tangible benefits to agriculture from being located near to a fully functioning ecosystem, or from maintaining functionality and additional trophic levels within an agro-ecosystem? And how does the broader layout of agricultural landscapes influence the ecosystem services that are provided by birds? The challenge here is to use rigorous science to connect the dots of biodiversity, conservation, ecosystem function, ecosystem services, and human wellbeing. Two new pilot projects will focus on (1) assessing the role of waterbirds as nutrient movers and vegetation modifiers in coastal systems; and (2) quantifying the role of raptors (most likely, owls) in controlling rodent populations in agricultural fields where small grains are grown.

Lastly, we are in the early stages of planning a project to explore the role of private protected areas in South Africa and to understand better their contribution to both social and ecological systems. Key questions here are (1) whether private protected areas can be relied on into the future to contribute to national biodiversity conservation goals; and (2) whether, and how, different (human) community engagement strategies adopted by private protected areas influence their long-term viability.

ABOVE AND BELOW Termitaria are nutrient hotspots with specialized plants which are now heavily threatened in an elephant-impacted environment.




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Research team 2010

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- Student: Dr Grant Joseph (PhD)



*M*AKING PREDICTIONS ABOUT THE FUTURES OF POPULATIONS REQUIRES AN IN-DEPTH UNDERSTANDING OF HOW THOSE POPULATIONS WORK – WHEN AND WHY THEY GROW AND WHEN AND WHY THEY SHRINK. IT IS MUCH MORE THAN A MATHEMATICAL GAME OF BIRTH AND DEATH RATES, IT INVOLVES UNDERSTANDING *WHY* THOSE RATES CHANGE OVER TIME AND SPACE. LONG-TERM STUDIES ARE ESSENTIAL TO TEASE APART THE RELATIVE IMPORTANCE OF EXTRINSIC AND INTRINSIC FACTORS IN AFFECTING THE POPULATION TRAJECTORIES OF DIFFERENT SPECIES. THE FITZTITUTE HAS SEVERAL SUCH STUDIES ONGOING, AT SITES RANGING FROM ISLANDS OF THE SUB-ANTARCTIC, ACROSS SOUTHERN AFRICA’S SHORELINE, TO THE DRYLANDS OF THE KALAHARI DESERT. TRANSCENDING THE BOUNDARIES OF ORNITHOLOGY AND CONSERVATION BIOLOGY, SOME OF THESE STUDIES EVEN HAVE RELEVANCE TO THE EVOLUTION OF HUMAN BEHAVIOUR.

POPULATION AND BEHAVIOURAL ECOLOGY



*A Critically Endangered Tristan Albatross *Diomedea dabbenena* prepares to take flight on Gough Island.*

Some are more equal than others

Understanding individual variation in albatross breeding success

THE LONG DISTANCES BREEDING SEABIRDS TYPICALLY COMMUTE BETWEEN FEEDING AND BREEDING GROUNDS ENFORCE OBLIGATE MONOGAMY AND HIGH LEVELS OF MATE FIDELITY. SLOW PREY DELIVERY RATES TO CHICKS ALSO RESULT IN SMALL CLUTCH SIZES, ENCOURAGING SEABIRDS TO INVEST MORE IN SURVIVAL THAN REPRODUCTION. BUT DESPITE THESE CONSERVATIVE LIFE HISTORY TRAITS, THERE ARE LARGE DIFFERENCES IN BREEDING SUCCESS BETWEEN INDIVIDUALS. GIVEN THE PARLOUS CONSERVATION STATUS OF MANY SEABIRDS, IT IS IMPORTANT TO UNDERSTAND WHY SOME PAIRS BREED CONSISTENTLY WELL, WHEREAS OTHERS FAIL TO RAISE ANY CHICKS.

In the early 1980s, John Cooper was appointed Antarctic Research Officer at the Fitztitute. One of the first tasks he undertook was to establish long-term monitoring colonies among surface-nesting seabirds at Marion and Gough Islands. Most of these studies have continued unbroken since then, providing an increasingly valuable data series for tracking environmental change in the sub-Antarctic. However, studies of individually marked albatrosses and giant-petrels also offer the chance to investigate the breeding behaviour and fine-scale demography of these birds. Although the projects have

been running for more than 20 years, the long lifespan of some individuals mean that we are still unable to estimate their lifetime reproductive success, but we can use their breeding histories as a proxy for individual fitness.

PhD student Genevieve Jones has spent three years searching for correlates that can explain past breeding success among Wandering Albatrosses *Diomedea exulans* at Marion Island from current breeding characteristics, including parental breeding behaviours (e.g. breeding phenology and mating strategies), body condition, and breeding investment (egg size, chick protection and provisioning). The success of current breeding attempts is correlated to previous reproductive success, indicating an effect of individual 'quality'



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OPPOSITE PhD student Genevieve Jones takes a blood sample from a Wandering Albatross *Diomedea exulans* chick, assisted by Quentin Hagens.

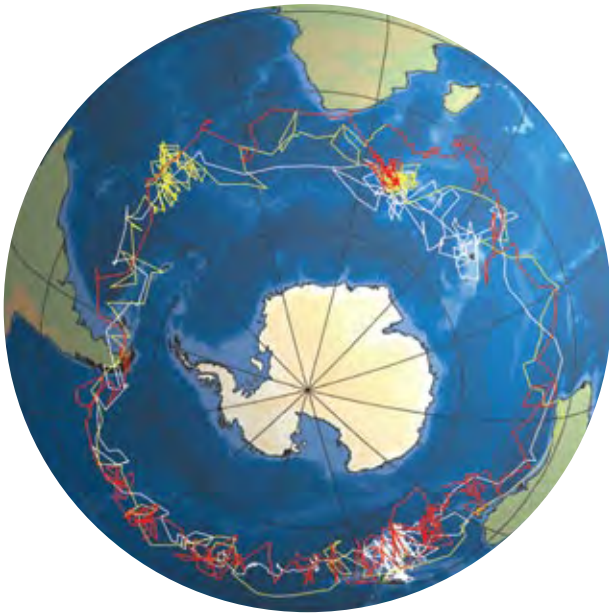
ABOVE A female Wandering Albatross broods its small chick. Breeding success varies consistently among individuals and pairs, suggesting that there are inherent or learned characteristics that make some birds better breeders than others.

on productivity, and a cross-fostering experiment suggests that parental behaviour is more important than inherent, genetic characteristics in this regard. Eggs from parents with poor reproductive histories are more likely to result in fledged chicks when placed with successful parents, whereas eggs from successful parents have less chance of succeeding when placed with parents with poor histories.

In terms of ecological correlates, birds decide whether to breed or not based on their time of arrival and body condition. Early arrivals are in better body condition and spend more time at the colony prior to laying. Neither of these factors explains current breeding success, but pairs with good reproductive histories spend more

time together prior to laying and tend to co-ordinate their arrival better than pairs with poor histories. Egg size has no effect on hatching success, development or fledging success, nor is it related to female body condition or 'quality'. Earlier hatching chicks are more likely to fledge than later hatching chicks, and chicks that were brooded for longer were more likely to fledge.

Male albatrosses are slightly larger than females. Although growth rates of chicks are independent of sex, male chicks attain greater size and mass prior to fledging, and thus require a greater parental investment. Mothers producing male chicks have better body condition than those producing females, which supports the Trivers-Willard theory that predicts individuals should invest in the more costly sex when in better condition. However, pairs with good reproductive histories tend to produce more females than pairs with poor histories. Experienced breeders forming new pairs also favour female offspring, possibly to offset the lowered predictability of partner investment compared to long-standing partnerships. By comparison, naive birds breeding for the first time show no sex bias in chick production.



Wandering Albatrosses breeding at Marion Island differ greatly in their movements during their sabbatical years following successful breeding. One male (above) travelled around the Southern Ocean three times, whereas the female (above right) mostly remained in the south-west Indian Ocean.



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Overall, there was a slight bias towards producing female chicks (56%) at Marion Island during 2006-2009. Wandering Albatrosses at the nearby Crozet Islands are reported to have a male-biased adult population, apparently linked to the females' more northerly foraging ranges which overlap more extensively with long-line fishing for tunas. A female-bias among chicks would help to offset an excess of adult males. However, estimating the adult sex ratio is complicated by only being able to sample birds at the colony, where unmated males are easier to detect than unmated females because they arrive earlier, spend more time ashore, and are more likely to return to the colony each year, whereas females often fail to visit during their sabbatical years. Significantly more non-breeding males than females were recorded prior to laying in each year of the study, but over all three years the breeding population was not significantly male biased (52%). Comparable data are needed from the Crozets to see whether that population really is male biased or not.

Although the cross-fostering study suggests that parental quality mainly determines breeding success, we have not ignored genetic factors. There is no evidence of inbreeding or outbreeding avoidance among the albatrosses, and we are currently awaiting results to see whether individuals select partners that complement their diversity in the major histocompatibility complex

(MHC), which is important in immune response. A fascinating aspect of the genetic work has been the ability to study the patterns in extra-pair paternity (EPP). Although albatrosses are renowned for 'mating for life', recent studies have shown that some albatross chicks are sired by males other than their social father. At Marion Island, 14-24% of Wandering Albatrosses were cuckolded in the three years of our study. Among pairs producing two chicks, there was a tendency to produce either within-pair chicks or extra-pair chicks, suggesting that EPP isn't a random event. Several forced copulations were observed in the study colony, but none resulted in an EPP, suggesting that female choice is the main mechanism. Females were observed consorting with extra-pair males inside and outside the colony, but we can find no support for any of the ecological or genetic hypotheses proposed to explain EPP among monogamous organisms.

In addition to the work on Wandering Albatrosses, we have conducted a similar study on Grey-headed Albatrosses *Thalassarche chrysostoma* on Marion Island. The study colony of this species was only started in 1997, when large numbers were being killed by the fishery for Patagonian Toothfish operating around the Prince Edward Islands. And because the colony is distant from the base on Marion, it was not possible to perform intensive checks throughout the breeding season. However, the albatrosses breed on a low cliff, so it is relatively easy to log the movements of all birds, and observe social interactions, throughout the pre-laying period. Morgan Commins analysed these data for his zoology honours project, and his findings will be compared with genetic evidence of EPP.



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Impact of the project

This is the first large-scale, multi-year analysis of albatross paternity at a colony where the birds' breeding histories are known. Albatrosses provide some of the best demographic data for any birds, but modelling their populations still relies largely on average parameter estimates. Our studies show that the 'average albatross' is a myth, and that we need to understand the factors driving individual-level variation in reproduction and, ultimately, survival. The demographic consequences of human-induced mortality, such as accidental capture by fishing gear, can only be ascertained properly once we assess which individuals are being killed. Genevieve Jones and Mareile Techow presented research from this project at the First World Seabird Congress held in Victoria, Canada, in September 2010.

ABOVE Differences in adult foraging are likely to be a key factor determining differences in breeding success among albatrosses, such as these Grey-headed Albatrosses *Thalassarche chrysostoma*.

Key sponsors

The South African National Antarctic Programme.

Research team 2010

Assoc. Prof. Peter Ryan (PFIPO)
 Dr Richard Phillips (British Antarctic Survey)
 Dr Mareile Techow (PFIPO Post-doctoral Fellow)
 Students: Morgan Commins (BSc Hons), Genevieve Jones (PhD)
 Research assistants: Ben Dilley (2009/10),
 Mia Cerfonteyn (2010/11)

Cooperative breeding by babblers

A unified front or self-serving behaviour?

COOPERATION AMONG INDIVIDUALS HAS ATTRACTED ATTENTION OVER THE YEARS BECAUSE OF THE APPARENT SELFLESSNESS AND HELPFULNESS OF GROUP MEMBERS. HOWEVER, A CLOSER LOOK AT THE CAUSES AND CONSEQUENCES OF HELPING BEHAVIOUR REVEALS CONFLICT AMONG GROUP MEMBERS AND COOPERATION FOR ENTIRELY SELFISH PURPOSES.



AB&B 15(6):31.

When we see several birds helping to feed young at the nest of another bird, we assume that those birds are being particularly useful. After all, why bother to help raise the young of others when instead you could be helping yourself? Hamilton tackled this question half a century ago and came up with an idea: individuals will only help their relatives. Why? By helping relatives to survive, they will successfully pass some of their own genes onto the next generation. So, helpful? Yes. But selfless? No.

Hamilton's idea inspired a generation of behavioural ecologists to investigate the relationship between levels of relatedness and helping behaviour. Unfortunately, his idea of kin selection wasn't always supported. Time and again, ecologists found unrelated individuals helping others to raise young. Were these simply confused individuals? Possible, but not likely: there must be other reasons to explain cooperative behaviour.

That is one of the key goals of the Pied Babbler Research Project, run by the FitzPatrick Institute and established by Dr Mandy Ridley over the last eight years. By habituating groups of Southern Pied Babblers *Turdoides bicolor*, it is possible to collect detailed behavioural observations under natural conditions, and to conduct experimental modifications of behaviour through the use of playbacks and supplemental feeding. Although the babblers are obligate cooperative breeders, there is huge variation among individuals in the amount of help given and the cost of that help. Curiously, the amount of help given is not predicted by relatedness. Indeed, the parents of the brood (and hence those most closely related to the brood) tend to help less than other group members. Recent genetic research by PhD student Martha Nelson-Flower has proved this genetic relationship. But why would this be?

Mandy has found that by partitioning help among group members, the group can dramatically increase productivity. For example, by passing on the care of fledglings to helpers, the dominant pair can gain weight and prepare for a new brood. Thus the group is able to produce more broods per season through division of labour among group members. This is great for the dominant pair, but how does an unrelated helper benefit? Mandy has discovered several benefits: larger groups are able to monopolise the best territories, which attract good-quality mates, and significantly increase the body condition of resident birds. Helpers in these groups can hope to inherit an 'empire' if a dominant bird dies, or they can disperse in very good condition,

OPPOSITE The provisioning of young is carried out by all group members, but current research shows that younger individuals bear more of the load than older birds.



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TOP Decisions about 'fight or flight' are based in part on calls and assessing the likely outcome of a confrontation.

ABOVE Mandy Ridley illustrates the meaning of habituation.

increasing their chances of successfully winning a fight for dominance in another group.

The way help is measured can have important influences on conclusions about the occurrence of cooperative behaviour. Traditionally, studies have measured the number of visits to the nest area. However, Mandy has found that this poses several problems. First, in cooperative species, young tend to receive significant care from adults for 2-3 months after they fledge, so care at the nest is only a fraction of the support given to young birds. Second, visit rate underestimates the amount of care provided by individuals that have very low foraging efficiency. In Pied Babblers, foraging ability increases dramatically with age. Young individuals take a long time to both find and handle food items. As they get older, babblers learn how to search for and dismember larger prey (such as scorpions) more efficiently. This means that a visit to the nest by an



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older bird may represent only half a minute of foraging effort, whereas it could represent up to 10 minutes of effort by a young bird. If help is measured relative to ability, then the predictions of who provides the most help to young change dramatically. This research suggests that traditional measures of help may have misrepresented the costs of cooperative helping. Does help need to be considered differently in other studies in order to understand the causes of variation in helping behaviour? This finding opens up an intriguing and controversial new area of research into cooperation.

Other research being conducted at the study site investigates alternative (non-kin) reasons for the occurrence of cooperative behaviour. For example, Mandy and PhD student Alex Thompson have used experimental playbacks combined with natural observations to show that sentinel behaviour is



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LEFT Sentinels allow the group to forage more intensively but contrary to previous studies Southern Pied Babbler *Turdoides bicolor* sentinels are not selfish and are the last birds to reach safety when a predator is spotted.

TOP Cooperatively breeding Southern Pied Babbler live in close-knit groups who regularly preen each other to cement social bonds.

ABOVE Fledgling begging in Southern Pied Babbler is a signal of need.

OPPOSITE When fledglings beg too intensely for food adults often reprimand them physically.

beneficial to the group by providing effective and useful information about predator presence. Larger groups benefit from having a sentinel present more often, and this provides a benefit in terms of lower predation rates on young. Their work on sentinel behaviour has shown that sentinels are not simply present for selfish reasons: previous work suggested that satiated individuals guard because this is the safest place to be to detect predators. However, in Pied Babbler, sentinels are not safe; they perch in exposed areas (such as dead trees), at a considerable distance from cover, and are more exposed than other group members. They choose these perches presumably because of greater visibility to detect approaching predators, but when a predator alarm is given using playback, the sentinel is the last to make it back to cover and safety.



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Alex is also conducting research into family relationships within each group, and the conflicts that arise within them. In the 1970s, Trivers formalized the idea of parent-offspring conflict, whereby offspring try to procure more care from parents than parents are willing to give. The majority of studies into this intriguing area of family life have been done at the nestling phase, but babblers offer the opportunity to study provisioning after fledgling, which is the longest and most intensive period of care. By investigating care-giving and conflict during this relatively understudied period, we can gain a greater understanding of the consequences of parent-offspring conflict, because variation in care at this stage can have long-term consequences for offspring. Thus far, Alex has investigated the dynamics of the fledgling begging system. Through playback and feeding experiments, he has shown that fledglings beg according to their level of hunger and that adults provision offspring accordingly. There is no evidence of competition between broodmates when they are begging. An investigation into conflict over the location of young fledglings has shown that offspring manipulate their care-givers into provisioning them: they do this by moving to the ground (a dangerous location for fledglings, who in their first two weeks are unable to fly) and putting themselves at risk. Adults respond to this change in location by immediately feeding fledglings to encourage them to move back into the safety of the trees. These insights are helping us gain a greater understanding of family life in cooperatively breeding birds. Research in this area is ongoing and

Alex is sure to unveil more of the mysteries of family life in these fascinating cooperative breeders.

Impact of the project

The Pied Babbler Research Project is one of only a few cooperative breeding bird projects in the world where daily information on changes in body condition can be collected. The high level of habituation has allowed researchers to gain an intimate view into the costs and consequences of cooperative activity and other behavioural decisions, providing unique information of novel value and interest to the cooperative breeding research community worldwide. The information gained from research at the site has the potential to change the way that we think about why cooperation occurs and how it is measured.

Key co-sponsors

The University of Cape Town's Research Committee, National Geographic Society, British Ecological Society and Macquarie University.

Research team 2010

Dr Amanda Ridley (Macquarie University & Honorary Research Associate)
 Prof. Phil Hockey (PFIAO)
 Dr Matthew Bell (University of Edinburgh)
 David Humphries (Macquarie University)
 Students: Martha Nelson-Flower (PhD),
 Alex Thompson (PhD)
 Research assistants: Adam Britton, Fiona Finch

Pushing the City limits: Peninsula Peregrines

*Drivers of population
growth in a cosmopolitan
'super-predator'*



THE PEREGRINE FALCON *FALCO PEREGRINUS* IS A BIRD GIVEN TO PARADOX. IT IS ONE OF THE MOST WIDESPREAD TERRESTRIAL VERTEBRATES ON THE PLANET, YET ASPECTS OF ITS BIOLOGY ARE HIGHLY SPECIALIZED AND IT IS GENERALLY QUITE RARE. IT IS AN ICON OF WILD PLACES AND UNTAMED NATURE, NOTORIOUS FOR ITS SUSCEPTIBILITY TO CHEMICAL POLLUTION, AND YET IT THRIVES IN BIG CITIES ACROSS THE GLOBE. WE HAVE AN INTIMATE KNOWLEDGE OF ITS NATURAL HISTORY, AND YET ITS CONSIDERABLE POTENTIAL AS A SUBJECT FOR SCIENTIFIC STUDY HAS REMAINED LARGELY UNTAPPED. THE FITZTITUTE'S WORK ON THIS REMARKABLE BIRD BEGAN OVER 20 YEARS AGO AND IS NOW STARTING TO BEAR FRUIT OF A BETTER UNDERSTANDING ABOUT RAPTOR BIOLOGY AND RAPTOR-HUMAN INTERACTIONS.



AB&B 15(1):46-55

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Single-species studies with little broader conservation relevance are no longer fashionable in biology, and unless a taxon is on the verge of extinction, such singular preoccupations are generally frowned upon. But the pedigree of the Peregrine, in particular its cosmopolitan nature, may set it apart as a valuable exception. Not only is the Peregrine a dramatic predator, and a super-fast and dynamic flier, it also offers some fascinating avenues for scientific research. What better way to understand the effects of macro-scale environmental variation on the life histories of birds of prey than by studying the raptor that occurs just about everywhere? Where else are we more likely to register the full spectrum of impacts of global climate change on birds of prey than in the single species subject to almost all climate regimes? And how do we investigate the adaptive constraints of urban living on an apex predator, other than by tracking the demography and success of

ABOVE A Peregrine Falcon *Falco peregrinus* contemplates the pros and cons of city living from the top of Table Mountain.

RIGHT Andrew Jenkins doing the same ...



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a species that has infiltrated and conquered the biggest metropolitan centres on nearly every continent?

The Fitzitute's research on Peregrines, spearheaded by Andrew Jenkins, began in the late 1980s, focusing on latitudinal trends in density and productivity. In the late 1990s, the emphasis shifted to a more localized study of the dynamics of the population resident in the Greater Cape Town area. To this end, a detailed colour-ringing



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project was initiated in 1997 and is still ongoing, accruing data annually on survival, mortality, breeding success, dispersal, recruitment and diet. In two decades of monitoring, the study population has grown from 10 pairs to nearly 50 pairs, and is now one of the highest densities of Peregrines on record anywhere in the world. The original aim of the marking scheme

was to develop a demographic model for this Southern Hemisphere population, to compare with better studied northern birds. This has recently been expanded to include a modelled comparison of three hypothetical drivers of growth in the Cape Peninsula population: directional change in spring weather conditions (which significantly influences breeding success each year),

Key aims of the project

- To identify the key environmental correlates of demographic variation among Peregrine Falcons in South Africa, with particular emphasis on the influences of climate and urbanization on population dynamics.
- To improve understanding of the demographic characteristics of healthy or increasing raptor populations at a species level, in a (poorly studied) south temperate context, and in the global context of a uniquely cosmopolitan taxon.
- To evaluate the relative importance of individual vs territory quality in affecting breeding success in a marked population of Peregrine Falcons.



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immigration (of unmarked birds from off the Peninsula), and urbanization (the most rapid growth in the population is occurring in industrial areas north of the city centre).

The latter work has been done in collaboration with Res Altwegg of SANBI, whose bio-statistical skills have added hugely to the academic and publication potential of the project. The results of Res's preliminary analyses were presented at the International Statistical Ecology Conference at the University of Kent, in July 2010. They confirmed the role of weather as a factor contributing to the growth of the population, suggesting that warmer, drier springs are implicated, perhaps coincident with regional patterns of climate change. Immigration emerged as an equally relevant variable, as did urbanization. The effects of urbanization were examined in terms of two variables – proximity to suburban or urban areas and the presence or absence of an artificial nest box. Provision of nest boxes to accommodate breeding pairs of Peregrines on buildings around Cape Town started at one site in 1989, but only became widespread in the early 2000s as an applied management tool designed to soften the interface between Peregrines that took up residence on buildings, and building owners and occupants. There are now at least 12 pairs with access to these boxes, most of which are among the most successful breeders in the population, at least partly because they are protected from the negative effects of poor weather conditions at critical times in the nesting cycle.

OPPOSITE Colour-ringed Peregrine at a nest site in urban Cape Town.

ABOVE A plucky female Peregrine watches on while her eggs are measured and weighed.

'Human subsidy' is a term coined by Res to encapsulate a range of positive elements associated with urban living by Peregrines, which operate over and above the more obvious advantages offered by numerous high buildings as nesting and hunting sites, and an abundance of suitable prey species – doves, starlings, sparrows and pigeons. Important subsidies include the setting up of nest boxes, the rehabilitation and release of injured birds, and the assistance given to newly fledged young by repeatedly recovering them from the street and replacing them in the nest until they are strong enough to stay airborne. Such human reactions to co-habiting with Peregrines, presumably stimulated by the charisma of the birds, and perhaps the need of urban *Homo sapiens* to experience and empathize with this agent of wilderness, effectively off-set the many negatives of city living (collision hazards, chemical pollution, disturbance, persecution). Paradoxically, they render some of the harshest, most disturbed and developed urban and industrial areas on earth as optimal habitat for predator that is naturally associated with wild, mountainous habitats.

Key co-sponsors

The late Steve Phelps and Peregrine Properties, BirdLife South Africa and the Cape Bird Club.

Research Team 2010

Dr Andrew Jenkins (PFAIO Research Associate)
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 Anthony van Zyl (PFAIO Research Associate)
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Sociable Weavers

Working together for their future?

SOCIABLE WEAVERS *PHILETAIRUS SOCIUS* LIVE IN LARGE COLONIES THAT ARE BUILT AND MAINTAINED COMMUNALLY: COLLECTIVELY, THEY MAKE THE LARGEST NEST STRUCTURE OF ANY BIRD IN THE WORLD. A BREEDING PAIR WITHIN THE COLONY IS OFTEN ASSISTED BY NON-BREEDING 'HELPERS' THAT BRING FOOD TO THE NESTLINGS. UNDERSTANDING THE BENEFITS AND COSTS OF COOPERATIVE NEST BUILDING AND BREEDING IN THIS SPECIES HAS BEEN THE CENTRAL FOCUS OF OUR RESEARCH PROGRAMME.

The Sociable Weaver study was initiated in 1993 by Mark Anderson (currently Executive Director of BirdLife South Africa) to collect basic demographic data on a highly colonial species with an intriguing cooperative behaviour. In addition, Mark, then an ornithologist with Northern Cape Nature Conservation and based in Kimberley, was also interested in getting people involved in bird ringing. He set up a study population of Sociable Weavers at Benfontein Game Farm, some 15 km outside of town. For five years Mark and an enthusiastic group of volunteers regularly cap-

tured the resident birds at some 20 colonies on the farm. From the onset, the study was supported by the PFIAO through Morné du Plessis, then Director of the Institute. A behavioural ecologist with an interest in cooperative breeding, Morné had seen the potential of conducting research on this species, both for the long-term demographic data it could provide and for the interesting cooperative behaviour of these weavers. He has been proven right on both counts. In 1998, Rita Covas, a PhD student from Portugal, started a project on the cooperative breeding behaviour and life-history strategies of the weavers, starting a line of research that continues today. The weavers' fascinating behaviour and the strategies employed to survive in the harsh, unpredictable conditions of the Kalahari have provided exciting insights into our understanding of cooperative behaviour, but nonetheless continue to intrigue researchers. The research programme has recently regained new energy through two European grants (Portugal and UK) to conduct further research on these birds: the programme has also recruited two new post-graduate students and a Post-doctoral Fellow. What is already one of the longest term studies of a single bird population in Africa is set to continue for several years to come.



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ABOVE As granivores in semi-arid environments, Sociable Weaver *Philetaurus socius* numbers are influenced by rainfall events.

OPPOSITE Researchers catch Sociable Weavers as they exit their colonies at dawn by encircling the nest tree with mist nets.

Cooperation: why help?

Why do the 'helpers' assist other birds with their breeding attempts instead of breeding on their own? What are the benefits of this behaviour for both breeders and helpers? And what are the costs? Over the years, our research has shown that it is often the older offspring of



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the breeding pair that are retained as ‘helpers’. This suggests that kin selection (i.e. increasing one’s fitness indirectly by assisting the reproductive effort of close relatives) may play an important role in the evolution of this behaviour. This, however, does pre-suppose that the helpers do indeed contribute to increasing the reproductive success of the breeding pair: in the case of the weavers, this is not immediately obvious. Although our results have shown that the breeders do benefit from the presence of helpers under some conditions, this is not always the case. We have, however, shown that parents reduce their work loads when helpers are present, which may improve parental survival. To date, we have been able to demonstrate this effect for females, but not males. This suggests that females who have helpers may in some way be able to make a ‘saving’ on their reproductive effort. As of now, the evidence points towards females decreasing their investment in producing eggs, thereby saving energy for future reproductive events and enhancing

their own survival. The additional food provided to the chicks by the helpers may compensate for the smaller or poorer quality eggs.

This possibility has sparked an interesting new line of research. A French student, Matthieu Paquet, has recently initiated a PhD project investigating maternal investment in relation to helper presence (under the supervision of Rita Covas and Claire Doutrelant of CEFE, CNRS, France). Matthieu is analysing egg size and nutrient content and conducting experiments to investigate the role of helpers in lightening the workload of parents to determine whether this does indeed lead to increased parental survival rates.

Whilst helpers may increase female survival, it appears that this does not necessarily translate into increased juvenile survival. To our great surprise, juveniles raised in the presence of helpers may be worse off than juveniles raised by pairs that lack helpers. This unexpected discovery may be a result of competition



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between helpers and juveniles. Because remaining in the natal colony confers several benefits, older helpers might force juveniles to disperse away from the study colonies and the study area (even though they are siblings). This intriguing possibility of familial conflict will form part of an MSc project to be initiated in 2011.

Cooperative nest building

The massive nests of Sociable Weavers are believed to be built communally by the all colony members, but how is this cooperation maintained? Who builds where and when and, interestingly, how is cheating avoid? The weavers' communal nest structure is a 'common good' that requires constant work to repair and enlarge. It

therefore provides an ideal setting to investigate how the 'tragedy of the commons' can be avoided. The tragedy of the commons arises when common goods cannot be maintained because individuals acting selfishly do not contribute to the maintenance of the common good, even though in the long run everyone benefits from having it. Professor Ben Hatchwell and Post-doctoral Fellow René van Dijk from Sheffield University joined the Fitztitute's Sociable Weaver research team in 2010 with the specific objective of investigating this conundrum.

Demography and population dynamics

One of the greatest benefits of long-term projects is to have variability in population parameters spanning several years and hence encompassing natural fluctuations in population trends. This provides unique opportunities to understand the factors that affect population dynamics and hence determine population trends. Data on the weaver population at Benfontein now span 17 years, during which time we have detected a slow but steady decrease in the population. To explore the reasons behind this trend, we collaborated with Dr Res Altwegg, a specialist researcher at SANBI. CB MSc student Michael Marais conducted work on this topic in 2010 and further work has been conducted since. The results indicate that part of the decrease may be the result of climatic changes in the area, in particular a trend of decreasing rainfall. Decreasing numbers, whether driven by climate or not, may themselves start a snowball effect. There is evidence that as colony size decreases, survivorship falls and emigration rates rise: these combined responses can together result in an accelerating population decrease.

Another benefit of long term-studies is that one is able to follow individuals throughout their lives: this can provide insights into animal life histories that cannot be gained in any other way. By way of example, at the end of 2010 we captured two Sociable Weaver that had been ringed by Mark Anderson in the mid 1990s: one of these (ringed as a juvenile) was 14 years old, and the other (ringed as an adult) was at least 16 years old, making it the oldest Sociable Weaver on record.

Impacts of the project

Understanding animal behaviour and the associated ecological and evolutionary mechanisms has always fascinated human beings and the respect for nature that it inspires is one of the main motivations behind conservation movements and ultimately, policies. Fundamental research such as this plays a key role in feeding these feelings. Furthermore, behaviours evolve as a response to ecology and understanding this



© CLAIRE DOUTRELANT

OPPOSITE Sociable Weavers live up to their name, breeding, feeding and nesting.

ABOVE All weavers caught are ringed, measured and bled.

interaction between species is a fundamental part of understanding the evolution and maintenance of biodiversity. This has in innumerable instances been used to put in practice crucial conservation measures, not only for the focal species, but also for closely related species that are ecologically or behaviourally similar.

Studies such as this require detailed knowledge of individual histories and of how individuals behave under different environmental conditions. Hence, they require long-term data sets, which are difficult to obtain, but are invaluable to understand population dynamics in the face of varying environmental conditions, including climate change. Data from the Sociable Weaver Project at Benfontein, which dates back to 1993, has been used in a paper that modelled the possible effects of climate change on this species. In addition, having such a long-term data set has allowed us to detect a declining trend in the Benfontein population.

Understanding the causes of this decline was the subject of Michael Marais's CB project, and a scientific publication on the subject is currently being prepared.

The results of such a study are not only important for the study species; they unravel how certain species' characteristics interact with ecological factors and hence have important implications for our understanding and management of similar systems.

Key co-sponsors

The Tswalu Foundation, the Portuguese Science and Technology Foundation (FCT), the French Research Agency (ANR) and the National Environmental Research Council (NERC - UK).

Research team 2010

Dr Rita Covas (PFIPO Research Associate)
 Dr René van Dijk (Univ. Sheffield)
 Dr Claire Doutrelant (CEFE, CNRS, Montpellier)
 Prof. Ben Hatchwell (Univ. Sheffield)
 Students: Matthieu Paquet (PhD), Michael Marais (MSc)

Coevolutionary arms races in African brood-parasitic birds and their hosts

“... *this strange and odious instinct* ...”

Charles Darwin, *The Origin of Species*

COEVOLUTION IS THE PROCESS BY WHICH TWO OR MORE SPECIES RECIPROCALLY INFLUENCE ONE ANOTHER'S EVOLUTION, AND CAN ESCALATE TO PRODUCE BEAUTIFULLY REFINED ADAPTATIONS. A RESEARCH PROGRAMME AT THE FITZTITUTE FOCUSES ON THE COEVOLUTIONARY INTERACTIONS BETWEEN AFRICAN BROOD-PARASITIC BIRDS SUCH AS CUCKOOS, CUCKOO FINCHES AND HONEYGUIDES, AND THE HOST SPECIES THEY EXPLOIT TO BEAR THE COSTS OF RAISING THEIR YOUNG.



© CLAIRE SPOTTISWOODE

The “strange and odious instinct” of brood parasitic cuckoos provides a textbook example of a coevolutionary arms race: hosts evolve defences against costly parasitism, parasites evolve ever better manipulation of hosts, and hosts respond with ever-more-refined defences. Cuckoos have been well studied in Europe and have revealed beautiful examples of adaptation, such as the differently coloured cuckoo eggs that mimic those of different host species. But cuckoos are not the only cheats in the bird world: brood parasitism has independently evolved seven times in birds, setting many different stages for trickery and counter-trickery. To see coevolution at its best, we may need to go to the tropics, where brood parasitism has a much more ancient origin and there should have been time for even more complex interactions to evolve.

Such little-studied parasitic systems might allow us to investigate some fundamental but unanswered questions about coevolution: for example, how are birds' refined visual systems fooled by egg mimicry? Might parasitic chicks exploit similar loopholes in their hosts'

sensory capacity to persuade them to supply more food? How should parasites respond if hosts evolve a range of egg types as a defence? And, how do different parasitic females of the same species inherit specialised adaptations that allow them to exploit their chosen host?

These are some of the questions being tackled by the Fitztitude's research programme on coevolutionary arms races in African brood parasites, using a combination of approaches including experiments made at host nests in the wild, sensory analyses of bird vision, and genetic techniques. The research has focussed principally on the Cuckoo Finch *Anomalospiza imberbis* and the Greater Honeyguide *Indicator indicator* and their hosts, as well as secondarily on the African Cuckoo *Cuculus gularis*. Research in southern Zambia is led by Research Associate Claire Spottiswoode, with the

ABOVE Eggs of Tawny-flanked Prinia *Prinia subflava* (left column, top four rows) and Red-faced Cisticola *Cisticola erythrops* (left column, bottom two rows) hosts, and eggs of their parasite, the Cuckoo Finch *Anomalospiza imberbis* (right column).

crucial help of a highly skilled team of Zambian nest-finding assistants.

Cuckoo Finches parasitise various species of prinia and cisticola, whose drab appearance betrays the remarkably colourful arms races played out within their nests. Research centres on the evolution of extreme levels of variation in egg appearance as a defence by hosts against parasitism. Variable eggs can be an effective defence, because they render it harder for the parasite to match any one host clutch well enough to evade detection. We are studying the evolutionary dynamics of these interactions through a bird's eye, in collaboration with Dr Martin Stevens, a specialist on avian vision at Cambridge University. In combination with field experiments, newly developed sensory models allow us to disentangle natural selection on different aspects of egg appearance from a bird's rather than a human's (comparatively limited) visual perspective. Research published in 2010 analysed precisely which egg traits are used by hosts in deciding whether to reject a parasitic egg, for the first time quantifying colour, luminance and several different aspects of pattern. Tawny-flanked Prinias *Prinia subflava*, the most frequent host, use multiple and specific visual cues, corresponding precisely to the main differences between host and parasite eggs. This work showed that hosts use the most informative traits in making rejection decisions, and that natural selection is acting to make Cuckoo Finches better mimics. We are currently analysing how the Cuckoo Finches' interactions with other host species has taken them down some quite different coevolutionary trajectories. We have found that diversity and complexity in host-egg appearance can act as a 'watermark' of identity, leading to astonishingly fast-paced arms races between hosts evolving new signatures, and parasites evolving new forgeries.

The second key study species is the Greater Honeyguide, famous for its mutualistic interaction with human honey-hunters. However, it is also an uncommonly brutal brood parasite: we have just filmed for the first time how honeyguide chicks use needle-sharp hooks on the tips of their beaks to stab their newly hatched foster siblings to death. Their unfortunate hosts are various species of hole-nester, in Zambia most commonly the Little Bee-eater *Merops pusillus*. Honeyguide-host interactions are being exposed as a curious mix of exquisite adaptation and, at the same time, a startling lack of it. A series of field experiments has begun to disentangle the selective pressures behind each line of parasitic attack and host counter-defence, from extreme reactions by hosts to laying parasites, to selection on egg mimicry from an unexpected quarter, to vocal mimicry by honeyguide chicks to con their foster parents into feeding them at a furious rate. Additionally,



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Close to fledging, a Cuckoo Finch chick completely fills the nest of its host, in this case a Red-faced Cisticola *Cisticola erythrops*.

in collaboration with Prof. Michael Sorenson at Boston University in the USA, we have been carrying out genetic analyses to reconstruct the evolutionary history of host specificity in Greater Honeyguides, and hence to ask how their specialised adaptations to different host species might be maintained over evolutionary time. Our results to date suggest that honeyguide specialisation is unusually ancient. These findings underscore the antiquity of host-parasite interactions in Africa relative to the much better-known north-temperate zone, and suggest that dangling from Zambian trees to study them may hold many more intriguing surprises.

Impact of the project

This research programme is revealing fascinating new trajectories that coevolutionary interactions between hosts and parasites can take in a tropical context. However, species interactions are not only fundamental to biodiversity, but also to health and disease. Better understanding of host-parasite coevolution has implications for broader coevolutionary dynamics involving one parasite and multiple hosts or host genetic strains, such those between ourselves and the pathogens that cause our diseases.

Key co-sponsor

The Royal Society, UK (through a Dorothy Hodgkin Research Fellowship to CS).

Research team 2010

Dr Claire Spottiswoode (Univ. Cambridge & PFI/O Research Associate)

Research assistants: Lazaro Hamusikili, Kiverness Moto, Collins Moya

WHETHER WE LIKE IT OR NOT, 'SPECIES' STILL FORM THE BASE CURRENCY OF MUCH BIOLOGY AND MOST CONSERVATION.

BUT AS MODERN, FORENSIC TECHNIQUES EVOLVE, WE ARE BECOMING INCREASINGLY AWARE THAT WE HAVE UNDERESTIMATED THE EVOLUTIONARY PANOPLY OF LIFE THAT SURROUNDS US. NEW SPECIES, BIRDS INCLUDED, ARE STILL BEING DESCRIBED AT A PRODIGIOUS RATE. EQUALLY IMPORTANTLY, HOWEVER, WE ARE CLOSER TO UNDERSTANDING HOW, WHEN AND WHERE THAT PANOPLY OF LIFE EVOLVED, FINDING UNEXPECTED COMMON ANCESTORS AND UNLIKELY CLOSE RELATIVES. AS OUR WINDOW ON THE PAST COMES INTO SHARPER FOCUS, WE CAN SEE HOW THE WORLD CHANGED DURING PAST CLIMATIC AND TECTONIC UPHEAVALS. IF WE CAN UNDERSTAND HOW THE WORLD'S CURRENT BIODIVERSITY WAS SHAPED IN THE PAST, WE HAVE A BETTER CHANCE OF PREDICTING HOW IT WILL BE SHAPED IN THE FUTURE.



SYSTEMATICS



One intriguing finding from recent genetic studies suggests that the closest relative of the sugarbirds, such as this Cape Sugarbird *Promerops cafer*, are three skulking, forest understorey birds confined to a handful of montane forest in central Africa: Spot-throat *Arcanator stictigula*, Dapple-throat *Modulatrix orostruthus* and Grey-chested Babbler *Kakamega poliothorax*.

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What are we looking at?

Mystery buzzards of the Western Cape

ONE OF THE ANCHOR-POINTS OF ORNITHOLOGY IS BEING ABLE TO GIVE A NAME TO A SPECIES UNDER OBSERVATION: SPECIES ARE THE CORE ELEMENTS OF BIODIVERSITY. RIGHT NOW, HOWEVER, WE FACE A FRUSTRATING PUZZLE – BUZZARDS ARE BREEDING IN THE WESTERN CAPE AND WE DO NOT KNOW WHAT THEY ARE (BEYOND THE FACT THEY ARE BUZZARDS).

Only two species of buzzards are known to breed in the Western Cape – Forest Buzzard *Buteo trizonatus* and Jackal Buzzard *B. rufofuscus*. Forest Buzzards are recent colonists from further east in South Africa, thought to have arrived in the late 1970s or early 1980s: they have never been common. In addition, two Palearctic-breeding species – Steppe Buzzard *B. vulpinus* and Honey Buzzard *Pernis apivorus* – occur as non-breeding summer migrants: the latter is rare. Steppe Buzzards are genetically closely related to Common Buzzard *Buteo buteo* (and some authorities treat them as conspecific). Common Buzzards breed in the Palearctic and some migrate to Africa, but none are thought to cross the Equator.

In recent years, however, strangely plumaged buzzards have been present and breeding around Table Mountain and in the Grabouw/Elgin area. These birds are very variable in plumage, ranging from individuals that closely resemble Steppe or Common Buzzards to

birds that are uniformly dark brown or cinnamon-brown. Some of these ‘mystery’ buzzards have hybridised with apparently pure Forest Buzzards and have successfully produced offspring, although it is not yet proven that these offspring are themselves reproductively viable. As yet, the identity of these ‘mystery’ birds is unknown. In appearance, most of them (but not all) fall closest to the Common-Steppe Buzzard complex.

Historically, a handful of migratory, Palearctic-breeding bird species established breeding populations in southern Africa. These include White Stork *Ciconia ciconia* and European Bee-eater *Merops apiaster*. The most recent of these colonists was the Booted Eagle *Aquila pennatus* (first recorded breeding in 1973). In none of these instances was the colonization process well documented, nor have any of the new arrivals hybridized with local species.

Over the past few years, we have gathered some basic biological information about the breeding biology of the mystery buzzards, which are becoming quite common in the Elgin area. We have also collected a number of blood samples and have an extensive library of photographs. The immediate focus of the study is now shifting to resolving the identity of the ‘mystery’ buzzards. This less easy than it sounds, not least because they are proving



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The mystery buzzards of the western Cape vary greatly in appearance. Some closely resemble Steppe Buzzards *Buteo vulpinus* (opposite), whereas others are much more uniformly coloured (left).



AB&B 15(5): 35-39.



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extremely difficult to catch and many position their nests in trees that even the most arboreal of human climbers cannot reach. However, early in 2011, MSc student Lisle Gwynn will be joining the team to address the problem.

Several alternative hypotheses can be tested:

- The birds, including the brown morphs, are Forest Buzzards. This is very unlikely because they are structurally different from Forest Buzzards and uniformly coloured brown and cinnamon Forest Buzzard are not known from the core of the species' range in the southern Cape.
- The new arrivals are Steppe Buzzards, some of which have hybridized with Forest Buzzards, giving rise to large phenotypic diversity. If this is the case, we may be seeing the birth of a hybrid swarm that could, assuming the birds continue to spread east (as our evidence suggests they are), threaten to hybridise the endemic Forest Buzzard to global extinction.
- The new arrivals are Common Buzzards, extending their known range south of the Equator. There is some weak support for this hypothesis, including plumage patterning, the occasional use of cliff nesting sites, and their large size.

At face value, it should be fairly easy to distinguish between these hypotheses using molecular techniques. However, speciation within the genus *Buteo* is recent (perhaps no more than 300 000 years) and the genetic differences between taxa are small. This lack of genetic diversification requires that multiple lines of evidence, comparing similarities and differences between known taxa and the Western Cape mystery birds need to be explored. These include morphometrics and phenotypes of eggs, chicks, juveniles and adults; siting and architecture of nests; vocalisations and breeding behaviour; and genetics. The genetic angle will require a combined mtDNA and microsatellite approach. There are new analytical programs that can explore the percentage of an individual's genome that is derived from which species. Our genetic analyses will be done in collaboration with Professor Rauri Bowie, a Centre of Excellence Core Team Member based at UC Berkeley.

Research team 2010

Prof. Phil Hockey

Prof. Rauri Bowie (UC Berkeley)

Dr Rob Simmons (Honorary Research Associate)

Volunteers: Ann Koeslag, Rob Martin, Jessie Walton

Elucidating evolutionary patterns

Phylogenetics, biogeography and conservation

THE ADVENT OF MOLECULAR TECHNIQUES HAS REVOLUTIONISED THE FIELDS OF TAXONOMY, PHYLOGENETICS AND BIOGEOGRAPHY. COMBINING GENETIC DATA WITH RIGOROUS ANALYSIS OF TRADITIONAL TAXONOMIC CHARACTERS, INCLUDING MORPHOLOGICAL AND BEHAVIOURAL TRAITS, IS RESULTING IN RAPID ADVANCES IN UNDERSTANDING JUST HOW MANY SPECIES OF BIRDS THERE ARE AND THEIR PHYLOGENETIC RELATIONSHIPS. WITH A ROBUST PHYLOGENY FOR BIRDS, WE CAN INFER THE BIOGEOGRAPHICAL FACTORS THAT HAVE PROMOTED THEIR EVOLUTIONARY DIVERSIFICATION. UNDERSTANDING POPULATION GENETICS ALSO HAS PRACTICAL BENEFITS FOR CONSERVATION, INFORMING DECISIONS REGARDING THE MANAGEMENT OF THREATENED SPECIES.

To date, most studies on the evolution of African birds have focused on forest species, and how forest refugia during cool, arid periods contributed to the origin and persistence of avian biodiversity. Martim Melo and Michael Mills are contributing to these studies at a large-scale by collecting material from western Angola, a centre of montane forest bird endemism (see p. 38-39). Work also continues on the relationships between montane forest birds and those of adjacent lowlands. For example, CoE team member Rauri Bowie and Post-doctoral Fellow Jerome Fuchs have collaborated with Jon Fjeldså to investigate the relationships within the Tiny Greenbul *Phyllastephus debilis*, which has different subspecies in the Eastern Arc montane forests (green-headed *albigula*) and adjacent lowland and foothill forest (grey-headed *rabai*). They found that the segregation results from secondary contact between two distinct lineages rather than from disruptive selection across an altitudinal gradient. Coalescent analyses suggest that some gene flow, mostly from *rabai* to *albigula*, is taking place at three mid-elevation localities, where lowland and montane forest meet. Introgression appears to result from the recent inland expansion of *rabai*. Based on these results, they recommend *albigula* be elevated to species rank, distinct from the lowland *rabai* and *debilis*.

As part of the FitzPatrick's 50th Anniversary, a concerted effort has been initiated to explore evolutionary processes underlying distribution patterns of birds in other African biomes. One of the first completed studies focused on a savanna-associated bird. Savanna is a dominant African biome that occurs around the two major lowland forest blocks. Most studies of the genetic structure of savanna species are based on mammals, and have revealed a suture zone (a zone of contact for several species) in southwest Kenya and northwest Tanzania that separates northern and eastern clades from southern clades. To provide an avian perspective, Jerome Fuchs, Rauri Bowie and Tim Crowe investigated spatial patterns of genetic structure in the Common Fiscal *Lanius collaris*. They found



OPPOSITE Genetic evidence shows that the Cape Grassbird *Sphenoeacus afer*, endemic to grassland and Fynbos in southern Africa, is part of a small family of African warblers that includes the crombecs *Sylvietta* and longbills *Macrosphenus*.

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two primary lineages: a northern (Malawi to Senegal) and a southern clade (Mozambique to South Africa). Unexpectedly, the miombo woodland Souza's Shrike *L. souzae* was sister to the southern clade, as was the localised Uhehe Fiscal *L. marwitzi* of southern Tanzania, suggesting that the northern and southern lineages of Common Fiscal should be treated as separate species. From a biogeographic perspective, this study revealed a novel biogeographic pattern for a widespread savanna species complex, with the transition between the two primary lineages occurring 10° farther south than the mammalian suture zone.

Southern Africa has a marked east-west moisture gradient, but there is little evidence of evolutionary patterns among birds across this gradient, despite most of the region's endemic birds being associated with the southwest arid zone. The few studies of small mammals and reptiles have revealed strikingly congruent patterns of divergence between the arid, northwest and more mesic, southeastern clades. Similar studies are generally lacking for birds, but this is now being addressed by a joint project led by Rauri Bowie and Gary Voelker,

together with Post-doctoral Fellows Jerome Fuchs and Hanneline Smit. PhD student Graeme Oatley continues to investigate relationships among southern African white-eyes, with particular reference to the differentiation of the arid country *Zosterops pallidus* from the more mesic *Z. capensis*. These small warblers have highly conserved morphologies, but differ in underpart coloration and vocalisations, and genetic sequence data confirm their segregation. Indeed, mitochondrial genes indicate that *Z. pallidus* is basal to a clade comprising *Z. capensis* and local populations of the Yellow White-eye *Z. senegalensis*. Nuclear intron data show localised introgression at the contact zones between *pallidus* and *capensis*, and similar contact zones occur between north-western and south-eastern populations of Fiscal Flycatchers *Sigelus silens*. Studies of reptiles and small mammals suggest that the Orange River has been an important barrier to dispersal in central South Africa, but perhaps unsurprisingly this is not the case among these birds, where contact zones are more closely linked to biome boundaries.

At a finer scale, PhD student Ângela Ribeiro is studying the evolutionary mechanisms that promote

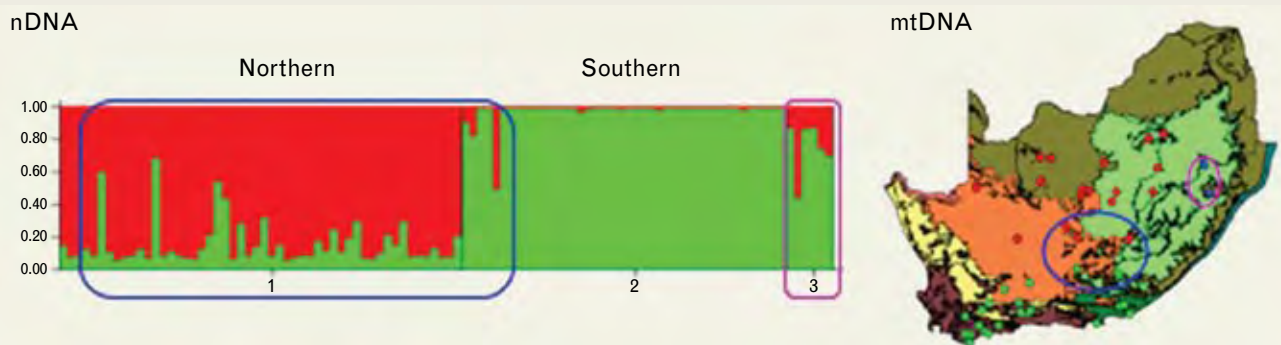


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divergence in arid zones, using the Karoo Scrub-Robin *Cercotrichas coryphoeus* as the study species. The distribution of this southern African endemic spans a broad aridity gradient, presenting an interesting opportunity to test the importance of energetic pathways in adaptation to arid conditions. She has developed a conceptual framework to integrate life-history traits, ecology morphology, molecular physiology and genetic data. Step I ties together ecological data, such as age, breeding status, social relationships with genetic data (e.g. kinship) to understand better how social bonds within family groups affect mating patterns and cause sex asymmetry in dispersal behaviour. Detailed knowledge about the breeding and dispersal biology of the species is crucial for Steps II and III. In Step II she tests whether selection on key proteins in energetic pathways counter-balances gene flow and hence promotes local adaptation along the aridity gradient. Her results suggest that selective pressures on physiology, mediated by the mtDNA genome, may be the mechanism facilitating local adaptation to arid conditions. However, the observed results can also occur due to a range expansion and demographic growth. Ângela currently is modelling range expansion phenomena in an attempt to disentangle the relative effects of selection and demography (Step III). Understanding adaptation to aridity is particularly relevant in the southern Africa context, because desertification is expected to increase in the near future and affect species' distributions.

Long-standing PhD student Callan Cohen finally completed his dissertation on the evolution of a suite of arid country birds – bustards, sandgrouse and coursers. He found considerable support for the hypothesis that

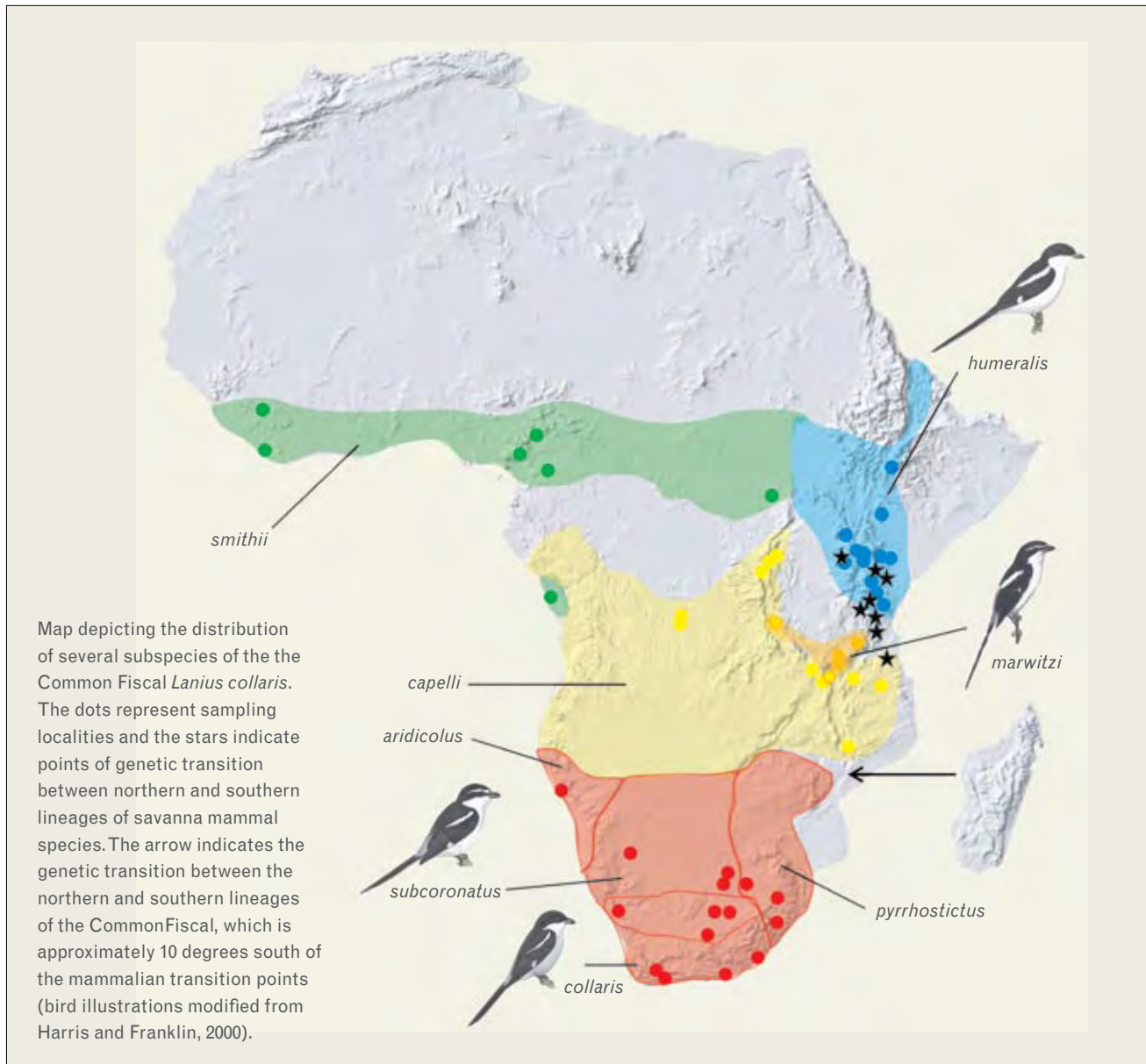
Fiscal Flycatchers *Sigelus silens* (above) show clear genetic differentiation between birds in the more arid, northern parts of South Africa and more mesic, southern and eastern areas, with narrow contact zones (see below for details).



The structure plot assigns birds to groups, with each bar representing a bird. The proportion of each bar conveys the assignment probability to the northern (red) or southern clade (green) based on nuclear DNA allelic diversity. Sample locations are plotted on

the biome map of South Africa: red dots = northern mtDNA clade, green dots = southern mtDNA clade, blue dots = eastern mtDNA clade. The blue circle highlights the south-central contact zone and the mauve circle the eastern contact zone.

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an arid corridor linking the arid regions of southwest and northeast Africa played a role in the radiations of these bird groups. Rather surprisingly, the couragers appear not to form a natural grouping, being paraphyletic with respect to the pratincoles. Callan also found that some of the recent revisions to bustard genera require further consideration, with the large *Ardeotis* bustards nested amongst *Neotis*, and *Afrotis* nested among *Eupodotis*. It appears that monogamy evolved once in the bustards, linked to the origin of the *Eupodotis* lineage, with a reversal to polygyny among the black korhaans currently placed in *Afrotis*. In the case of the sandgrouse, the current recognition of two genera is not supported, but the timing of drinking is highly conserved. Callan's work complements that of former PhD student Keith Barnes, who studied the radiation of

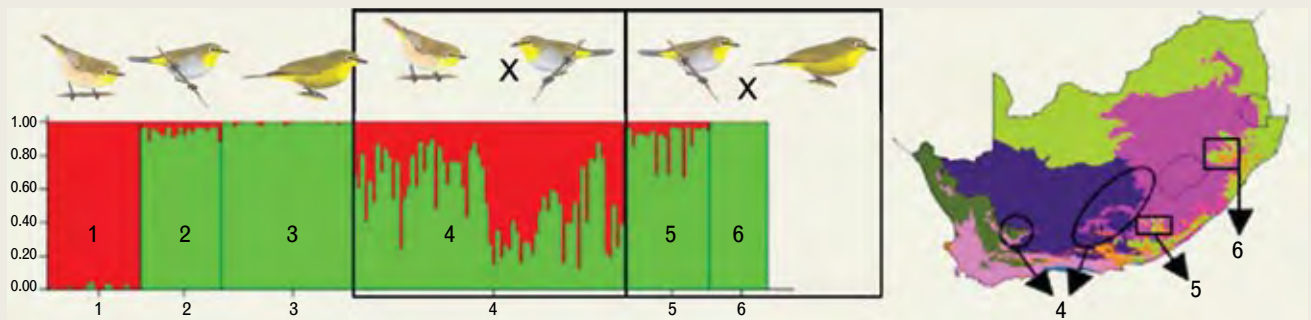
African larks. Unfortunately Keith has been unable to complete papers from his thesis for publication, so Per Alstrom and Keith Barker have carried this work forward, with Keith producing additional sequence data and Per spending some time at the Fitztute at the end of 2010 to work on a manuscript describing the radiation of larks. Per has previously worked on the more modest radiation of larks in Asia.

Moving to wetland habitats, PhD student Owen Davies is working on the radiation of marsh cisticolas. The cisticolas are a large genus of morphologically conservative, mainly African warblers that cause headaches for birders and systematists alike. The seminal work on their taxonomy remains Rear Admiral Lynes's 673-page special issue of *Ibis*, published in 1930. Lynes spent years working on cisticolas in the field and



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Genetic evidence confirms that the peachy-flanked Orange River White-eyes *Zosterops pallidus* (above) is quite distinct from the Cape White-eye *Z. capensis*, which replaces it in more mesic areas, although there is some evidence of intergradation (see below).



The structure plot for 190 white-eyes based on four nuclear DNA introns: (1) Orange River White-eyes *Z. pallidus* from the Nama Karoo (purple on map) and northern savanna (light green) and grasslands (mauve), (2) grey-bellied Cape White-eyes *Z. c. capensis* from the Fynbos (pink) and Succulent Karoo (green), and green-bellied *Z. c. virens* from Forest (blue), Thicket (orange) and lowland mixed savanna (light green, eastern

side of the map). Zone 4 is two contact zones between peach-flanked and grey-bellied birds, whereas zones 5 and 6 are contact zones between grey- and green-bellied birds. At present we cannot distinguish genetically between the two morphs of Cape White-eye, suggesting that their plumage difference has evolved very recently. In the next year, we hope to be able to quantify better the extent of inter-breeding in the habitat transition zones.

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collected a large number of skins. Owen visited the UK in 2010 to gather data from more than 2000 skins in the British Museum, many collected by Lynes himself. Owen then visited Martin Irestedt at the Swedish Museum of Natural History, Stockholm, where he was able to extract DNA from the toe pads of cisticola study skins. His preliminary results on the radiation of the so-called marsh cisticolas confirms long-standing divergence among taxa traditionally placed in the

Winding Cisticola *C. marginatus* complex, with Chirping Cisticola, *C. pipiens* nested within this group. He also found that Lynes was correct in keeping Levaillant's Cisticola *C. tinniens* separate from the marsh cisticolas, despite their similarities in appearance and habitat use.

Although Tim Crowe has been plagued by ongoing health problems, he has continued to work on a definitive phylogeny of the gamebirds. An understanding of their taxonomy and biogeography has helped to

identify evolutionarily important biodiversity areas and, combined with their phylogeny, has helped infer how changes in the geomorphology, climate and vegetation of Africa have affected avian evolution over the last 50 million years. With the help of numerous collaborators, Tim has amassed more than 60 000 base pairs of molecular sequence data from a host of nuclear and mitochondrial markers, as well as morphological and behavioural traits, for representatives of all major gamebird clades. So far, these data appear mostly to confirm his earlier inference of the group's history based on a much smaller set of data. CB MSc student Vincent van der Merwe worked with Tim and Salvador Arias, a colleague from Columbia currently studying in Argentina, to test a novel, objective approach to historical biogeography using the gamebird data set. Vincent wasn't able to realize his initial goal of being able to identify key centres where historical radiations took place with a view to predicting important sites for future evolution, but he was able to provide strong support for the importance of vicariance events in gamebird evolution. PhD student Tshifhiwa Mandiwana-Neudani also worked with Salvador to demonstrate that montane forest spurfowls (*Pternistis* spp.) now confined to the highlands of southwest Cameroon, western Angola and north-eastern Africa, once shared a common ancestor, and presumably these regions were once connected by forest corridors. Tshifhiwa's studies also suggest that the localised Grey-breasted Spurfowl *P. rufopictus* probably arose as a result of hybridization between Red-necked *P. afer* and Yellow-necked Spurfowls *P. leucoscepus*, where the two species meet in Tanzania.

From a more applied perspective, PhD student Lisa Nupen is studying the conservation genetics of

threatened Benguela seabirds, particularly African Penguins *Spheniscus demersus*, Cape Gannets *Morus capensis* and Cape Cormorants *Phalacrocorax capensis*. Her main aim is to test whether geographic isolation and adult philopatry has led to any genetic differentiation between island subpopulations, which would be important for the species' conservation given regional differences in population trajectories. Her results to date indicate that for gannets at least there has been sufficient dispersal among colonies to prevent genetic differences accumulating. Lisa also is investigating the broader systematic relationships of the endemic Crowned *Microcarbo coronatus* and Bank Cormorants *Phalacrocorax neglectus*. Finally, staying with seabirds, Post-doctoral Fellow Mareile Techow published a paper on speciation and phylogeography of giant-petrels *Macronectes* spp. in the highly rated journal *Molecular Phylogenetics & Evolution* in 2010.

Impact of the project

Several projects have demonstrated the need for revisions in the taxonomy of focal bird groups (e.g. bustards, shrikes and gamebirds). The novel biogeographic patterns in the distribution of bird taxa can be used to infer the processes (e.g. climate change, geographic barriers) that have driven their evolution. Lisa Nupen's work has a strong applied focus, with her findings important for management of threatened Benguela seabird populations. During 2010 Tim Crowe and Ângela Ribeiro presented their findings at the 25th International Ornithological Congress in Brazil and Lisa Nupen gave a talk at the First World Seabird Conference in Victoria, Canada.

Key co-sponsors

The University of California at Berkeley. We thank South African provincial conservation agencies, SANParks and the Tanzanian Commission for Science and Technology and the Tanzanian Wildlife Research Institute for logistical support and permission to collect samples. Many ringers also kindly contributed blood samples.

Research team 2010

Prof. Tim Crowe (PFIPO)
 Dr Per Alstrom (Swedish Species Information Centre, Uppsala)
 Dr Salvador Arias (Instituto Miguel Lillo, Tucumán, Argentina)
 Dr Keith Barker (Bell Museum, Minnesota)
 Dr Jacqueline Bishop (UCT Zoology)

Prof. Paulette Bloomer (CoE Team Member, Univ. Pretoria)
 Prof. Rauri Bowie (CoE Team Member, UC Berkeley)
 Dr Jon Fjeldså (Univ. Copenhagen)
 Dr Jérôme Fuchs (PFIPO Post-doctoral Fellow)
 Dr Martim Melo (PFIPO Post-doctoral Fellow)
 Assoc. Prof. Peter Ryan (PFIPO)
 Dr Hanneline Smit (Post-doctoral Fellow, UC Berkeley & Univ. Stellenbosch)
 Dr Mareile Techow (PFIPO Post-doctoral Fellow)
 Dr Gary Voelker (Texas A&M)
 Students: Callan Cohen (PhD), Owen Davies (PhD), Potiphar Kaliba (PhD), Tshifhiwa Mandiwana-Neudani (PhD), Lisa Nupen (PhD), Graham Oatley (PhD), Ângela Ribeiro (PhD), Vincent van der Merwe (CB MSc)

Inferring process

Speciation and cryptic species

THE RAPID DEVELOPMENT OF GENOMIC TECHNIQUES PROMISES TO SHAKE UP EVOLUTIONARY BIOLOGY IN THE SAME WAY THAT GENETIC SEQUENCING HAS REVOLUTIONISED SYSTEMATICS. BY SAMPLING LARGE PORTIONS OF THE GENOME, OR EVEN THE ENTIRE GENOME, WE CAN IDENTIFY THE GENES RESPONSIBLE FOR DIFFERENCES AMONG SPECIES OR ECOTYPES, AND ASSESS DIRECTLY HOW POPULATIONS RESPOND TO SELECTION PRESSURES. AT THE SAME TIME, WE CONTINUE TO WORK ON SEVERAL CRYPTIC SPECIES COMPLEXES AND HYBRID ZONES TO TRY TO UNDERSTAND HOW THEY AROSE AND ARE MAINTAINED.



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ABOVE A White-bellied Storm-Petrel *Fregetta grallaria* on the plateau of Inaccessible Island. All the birds examined at the coast appear to be white-bellied morphs of the Black-bellied Storm Petrel *F. tropica*.

The main focus of these studies is to understand speciation processes among island finch populations, with study systems in the Gulf of Guinea and the Tristan archipelago. Post-doctoral Fellow Martim Melo worked on the radiation of *Crithagra rufobrunneus/Neospiza concolor* at São Tomé and Príncipe for his PhD at Edinburgh University. He has since formed a productive partnership with Bengt Hansson from Lund University, with Martin Stervander completing his MSc at Lund on the genetics of this radiation. Peter Ryan studied *Nesospiza* finches at Tristan for his PhD, and has returned to the islands at decadal intervals to test for changes in finch phenotypes. MSc student Alex Jansen van Rensburg continued genetic studies of this system at the University of Pretoria. Both Martin and Alex found further support for the sympatric evolution of large-billed forms in each system, contrary to the prevailing wisdom that speciation among island birds is allopatric. However, the candidate gene approach testing for differences between finch populations failed to deliver useful results (e.g. the *Bmp4* gene linked to bill size development in Darwin's finches does not vary among *Nesospiza* taxa).

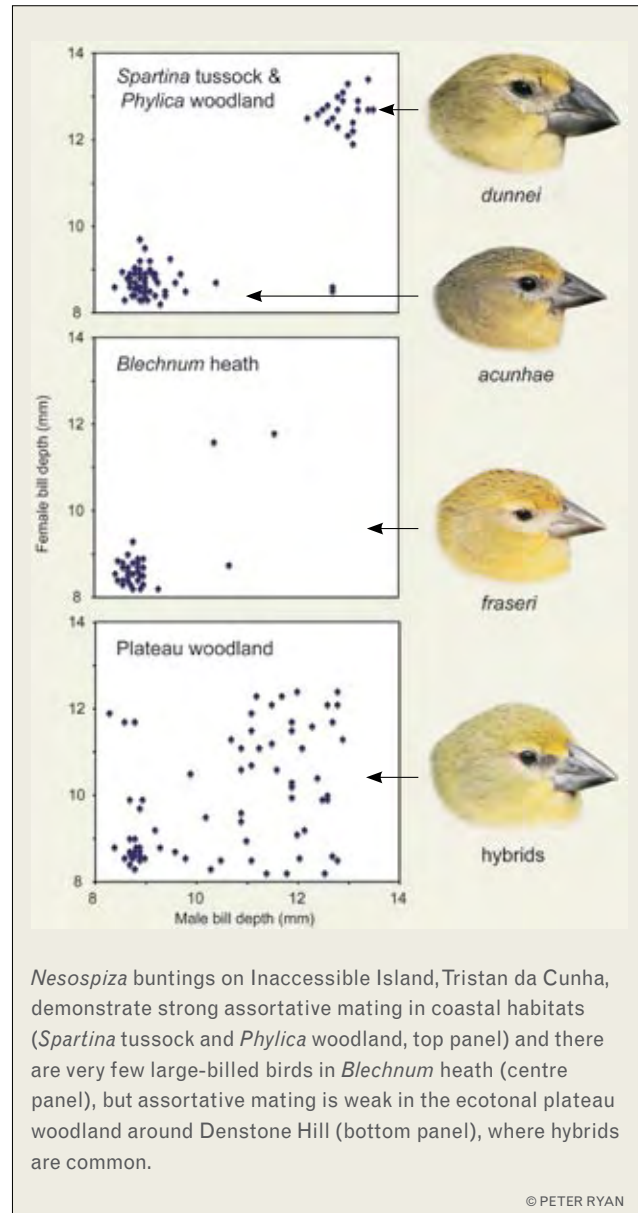
Genomics offers the brute power to identify the genes underpinning differences between species. When the project was initiated in 2009, we planned to use micro-array techniques to sample *ca* 15 000 genes. However, the technology has evolved apace. Expression can now be estimated with full transcriptome sequencing. Furthermore, we are now using Restriction Site Associated DNA (RAD) sequencing to sample around 75 000 genes, and the project has attracted the attention of Vincent Savolainen from the Imperial College, London, who is talking about obtaining a complete genome sequence for *Nesospiza*. The main challenge with genomics is handling the vast amounts of data generated, and the project has funds to employ a bioinformaticist. Bengt Hansson visited the Fitzpatrick Institute in early 2010 and again briefly in October 2010, when he was joined by Martin Stervander. Martin is carrying the work forward for his PhD, which will include an assessment of the co-evolution between *Nesospiza* and the Island Tree *Phyllica arborea*, given the dependence of the large-billed birds on the tree's fruit.

An intriguing spin-off from the *Nesospiza* field work on Inaccessible Island in 2009 was the confirmation that two species of *Fregetta* storm petrels occur at the Tristan archipelago. The taxonomy of *Fregetta* is contentious, but two species are widely recognised, the temperate-breeding White-bellied Storm Petrel *F. grallaria* and the sub-Antarctic Black-bellied Storm Petrel *F. tropica*. As their common names suggest, they differ mainly in the colour of their underparts, although this is quite variable in some Pacific Ocean populations of *F. grallaria*. The *Fregetta* storm petrels at Tristan and Gough have white bellies, and typically are placed with *F. grallaria*, but also have been treated as a white-bellied form of *F. tropica*, based on tarsal structure and white bases to the chin feathers. We supplied blood samples to Bruce Robertson from Otago University, who has been investigating the affinities of the enigmatic New Zealand Storm-Petrel *Oceanites maorianus* (which may also belong to the genus *Fregetta*). Sequence data from a combination of mitochondrial and nuclear markers indicate that both *F. grallaria* and *F. tropica* breed on Inaccessible Island, with *F. tropica* occurring throughout the island whereas *F. grallaria* was caught only on the island's plateau. The two species differ in morphology (primarily wing and tarsus lengths) as well as ecology (the stable isotope ratios of nitrogen and, to a lesser extent, carbon in their feathers differ).

Martim Melo's island finch work in the Gulf of Guinea forms part of a broader survey of the evolution of the region's endemic birds. In 2010, this resulted in the publication of a paper confirming the species status of the Príncipe Thrush *Turdus xanthorhynchus*. Martim's research has a strong conservation component. In addition to describing the thrush as a new species, he conducted almost 200 point counts and found that the Príncipe Thrush is an extremely rare species, restricted to the most inaccessible areas of the remaining 45 km² of primary rainforest on Príncipe. The thrush was immediately classified as *Critically Endangered*. On a more positive note, while Peter Ryan was working on *Nesospiza* finches on Inaccessible Island in 2009, he and Rob Ronconi were able to show that numbers of Spectacled Petrels *Procellaria conspicillata*, endemic to the island and once listed as *Critically Endangered*, continue to increase. A paper is in press with *Antarctic Science*.

Impact of the project

The use of genomic tools to investigate speciation in island finches promises to be particularly exciting. A week-long workshop on genomic approaches was hosted by the University of Pretoria during September, ending in a one-day seminar series where many of the island finch team presented their findings to date.



Nesospiza buntings on Inaccessible Island, Tristan da Cunha, demonstrate strong assortative mating in coastal habitats (*Spartina* tussock and *Phyllica* woodland, top panel) and there are very few large-billed birds in *Blechnum* heath (centre panel), but assortative mating is weak in the ecotonal plateau woodland around Denstone Hill (bottom panel), where hybrids are common.

Key co-sponsors

The European Union (through a Marie Curie FP7-IRSES grant), the Portuguese Science Foundation (FCT), the South African National Antarctic Programme, the Swedish Research Council and the UK Overseas Territories Environment Programme.

Research team 2010

Assoc. Prof. Peter Ryan (PFIAO)
 Prof. Paulette Bloomer (CoE Team Member, Univ. Pretoria)
 Dr Bengt Hansson (Lund Univ.)
 Dr Martim Melo (PFIAO Post-doctoral Fellow)
 Dr Bruce Robertson (Otago Univ.)
 Dr Rob Ronconi (Dalhousie Univ.)
 Students: Alexandra Jansen van Rensburg (MSc, Univ. Pretoria), Martin Stervander (PhD, Lund)

Conservation Biology Masters Programme 2010

The Conservation Biology Programme continues to go from strength to strength. The 18th cohort of Conservation Biology students completed their projects early in 2010, with all but one of the 12 students graduating in June 2010. Special congratulations go to Christina Moseley, who obtained her degree with distinction. Unfortunately, Sharon George had to delay completion of her project due to technical difficulties as well as health problems, but she submitted her thesis in October 2010 and will graduate in 2011.

The 2009/10 cohort brought the total number of students graduated from the course since its inception in 1992 to 200, from almost 40 countries world-wide, including 18 African countries. As a measure of the success and prestige of the course, some 85% of the graduates are employed in the conservation field, emphasising the need for well-trained people with these skills. Many of them occupy highly influential positions, including the Head of the IUCN World Commission on Protected Areas (Washington D.C.), the Director of the Rwanda Wildlife Conservation Agency, Director of the Southern Africa Hotspots Programme of Conservation International and Project Manager of the Tropical Biology Association.

The 19th cohort of CB students started in January 2010, comprising 12 students from seven countries: Canada, Costa Rica, Germany, Kenya, South Africa, the United Kingdom and the United States. The students thrived during the coursework component of the programme, with eight obtaining distinctions, by

far the highest number of distinctions achieved to date. Feedback on the revised curriculum, now in its third year, remains positive. Eight students completed their research projects by February 2011, and the remainder will hand in later during 2011.

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 Fitztute for their willingness to teach on the course and the consistently high academic standards that they have maintained. With Graeme Cumming away on sabbatical in 2010, Andrew Knight stepped in to teach the Landscape Ecology module. We are particularly grateful to Sue Milton, who taught on the course for the last time in 2010 after almost two decades. Sue will be replaced in 2011 by Peter Carrick, a leading consultant in restoration ecology. Sheona Shackleton also has had to withdraw from the course in 2011 due to pressures of work at Rhodes University and will be replaced by another Rhodes University social scientist and ecologist, Georgina Cundill.

In addition to the module leaders, many other people have contributed through guest lectures, field trips and discussions. The programme is also strengthened by the dedication of the Fitztute support staff, especially Hilary Buchanan, who administers the CB applications and generally assists the settling-in process for the newly arrived foreign students.

Recent key co-sponsors

The Umhlanga Rotary Club provided CB bursaries (R50 000 per year for two years) in 2010 and 2011, with the possibility of an extension thereafter. Gina Louw was the Rotary Bursary holder for 2010 and Edward Rice will be the Rotary Bursary holder for 2011. The DST/NRF Centre of Excellence at the Fitztute also contributes two R50 000 bursaries annually to CB students and from 2011 will contribute to CB student project running costs. The Nature Conservation Corporation granted a generous donation to upgrade the CB lab computer facilities for the 2010 cohort.

Another exciting development announced at the 50th AGM dinner is the introduction of a R12 000 Patrick Niven Award for the top CB student in the 2010/11 class. The award is funded by Peter Johnson's family in celebration of both the Fitztute's 50th and the significant support from the Niven Family for the Institute. It will be a much sought-after award, and will bolster the receiving candidate's CV.



© KATE ENGLAND

ABOVE Prof. William Bond explains the intricacies of Fynbos regeneration to the 2010 CB class.

Course co-ordinators

Prof. Graeme Cumming
 Assoc. Prof. Peter Ryan

External/contractual lecturers

Assoc. Prof. Colin Attwood (Zoology Department, UCT)
 Dr Phoebe Barnard (SANBI)
 Dr Jacqueline Bishop (Zoology Department, UCT)
 Assoc. Prof. John Hoffmann (Zoology Department, UCT)
 Assoc. Prof. Astrid Jarre (Zoology Department, UCT)
 Dr Jackie King (Zoology Department, UCT)
 Dr Andrew Knight (Univ. Stellenbosch)
 Prof. Sue Milton (PFIAO and Univ. Stellenbosch)
 Prof. Norman Myers (Oxford University)
 Prof. Dave Richardson (Univ. Stellenbosch)
 Dr Jack Ritchie (Philosophy Department, UCT)
 Dr Sheona Shackleton (Rhodes University)
 Dr Jane Turpie (UCT & Anchor Consultants)

Conservation Biology projects: 2010/11

De Abreu, Petra: The ecological and hydrological impact of re-habilitation on degraded ostrich farms in the Little Karoo, South Africa. Supervisors: Sue Milton and Timm Hoffman.
 Du Plessis, Kate: Heat tolerance of Southern Pied Babblers *Turdoides bicolor* in the Kalahari Desert. Supervisors: Phil Hockey, Mandy Ridley, Rowan Martin and Susie Cunningham.
 England, Kate: Assessing conservation of a tropical African estuary: waterbird disturbance, livelihoods and ecotourism. Supervisors: Phil Hockey, Rob Simmons and Jane Turpie.
 Gudka, Masumi: The effects of pesticides on the breeding success and population of African Fish Eagles *Haliaeetus vocifer* at Lake Naivasha, Kenya. Supervisors: Rob Simmons and Aqiel Dalvie.
 Jurk, Clova: Fouled yachts: a vector for introduced species to South African shores. Supervisor: Charles Griffiths.
 Krahnert, Andre: Impact of the invasive ant *Linepithema humile* on native ant assemblages on the western slopes of Table Mountain and the implications for ant-butterfly associations. Supervisor: Mike Picker.
 Lewis, Sarah: Valuing an ecotourism resource: a case study of the Boulders Beach African Penguin *Spheniscus demersus* colony. Supervisors: Peter Ryan and Jane Turpie.
 Louw, Gina: How will climate change affect birds in hot African deserts? Supervisors: Phil Hockey, Rowan Martin, Susan Cunningham.
 Marx, Dane: The impacts of community based rehabilitation on communal grasslands in the Drakensberg foothills. Supervisor: Timm Hoffman.
 Solano Fernandez, Sofia: Empirical evaluation of the effectiveness of South Africa's Marine Protected Area network in representing fish communities. Supervisor: Colin Attwood.
 Van der Merwe, Vincent: The historical biogeography of terrestrial gamebirds (Aves: Galliformes). Supervisor: Tim Crowe.
 Wright, Dale: Evaluating a citizen-science research programme: understanding the people who make it possible.



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TOP Phil Hockey congratulates Gina Louw on becoming the first recipient of an Umhlanga Rotary Club Bursary for a student in Conservation Biology at the Fitztitute.

MIDDLE The 2010 CB class take a break at the beach on an outing with marine ecologist Colin Attwood.

BOTTOM The CB class with Sue Milton in the revamped CB teaching facility.

Niven Library 50th Anniversary Annual Report

This report will deviate from the usual structure by including an initial historical overview, followed by the more detailed account of activities in the library during 2010.

HISTORICAL OVERVIEW

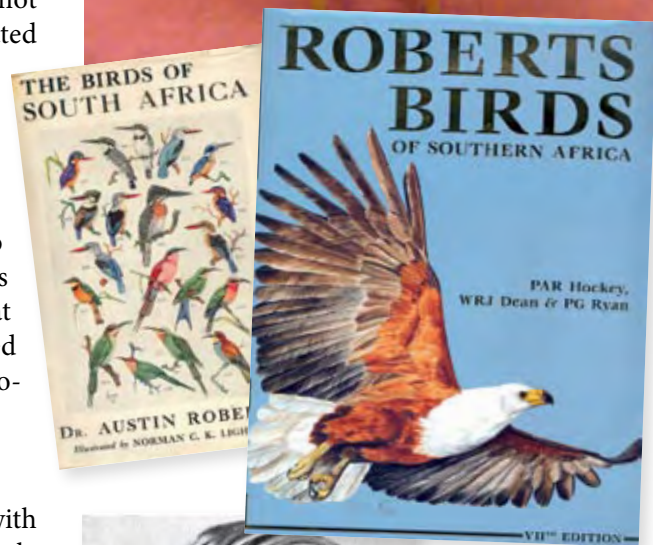
Library beginnings

The Percy FitzPatrick Institute of African Ornithology opened its doors on the University of Cape Town campus in December 1960. A collection of ornithological books and journals which belonged to the South African Ornithological Society had already found a temporary home in the Jagger Library at UCT from 1953 to 1960. This collection was subsequently transferred to the new Institute where it was initially housed in the Director's office. Thus the Fitztitute started out with a collection of journals and books which did not belong to the Institute, without a library in which to house the collection, and without a librarian to manage and develop the collection.

During the years 1960 to 1970 this situation did not change, but the collection grew apace and was curated by a variety of Fitztitute staff members. By 1971, when the Fitztitute became an Institute within the University of Cape Town rather than an independent entity, the collection had grown to the point that a position for a dedicated curator was urgently needed. Funding to supplement the collection to acquire additional academic ornithological texts also became necessary. By 1986 it was clear that the collection needed to be housed in a dedicated area and required the attention of a dedicated, professional librarian.

Exchanges

The Niven Library collection started its life in 1930 with the publication of *The Ostrich*, journal of the newly formed SAOS. A large percentage of the holdings of the Niven Library were effected through exchanges for this title from 1930 until 2003, and many of the books in the library have been received as book reviews copies to be published in *The Ostrich* over the years, a practice which still continues. The first mention of a library and of exchanges for copies of *The Ostrich* was made by Austin Roberts in 1934. BirdLife South Africa (the new name for the SAOS) relinquished the publication of *The Ostrich* in 2003, effectively curtailing all the exchanges received in the Niven Library.



TOP Niven Library reading room, 2010
 ABOVE Roberts 1st Edition (1940) and 7th Edition (2005)
 LEFT Austin Roberts
 OPPOSITE John Voelcker (top left); naming the Library (below left)
 Director Roy Siegfried presents Cecily & Jack Niven with the library key at 21st Anniversary of Fitztitute; Boardroom/Library, 1975 (right).



Exchanges however continue to be part of the life-blood of the Niven Library, primarily through the generosity of African Geographic, the publishers of *Africa Birds & Birding*. Since 2007, at no cost to the Fitztitute, 21 ornithological journals are received from around the world in exchange for *Africa Birds & Birding*.

Birds of South Africa

The Niven Library history would be incomplete without some background history of the quintessential book on southern African ornithology at the time – Roberts's *Birds of South Africa*. This book, which became the Central News Agency's best-selling South African book for many years, had a significant impact on popularising ornithology and fostering an interest in South African birds both within South Africa and throughout the world.

In 1947, the idea of a publication on birds of South Africa beyond the field guide format was contemplated. This was visualised as a 10 to 12 volume work, containing the life work of Austin Roberts. This ambitious project did not come to fruition, mainly because of the untimely death of Austin Roberts in 1948. It was not until 1997 that this idea was resurrected when the Trustees of the John Voelcker Bird Book Fund were considering the format of the seventh edition of what was now titled *Birds of Southern Africa*. The general consensus among ornithologists was that this should become a compendium of knowledge about southern African birds rather than another field guide. With the

award of the project to the Percy FitzPatrick Institute, the decades of ornithological research, published and unpublished, and archived in the Niven Library, fulfilled the purpose visualised by a succession of far-thinking ornithologists including W.L. Sclater, Austin Roberts, John Voelcker and Cecily Niven.

Library dedication

A few years prior to the move of the Fitztitute to its current premises in 1986, a suggestion was made that the library needed a name, and that it should be dedicated to the Niven family in recognition of the contribution made by Cecily, her husband Jack and her sons, Patrick, Dan and Desmond. The response was unanimous and in September 1981 the library was named *The Niven Library*. A plaque was unveiled and Cecily was presented with a key to the library as part of the celebrations held for the 21st Anniversary of the Fitztitute in 1981.

Niven Library collections

Collections housed in the Niven Library (2010 figures) are:

- The Animal Demography Unit. This collection is made up of books published by the ADU and donated to the Niven Library and the journals of the Ringing Unit. The number of titles of the latter is not finalised as this collection is still being incorporated.
- The BirdLife South African collection of books (763 titles), journals (299 titles) and newsletters (135 titles)

- The Percy FitzPatrick Memorial Trust collection, these are either donations to the Percy FitzPatrick Institute (with the proviso that they are housed in the Niven Library), or titles purchased with Fitztitute funds. The collection is made up of books (4 920 titles), theses (571), journals (673 titles) and newsletters (867 titles). All donated books are acknowledged in the Annual Report during the year of donation and receive a permanent dedication in the Niven Library catalogue.
- UCT Library semi-permanent loans. This is made up of books (268 titles), theses (2 titles) and journals (18 titles)
- The Zoology Department collection. This is made up of books (216 titles), journals (16 titles), theses (54) and honours projects (591 titles)



Victorian bird display donated by the Durban Museum

The professional status of this position was short-lived: in 1998 other professional positions at UCT were re-aligned with national levels, but not carried through to the Niven Library. In 2008 the Niven Librarian position was once again aligned with other professional positions at UCT but because of a further re-alignment with national levels in 2010, the position has once again slipped to a non-professional level.

Use of the library

The Niven Library holds the most comprehensive collection of ornithological material in the Southern Hemisphere and consequently fields a stream of requests for information from within South Africa, across Africa and beyond Africa.

No statistics were kept of library usage during the early days of the Niven Library, with the first Library report in 1974, 14 years after the opening of the Fitztitute. The following table shows the available usage figures at 5 year intervals. The drop in reprints distributed in 2004 should be seen in the context of electronic journals which were introduced around 1995, which allowed users to acquire Fitztitute papers in international electronic journals without asking for reprints (see below).

Collection accessibility

The Niven Library collection was first indexed on an electronic system in 1983, but neither this nor the subsequent upgraded system in the early 1990s enabled users to search the collection from their offices. At the end of 2004 a new system was put in place which was launched on the web, enabling users throughout the world to interrogate the Niven Library collection. The impact of advertising the collection in this way can be seen in the 2009 figures (Table 1).

Niven Library funding

From the outset, the Niven Library collection was funded jointly by the South African Ornithological Society, through the exchanges mentioned above, by the Percy FitzPatrick Memorial Trust, through donations, and, since 2007, by Africa Geographic exchanges and a budget for books from the Centre of Excellence. Funding through UCT departmental book grants, between 1980 and 1994, were deemed to be UCT Library holdings and the great majority of these have been returned to UCT Library as the loan period expired at the end of 2010, although the remaining loans have been extended to the end of 2011.

From 1982-1987, the Niven Library was run by a Bibliographic Assistant, a position funded partly by UCT and partly by the Fitztitute. In 1987, UCT took over the funding entirely, but it was only in 1994 that a professional position, funded by UCT, was approved.

TABLE 1. Use of the library 2010

YEAR	TOTAL REQUESTS FOR INFORMATION	INTER-LIBRARY LOANS	REPRINTS DISTRIBUTED	NUMBER OF COUNTRIES REQUESTING INFORMATION	NUMBER OF AFRICAN COUNTRIES REQUESTING INFORMATION
1974	598	unknown	unknown	unknown	unknown
1979	427	77	271	26	2
1984	259	177	1069	41	5
1989	534	423	1115	48	4
1994	unknown	108	1016	90	13
1999	1200	215	426	51	9
2004	887	403	275	37	7
2009	2168	167	238	31	6

2010 NIVEN LIBRARY ANNUAL REPORT

Overview

The library hosted numerous 2010 50th Anniversary talks throughout the year. The 50th Anniversary AGM party was held off campus and not as usual in the Niven Library.

The 50th Anniversary book sale, has been highly successful with approximately R50,000.00 raised between October and December 2010. The sale of books will continue into 2011.

Staff and staff development

Margaret Koopman

The Niven Librarian had hoped to attend an ABCD integrated library system hands-on workshop in Harare in November 2010, but unfortunately the funds were not readily available for this activity. It may be possible to visit an expert in Namibia during 2011 for assistance with the implementation of the new library software.

Much time was spent in following up on the re-alignment of professional librarian posts at UCT in order that this could be implemented for the Niven Library position. By the end of 2010 no progress had been made.

Phelisa Hans was once again employed on a contractual basis extended to 15 hours per week. She undertook a project to create pdfs of all past scientific papers, which she completed by the end of 2010. She also took control of organising material to be sent for binding.

Workshops given

The Librarian conducted the annual Conservation Biology Masters information skills workshop. This involved a tour of the UCT Library and the Niven Library and the students were shown the various databases available for research, given a practical exercise and, with the results of the exercise, shown how to compile a bibliography for a specific research topic.

The Librarian conducted a workshop for staff, post-grads and post-docs on the use of *RefWorks*, a bibliographic database which interfaces with a word processor for the writing of theses and papers. A database for indexing PDFs, called *Mendeley*, which has similar functionality, was also demonstrated and discussed. A powerpoint showing how to use these two tools was lodged on the share drive for the use of students and staff.

The Librarian conducted a workshop for Zoology staff members to assist with staff rate for pay assessments and ratings applications. This workshop demonstrated the Web of Science database H-index calculation, Google Scholar H-index calculation, citation impact per citation and Impact Factors for journals.

Library liaison

In July 2010, the Niven Librarian hosted a visit from the African Studies Library at UCT. UCT had recently received a bequest of Antarctic material and were interested to find out how the Niven Library collection complemented this bequest. The Niven Librarian prepared lists of books, journals and newsletters held in the Niven Library for the African Studies Library on the topic Arctic, Antarctic, Polar and Southern Ocean research.

The Niven Librarian attended the launch of the Danowski Antarctic Collection at the African Studies Library in August 2010, and found that there although there was some overlap between this collection and that in the Niven Library, that on the whole the collections complement each other well.

The Niven Librarian arranged for a one year extension of the loan period on the semi-permanent loan books from UCT Library which were due to expire on 31 December 2010. There are not many semi-permanent loans remaining in the Niven Library collection because donations to the collection enabled the return of numerous duplicated titles to UCT Library. There are currently 270 UCT Library titles (books and theses) held on semi-permanent loan which amounts to about 3% of the collection. There are also 18 short journal runs on semi-permanent loan from UCT Library, all of which complement more comprehensive holdings which belong to the Niven Library collection.

There was an assumption by the UCT Library that many of the titles held on semi-permanent loan in the Niven Library had been lost or stolen during the intervening years, but this proved to be unfounded. Only



Librarian
Margaret Koopman



Contract staffer
Phelisa Hans

two titles have gone missing over a loan period of over 30 years (some of the loans were negotiated in the early 1970s).

Library development

Space management:

The new (2009) compact storage area in the Niven Library has made a notable improvement in the workflow and time management in the library during 2010.

Moving the Victorian bird display cabinet from under the stairs in the foyer into the focal point of the library and installing lighting has enhanced the appearance of the library and many positive comments from students and visitors have been received.

50th Anniversary Book Sale

During 2010 the Niven Librarian and the Library Assistant made preparations for a book sale to celebrate the 50th Anniversary of the Fitztitute and to raise money to purchase new ornithology books. The sale of these books will also make space for material to be moved from a 3rd floor storeroom. The sale books are all duplicates or triplicates of material already in the library. All donor material is acknowledged permanently in the Niven Library catalogue and all new books purchased with sale money will be deemed to be the donation of the person who originally donated the book or books. A detailed spreadsheet with this information has been compiled by the Niven Librarian. The book sale was advertised on SA Birdnet and on Cape Birdnet and the response was overwhelming. By the end of 2010, 43 individuals had purchased books from the sale, in most cases multiple books, to a value of approximately R50,000. The sale will continue into 2011.

Library maintenance

The library access card machines, which had been problematic for many years, were replaced towards the end of 2010 with a new Prox Card system that does not require users to swipe their cards. In most cases staff and students had to have their ID cards replaced in order to operate the new system. All access privileges had to be renegotiated with Access Control by the Niven Librarian.

The wooden window frames of the library are badly in need of maintenance, but this is regarded as a low priority task in the UCT scheme of maintenance tasks. The task has been reported for future attention.

Collection management

Journals: The number of exchanges for ornithological journals, which are generously donated by Africa Geographic, dropped to 21 during the year because The

Wildlife Society in the USA stopped publishing their journal *Wildlife Conservation*. The exchange agreements represent a savings in 2010 subscriptions of R16,352.

During 2010 the Niven Library received 19 titles on the basis of subscriptions. Titles available through UCT Library electronic subscriptions continue to fluctuate. New vendor subscriptions for 2010 were Cambridge University Press Journals which allows access to *Bird Conservation International* electronically. The Niven Library continues to receive the print editions because of the unpredictability of the electronic subscriptions. During 2009 *Journal of Ornithology* was available through the Springer-Link platform but no longer available from UCT Library during 2010. Fortunately *Journal of Ornithology* is also an exchange journal which has the added prestige of being the only remaining exchange title from the original exchanges since the opening of the Fitztitute in 1960.

Reprints: The Niven Librarian continued to add to the reprint collection, focussing on articles in journals not held by the library. Many of these reprints are requested directly from the authors who supply copies in pdf format rather than posting a paper copy.

Books: 185 new titles were accessioned into the collection during 2010. These were made up of purchases (12 books), review copies (8 books), theses (42) and the remaining 123 were donations. Of the review books Lynx Edicions, Barcelona were once again very generous in sending books for review, including Volumes 14 and 15 of the Handbook of the Birds of the World.

A few other significant titles include:

- Avian malaria parasites and other haemosporidia
- Biology of marine birds
- Farmland birds across the world
- Raptor survey and monitoring, a field guide for African birds of prey
- Ecological and environmental physiology of birds
- Birds of the Middle East, 2nd edition
- Effects of climate change on birds
- Makgadikgadi Pans Important Bird Area
- Birding Ethiopia, a guide to the country's birding sites
- Bird migration and global change

During 2010 the Niven Library was the beneficiary of the Estates of the Late Norman Campbell and Rolf Attwell.

Staff Books published during 2010

Sinclair, I., Ryan, P., Christy, P., Hockey, P., Arlott, N. ill., Hayman, P. (ill.) and Harris, A. (ill.) 2010. Birds of Africa south of the Sahara. 2nd ed. Cape Town, Struik.

Terauds, A., Cooper, J., Chown, S.L. and Ryan, P. 2010. Marion and Prince Edward, Africa's southern islands. Stellenbosch, SUN Press.

Databases:

The *Afrotropical Bird Database (ATBD)* continues to be available to users of the Niven Library, although the African content in many instances is not being kept up to date by the developers. Titles such as *Malimbus* (West Africa), *Bulletin of the African Bird Club*, *Honeyguide* (Zimbabwe), and *Babbler* (Botswana) have not been indexed for up to 6 years.

Electronic Journals:

Ornithological titles available through UCT are: *Bird Conservation International*, *Ibis*, *Journal of Avian Biology*, *Journal of Field Ornithology*.

In addition there are a number of general zoological titles, which are relevant to ornithological research, which are available through UCT vendor or consortium subscriptions:

- Behavioral Ecology
- Behavioral Ecology and Sociobiology
- Behaviour
- Biology Letters
- Evolution
- Philosophical Transactions of the Royal Society B: Biological Sciences
- Proceedings of the Royal Society B: Biological Sciences

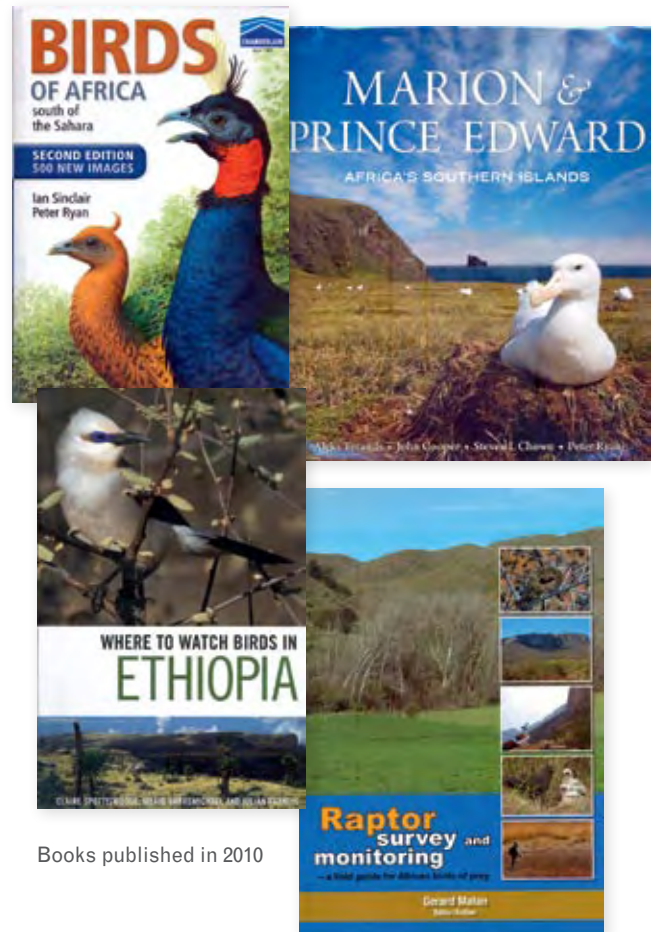
Niven Library Database

The Niven Librarian spent the year consolidating the records in the CDS/ISIS database so that records migrated to the new ABCD software in 2011 would be compatible with international library standards. As this involves editing over 6,200 records the task is not yet complete. The CDS/ISIS database will form the database component of the new Integrated Library System.

Use of the Library

TABLE 2. Niven Library stock circulation over the past four years.

	2010	2009	2008	2007
MONOGRAPHS	281	228	300	376
REPRINTS	14	52	27	88
THESES	16	26	24	45
JOURNALS	153	181	141	265
AUDIO-VISUAL	6	3	5	5
TOTAL	470	490	497	779



Books published in 2010

Document Delivery

TABLE 3. Niven Library inter-library loans over the past four years

	2010	2009	2008	2007
ITEMS REQUESTED (BY STAFF/STUDENTS)	134	61	96	90
ITEMS SUPPLIED	121	78	189	151
REQUESTS NOT SATISFIED	13	14	15	8

Reprint requests

TABLE 4. Requests for PFIPO Reprints

REPORTING PERIOD	2010	2009	2008	2007
NUMBER OF REPRINT REQUESTS	177	238	243	258
NUMBER OF COUNTRIES	33	23	35	36

The breakdown of reprint requests by country (Table 4) is (2009 statistics in brackets): Argentina 10(8), Australia 9(11), Brazil 2(10), Canada 12(4), Columbia 1, Czech Republic 8, France 11(9), Germany 7(27), Guatemala 2, Hawaii 1, India 3(7), Ireland 1, Israel 2(1), Italy 9, Japan 1(1), Malawi 2, Mexico 2, Netherlands 1(2), Poland 1(1), Portugal 5, Gough Island 4, Russia 1,

South Africa 36(72), South Korea 1, Spain 3, Tristan da Cunha 2, United Kingdom 13(27), United States of America 21(38), Uruguay 1, Venezuela 1(1), Vietnam 1, Zambia 1.

Cash photocopying

The number of cash copies in 2010 was minimal as a result of the copier/scanner installed during 2009. 190[2009–1146] cash copies amounting to R76.00 [R458.40] were made on the photocopier in the library during 2010. The charge for photocopying remained at 40c per page for 2010. Previous year's statistics in [brackets].

Research requests [2009 figure in brackets]

A total of 2 141 [2 168] requests for information were received during the period under review, with approximately 26% of these requests generated by staff and students of the Fitztitite. 1090 [1560] pdf or jpg files were supplied by e-mail to users locally, nationally and internationally. The number of hard copy articles supplied 48 [155] has been significantly reduced as the new scanner enables pdfs to be created very easily and articles are then e-mailed. In addition, 161 [228] 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 URLs and e-mail addresses and numerous other general queries. The Library received 633 [803] research requests from the staff and students of the PFI/O, 346 [407] from Zoology staff and students, and 85 [62] from ADU staff and students. 147 [128] requests for information were also received from elsewhere on the UCT campus, and 781 requests both nationally and internationally, including the supply of Fitztitite reprints.

Requests for information

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

Ornithological NGOs

Dirk Van den Abeele, MUTAVI, Research & Advice Group, Ornitho-Genetics VZW, Belgium Lovebird Society; BirdLife South Africa

Conservation NGOs

Yan Roupert-Coudert, SCAR Expert Group; John Cooper, ACAP

Publishers

Vanessa Stephen, EarthTouch; Daniel Philippe, Howard and Moore Checklist of the Birds of the World; Bronwyn Howard, The Birder e-magazine

Private Companies

Simon Dures, Wilderness Safaris, Botswana

South African Universities

Nelson Mandela Metropolitan University, Rhodes University, Stellenbosch University, University of Cape Town

International Universities

Sara Lipshutz, Swarthmore College, Pennsylvania, USA; Lindley Mease, Stanford University, California, USA

Acquisitions and collection building

At the end of December 2010 the bibliographic records in the Niven Library database totalled 52 627 [50 625]. The numbers of individual items received in the Niven Library are shown below:

TABLE 5. Niven Library acquisitions over the last four years

	2010	2009	2008	2007
MONOGRAPHS	185	155	113	102
JOURNALS	443	530	351	530
NEWSLETTERS	165	328	296	272
REPRINTS	49	10	121	93
PDFS	1764	1332	1300	1357
AUDIOVISUAL	4	3	12	8

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, Animal Demography Unit and the African Seabird Group continued to donate their exchange journals.

Donations

We acknowledge with thanks donations from the following: Animal Demography Unit; Rauri Bowie; John Cooper; Late Rolf Attwell; Late Norman Campbell; Lynx Edicions; Patrick Morant; NISC; Dieter Oschadleus; Martin Riddle, Australian Antarctic Division; Peter Ryan; Roy Siegfried.

Scientific publications of the FitzPatrick Institute

2005-2010

What follows is a list of scientific publications produced by the FitzPatrick Institute since the inception of the DST/NRF Centre of Excellence. Names in bold are members of the FitzPatrick Institute or the Centre of Excellence. IF = Impact Factor.

SCIENTIFIC PUBLICATIONS 2005

- Archibald, S., Bond, W.J., Stock, W.D. & Fairbanks, D.H.K. 2005. Shaping the landscape: fire-grazer interactions in an African savanna. *Ecological Applications* 15: 96-109. IF 3.804
- Balmford, A.**, Bennun, L., ten Brink, B., Cooper, D., Côté, I.M., Crane, P., Dobson, A., Dudley, N., Dutton, I., Green, R.E., Gregory, R.D., Harrison, J., Kennedy, E.T., Kremen, C., Leader-Williams, N., Lovejoy, T.E., Mace, G., May, R., Mayaux, P., Morling, P., Phillips, J., Redford, K., Ricketts, T.H., Rodriguez, J.P., Sanjayan, M., Schei, P.J., van Jaarsveld, A.S. & Walther, B.A. 2005. The Convention on Biological Diversity's 2010 target. *Science* 307: 212-213. IF 30.927
- Balmford, A.** & Bond, W. 2005. Trends in the state of nature and implications for human well-being. *Ecology Letters*. 8: 1218-1234. IF 5.151
- Balmford, A.**, Green, R.E. & Scharlemann, J.P.W. 2005. Sparing land for nature: exploring the potential impact of changes in agricultural yield on the area needed for crop production. *Global Change Biology* 11: 1594-1605. IF 4.075
- Balmford, A.**, Crane, P., Dobson, A., Green, R.E. & Mace, G.M. 2005. The 2010 challenge: data availability, information needs and extraterrestrial insights. *Philosophical Transactions of the Royal Society B - Biological Sciences* 360: 221-228. IF 4.997
- Beresford, P.**, Barker, F.K., **Ryan, P.G.** & **Crowe, T.M.** 2005. African endemics span the tree of songbirds (Passeri): molecular systematics of several evolutionary 'enigmas'. *Proceedings of the Royal Society B* 272: 849-858. IF 3.51
- Bomhard, B.**, Richardson, D.M., Donaldson, J.S., Hughes, G.O., Midgley, G.F., Raimondo, D.C., Rebelo, A.G., Rouget, M. & Thuiller, W. 2005. Potential impacts of future land use and climate change on the Red List status of the Proteaceae in the Cape Floristic Region, South Africa. *Global Change Biology* 11: 1452-1468. IF 4.075
- Bowie, R.C.K.**, Voelker, G., Fjeldså, J., Lens, L., Hackett, S.J. & **Crowe, T.M.** 2005. Systematics of the Olive Thrush *Turdus olivaceus* species complex with reference to the taxonomic status of the endangered Taita Thrush *T. helleri*. *Journal of Avian Biology* 36: 391-404. IF 1.752
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