SCAR Fellowship Report

Marine Top Predator Habitat Use around the Sub-Antarctic Prince Edward Islands

Name of Fellow

Position
CESAB Post-doctoral fellow
Affiliation
Centre d'Etudes Biologique de Chizé, UMR 7372 du Centre National de la Recherche Scientifique-Université de La Rochelle
Country
France
Email
ryan.r.reisinger@gmail.com

Home Institution

For Fellowship:
Home Contact
Dr Pierre Pistorius
Nelson Mandela University
Home Contact Email
pierre.pistorius@nmmu.ac.za
Home Country
South Africa

Currently:
Home Contact
Dr Yan Roupert-Coudert
Centre d'Etudes Biologique de Chizé, UMR 7372 du Centre National de la Recherche Scientifique-Université de La Rochelle
Home Contact Email
yan.ropert-coudert@cebc.cnrs.fr
Home Country
France

Host Institution

Host Contact
A/Prof Ben Raymond
Australian Antarctic Division
Host Contact Email
ben.raymond@aad.gov.au
Host Country
Australia

Host Contact
Prof Mark Hindell
Institute for Marine and Antarctic Studies
Host Contact Email
mark.hindell@utas.edu.au
Host Country
Australia

Introduction (~ 100 words)

What motivated the application and project? Brief explanation of the background and rationale for the proposal.

Marine predators are considered sentinels of the state of their environment. Marine predators have been studied for decades at South Africa's Prince Edward Islands, yet no study has considered a suite of species or quantified the changes in foraging distribution expected, given climate change predictions. It was thus important to collate existing tracking data towards a broader-scale understanding of biodiversity patterns and environmental change in the sub-Antarctic region. Using multiple species provides insights which are not apparent when considering single species and such information is vital for spatial and ecosystems-based management.

Project Objectives (~ 100 words)
What were the aims of the project at the outset?

By using existing animal tracking data, we aimed to:

1. Identify important environmental predictors of marine top predator distribution around the sub-Antarctic Prince Edward Islands and model suitable habitat.
2. Identify overlap in preferred foraging habitats (hotspots) of marine top predators breeding at the Prince Edward Islands. Assist with the identification of significant areas (e.g., Important Bird Areas and Ecologically and Biologically Significant Areas).
3. Use existing climate change predictions and the models developed in objective 1 to forecast marine top predator foraging distributions and

thereby predict consequences of environmental change for sub-Antarctic marine top predators.

4. Contribute data to and assist with methods development for SCAR EGBAMM's (Experts Group on Birds and Marine Mammals) Retrospective Analysis of Antarctic Tracking Data.

Methods, Execution and Results (∼200 words)

What was the nature of the research and activities undertaken? Did everything go as you and your host had hoped? What results were generated and how do they reflect expectations?

Objectives 1 & 2 (output 1, below):

Ensemble habitat models were constructed based on tracking data for 14 marine predator species. These were overlaid to identify areas of common importance around the Prince Edward Islands and to identify environmental drivers of hotspots. Tracking locations covered 39.75 million km^2, up to 7,813 km from the Prince Edward Islands. Areas of high mean importance were located broadly from the Subtropical Zone to the Polar Frontal Zone in summer, and from the Subantarctic to Antarctic Zones in winter. Areas of high mean importance were best predicted by factors including wind speed, sea surface temperature, depth and current speed.

Objective 3 (output 2):

We extracted historical and end-of-century ocean and atmosphere environmental data layers from the Max Planck Institute Earth System Model for Representative Concentration Pathway 8.5. The models from output 1 are being re-run using the historical data layers, and will be predicted to the end-of-century data layers. We will then compare these sets of maps to assess potential distribution shifts, and the environmental changes driving them.

Objective 4 (output 3):

We have collated tracking data from more than 70 contributors across 12 national Antarctic programs, comprising 17 predator species, 4,041 individual animals, and over 2.9 million observed locations. We are using these data to build habitat models and identify areas of ecological significance (as in objective 1).

Project Outcomes (∼ 200 words)

What do you feel were the significant outcomes in terms of the research but also in terms of personal development?

The project has resulted in at least three publications (in review or in preparation - below). These contribute to a significantly better understanding of the spatial distribution of predators in the Southern Ocean and will illustrate likely scenarios for their future spatial distribution. A critically important aspect of these analyses is their multi-species nature. Information from the first paper (output 1, below) is already being incorporated in South Africa's next National Biodiversity Assessment (in which the Prince Edward Islands are being included for the first time). The RAATD dataset (output 3, below) forms the basis of the analyses in my current post-doctoral position; the outcomes roughly mirror outputs 1 and 2 (below) at a whole Southern Ocean scale and will be submitted to high impact factor journals (e.g., Nature, Science, Nature Climate Change) with lead authors MA Hindell and myself, respectively.

In terms of personal development, the Fellowship will allow me to author and co-author several important publications, has contributed to my employment as an international post-doctoral fellow, and has enabled me to set up international collaborations.

Publications, Presentations and Products

Are there papers or articles submitted or in preparation as a result of the Project? Have you made presentations as a result of the Fellowship? Are there significant products as a result that will have use beyond the Fellowship for yourself or others?

1. **Reisinger RR**, Raymond BPI, Hindell MA and 16 others. (In Review). Habitat modelling of tracking data from multiple marine predators identifies important areas in the Southern Indian Ocean. *Diversity and Distributions*.

2. **Reisinger RR**, Raymond BPI, Hindell MA and 17 others. (In Preparation). Habitat model forecasts show potential distribution shifts of a suite of Southern Ocean predators.

3. Ropert-Coudert Y, Van de Putte AP, Bornemann H, Charrassin J-B, Danis B, Huckstadt L, Jonsen ID, Lea M-A, **Reisinger RR** and 69 others. (In Preparation). The Retrospective Analysis of Antarctic Tracking Data from the Scientific Committee on Antarctic Research. *Scientific Data*.

Capacity Building, Education and Outreach Activities (~ 200 words)

As a result of the Fellowship did you engage in educational and/or outreach activities before/during/after your visit? Did you meet with students to explain your work? Did you give a public lecture? Was there any publicity about your visit - either in your host country or your home country?

Antarctic Legacy of South Africa Blog:
http://blogs.sun.ac.za/antarcticlegacy/2016/08/23/a-south-african-researcher-is-awarded-a-scar-fellowship/

Future Plans and Follow ups (~ 100 words)

Do you plan to continue contact with the host institute and others you met as a result of the project? What will be the nature of the future work?

I was recently employed as an FRB (Fondation pour la Recherche sur la Biodiversité) CESAB (Centre de Synthèse et d'Analyse sur la Biodiversité) post-doctoral fellow in the RAATD project. I am thus actively working with a multinational group (including my SCAR Fellowship hosts) responsible for this tracking synthesis project. I shall maintain active collaborations with these individuals and institutions after my post-doctoral fellowship. I shall also apply for another post-doctoral fellowship with one of my hosts (Prof. Mark Hindell) to continue working on this and an expanded tracking synthesis project. Ultimately, however, I would like a permanent academic position in South Africa, and would like to continue these collaborations thence.

Personal Impact

How do you feel the Fellowship has and will continue to impact your research and career objectives? What was the main impact for you personally?

The SCAR Fellowship has had an important impact on my personal development. Firstly, the Fellowship allowed me to pursue a line of research which I plan to pursue and develop during my career. Practically, the Fellowship will allow me to author and co-author several important publications, it has contributed to my employment as an international post-doctoral fellow, and I have set up international collaborations through the project. Participating in activities linked to the Fellowship has allowed me to broaden my professional network. Moreover, the Fellowship has allowed significant development of my data analysis skills. Overall, this has really improved my career trajectory and I enjoyed my research visit very much!

Financial Statement

Please provide a brief breakdown how the funds were used. Example: The SCAR Fellowship was used to help cover travel to the host institute, buy supplies for the experiments and cover a month of rent at the host location.

Item	(ZAR)	(USD)
Travel (France-Hobart-France)	-26,698.44	-1,893.89
Subsistence in Hobart (food, local travel, etc.)	-41,055.19	-2,912.305
Accommodation in Hobart	-26,698.44	-1,893.89
Total Expenses	*-94,452.06*	*-6700.084*
SCAR Fellowship Funds	*+94,450.88*	*+6,700.00*

Balance	-R1.18	-0.84

Acknowledgements and References: