



SCAR Fellowship Report

Impacts of climate, fisheries and habitat degradation on an albatross community.



Riding over the River Cam to work at the British Antarctic Survey.



With collaborators from the British Antarctic Survey. From left: Dr Annette Scheffer, myself, Dr Ana Bertoldi and Dr Tommy Clay.

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22-07-2015 to 24-10-2015

Introduction (~ 100 words)

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

Bottom-up and top-down drivers of environmental change can impact upon populations in complex ways. For marine predators, the influence of environmental change on demographic rates can be experienced both at sea and at the breeding colony through mechanisms such as increased mortality by fisheries, oceanographic changes affecting food availability or breeding habitat loss. Understanding the mechanisms that drive populations is vital for their conservation and management. I sought a SCAR Fellowship to visit the British Antarctic Survey to learn advanced demographic modelling techniques that would allow me to discover the population level drivers of a community of Southern Ocean albatrosses.

Project Objectives (~ 100 words)

What were the aims of the project at the outset?

This project aimed to undertake a comprehensive demographic analysis of the black-browed, grey-headed, light-mantled and wandering albatrosses breeding on subantarctic Macquarie Island. All four species are long-ranging pelagic foragers that occupy different ecological niches. As a consequence, there are different pressures on life-history traits and each species responds differently to environmental variation. Subsequently, we aimed to quantify the links between environmental change and demographic rates across the community of albatross species to provide insights into the major determinants of population trends.

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?

Evaluating the nature of climate and fisheries interactions using marine top predators and their life-history traits requires robust statistical methods. In collaboration with Dr Deborah Pardo and Dr Richard Phillips from British Antarctic Survey (BAS), I completed a demographic study of Macquarie Island (MI) albatross from a long-term mark-recapture data series (1953-2014) using E-SURGE Software (Choquet et al., 2009). This allowed us to simultaneously assess the effect of climatic variation, fisheries impacts and habitat change on demographic parameters of survival and reproductive output. We found that survival of black-browed albatross was negatively affected by longline fishing in the south-west Atlantic. Wind patterns were also found to affect survival, with high Southern Annular Mode indices (stronger winds at higher latitudes) explaining higher survival in three of four species (excluding wandering albatross) and higher breeding success in black-browed and grey-headed albatross. Unexpectedly, we found heavy grazing by invasive rabbits, and climate-driven extreme rainfall events played a considerable role in regulating albatross breeding probability and breeding success. Our results further indicated that a high degree of synchronicity in demographic trends exists among each species and there is less capacity to buffer survival against climate effects (temporal changes in wind patterns and sea ice extent) than previously credited.

Project Outcomes (~ 200 words)

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

This research represents the first time that environmental effects have been incorporated into the demographic modelling of these populations and one of few that have been able to simultaneously assess oceanic, fisheries and onshore habitat drivers on the vital rates of Southern Ocean top predators. The findings of this study fills an important gap for the Agreement on the Conservation of Albatross and Petrels, providing up to date, relevant information about four species under the agreement. In a SCAR context, this fellowship has connected me with researchers within AnT-ERA, AnT-ECO and EG-BAMM groups, where together we have been able to advocate for greater representation of long-term demographic and population studies, which are fundamental to the conservation of populations. Most valuable, this research fellowship has enabled me to diversify my analytical skills from foraging ecology to become proficient in demographic modelling and population analysis. It has not only connected me with prominent scientists at the British Antarctic Survey but also, a network of early career researchers, spurring further positive scientific collaborations and working relationships that will last into the future.

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?

This fellowship has facilitated two scientific papers, one currently in review and the second in preparation. The results have been presented at the SCAR 2016 Open Science Conference in Malaysia and the 3rd World Seabird Conference in Cape Town. The reconstruction and quality control of a 63-year albatross mark-recapture database used in this study would not have been as successful without the support from the host institution. Further to this, the mark-recapture dataset used as a part of the research will be made publicly available through the Australian Antarctic Division Data Centre.

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?

My host institution, the University of Tasmania published a feature article when I first received the SCAR Fellowship in their research magazine about my upcoming visit to Cambridge. While in Cambridge, I did several remote educational activities with Montague Bay Primary School (Tasmania) about my research at British Antarctic Survey, in collaboration with the CSIRO Scientists in Schools Program. On returning to Tasmania, I gave a presentation on my experiences at the British Antarctic Survey to the Antarctic Climate and Ecosystems Cooperative Research Centre. The demographic modelling skills I acquired during my fellowship have allowed me to support fellow postgraduates at my home institute for which I have given several tutorials on the technical aspects of mark-recapture analysis.

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 am in regular contact with researchers from the host institution. We are currently working to build a sustainable research model for top predator foraging ecology research that will enable continuous deployments of tracking devices over the next several years and provide insight into long-term resilience/vulnerability of to climate-driven oceanographic changes.

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 broadened my scientific network and exposed me to further opportunities inside and outside of SCAR. Most recently I have been appointed the APECS representative to SCAR EG-BAMM and have been involved in several of their initiatives. The greatest personal impact I have experienced has been the connection I have made with other early career scientists at the British Antarctic Survey. We consistently worked together to solve difficult problems and find ways forward with our independent analysis. We repeatedly discussed future projects and collaborations, from which one has already come to fruition. I am confident that this will continue into the future and be a positive contribution to SCAR.

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.

The SCAR Fellowship was used to cover the return flights from the home (the University of Tasmania, Institute for Marine and Antarctic Studies, Tasmania, Australia) to the host institute (British Antarctic Survey, Cambridge, UK) and three months rent and living in Cambridge. The remaining funds covered the registration fee for the SCAR Open Science Conference in Malaysia, 2016 and the registration fee and supported flights to the SCAR Biology Conference in Belgium, 2017 where the results of this research were presented.

Acknowledgements and References:

I would like to thank SCAR for awarding me a fellowship to visit the British Antarctic Survey and researchers Deborah Pardo and Richard Phillips for warmly welcoming me into their research teams.

CHOQUET, R., ROUAN, L. & PRADEL, R. 2009. Program E-SURGE: a software application for fitting Multievent models. *In*: THOMSON, D. L., COOCH, E. G. & CONROY, M. J. (eds.) *Modelling Demographic Processes in Marked Populations*. Springer US.