



WP

11

Agenda Item:

2.2.2

Person Responsible:

H Griffiths

EXCOM 2015

Tromsø, Norway 27-28 August 2015

State of the Antarctic Ecosystem



Executive Summary

Title: State of the Antarctic Ecosystem (AntEco)

Authors: Jan Strugnell, Huw Griffiths, Aleks Terauds, Pete Convey and the AntEco Steering Group.

Introduction/ Background: The Scientific Research Programme - AntEco (State of the Antarctic Ecosystem) has a focus on understanding and clarifying the processes driving patterns of biodiversity in all environments across the Antarctic, sub-Antarctic and Southern Ocean regions. The programme prioritises applied research and aims to provide scientific knowledge on biodiversity that can also be used for conservation and management.

Important Issues or Factors: Since its formal inception in 2013, AntEco has focused on building and extending research networks, facilitating research that is aligned with the research priorities of the programme, and publishing research findings. Members have not only published papers in high quality journals, but also ensured that findings are disseminated widely, through conference symposia, media and popular articles. Publications in high quality journals continue to be a priority, and we are currently on track to exceed the ambitious targets set out in the implementation plan. One of the primary goals of AntEco is to foster collaboration between scientists, institutions and countries. To this end, AntEco has provided several letters of support for a number of large-scale multinational research proposals. AntEco has secured a research cruise, largely funded by the British Antarctic Survey, to investigate the biodiversity, biogeography and the Marine Protected Area in the South Orkney plateau. This expedition includes AntEco participants from 16 institutes and 9 countries. As a group, we invested considerable time and resources into the 2014 SCAR OSC, with three workshops and a diverse range of sessions, all of which were very well attended. We also supported a session at the 2015 ISAES meeting in Goa, India. Over the next year, AntEco will not only continue to support new research, but also focus on the delivery of advice to stakeholders, in particular the ATCM through the CEP.

Recommendations/Actions and Justification: Given the substantial progress made in its first two years, and the momentum that is building in the AntEco research community, we recommend that the delegates (1) note and approve of AntEco actions to date, and (2) continue to support AntEco at current levels for the next two years.

Expected Benefits/Outcomes: Continuing support will allow the number and quality of important publications to continue, will ensure outreach delivery, facilitate advice to stakeholders and enhance SCAR's profile and reputation.

Partners: All outputs to date involve partners and collaborators both within and external to SCAR. So far these groups include SC-ATS, EG-BI, AnT-ERA, CAML, APECS, and a range of research institutional partners. Cross-disciplinary and cross-group collaborations will continue to be a driving theme in AntEco supported research.

Budget Implications: To achieve the objectives and goals over the next two year period, we request that funding is maintained at \$US20 000 per year.

State of the Antarctic Ecosystem (AntEco)

1. Rationale for the Programme

Biological diversity is the sum of all organisms in a system. These organisms collectively determine how ecosystems function and underpin the life-support system of our planet. The SCAR Scientific Research Programme - State of the Antarctic Ecosystem (AntEco) has been designed to focus on past and present patterns of biodiversity across all environments within the Antarctic, sub-Antarctic and Southern Ocean regions. The broad objectives of the programme are to increase the scientific knowledge of biodiversity, from genes to ecosystems that, coupled with increased knowledge of species biology, can be used for the conservation and management of Antarctic ecosystems.

Through the development and maintenance of an international research network, AntEco aims to inform our understanding of current biodiversity and patterns therein, to distinguish the impact of present processes from historical signals, and to use this knowledge to develop scenarios of its future state through interdisciplinary approaches. While the scope of research activities supported will be broad, research priorities will be directed towards science that is policy relevant and assists in guiding management and conservation in the region.

AntEco is structured into five research sectors, each with a sector leader:

1. Spatial Ecology (Huw Griffiths, British Antarctic Survey, UK)
2. Molecular Ecology and Evolution (Jan Strugnell, La Trobe University, Australia)
3. Ecoinformatics and Systems Biology (Alison Murray, DRI, USA)
4. Paleoecology (Dominic Hodgson, British Antarctic Survey, UK)
5. Impacts, Trends and Conservation (Annick Wilmotte, University Liège, Belgium).

Research will not be carried out in isolation within these sectors. Multidisciplinary approaches are a key guiding principle within AntEco, with collaborations encouraged not only between research sectors, but also more broadly across SCAR Research Programmes and other relevant SCAR Standing Committees and Expert Groups.

The AntEco Executive is comprised of the joint Chief Officers (Jan Strugnell and Huw Griffiths), joint Deputy Chief Officers (Don Cowan and Pete Convey), Secretary (Anton Van de Putte) and the research sector leaders (Alison Murray, Dominic Hodgson and Annick Wilmotte). The remainder of the Steering Group is comprised of leading researchers that, together, represent a broad range of countries and disciplines (Appendix 1).

2. Important Issues or Factors

In the past 12 months, AntEco Science highlights include conference symposia, published papers in leading international journals and significant collaborative efforts.

i) Five Scientific Highlights

1. SCAR OSC in Auckland

AntEco convened five sessions at the SCAR –OSC in Auckland: i) Diversity and Distribution of life in Antarctica; ii) Impact of Past Glaciation and Climate; iii) Scientific Advice for Policymakers and Evidence-based Conservation; iv) Microbes Diversity and Ecological Roles; v) Diversity and Connectivity in Antarctica & Spatial Analysis of Antarctic Biodiversity. These sessions represent each of the research sectors in the AntEco implementation plan and were extremely well subscribed and attended. The sessions included over 70 oral presentations covering all aspects of AntEco work from the marine, lacustrine and terrestrial realms. AntEco also convened three well-attended and successful workshops during the OSC.

2. The Biogeographic Atlas of the Southern Ocean

The Biogeographic Atlas [1] presents the distribution patterns and processes of a significant representation of Southern Ocean organisms, illustrated by more than 800 distribution maps and 200 pictures and graphs. The Atlas is a legacy of the International Polar Year 2007-2008 and a contribution to the SCAR scientific research programmes AntEco (State of the Antarctic Ecosystem) and AnT-ERA (Antarctic Thresholds - Ecosystem Resilience and Adaptation). The Atlas was launched at the SCAR Meeting and Open Science Conference (Auckland, New Zealand August 25-28th 2014).

3. ANDEEP-SYSTCO (ANTarctic benthic DEEP-sea biodiversity: colonization history and recent community patterns - SYSTem COupling) aimed to uncover responses of the abyssal benthos to differences and longer-term changes in primary productivity [2]. Investigations on pelagic-benthic coupling included the analysis of a phytoplankton bloom from the surface down to the abyssal seafloor at a single station in the South Polar Front. These analyses also suggested a strong benthic-pelagic coupling at certain stations. As expected, sediment oxygen consumption measurements revealed higher values after the bloom. The response of bacteria and metazoan meiofauna indicated that enhanced oxygen consumption was related to respiratory activity of the living benthic component. High nematode relative abundance in the top centimetre layer of sediment only after the phytodetritus had settled suggests an early stage of a meiofaunal response. The study also showed that foraminiferans collect a diluted and sparse food resource (phytoplankton) and concentrate it as they build up their cytoplasm. As benthic foraminiferans serve as a food source for many abyssal metazoans, this study highlights the link between the degraded food resources, phytodetritus and metazoan

4. Antarctic marine ecosystems have been changing for at least the past 30 years [3]. This article reviews current and expected changes in physical habitats in response to climate change. It then reviews how these changes may impact the autecology of marine biota of this polar region. The general prognosis for the physical environment is for an overall warming, and freshening and strengthening of westerly winds. A potential pole-ward movement of those winds and the frontal systems, and an increase in ocean eddy activity is also predicted. Many habitat parameters will have regionally specific changes, particularly relating to sea ice dynamics.

5. The Monaco Assessment: AntEco Executive members Peter Convey and Aleks Terauds attended a meeting of global biodiversity and Antarctic experts entitled '*Antarctica and the Strategic Plan for Biodiversity 2011-2020: The Monaco Assessment*' which was convened over a three day period in Monaco. The workshop was supported by the Monaco Government, the Centre Scientifique de Monaco, SCAR and Monash University. The central purpose of the meeting was to examine the extent to which conservation of the biodiversity of Antarctica and the Southern Ocean is realizing the set of ambitions agreed for the world as part of the Strategic Plan for Biodiversity 2011-2020. The meeting also aimed to provide guidance for action that can effectively help deliver further conservation successes for Antarctica and the Southern Ocean. An additional goal was to identify key areas for work and indicators to help guide that work. One of its first outcomes is a statement by the participants, on Antarctic and Southern Ocean conservation in the context of the Strategic Plan for Biodiversity 2011-2020, based on an expert elicitation process, and entitled 'The Monaco Assessment' (<http://www.scar.org/monaco-assessment/document>).

ii) Progress against prior work plan, including metrics of performance.

AntEco is on track to deliver all work items identified and outlined in the Implementation Plan (2013) http://www.scar.org/scar_media/documents/science/anteco/AntEco_Implementation_Plan.pdf.

Publication rates are currently exceeding the metrics of performance outlined in this plan and deliverables are exceeding or in line with expectations (see Section 3).

3. Outputs/Deliverables

Selected publications:

As noted in the AntEco Implementation Plan, publications in peer-reviewed journals are one of the highest priority outputs for the AntEco programme. Over the last 12 months, these have included (but are not

limited to): Divergence between Antarctic and South American marine invertebrates: [4] ; studies of organisms in the Polar Frontal Zone: [5 & 6]; the very first metaviromics survey of an Antarctic soil habitat [7]; defensive metabolites from Antarctic invertebrates [8]; vulnerability of shallow Antarctic ecosystems [9]; a comprehensive review of climate change impacts in polar region [10]; the current status of biological invasions in terrestrial Antarctica [11]; the identification of important foraging areas off East Antarctica [12] as well as the 66 chapters of the SCAR Biogeographic Atlas [1] covering the evolution, physical environment, genetics and possible impact of climate change on marine organisms in the region.

Products:

In addition to the printed Atlas [1], AntEco has played a leading role in producing the Marine Biodiversity information summary for the Antarctic Environment Portal. This summary is set to be released on the portal in coming weeks and summarises the policy relevant information from the Atlas.

Workshops and meetings:

AntEco convened three satellite meetings at the Auckland OSC (2014):

AntEco Workshop 1: Physical drivers of biodiversity at multiple spatial scales. Convened by Aleks Terauds and Huw Griffiths. Attendance: By invitation

Update: Significant progress in the collation of biodiversity has been made since the meeting, with both marine and terrestrial datasets being consolidated. Analyses has began on some specific marine taxa and terrestrial models are currently under development.

AntEco Workshop 2: Antarctic Aerobiology. Convened by David Pearce. Attendance: By invitation

Update: A Perspective article, led by David Pierce and entitled ‘Aerobiology over Antarctica – a new initiative for a pan-continental sampling approach’, has been submitted to the International Society of Microbial Ecology journal

AntEco Workshop 3 (mini-workshop): Eradication in Antarctica: Management and ecological considerations to inform conservation decision-making. Convened by Justine Shaw and Yi Han. Attendance: By invitation.

Update: A manuscript detailing the findings of this workshop in preparation and should be finalized by the end of the year.

A further AntEco supported workshop was held in England (2014). Moss-Dominated Ecosystems in Antarctica and surrounding regions: Past, Present and Future. Organisers: Matt Amesbury, Dan Charman, Tom Roland (University of Exeter); Zicheng Yu, (Lehigh University). Attendance: By invitation. A manuscript is in preparation on the findings of this workshop.

AntEco convened five sessions at the SCAR OSC in Auckland (see Section 2), we also supported a session at the 2015 ISAES meeting in Goa, India, “Key drivers of Antarctic biodiversity through the Cenozoic: the influence of climate, oceanography and tectonics”. AntEco supported early career researcher Claudio Gonzalez-Wevar in attending the conference (\$1100).

AntEco supported the ‘Antarctic Near-Shore and Terrestrial Observation System’ (ANTOS) workshop held in Hamilton, NZ, 18-19 August, 2015. (\$5k allocation)

Jan Strugnell was an invited speaker at the Polar Marine Science, Gordon Research Conference, 15-20 March, 2015, Lucca Italy. She represented AntEco at the meeting and gave a presentation titled “Evolutionary Patterns and Processes in Antarctica and the Arctic”

AntEco continues to provide a major biological contribution (from Pete Convey and Dominic Hodgson) into the annual ACCE reporting process to SCAR and the ATCM

Capacity Building, Education and Outreach:

The Biogeographic Atlas had a significant media impact, with over 60 media articles published online following the press release including ABC News (Australia) and the BBC news website. Radio interviews included voice of Russia, RTE (Ireland) and the BBC World Service. Printed media included The Irish Times, El Mundo and the Independent (UK).

Support for early career researchers Dolores Deregibus to attend the XVI Colacmar-Senalmar Meeting, 2015 (\$1.5k)

AntEco has provided letter of support for funding for Melanie Mackenzie (Museum Victoria) and Rachel Downey (Senckenberg Research Institute and Nature Museum) for funding to participate in the BAS funded South Orkney Islands cruise.

AntEco also provided letter of support for funding for Dr Helena Feindt-Herr and her co-investigators for ship time on the *RV Polarstern*.

AntEco steering committee members took part in the Lyme Regis Fossil Festival (UK) enthusing the general public about Antarctic biodiversity (past and present, marine and terrestrial). Over 8,000 visitors from all age groups visited the stand and the twitter feed reached an audience over 50,000 people.

Jan Strugnell highlighted the work of AntEco in a public event titled 'Showcasing Victoria's Marine Science' at Museum Victoria, Australia 4 March, 2015.

Data and Information activities:

Data from the Biogeographic Atlas [1] are now available online through biodiversity.aq.

4. Budgetary Implications

Current (until end of 2015)

The main expenditure of AntEco is travel support for members to attend meetings and workshops that facilitate the goals and priority deliverables as outlined in the Implementation Plan (2013). The main expenditure for 2015 will be in support of the Cross-Programme Workshop (organised in conjunction with other SRPs AnT-ERA and AntClim21) including assistance with long haul travel costs and funding accommodation and other costs for all delegates.

Dolores Deregibus (early career researcher) has been allocated funding to attend the XVU Colacmar-Senalmar in Colombia to present AntEco related work and to attend several relevant and capacity building training courses. The courses are "Marine Protected Areas and climate change", "Assessment in environmental quality of coastal areas through the use of indicators" and "Hydroacoustics applied to marine sciences".

Claudio Gonzalez Wevar was funded to attend the ISAES 2015 meeting in Goa. Session 21 titled "Key drivers of Antarctic biodiversity through the Cenozoic: the influence of climate, oceanography and tectonics" was coordinated by three convenors, two of them: Dr. Pete Convey and Dr. Claudio González-Wevar are members of the Steering Group Members of AntEco. This session explored the relationship between Southern Ocean and Antarctic environments and biodiversity through the Cenozoic, linking biotic patterns from the past to the present with changing climate and the geological evolution of the continent.

\$3000 was allocated to support the ANTOS action group meeting in New Zealand in August 2015 to facilitate travel to enable international representation.

Expenditure (actual and forecast) since March 2014 (last Financial statement) to end of 2015

Activity and expenditure (to end of 2015)	Cost (US\$)	Remaining (US\$)
Starting Balance (March 2015)		\$20 000
Deposit for accommodation in Barcelona for CPW	\$906	\$19 094
Remainder for accommodation in Barcelona	\$2 115	\$16 979
Workshop costs (food, venue hire)	\$1 481	\$15 498
Travel to Barcelona for long haul travelers x 5	\$5 000	\$10 498
Antos workshop (Craig Cary)	\$3 000	\$7 498
Dolores Deregibus to attend XVU Colacmar-Senalmar	\$1 500	\$5 998
Claudio Gonzalez Wevar to attend ISAES	\$1 100	\$4 898
VIII Southern Connection Congress 2016: Conference session (2015-2016 carry over) (Pete Convey)*	\$5 000	\$-102

*The expenditure for the VIII Southern Connection Congress will be carried forward into 2016 as the funds will be claimed retrospectively. Thus the projected overspend will not actually take place but funds have been earmarked in advance.

Future Expenditure (2015 and 2016)

Over the next funding cycle (2016), AntEco will continue to fund activities that facilitate collaboration and progress research priorities of the programme.

Funding will be allocated to assist travel costs associated with the SCAR Open Science Conference in Malaysia in 2016 (approx. 10k allocation). These figures are only approximate at this stage and further details, including workshop convenors and topics are currently under discussion.

5. Future Plans

Cross-Program SCAR workshop on 'Interactions between biological and climate processes in the Antarctic' September 2015, Barcelona, Spain. AntEco is one of 4 programs hosting the event (along with AnT-ERA, AntarcticClimate 21 and Antarctic Climate Change and the Environment). AntEco will support 12 invited delegates to attend. (Approx. \$3k allocation)

The British Antarctic Survey is funding a research cruise to the South Orkney Islands (February 2016) with a team of AntEco scientists. As part of the research and monitoring required by CCAMLR to inform and support the management of Marine Protected Areas (CM 91-04) an expert team of invited AntEco scientists will conduct a benthic study of the South Orkney Islands Southern Shelf MPA and adjacent shelf and shelf-slope areas. This expedition will provide data and policy advice from the AntEco community and fits to the broader objective of "science that is policy relevant and assists in guiding management and conservation in the region."

'VIII Southern Connection Congress 2016' Punta Arenas, Chile. 18-23 January 2016 – Pete Convey to give invited plenary. AntEco invited paper session. (Approx. \$5k allocation)

'XXXIV SCAR Open Science Conference 2016' Kuala Lumpur, Malaysia. 20-30 August 2015 – multiple AntEco sessions proposed. (Approx \$10k allocation)

Appendices**Appendix 1: SRP Steering Committee**

Name	Affiliation	Country	Main field of interest
Aleks Terauds	AAD	AUS	Terrestrial ecology
Don Cowan	U. Pretoria	RSA	Terrestrial microbial ecology
Pete Convey	BAS	UK	General biology
Angelika Brandt	U. Hamburg	DE	Marine biology
Alison Murray	DRI	USA	Marine microbiology
Annick Wilmotte	U. Liège	BEL	Microbiology, human impacts
Craig Cary	U. Waikato	NZ	Terrestrial microbiology
Guido di Prisco	U. Naples	IT	Marine biology
Jan Strugnell	La Trobe	AUS	Marine biology
Claudio Gonzales-Wevar	U. Chile	CHI	Marine biology
Dom Hodgson	BAS	UK	Terrestrial paleoreconstr.
Huw Griffiths	BAS	UK	Marine biology
Anton van de Putte	RBINS	BEL	Marine biology
Stefano Schiaparelli	U. Genoa	IT	Marine ecology
Mary-Ann Lea	IMAS, U Tas	AUS	Marine ecology
Conxita Avila	U. Barcelona	ESP	Marine biology
Julian Gutt	A. W. Inst.	DE	Linkage with Ant-ERA

Appendix 2: References

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