

Short report on the

"SCAR Cross-Program Workshop on
Interactions between Biological and Environmental Processes in the Antarctic"

held at the *Institut de Ciències del Mar*, 16 - 18 September in Barcelona, Spain.

by *Julian Gutt* with participants of the workshop

The aim of this workshop was to exchange novel ideas among scientists in order to gain an improved understanding of interactions between biological and environmental processes in the Antarctic and Southern Ocean. The background of this interdisciplinary brainstorming was the awareness that in the past 5-8 years scientific knowledge and research opportunities have increased enormously. These advances include biogeographic information as well as the mapping of environmental factors including the fast availability of data and expeditions, experiments and advanced modelling approaches for environmental projections and biological processes, respectively. These advances now allow us to address and specify questions that have recently been identified during the *1st SCAR Antarctic and Southern Ocean Science Horizon Scan* to be relevant for the next 20 years, especially on the threats and vulnerability of Antarctic ecosystems. Whilst advances in mono-disciplinary studies are relatively fast the focus of the workshop was interdisciplinary approaches, which demand significant efforts especially in the coordination of ideas, plans and research activities.



The workshop was held at ICM in Barcelona, Spain, and was comprised of 38 participants from 14 countries who were invited by the SCAR scientific programs *Antarctic Thresholds - Ecosystem Resilience and Adaptation* (AnT-ERA), *State of the Antarctic Ecosystem* (AntEco) and *Antarctic Climate Change in the 21th Century* (AntClim21) including the *Antarctic Climate Change and the Environment*

advisory group and met at the ICM in Barcelona, Spain. Additional scientific initiatives, such as BEPSII, PAIS, EGBAMM, ICED, IPCC were also represented (for acronyms see below). Titles of the sessions (see below) were based on topics proposed by the participants in a questionnaire prior to the workshop. At the beginning of the workshop all participants summarised their scientific background and their interdisciplinary questions in flash presentations. Special attention was paid to questions, which could be answered through improved or newly developed interdisciplinary interactions. The largest part of the workshop was dedicated to discussions. A maximum of two parallel topical sessions partly covered a

diverse and broad range of scientific issues, e.g. on spatial and temporal scales and climate change impact or in some cases had a more narrow focus, e.g. on sea-ice or terrestrial ecology. Different levels of biological organisation were covered. These ranged from biomolecular and physiological to full ecosystem approaches and included a variety of environmental factors. These included physical oceanography, marine and soil chemistry including nutrient cycles, plate tectonics, geology, sedimentology, atmospheric science and biogeochemistry. In order to achieve a structured output it was decided during the workshop to provide extra time to narrow the broad variety of discussed aspects and focus on the most important questions based on new developments and on first steps towards their implementation. The results were protocolled and briefly presented to the audience. The division of the workshop into parts with short flash presentations and a central time window with a larger amount of time for discussions helped shape this fruitful and successful brainstorming event.

This workshop is considered as an important step within a continued process. It builds upon predecessors including an ICED workshop in 2014 and the 1st SCAR *Horizon Scan* and will be continued until and during the *SCAR Open Science Conference* in 2016 in Kuala Lumpur, Malaysia. This summary and introduction to the single reports of the sessions is published on the AnT-ERA webpage in order to provide potential benefit to the broader community. The protocols of the sessions are not public but can be made available on request.

BEPSII: Biogeochemical Exchange Processes at Sea Ice Interfaces, PAIS: Past Antarctic Ice Sheet dynamics, EGBAMM: Expert Group on Birds And Marine Mammals, ICED: Integrating Climate and Ecosystem Dynamics in the Southern Ocean, IPCC: Intergovernmental Panel on Climate Change

Titles of sessions

1. Biogeochemical spatio-temporal scales
2. Risk maps and ecoregions
3. Organisms response, resilience and thresholds
4. Ecosystem response to climate natural variability and anthropogenic change: studying the response to multiple stressors
5. Interactions between biological and climate processes - Antarctic top predators and food webs
6. Circumpolar, nearshore, and off-shore environments and ice sheet dynamics
7. Physical/biological sea-ice ocean and sea-ice atmosphere boundary layers - impact of changes on primary production and other biological processes
8. Evolution of biota related to glaciation history, marine and terrestrial glacial refugia, trans-antarctic seaways
9. Terrestrial and limnetic biodiversity and processes

SCAR Cross-Program Workshop on "INTERACTIONS BETWEEN BIOLOGICAL AND CLIMATE PROCESSES IN THE ANTARCTIC"

PROGRAM	PARTICIPANT	INSTITUTION, TOWN	COUNTRY
Internat. convener	Julian Gutt	Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI), Bremerhaven	GER
Local convener	Enrique Isla	Institut of Marine Sciences (ICM-CSIC), Barcelona	ES
AnT-ERA	Irene Schloss	Instituto Antártico Argentino and Institut des sciences de la mer de Rimouski	ARG & CAN
AnT-ERA/ICED	Jose Xavier	Marine and Environmental Research Centre (MARE) & British Antarctic Survey (BAS)	POR & UK
AnT-ERA	Craig R. Smith	Department of Oceanography, University of Hawaii	USA
AnT-ERA	Diana Wall	Colorado State University	USA
AnT-ERA	Sieglinde Ott	Institute for Botany, Heinrich-Heine University, Düsseldorf	GER
AnT-ERA	Vonda Cummings	New Zealand National Institute of Water and Atmospheric Research (NIWA), Wellington	NZ
AnT-ERA	Guido di Prisco	Institute of Biosciences and BioResources, CNR, Naples	IT
AnT-ERA	Cinzia Verde	National Research Council	IT
AnT-ERA	Thomas Saucède	Biogéosciences (CNRS laboratory), Dijon	F
AnT-ERA	Fred Jopp	Justus Liebig University, Giessen & Dept. Biology, University of Miami, FL	GER & USA
AnT-ERA	Satoshi Imura	National Institute of Polar Research (NIPR), Tokyo	JP
AnT-ERA	David DeMaster	Dept. of Marine, Earth, and Atmospheric Sciences North Carolina State University	USA
SCAR	Jerónimo López- Martínez	Universidad Autonoma de Madrid, Facultad de Ciencias, Dept. Geología y Geoquímica	ES
BEPSII	Jacqueline Stefels	University of Groningen, Centre for Ecological and Evolutionary Studies, Ecophysiology of Plants	NL
SCAR-Acidification	Scarlett Trimborn	Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI), Bremerhaven	GER
SOOS	Oscar Schofield	Center for Ocean Observing Leadership, Rutgers University	USA
EGBAMM/SCAR SSG-LS	Yan Ropert-Coudert	University of La Rochelle, CEBC-CNRS	F
ICED	Rachel Cavanagh	British Antarctic Survey, Cambridge	UK
AntEco, convener	Huw Griffiths	British Antarctic Survey, Cambridge	UK
AntEco, convener	Jan Strugnell	La Trobe University, Melbourne	AUS
AntEco	Pete Convey	British Antarctic Survey, Cambridge	UK
AntEco	Elie Verleyen	Ghent University, Laboratory of Protistology and Aquatic Ecology	B
AntEco	Alison Murray	Desert Research Institute, Earth & Ecosystem Sciences	USA
AntEco	Stefano Schiaparelli	University of Genoa (DISTAV) & Italian National Antarctic Museum (MNA)	IT
AntEco	Nerida Wilson	UCSD, West Australian Museum	AUS
AntEco	Alix Post	Geoscience, Australia	AUS
AntEco	Uffe Nielsen	Hawkesbury Institute for the Environment, University of Western Sydney	AUS
AntClim21, convener	Nancy Bertler	Victoria University of Wellington and GNS Science	NZ
AntClim21	Thomas Bracegirdle	British Antarctic Survey, Cambridge	UK
AntClim21	Reed Scherer	Northern Illinois University, Geology & Environmental Geosciences, DeKalb, IL	USA
AntClim21	Craig Stevens	New Zealand National Institute of Water and Atmospheric Research (NIWA)/University of Auckland	NZ
AntClim21	Rob De Conto	University of Massachusetts, Amherst, Dept. of Geosciences, MA	USA
AntClim21	Greg Bodeker	Bodeker Scientific	NZ
AntClim21	Joe Comiso	Earth Sciences Division, Cryospheric Sciences Laboratory, NASA Goddard Space Flight Center, Greenbelt, MD	USA
AntClim21	Matthew England	University of New South Wales	AUS
AntClim21/APECS	Alia Khan	University of Colorado - Boulder, Institute of Arctic and Alpine Research	USA