



WP 12

Agenda Item: 4.3.3

Person Responsible: Julian Gutt

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Antarctic Thresholds - Ecosystem Resilience and Adaptation (AnT-ERA)

Executive Summary

Title: Antarctic Thresholds - Ecosystem Resilience and Adaptation (AnT-ERA)

Authors: J. Gutt and members of the Steering Committee

Introduction/ Background:

The first half of 2013 was devoted to a preparatory phase. As a consequence, AnT-ERA's launch in July 2013 was easy and smooth. During a constituent session at the SCAR Biology Symposium the Steering Committee (SC) prepared a first phase documentation of AnT-ERA projects and accomplishments and presented these to the SCAR biology community. The discussion was dominated by the key research aims, outreach, support for scientific work and early career scientists as well as cooperation with other international and national programs.

Important Issues or Factors:

Because the preparatory phase was intensive and included the development of an implementation plan and outreach activities, the start of AnT-ERA has, thus, been straightforward. This success was based on the composition of the SC, which comprises early career and experienced scientists as well as representatives from all continents, who are well integrated in a broad variety of AnT-ERA's research fields and other international and national programs. The smooth start of AnT-ERA also benefitted from the experience of some members with committee work such as in predecessor programs (EBA, EVOLANTA, RISC, EASIZ).

Recommendations/Actions and Justification:

AnT-ERA represents a large community of active scientists focusing on biological processes in the Antarctic, which are most probably affected by climate change. Promoting the understanding of thresholds and ecosystems responses to it is therefore urgent and important. The quality of the research projects benefits from intensive exchange of ideas and experiences for which SCAR provides the best and broadest platform. We request support in the coordination, dissemination and exchange of information by SCAR beyond financial support, especially by the representatives of national programs, SCAR's LSSG and secretariat, who can shape considerably the success of this new biology program, since AnT-ERA lives not only from the work of the SC but also from contributions from the AnT-ERA community. In particular, assistance with the development and contributions to AnT-ERA's webpage under the umbrella of the SCAR webpage, as this will become an important tool for the exchange of information.

Expected Benefits/Outcomes:

As the main focus of AnT-ERA is science, our major output will be high quality scientific publications, promoting the integration of early career scientists, emerging national programs and interdisciplinary as well as international cooperation.

Partners:

The best cooperation at the SCAR level exists already with AntClim21 and AntEco. Nine months after the start of these programs success is foreseeable. However, at this stage, it is too early to provide concrete evidence. Relationships with others, e.g. CCAML are under development.

Budget Implications:

The success of AnT-ERA is based around actions that do not require extra funds and those that demand the monetary help of SCAR. The coordination of research projects, including newly emerging programs can be best implemented by having the experts meet. Such joint workshops as well as facilitating participations of early career scientists in various SCAR and non-SCAR workshops depend on future funding.

Antarctic Thresholds - Ecosystem Resilience and Adaptation (AnT-ERA)

1. Rationale for the Programme (modified from the implementation plan)

Environmental change occurs across broad temporal and spatial scales. Recent climate change is slow compared to daily changes, but is much faster than long-term changes such as glacial cycles. For example, the Antarctic Peninsula is warming very fast: ocean surface temperatures have increased by approximately 2°C, and sea ice extent and persistence have declined markedly since the 1950s; in contrast, sea ice extent and persistence is increasing in the Ross Sea sector, but this increase is predicted to slow and then reverse if the ozone hole closes. Currently, organisms across the planet experience a range of environmental change from daily (e.g. tidal) to seasonal and multi-year (e.g. El-Niño, Southern Annular Mode) to medium- and long-term (e.g. Little Ice Age, mid-Holocene warming, glacial cycles). Terrestrial Antarctic species experience daily and seasonal temperature change that marine species have not experienced in millions of years. Although regions of continental Antarctica are cooling, there has been an increase in warming events, which affect permafrost and the physiologies of their associated terrestrial communities. Antarctic species have evolved special adaptations to extreme environments that suggest their responses to climate change may differ from species elsewhere. All Antarctic ecosystems (marine, terrestrial, freshwater, subglacial lakes and cryconites) are vulnerable to environmental, especially climate, changes. However, the possible responses of organisms to environmental change can vary markedly across process scales, from gene to ecosystem, and spatial scales from nanometre to regional.

As a consequence, AnT-ERA will focus on current biological *processes* that may reflect a cascade of responses to environmental forcing - from molecular and physiological to those at the organismic and ecosystem levels. AnT-ERA will be classified into three overlapping general themes:

- (1) Assessment of when, where, and with what impact climate change affects **molecular and physiological performance**, and which performances will allow coping with change or be forced across critical thresholds.
- (2) Identification of interactions between drivers and **population processes** (resulting, for example, from species traits) for a predictive understanding of population resilience under future environmental conditions.
- (3) Examination of **ecosystem functions** that are potentially sensitive to climate-forced changes, and critical to the maintenance of biogeochemical cycles and **ecosystem services**, including carbon storage, maintenance of biocomplexity, nutrient regeneration, and biomass production.

2. Important Issues or Factors

i) Five Scientific Highlights

- The rapid recent **warming of the Antarctic Peninsula** has resulted in changes in the terrestrial ecology, however, the biological records are shorter in length than the meteorological data, and observed population changes cannot be securely linked to longer-term trends apparent in paleoclimate data. To overcome this limitation a new, unique time series of past moss growth and soil microbial activity has been developed from a 150-year-old moss bank at the southern limit of significant plant growth. Growth rates and microbial productivity have risen rapidly since the 1960s, consistent with temperature changes. The recent increase in terrestrial plant growth rates and soil microbial activity are unprecedented in the last 150 years (Royles J, Amesbury MJ et al 2013. *Current Biology* **23**: 1702-1706).
- A circumpolar risk-map of **krill** hatching success under projected CO₂ levels shows high-risk areas for krill recruitment in important krill habitats (Kawaguchi S, Ishida A et al 2013. *Nature Climate Change* **3**: 843-847). A comprehensive review on this species has been carried out focusing on the **impact of climate change**, resulting in the general conclusion that despite some positive aspects, the cumulative

impact of several factors is most likely negative (Flores H, Atkinson A et al 2012. *Marine Ecology Progress Series* **458**: 1-19). In general, **marine invertebrates** take 2 to 6 months to acclimate to a 2-3° C rise in temperature, an order of magnitude longer than temperate species (Peck LS, Morley SA, et al 2014. *Journal of Experimental Biology* **217**: 16-22).

- Antarctic coastal **benthic communities** are assumed to be especially **climate-sensitive** due to their high regional heterogeneity and uniqueness (Grange LJ, Smith CR 2013. *Plos One* 8(11): e77917. doi:10.1371/journal.pone.0077917). Ecological key species were found to **respond to environmental change with dynamic population performance**. Unusual growth events of glass sponges in McMurdo Sound correlated with shifts in phytoplankton productivity driven by the calving of an iceberg but also high mortality was registered in an adjacent area due to a variety of potential biological and physical reasons (Dayton PK, Kim S et al 2013. *Plos One* 8(2): e56939. doi:10.1371/journal.pone.0056939). Dense populations of fast-growing ascidians were observed in 2007 in the Larsen areas East of the Peninsula, assumed having developed since the **climate-induced disintegration of the iceshelves**. These disappeared within the next 4 years maybe due to intensive predation by gastropods. In the same period species composition of brittle stars shifted from filter to deposit feeders (Gutt J, Cape M et al 2013. *Polar Biology* **36**: 895-906).
- Along the warming Antarctic Peninsula, Gentoo **penguins** increased in abundance at 32 of 45 investigated sites between 1979/1980 and 2009/2010 and are expanding southward, which correlates with loss of November **sea-ice coverage** (Lynch HJ, Naveen R et al 2012. *Ecology* **93**(6): 1367-1377).
- **Exceptional phytoplankton (diatom) blooms** were observed around King George Island, in the NW Antarctic Peninsula (Schloss IR, Wasilowska A et al 2014. *Limnology & Oceanography* **59**: 195-210), which does not coincide with previous findings on a southern shift of primary productivity and its relation to phytoplankton dominant groups. This relates with the varying **ice and wind** conditions. Planktonic diatoms, on the other hand, have been shown to play a central role in Southern Ocean's **CO₂ sink** (Moreau S, Mostajir B et al in press. *Aquatic Microbial Ecology*; Moreau S, diFiori E, Schloss IR et al 2013. *Deep-Sea Research I* **82**: 44-59).

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

One major aim, to make AnT-ERA the centre of a network of specialists and projects dealing with thresholds and resilience of Antarctic life had been accomplished. The initial SC had the same composition as the planning group, a condition, which allowed an un-problematic start of AnT-ERA. The composition considered very well the gender question, the representation of excellent experts in their field of research, early career scientists (two APECS representatives) and experienced seniors, work in terrestrial and marine ecosystems as well as at all three levels of biological organisation representing the three main themes of AnT-ERA. Approx. half a year after the start of AnT-ERA it was decided to complete the SC by new members representing terrestrial and limnetic systems (S. Ott, Germany & I. Hogg, New Zealand) and for a better balance between national programs (I.-Y. Ahn, South Korea). EXCOM's decision: "All SRPs including ex officio members of other relevant SRPs in their steering committees..." was implemented by including G. di Prisco in the SC. The number of scientific publications in the field of AnT-ERA can be estimated to be more than 100 per year.

Another important objective, to focus, stimulate and coordinate research activities had also been fulfilled mainly during various scientific meetings. The talks during the XIth Biology Symposium and the forthcoming OSC show that biological processes are slightly underrepresented relative to the biodiversity-orientated talks. These measures show the potential of studies on biological, mainly climate-change questions for further development. This development is convincingly reflected in the selection of the 18 biological questions plus one on ecosystem services by SCAR's Horizon Scan process; more than 2/3 of the questions address biological processes, mainly related to recent environmental changes.

The idea of an ICED - AnT-ERA cooperation resulted in a joint AnT-ERA - ICED - AntClim21 session during the OSC in Auckland; the cooperation between AnT-ERA and AntClim21 was brought forward from 2016, also by this joint session and active cooperation at the level of a joint review publication to be submitted still in 2014. A planned kick-off workshop at the XI Biology Symposium had been successfully

held. A cooperation between CCAMLR/ATCM and AnT-ERA is reflected by JG participation in the planning of a Weddell Sea MPA.

The dissemination of knowledge in the field of biological climate-related processes will become one of our main foci as soon as the new SCAR homepage is ready for program-specific development.

In essence: approx. 90% of the fixed goals for the first year of the project were achieved. The lacking 10% is due to some delay in the **web-page** publication. Additional important aspects attracted already more attention than planned, e.g. **Horizon Scan** and its output.

3. Outputs /Deliverables

Publications (selected highlights):

- Convey P, Chown SL, Clarke A, Barnes DKA, Bokhorst S, **Cummings** V, Ducklow HW, Frati F, Green TGA, Gordon S, Griffiths HJ, Howard-Williams C, Huiskes AHL, Laybourn-Parry J, Lyons WB, McMinn A, Morley SA, **Peck** LS, Quesada A, Robinson SA, Schiaparelli S, **Wall** DH 2014. Ecological Monographs 84: 203-244.
- Guy CI, Cummings VJ, Lohrer AM, Gamito S, Thrush SF 2014. Polar Biology 37: 541-553. **Hogg** ID, Stevens MI, Wall DH 2014. Invertebrates. In D Cowan (ed) *Antarctic Terrestrial Microbiology: Physical and Biological Properties of Antarctic Soils*. Springer Berlin Heidelberg. pp.55-78.
- Jones TC, **Hogg** ID, Wilkins RJ, Green TA 2013. *Polar Biology*. 36, 767-774.
- Constable AJ, Melbourne-Thomas J, Corney SP, Kevin Arrigo K, Barbraud C, Barnes D, Bindoff N, Boyd P, Brandt A, Costa DP, Davidson A, Ducklow H, Emmerson L, Fukuchi M, **Gutt** J, Hindell MA, Hofmann EE, Hosie G, Iida T, Jacob S, Johnston NM, Kawaguchi S, Koubbi P, Lea M-A, Makhado A, Massom R, Meiners K, Meredith M, Murphy E, Nicol S, Richerson K, Riddle MJ, Rintoul SR, Smith Jr. W, Southwell C, Stark JS, Sumner M, Swadling K, Takahashi K, Trathan P, Welsford D, Weimerskirch H, Westwood K, Wienecke B, Wolf-Gladrow D, Wright S, **Xavier** JC, Ziegler P in press. *Global Change Biology*.
- Gutt** J, Cape M, Dimmler W, Fillinger L, **Isla** E, Lieb V, Lundälvt T, Pulcher C 2013. *Polar Biology* 36: 895-906.
- Turner J, Barrand NE, **Bracegirdle** TJ, Convey P, Hodgson D, Jarvis M, Jenkins A, Marshall G, Meredith MP, Roscoe H, Shanklin J, French J, Goosse H, **Gutt** J, Jacobs S, Kennicutt II MC, Masson-Delmotte V, Mayewski P, Navarro F, Robinson S, Scambos T, Sparrow M, Summerhayes C, Speer K, Klepikov A 2013. *Polar Record*, doi:10.1017/S0032247413000296.
- Gutt** J, Griffiths HJ, Jones CD 2013.. *Mar Biodiversity* 43: 481-487.
- Kaiser S, Brandão SN, Brix S, Barnes DKA, Bowden DA, Brenke N, Ingels J, Leese F, Schiaparelli S, Arango CP, Badhe R, Bax N, Blazewicz-Paszkowycz M, Brandt A, Catarino AI, David B, De Ridder C, Dubois P, Ellingsen KE, Glover AG, Griffiths HJ, **Gutt** J, Halanych KM, Havermans C, Held C, Janussen D, Lörz A-N, Pearce DA, Pierrat B, Riehl T, Rose A, Sands CJ, Soler-Membrives A, Schüller M, Strugnell JM, Vanreusel A, Veit-Köhler G, Wilson NG, Yasuhara M 2013. *Mar Biology* 160: 2295-2317.
- Gutt** J, Böhmer A, Dimmler W 2013. *MEPS* 480: 57-71.
- Tavares S, **Xavier** JC, Phillips RP, Pereira ME, Pardal MA 2013. *Environmental pollution* 181:315-320.
- Xavier** JC, Barbosa A, Agusti S, Alonso-Sáez L, Alvito P, Ameneiro J, Avila C, Baeta A, Canário A, Carmona R, Catry P, Ceia F, Clark MS, Cristobo FJ, Cruz B, Duarte CM, Figuerola B, Gili J-M, Gonçalves AR, Gordillo FJL, Granadeiro J P, Guerreiro M, **Isla** E, Jiménez C, López-González PJ, Lourenço S, Marques JC, Moreira E, Mota AM, Nogueira M, Núñez-Pons L, Orejas C, Paiva VH, Palanques A, Pearson GA, Pedrós-Alió C, Peña Cantero AL, Power DM, Ramos JA, Rossi S, Seco J, Sañe E, Serrão EA, Taboada S, Tavares S, Teixidó N, Vaqué D, Valente T, Vázquez E, Vieira R, Viñegla B 2013. *Journal of Sea Research* 83: 9-29.

- Xavier JC**, Louzao M, Thorpe SE, Ward P, Hill C, Roberts D, Croxall JP, Phillips R A 2013. *Marine Biology* 160: 1597-1606.
- Xavier JC**, Cherel Y, Roberts J, Piatkowski U 2013. *ICES Journal of Marine Science* 70: 46-49.
- Schloss IR**, Wasilowska A, Dumont D, Almandoz GO, Hernando MP, Michaud-Tremblay C-A, Saravia L, Rzepecki M, Monien P, Monien D, Kopczyńska EE, Bers V, Ferreyra GA 2014. *Limnology & Oceanography* 59: 195-210.
- Moreau S, Mostajir B, Almandoz GO, Demers S, Hernando M, Lemarchand K, Lionard M, Mercier B, Roy S, **Schloss IR**, Thyssen M, Ferreyra GA in press. *Aquatic Microbial Ecology*.
- Almandoz GO, Ferrarrio ME, Ector L, Sullivan M, **Schloss IR** in press. *Phycologia*.
- Moreau S, diFiori E, **Schloss IR**, Almandoz GO, Esteves JL, Paparazzo FE, Ferreyra GA 2013. *Deep-Sea Research I* 82: 44-59.
- Bers V, Momo F, **Schloss IR**, Abele D 2013. *Climatic Change*, doi:10.1007/s10584-012-0523-4.
- Cottin M, Macintosh A, Kato A, Takahashi A, Debin M, Raclot T, Ropert-Coudert Y 2014. *Marine Ecology Progress Series* 496: 249-262.
- Sakamoto K, **Takahashi A**, Iwata T, Yamamoto T, Yamamoto M, Trathan P 2013. *Journal of Experimental Biology* 216: 3175-3182.
- Watanabe Y, Takahashi A 2013. *Proceedings of National Academy of Science USA* 110: 2199-2204.
- Watanabe Y, Ito M, **Takahashi A** 2014. *Proceedings of the Royal Society B* 281: 20132376.
- Mazzarella L**, **Merlino A**, **Vitagliano L**, **Verde C**, di Prisco **G**, **Peisach J**, **Vergara A** in press. *RSC Advances*.
- Giordano D, Coppola D, Russo R, Tinajero-Trejo M, **di Prisco G**, Lauro F, Ascenzi P, **Verde C** 2013. *Adv Microb Physiol* 63: 329-389.
- Russo R, Zucchelli S, Codrich M, Marcuzzi F, **Verde C**, Gustinich S 2013. *Biochim Biophys Acta* 1834: 1939-1943.
- Coppola D, Giordano D, Tinajero-Trejo M, **di Prisco G**, Ascenzi P, Poole RK, **Verde C** 2013. *Biochim Biophys Acta* 1834: 923-931.
- Russo R, Giordano D, **di Prisco G**, Hui Bon Hoa G, Marden MC, **Verde C**, Kiger L 2013. *Biochim Biophys Acta* 1834: 1932-1938.
- Van Leuven W, Cuypers B, Desmet F, Giordano D, **Verde C**, Moens L, Van Doorslaer S, Dewilde S 2013. *Biochim Biophys Acta* 1834: 1757-1763.
- Ronda L, Merlino A, Bettati S, **Verde C**, Balsamo A, Mazzarella L, Mozzarelli A, Vergara A 2013. *Biochim Biophys Acta*. 1834: 1885-1893.

Talks (selected highlights):

- Cummings VJ** et al "Success of Antarctic bivalve populations in a changing ocean: results of experiments and models". 2013. Strategic Science in Antarctica conference, Hobart, Australia, June 24-26.
- Cummings VJ** et al Antarctic bivalves in a changing ocean: experiments, models and future population success. 2013. XIth SCAR Biology Symposium, Barcelona, Spain, July 15-19.
- Cummings VJ** "Near-shore ecosystems: structure, function and monitoring in a changing environment". 2013. Joint Biology Workshop between Korea and New Zealand. Korea Polar Research Institute, Incheon, Korea, August 27-30.
- Gutt J (key note)** "Antarctic marine biodiversity: Results from the "Census" serve as basis to develop future scenarios". XIth SCAR Biology Symposium, July 2013, Barcelona, Spain,

- De Broyer C, Koubbi P, Griffiths HJ, Danis B, David B, Grant S, **Gutt J**, Held C, Hosie G, Huettmann F, Post AL, Raymond B, Ropert-Coudert Y, van de Putte AP (editors). "The CAML / SCAR-MarBIN Biogeographic Atlas of the Southern Ocean". "Strategic Science in Antarctica" Conference, Hobart, Australia, June 2013
- Gutt J (invited talk)** "The Antarctic marine ecosystem under recent climate stress". International workshop on polar climate and ecosystem changes and their global implications., Nanjing University of Information and Technology, VR China, May 2013,
- Xavier JC** et al Malcolm Clarke and cephalopod beaks: the past, present and future in assessing cephalopods in the diet of top predators worldwide. In: The role of cephalopods in the world's oceans: a symposium in honour of Malcolm Clarke. In World Congress of Malacology, 2013, 21-27 July
- Xavier JC** et al, Feeding ecology of Antarctic top predators: have we always under-estimated the role of cephalopods in their diets? SCAR Biology Conference, Barcelona, 2013, 15-19 July
- Xavier JC (keynote)** "Marine Science in the Polar Regions. In" International workshop on polar science and education". University of Coimbra, 26-28 March 2013
- Xavier JC (keynote)** "Penguins and polar bears: the role of mathematics in addressing key research questions in Polar Science." International Conference on Earth, Mathematics of Energy and Climate change. 25 March. Lisbon
- Xavier JC (keynote)** "Challenges in Antarctic Biodiversity and food web studies: a top predators perspective. 25th International Polar Conference", Hamburg, Germany, 17-22 March 2013.
- Schloss IR** et al "Climate and phytoplankton development in an Antarctic coastal area XXI SCAR Biology Symposium, Barcelona, Spain. July 2013.
- Gremion G, **Schloss IR**, Dumont D, Vernet M "Climate change signature in Palmer Station, Antarctic Peninsula: modeling the response of the plankton system". XXI SCAR Biology Symposium, Barcelona, Spain. July 2013.
- García MD, Hoffmeyer MS, Barría de Cao M, Pettigrosso RE, López Abbate MC, Almandoz G, Hernando M, **Schloss IR** "Differential response of micro- and mesozooplankton assemblages to phytoplankton maxima and physical forcing in Potter Cove (King George Island, WAP) during austral summers 2010 and 2011". XXI SCAR Biology Symposium, Barcelona, Spain. July 2013.
- Alurralde G, Fuentes VL, Movilla J, Olariaga A, Orejas C, **Schloss IR**, Tatían M "Consequences of glacier retreat on the trophic ecology of filter feeders and benthic-pelagic coupling in an Antarctic coastal ecosystem", XXI SCAR Biology Symposium, Barcelona, Spain. July 2013.
- Schloss IR** "Tips and tricks on how to write your first paper". APECS Workshop, XXI SCAR Biology Symposium, Barcelona, Spain, July 2013.
- Cary SC, Lee CK, McDonald IR, Tiao G, Bottos EM, **Hogg ID** "Spatial and temporal heterogeneity in terrestrial Antarctic microbial communities: a baseline survey". *XIth SCAR Biology Symposium: Life in Antarctica: Boundaries and Gradients in a Changing Environment*. Barcelona, Spain, 15-19 July 2013.
- Hogg ID**, Green TA, Sancho LG, Nielsen UN, Adams BJ, **Wall DH**. "Unexpectedly high biodiversity in the central and southern transantarctic mountains (83-87°S)". *XIth SCAR Biology Symposium: Life in Antarctica: Boundaries and Gradients in a Changing Environment*. Barcelona, Spain, 15-19 July 2013.
- Collins GE, **Hogg ID**, Bennett K, Demetras NJ "Genetic variability of mites in the Ross Sea region, Antarctica". *16th New Zealand Molecular Ecology Meeting*. Paekakariki, New Zealand, 29 November - 1 December 2013.
- Hogg ID**, Bennett K, Collins GE Biodiversity of springtails (Collembola) is underestimated even in simple Antarctic ecosystems. *5th International Barcode of Life Conference*. Kunming, China, 27-31 October 2013.
- Hogg ID**, Green TA, Sancho LG, Nielsen UN., **Adams BJ**, **Wall DH** "High biodiversity revealed for the

central and southern Transantarctic Mountains (83-87°S)". *5th joint conference of New Zealand Ecological Society and Ecological Society of Australia*. Auckland, New Zealand, 24-29 November 2013. p.75-75.

Verde C (invited Lecture) "Globins in Antarctic fish". *Society of Experimental Biology*, Annual Meeting, Manchester (UK) 1-4 July 2014

Verde C "Neuroglobin in the icefish: a natural knockout for hemoglobin and myoglobin". *Society of Experimental Biology*, Annual Meeting, Valencia (Spain) 3-6 July

Verde C "Antarctic bacterial globins and their physiological role in nitrosative and oxidative stress. *XI SCAR BIOLOGY SYMPOSIUM*. Barcelona, (Spain) 15-19 July 2013

Databases and information activities:

Despite being a repository mainly for structural data members of the AnT-ERA community uploaded comprehensive data sets to SCAR-MarBIN (ANTABIF), e.g. on benthic communities, which do not only include presence information but also ecosystem functional aspects on a descriptive level. In addition to the contributions to ANTABIF and the related SCAR biogeography atlas AnT-ERA will be one of the most intensive user of these SCAR products. Other biological and environmental data are uploaded and available at the World Data Centre PANGAEA.

Education and outreach activities officially and efficiently supported by AnT-ERA (selected highlights):

Support of early career scientists (see below)

Development of merchandising articles: logo, mission statement, leaflet, stick, opens, sticker.

Gutt J: Press chat at UNFCCC-Climate Change Conference, Bonn, 2013

Schloss IR, Wall D, Xavier JC, Gutt J, Peck L: Active contribution to the SCAR Horizon Scan Retreat, Queenstown, New Zealand, April 2014, with three SC members playing a **leading role**.

Xavier JC: International educational workshop "Polar Science meets education", Coimbra, Portugal, March 2013. Interviews by to TV network stations (RTP, SICN, UCV, Centro TV, TVI24, TV Record), radio (RUC), newspapers (Lusa x 3, Diário de Aveiro; DN, DN Madeira, NM, JN, Beiras, Boas notícias, Pontos de Vista, Sul informação, Açoriano Oriental, Diário dos Açores, PT jornal, IOL, Ciência Hoje, Diário Coimbra, ionline, Diário Digital, Destak, CM, Expresso, J. Açores, Visão) on APECS and of ICESHEET. Blog writing for the research carried out in NZ.

Schloss IR: ArcticNet Student Day Conference, Halifax, N.S., 10 December 2013

Gutt J: "International Workshop on polar climate and ecosystem changes and their global implications", Nanjing University of Information Science and Technology, May 2013, China

Lourenço, S. J Seco, A. Trindade, AS David, J Agrela, M Nogueira, M Cardoso, P Azinhaga, S Aparício, V Rei and **Xavier JC**. APECS Portugal: Growing and promoting Polar Science in Portuguese. SCAR Biology Conference, Barcelona, 15-19 July (Talk)

Xavier JC: From sunny Europe to cold Antarctic: how to boost polar marine science? National Institute of Water and Atmospheric Research (New Zealand) Invited Seminar

Xavier JC: Research in the Polar Regions: relevance to early career scientists. University of Azores research seminars (**invited talk**)

Xavier JC: How to make the best of an international conference? APECS workshop, Barcelona (**invited talk**)

Xavier JC: Education and Outreach in the Polar regions: how polar bears do not eat penguins? APECS Workshop Belgium, Brussels, 17 May

Xavier JC: Navigating language barriers in the polar research world. Career Development webinar organized by the Association of Polar Early Career Scientists (APECS).

Xavier JC, Azinhaga P: Participation of APECS and PEI international POLAR WEEKS, which engaged more than 13000 students, 20 scientists and 300 teachers/educators from Portugal, Brazil, UK, S. Tome and Principe Islands, Angola, Germany, France with talks in schools, skype calls, discussion panels, seminars and international workshops.

Hogg ID: Life in the Freezer: A Snapshot of Antarctic Biology Research, Cambridge Rotary Club, Cambridge, New Zealand, 21 August 2013.

Hogg ID: Contrasting Canada's Arctic with New Zealand's Ross Dependency: a Biologist's Perspective. *Canada's Arctic: Vibrant and Thriving Photographic Exhibition*. University of Waikato, Hamilton, New Zealand, 21 March 2014.

Isla E: I Antarctic Congres at the Museu Blau (Natural Sciences Museum) in Barcelona. Meeting hosted at the museum facilities including the participation of local junior and high schools and Antarctic scientists from the Institut de Ciències del Mar-CSIC as a follow up of the AntERA expedition ANT-XXIX/9 with the aim to make closer Antarctic science to students.

Isla E: Exhibition "L'Antàrtida, la vida al límit. Els viatges científics avui" ("Antarctic, life at the limit. The scientific expeditions today") at the Museum Marítim de Barcelona (Maritime Museum of Barcelona).

<http://mmbeducacio.blogspot.com.es/2014/02/antantida-la-vida-al-limit-els-viatges.html>

Other committee work and organisation of workshops etc. related to AnT-ERA

International Organising Committee of the XIth SCAR Biology Symposium 2013 in Barcelona, Spain and of the OSC in Auckland 2014 (**Gutt, Isla, Xavier, Schloss, Smith**)

Invited participation in the SCOR SOOS "ecosystem Essential Ocean Variables (eEOV)" Workshop, New Brunswick, U.S.A., March 2014 (**Gutt**)

Member of SCAR Advisory Group "Antarctic Climate Change and the Environment" (ACCE) and contribution to the ATCM working papers on the regular ACCE updates. (**Gutt & di Prisco**)

Representative of Portugal at the Antarctic Treaty Consultative Meetings (ATCM), nominated by the ministry of foreign affairs of Portugal (**Xavier**)

Member of the Expert group of Antarctic Birds and Marine Mammals of the Scientific Committee on Antarctic Research (SCAR- EGBAMM) (**Xavier**)

Member of the Scientific Committee (**Xavier**) of the World Congress of Malacology, Azores (2013)

Member of the Scientific Committee (**Xavier**) for Antarctic Research (SCAR) Development Council (Executive committee, Western Europe Representative and Vice-Chair for Early Career Scientists)

Co-chairing (**Schloss & Bracegirdle**) of the SCAR OSC at Portland in 2012 "Prediction of Changes in the Physical and Biological Environment and Observing Antarctica and the Southern Ocean"

Co-Chair and invited talk of "Antarctic Conservation in a Century of Changes" Mini-Symposium, OSC, Portland 2012 (**Gutt**)

Barcoding efforts from New Zealand and Antarctica. *International Barcode of Life ISCC Meeting*. Kunming, China, 30 October 2013 (**Hogg**).

Participation in the ANTOS workshop, SCAR Biology Symposium, Barcelona 2013 (**Adams & Cummings**)

Standing Scientific Group on Life Sciences: italian delegate since 1986 (**di Prisco**)

Member of the *Steering Committee of AntEco* (**di Prisco**)

Scientific committee for the Forum Québécois en sciences de la mer. Mont-Joli, Canada, November, 2012. (**Schloss**)

4. Budgetary Implications

The 2013/2014 budget will totally be used for various AnT-ERA specific actions:

1. Support by mini-grant of approx **15 early career scientists** (done & decided)
2. Support to advertise AnT-ERA in China (partial financing), (done)
3. Merchandising articles (done)
4. Support of the Coimbra APECS workshop, Portugal (done)
5. Support of SC meetings: biology symposium in Barcelona and OSC Auckland (done & decided)
6. Support of the IBBR-Workshop in Napoli, Italy (decided)
7. OSC Auckland (decided)
8. Web-page development (decided).

The decisions were made by a financial committee of AnT-ERA (I. Schloss, E. Isla, C Verde, J. Gutt) to ensure a transparent and democratic expenditure of the SCAR funds along the lines developed in the programs proposal and implementation plan.

We stucked to the plan to spend in the first two years in addition to make SC meetings possible, most of the funds with support of early career scientists and advertisement actions, where the first received by far the most money. We will continue along the lines in the implementation plan to support traveling and capacity building. Based on the experience during the biology symposium in Barcelona in 2013 we plan to bring forward our plan to meet during one to two workshops to clarify and further develop already existing ideas to write review papers. We do not want to wait too long in the succession of AnT-ERA if we consider the situation as favourable for this core goal of AnT-ERA, the scientific work and its international and maybe interdisciplinary cooperation. Details are to be discussed in the SC meeting during the OSC in Auckland, August 2014.

5. Future Plans

(Future plans over next two years, in particular any deviations from original work plan.)

- a. A joint publication on climate change and SO ecosystems between AntClim21 and AnT-ERA's topic 3.
- b. To lead three sessions during the OSC in Auckland, one being an interdisciplinary session.
- c. Participation of B. Adams from our SC in an AntEco-workshop on spatial distribution of organisms
- d. Continuation of contributions to ACCE updates for the ATCM, especially on changes in the SO ecosystem
- e. Realisation of 1-2 workshops under AnT-ERA's leadership to merge ideas and resulting in review papers.
- f. Intensification of outreach and communication by the development of an own web-page (under SCAR).
- g. Joint Argentinean-Canadian expedition to Antarctica in the frame of the project PICT-2011-1320 (PI: **Schloss IR**) to study the combined effects of glacier melting and surface water temperature increase on plankton of polar (Antarctic and Arctic) environments.
- h. Organizing committee Canadian Meteorological & Oceanographic Society congress, June 2014. (**Schloss**)
- i. International workshop "Molecular and Genetic Advances to Understanding Evolution and Biodiversity in the Polar Regions: the Legacy of EBA", Naples, October 2nd-3rd, 2014, Institute of Biosciences and BioResources, National Research Council (IBBR-CNR). (**Verde, di Prisco**)
- j. Post-expedition workshop on biological processes in a spatially and temporally highly variable Antarctic environment", Polarstern ANT-XXIX/3 , September 2014, Dijon, France (**Gutt & Isla**)

- k. Three proposals for additional workshops have been submitted (capacity building, diatom biology, ecosystem functioning review). A selection of events to be supported by AnT-ERA funds will be done during the **SC** meeting in Auckland, a final decision by the end of 2014.

Appendix

Composition of the Steering Committee (new members in bold)

Chair: JULIAN GUTT, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany, julian.gutt@awi.de

Theme 1: LLOYD PECK, British Antarctic Survey, Cambridge, lspe@bas.ac.uk; CINZIA VERDE, Institute of Protein Biochemistry, National Research Council, Naples, Italy, c.verde@ibp.cnr.it; BYRON ADAMS, Brigham Young University, Provo, U.S.A., byron_adams@byu.edu; **IAN HOGG**, Biological Sciences, University of Waikato, New Zealand, hogg@waikato.ac.nz.

Theme 2: DIANA WALL, Natural Resources Ecology Laboratory, Colorado State University, Fort Collins, U.S.A., Diana.Wall@colostate.edu; AKINORI TAKAHASHI, National Institute of Polar Research, Tokyo, Japan, atak@nipr.ac.jp; VONDA CUMMINGS, NIWA, Wellington, New Zealand, v.cummings@niwa.co.nz; **IN-YOUNG AHN**, Korea Polar Research Institute, Korea Institute of Ocean Science & Technology (KIOST), South Korea, iahn@kopri.re.kr.

Theme 3: CRAIG SMITH, Department of Oceanography, University of Hawaii at Manoa, Honolulu, U.S.A., craigsmi@hawaii.edu; ENRIQUE ISLA, Institut de Ciències del Mar-CSIC, Barcelona, Spain, isla@icm.csic.es; IRENE SCHLOSS, Dirección Nacional del Antártico, Buenos Aires, Argentina & Institut des sciences de la mer de Rimouski, Rimouski, Québec, Canada, irene_schloss@uqar.qc.ca; JOSÉ XAVIER, Institute of Marine Research, University of Coimbra, Coimbra, Portugal, xavier@zoo.uc.pt; **SIEGLINDE OTT**, Institut für Botanik, Heinrich Heine Universität, otts@uni-duesseldorf.de.

Liaison officers: to PS SSG, especially AntClim21: T. Bracegirdle (British Antarctic Survey, BAS); to IASC: R. Gradinger (School of Fisheries and Ocean Science, Fairbanks, Alaska); to ICED: E. Murphy (BAS); to ANTOS: D. Wall. APECS representative: C. Suckling (Bangor University, UK) & T. McIntyre (University of Pretoria, South Africa).