



XXXII SCAR Delegates' Meeting

Portland, USA, 23-25 July 2012

Agenda Item: 5.3.3

Person Responsible: Pete Convey

SCAR SRP 'Evolution and Biodiversity in the Antarctic'

Report for Delegates, 2012

Executive Summary (1 page)

Title: SCAR SRP 'Evolution and Biodiversity in the Antarctic'

Authors: P. Convey, G. di Prisco (EBA Co-Chairs), J. Xavier, M. Rajanahally (EBA Co-Secretaries)

Relevant URLs or references to other reports: www.eba.aq

Introduction/ Background: EBA is one of five current approved Science Research Programmes of SCAR, and the only one representing the interests of the very large and diverse biological sciences research community with interests in Antarctica. The Programme has a planned lifetime of 2005-2013. Assuming approval of the two new SCAR biology programme proposals to commence in January 2013, we anticipate EBA being wound up somewhat early in funding terms, not requesting funds for 2013, although extending the time period for use of its existing 2012 funds to the next SCAR Biology Symposium (Barcelona, mid-2013), as a timely and high profile 'wind up' event for the programme. Work under the auspices of EBA is divided into five 'workpackages', each working in both the marine and terrestrial environments of Antarctica.

Important Issues or Factors: Since the Programme's last Report to Delegates, it has continued to be very active in its primary coordination role, and in particular recently contributing to the development of robust scientific advice central to informing the CEP and hence ATCM on issues relating to human impacts on the ecosystems of Antarctica, and conservation planning and governance issues. EBA is now in its final year of operation. Major delivery aims in this period are (1) for the programme leaders to deliver a themed mini-symposium documenting the 'state of the art' and major future challenges in the programme's science fields at the 2012 SCAR OSC, where overview presentations of progress under each work package, and for the programme overall, will be given, ideally to be accompanied by appropriate publication outputs; (2) to complete the delivery of planned research workshops or meetings in the remainder of 2012; (3) to play an active and central role in the transition to successor SCAR biological and cross-disciplinary research programmes.

Recommendations/Actions and Justification: (1) to note and approve of EBA actions and progress to date; (2) to confirm support for EBA's outline plans for the remaining life of the programme [1 provides an indication that Delegates recognise that EBA continues to deliver to SCAR as planned, 2 provides the programme security for its remaining life].

Expected Benefits/Outcomes: Continued significant publication output (both content and numbers), outreach delivery, advice to stakeholders, enhancement of SCAR profile.

Partners: Various outputs involve interactions with CEP, COMNAP, SCAR Expert and Action Groups, IPCC

Budget Implications: No further budgetary approval is required for EBA itself, unless SCAR Delegates fail to approve the two new biological SRP proposals, in which case we would request continuation to the original planned end date of the Programme.

Evolution and Biodiversity in the Antarctic: The Response of Life to Change (EBA). Report for SCAR Delegates, June 2012

1. Rationale

Evolution and Biodiversity in the Antarctic: the Response of Life to Change (EBA) was endorsed by SCAR and became operational from January 2006.

The overall aim of the EBA programme is to understand the evolution and diversity of life in the Antarctic, to determine how these have influenced the properties and dynamics of present Antarctic and Southern Ocean ecosystems, and to make predictions on how organisms and communities will respond to current and future environmental change.

This programme involves an explicit integration of work on marine, terrestrial and limnetic ecosystems. The science in this programme thus extends over an entire biome on Earth. By comparing the outcome of parallel evolutionary processes over the range of Antarctic environments, fundamental insights can be obtained into evolution and the ways in which life responds to change, from the molecular to the whole organism level and ultimately to biome level. Most national programmes individually cannot attempt a study on such a bold scale, whereas the collaborative spirit of the Antarctic science community provides a mechanism for achieving outstanding scientific success.

EBA has established five linked Work Packages to cover the intended areas of research:

- Work Package 1: Evolutionary history of Antarctic organisms
- Work Package 2: Evolutionary adaptation to the Antarctic environment
- Work Package 3: Patterns of gene flow and consequences for population dynamics: Isolation as a driving force
- Work Package 4: Patterns and diversity of organisms, ecosystems and habitats in the Antarctic, and controlling processes
- Work Package 5: Impact of past, current and predicted future environmental change on biodiversity and ecosystem function

2. Overview of Progress

Information regarding the outputs and inputs specifically concerning the EBA programme and its undertakings are provided in the summary format requested by SCAR below. These highlight the high level, diversity and connectivity of research that contributes to EBA, and also emphasise that EBA has continued 'business as normal' since its previous report to Delegates, as would be expected of a programme in its final phase.

3. Major Tasks and Timeframe

Note that the level of detail provided in the original EBA implementation plan developed in 2004/5 is predictably limited for the final years of the programme. Included here are significant workshops and meeting that have had high relevance to EBA in 2011/12.

Year	Task outlined in 2005 Implementation Timeline, or subsequently developed	Comments
2011	<p>Last field seasons</p> <p>Side-Meeting Event and sessions: Advances on Evolution and Biodiversity in Marine Antarctic Environment, <i>World Conference on Marine Biodiversity</i>, Aberdeen (Scotland) Sept 2011 (organised by G. di Prisco, P. Convey, C. Verde)</p> <p>Antarctic Conservation and Governance workshop (South Africa, organised by S.L. Chown)</p>	<p>Participation of EBA members; EBA sponsorship</p>
2012	<p>IPY, Montreal</p> <p>APECS Brazil South America-Antarctica linkages meeting</p> <p>SCAR Open Science Meeting (Portland)</p> <p>Society for Experimental Biology main meeting (Austria July 2012)</p> <p>CCAMBIO workshop (Belgium, organiser A. Wilmotte)</p> <p>Tbc: Latin America/Spain/Portugal/UK/Germany workshop on human influences and impacts in Antarctic linkages</p>	<p>Significant EBA presence and contribution</p> <p>EBA sponsorship and participation</p> <p>PC Co-Chair of International Scientific Organising Committee.</p> <p>EBA mini-symposium, lead organiser J. Gutt</p> <p>EBA sponsored session on 'Physiology of Environmental Gradients', planned special issue of <i>Journal of Thermal Biology</i>.</p> <p>EBA sponsored – workshop on application of next generation sequencing in Antarctic microbial and diversity research</p> <p>Proposed by J. Xavier</p>
2013	<p>SCAR Biology Symposium – wrap-up of results and last year of programme</p> <p>Biodiversity workshop planned (Italy, organisers C. Verde, G. di Prisco)</p>	<p>Formal end of programme financing by SCAR now intended to be 2012, dependent on Delegate approval of new SRP proposals.</p>

4. Deliverables

The EBA Implementation plan (2005) outlined that the main output from the EBA programme would be a significant step forward in our understanding of the Antarctic biota and its evolution. There would also be important contributions to fundamental understanding in a number of disciplines. Specific outputs do and will include the following (as demonstrated in the following sections):

- Primary literature publications and books
- Conference proceedings and publications from workshops
- Programme reports
- Website
- Input to databases
- Advisory reports to ATCM and others (e.g., CEP, CCAMLR, COMNAP)
- Input to, and feedback from, international programmes

- Synergies with other SCAR programmes (e.g., ACE, AGCS, SALE)
- Trained PhD graduates and post-doctoral research fellows
- Capacity development of students and members from developing Antarctic nations
- Outreach via National Programmes and in coordination with proposed SCAR Outreach Committee
- Approximately 40 projects identified under the EBA Banner (listed in previous Report, and not repeated here)

5. EBA Committee

Name	Role	Gender	Country	Term From
Prof Peter Convey	<i>Co-Chair</i>	Male	United Kingdom	2005
Prof Guido di Prisco	<i>Co-Chair</i>	Male	Italy	2005
Jose Xavier	<i>Co-secretary</i>	Male	Portugal/UK	2010
Meghana Rajanahally	<i>Co-secretary, APECS representative</i>	Female	NZ/India	2010
Dr Dana Bergstrom	Member	Female	Australia	2005
Prof Angelika Brandt	Member	Female	Germany	2005
Dr Marc Lebouvier	<i>Member (conservation matters)</i>	Male	France	2005
Dr Kathy Conlan	<i>CO LSSSG (ex officio)</i>	Female	Canada	2008
Dr Michael Stoddart	<i>Census of Antarctic Marine Life</i>	Male	Australia	2005
Dr Brigitte Ebbe	Work Package 1 leader	Female	Germany	2005
Dr Dominic A. Hodgson	Work Package 1 leader	Male	United Kingdom	2005
Dr Katrin Linse	Work Package 1 leader	Female	United Kingdom	2009
Prof Takeshi Naganuma	Work Package 2 leader	Male	Japan	2005
Dr Elie Poulin	Work Package 3 leader	Male	Chile	March 2008
Dr Ian D. Hogg	Work Package 3 leader	Male	New Zealand	2005
Dr Satoshi Imura	Work Package 4 leader	Male	Japan	2005
Dr Lúcia de Siqueira Campos	Work Package 4 leader	Female	Brazil	Sept 2008
Dr Julian Gutt	Work Package 5 leader	Male	Germany	2005
Dr David Renault	Work Package 5 leader	Male	France	March 2008

6. Outputs

a. Key achievements

- I. *Publications:* As previously reported, at least 280 peer reviewed papers were published by groups contributing to EBA between 2008 and 2009, further to the minimum of ~280 previously reported from 2006/7. These include several journal ‘special issues’, and a major editorial and author contribution to the ACCE report. Further special issues and other similar or major outputs published subsequent to the last report are listed in section 6c below, but we have not attempted a further collation of all EBA-related outputs
- II. *Workshop Sponsorship:* As the role of EBA has developed several workshops have been sponsored to encourage communication among scientists particularly to foster new ideas and cross-discipline discussions. Appendix 1 lists the various workshops that EBA has sponsored or has been involved in since the previous Report in 2010 (workshops prior to that were listed in 2010, and are not repeated).
- III. *EBA Website:* The EBA website (www.eba.aq) was launched in July 2007 to help promote the cause of EBA and bring to the fore the various groups that contribute to EBA. It receives many thousands

of unique visitors each year, and over 100,000 hits. The website has recently been extensively redesigned.

- IV. *EBA Newsletter*: The EBA Newsletter gives recent news of the various parts of EBA. Started in March 2008, two newsletters have been compiled and circulated each year. The latest newsletter issue is available from the EBA website.
- V. *Links with the Antarctic Master Directory*: An EBA portal exists in the Antarctic Master Directory where information about Antarctic data is stored. This enables us to easily search for all types of data that contribute to EBA outcomes. SCADM have not appointed a new representative to the EBA committee following the resignation of S. Gordon from this role in 2010 after a change in employment.

Bruno Danis has requested GCMD to add the identifier 'ANTABIF' to the AMD for use with the proposed amalgamation of the marine and terrestrial databases (see d. Project Databases) into one portal at www.biodiversity.aq. ANTABIF stands for Antarctic Biodiversity Information Facility. Existing metadata records will be marked with this identifier for retrieval in the new portal.

b. Contributions to IPY Programmes

Besides being a SCAR programme, EBA has also been endorsed by the IPY Committee (Project # 137, coordinated by Guido di Prisco). All of the EBA-IPY projects contribute to the EBA SRP and several other projects that contribute to EBA are themselves IPY endorsed projects (e.g. CAML, SCAR-MarBIN, Aliens, TARANTELLA, ICED and TUNU-MAFIG). With the completion of the IPY period, we are now in a period of data analysis, presentation and publication, exemplified by the strength of EBA and component IPY programme contributions to the 2010 and 2012 IPY meetings in Oslo and Montreal. G. di Prisco and C. Verde have guest-edited a Springer volume on marine biology research outcomes of the IPY (see section 6c), and are guest-editing a second volume on the same topic, to be published in 2012.

c. Publications in peer reviewed literature

As highlighted, EBA as it stands does not publish, however the many projects and programmes that contribute to EBA do. Individual publications from these groups have not been compiled since the last Report. Note that many publications are co-written by members of more than one project.

A selection of important publications (special issues, other volumes, highlights) supported by or with large EBA member contributions are listed below:

Aitken, S., Barry, T., Convey, P., Coulson, S.J., Dang, P., di Prisco, G., Gill, M., Hakkaku, J., Hik, D., Jonsdottir, I.S., Kularni, T. & Lewis, G. (eds.) (in review). *Climate Change Impacts on Arctic and Antarctic Biodiversity*. *Biodiversity* (special issue).

Bell, E. (ed.) 2012. *Life at Extremes*. CABI Publishing, Wallingford,

Campos, L., Bassoi, M., Verde, C. & Gutt, J. (eds.) (2011). Antarctic-South American interactions in the marine environment (ASAI). *Oecologia Australis* special issue, Vol 15. ISSN: 21776199

Chown, S.L., Lee, J.E., Hughes, K.A., Barnes, J., Barrett, P.J., Bergstrom, D.M., Convey, P., Cowan, D.A., Crosbie, K., Dyer, G., Frenot, Y., Grant, S.M., Herr, D., Kennicutt, M.C., Lamers, M., Murray, A., Possingham, H.P., Reid, K., Riddle, M., Ryan, P.G., Sanson, L., Shaw, J.D., Sparrow, M.D., Summerhayes, C., Terauds, A. & Wall, D.H. In review. *Challenges to the future conservation of the Antarctic*. *Science*.

di Prisco, G. & Verde, C. (eds.) (2012). *Adaptation and evolution in marine environments. The impacts of global change on biodiversity*. Vol 1. Springer, Berlin.

Fukuchi, M., Hodgson, D., di Prisco, G., Hosie, G., Convey, P. & Bergstrom, D. (eds.) (2010). *Antarctic Biology in the 21st Century - Advances in and beyond IPY*. *Polar Science* 4(2) (special issue).

Gutt, J., Zurell, D., Bracegirdle, T.J., Cheung, W., Clark, M.S., Convey, P., Danis, B., David, B., De Broyer, C., di Prisco, G., Griffiths, H., Laffont, R., Peck, L.S., Pierrat, B., Riddle, M.J., Saucedo, T., Turner, J., Verde, C., Wang, Z. & Grimm, V. 2012. The use of correlative and dynamic species distribution

- modelling for ecological predictions in the Antarctic: a cross-disciplinary concept. *Polar Research* 2012, 31, 11091, <http://dx.doi.org/10.3402/polar.v31i0.11091>
- Rogers, A.D., Johnston, N.M., Murphy, E. & Clarke, A. (eds.) 2012. *Antarctica: An Extreme Environment in a Changing World*. Blackwell, Oxford.
- Schiaparelli, S. & Hopcroft, R.R. (2011). The Census of Antarctic Marine Life: Diversity and change in Southern Ocean Ecosystems. *Deep-Sea Research II* 58(1-2):1-276
- Simões, J.C., Garcia, C.A.E., Evangelista, H., Campos, L.S., Mata, M.M. & Bremer, U.F. (2012). *Antártica e as Mudanças Globais*. Blucher, Rio de Janeiro.
- Terauds, A., Chown, S.L., Morgan, F., Peat, H.J., Watts, D., Keys, H., Convey, P. & Bergstrom, D.M. 2012. Conservation biogeography of the Antarctic. *Diversity and Distributions* DOI: 10.1111/j.1472-4642.2012.00925.x.
- Tin, T., Liggett, D., Maher, P. & Lamers, M. (eds.). In press. *The Future of Antarctica: Human impacts, strategic planning and values for conservation*. Springer.
- Verde, C. & di Prisco, G. (eds.) (in press) *Adaptation and evolution in marine environments. The impacts of global change on biodiversity*. Vol 2. Springer, Berlin.
- Verde, C., Convey, P. & di Prisco, G. (2012) Molecular and genetic advances to understanding evolution and biodiversity in the polar regions. *Marine Genomics*, special issue, in press
- Wall, D. & Hogg, I. (2011). Global change and Antarctic terrestrial biodiversity. *Polar Biol*, special issue 34:1625-1796

d. Dissemination articles

- di Prisco G, Verde C, Convey P (2011) EBA - A living and changing Antarctic. *International Innovation* (Research Media Ltd). Issue 1:104-105
- di Prisco G, Verde C, Convey P (2011) EBA – Advancing our understanding of Antarctica. *International Innovation* (Research Media Ltd). Issue 1:106-107

Note that particularly significant EBA-related publications have been picked up effectively by the media arms of author parent organizations.

e. Project Databases

Biodiversity Database

The Australian Antarctic Data Centre (AADDC) continues to host and maintain a Biodiversity Database (<http://data.aad.gov.au/aadc/biodiversity/>) which contains data on Antarctic and sub-Antarctic flora and fauna. This started through EBA's predecessor, RiSCC, and is EBA's main database. This database contains as many collections of data that we are aware of in the public domain (see <http://data.aad.gov.au/aadc/biodiversity/collections.cfm>). The samples and/or observations from each collection are classified into one of three possible habitat domains - terrestrial, limnetic or marine (see table below).

There are also other databases that are coordinated by several of the individual projects/programmes that contribute to EBA. See: SCAR-MarBIN, MERGE, SO-CPR.

As previously noted, the Royal Belgium Institute of Natural Sciences funded a two-year project called ANTABIF, as a follow on from SCAR-MarBIN project, on building a regional biodiversity portal for the Antarctic and sub-Antarctic. This is now in existence and is available at www.biodiversity.aq. This project utilises as far as possible data standards, components and tools developed at GBIF. It is also proposed to build an authoritative terrestrial and limnetic taxa catalogue to complement the existing Register of Antarctic Marine Species (RAMS). A suitable acronym for this product is suggested to be Register of Antarctic Freshwater and Terrestrial Species (RAFTS).

The contents of the existing terrestrial database were central to a jointly funded EBA and SC-ATS analysis of terrestrial biodiversity patterns across Antarctica, also including links with the Environmental Domains Analysis V2 from New Zealand. This analysis has previously been reported to SCAR, and is central to plans

for future advice to CEP and ATS parties relating to conservation planning and management in Antarctica. The work is now formally published (Terauds et al., 2012 – see 6c above).

7. *Inputs*

a. Meetings and workshops

Since the previous Report, several meetings and workshops have been, and are planned to be, sponsored by EBA, and many have been linked to EBA. These can be found in Appendix 1.

b. Links to other SCAR SRPs or SCAR Action or Expert Groups

The Southern Ocean Continuous Plankton Recorder Survey (SO-CPR Survey) has identified itself as a project that contributes to EBA and this is currently an LS-SSG Action Group.

Links have been made with ACE and AGCS through the SCAR inter-programme leaders group, the editorial committee and authorship of the ACCE report and its subsequent updates, through the creation of a new Expert Group on ACCE, and the Action Group on the Prediction of Change in the Biological and Physical Environments of Antarctica.

Along with SSG-LS, EBA members have been very closely involved in the development of the two new SCAR biological SRP proposals. These proposals provide a very firm and exciting foundation for the involvement of a wide cross-section of the international biological research community in Antarctic biological research over the next 5-8 years. EBA members have also been directly and positively engaged in the development of the new physical science research proposal ‘AntClim21’ and, to a lesser but specifically important extent, that of PAIS.

A meeting was held in January 2012 at the University of Modena and Reggio Emilia to explore linkages between the SCAR SSGs (and also SCADM, SCAGI and SCATS) and develop a strategic portfolio of the next generation of SRPs. The objective was to present the SCAR Delegates with a coherent, integrated package of new interlinked SRPs for approval.

Appendix 1: Workshops/Meetings Supported by EBA or linked to EBA since 2010 Report

Title	Venue	Date	Report/Supported Personnel	Attendees/Supported
2010				
Workshop “Polar marine and lacustrine organisms: Gene and protein evolution in a changing environment”	Naples, Italy	24-25 May 2010	Special Issue of Marine Genomics	EBA Sponsorship for the workshop. 22 invited speakers from Italy, UK, USA, Germany, Argentina, Norway, New Zealand, Brazil, Chile, Russia
Workshop “Future of SCAR biology”	Castiglioncello (Livorno), Italy,	27-28 May 2010,		25-30 participants from UK, Italy, USA, Australia, New Zealand, Spain, Brazil, Chile, France, Germany, Canada
SCAR OSC	Buenos Aires, Argentina	August 2010	Various sessions with EBA inputs, including proposed special issues	EBA sponsorship for ECS
2011				
Genetic monitoring in the polar regions	Cambridge, UK	April 2011	Draft ms aimed at Nature Climate Change	EBA and IASC sponsorship, multinational participants
Antarctic Diversity, status and trends	Brussels, Belgium	June 2011	Used virtual media for some long haul participants	EBA sponsorship of meeting, postponed from Nov 2010
Side-event and sessions on Advances on Evolution and Biodiversity in Marine Antarctic Environment, <i>World Conference on Marine Biodiversity</i>	Aberdeen, UK	September 2011	Special Issue of Marine Genomics	EBA and PNRA sponsorship
International Dialogue: Antarctica and its history. <i>Festival della Scienza</i>	Genova, Italy	October-November 2011		EBA and PNRA sponsorship. Multinational participation
Antarctic conservation planning and governance	Kruger, South Africa	June 2011	Major sponsorship from SC-ATS and Martha Muse prize (S.L. Chown), EBA also sponsored. ‘Horizon scanning’ exercise.	Multinational participation. Resulting paper in review in <i>Science</i> .
2012				
APECS Brazil South America-Antarctica linkages meeting	Rio Grande, Brazil	May 2012	EBA/SCAR keynote. Brazil programme large contributor to EBA. Also relevant Argentinian, Chilean and Uruguayan	Multinational participation. Resulting paper in review in <i>Science</i> .

			personnel present	
SCAR OSC	Portland, USA	July 2012	EBA mini-symposium. Various EBA related sessions	
Society for Experimental Biology main meeting	Austria	July 2012	EBA-sponsored session on environmental gradients	Special issue of <i>Journal of Thermal Biology</i> planned
CCAMBIO workshop	Belgium	October 2012	Workshop on application of next generation sequencing technologies in Antarctic microbiology	EBA sponsored
2013				
SCAR Biology Symposium – wrap-up of results and last year of programme	Barcelona, Spain	Summer 2013	Special issue?	Sponsored by SCAR
Biodiversity workshop under planning	Naples, Italy	Autumn 2013	Special issue?	Sponsored by EBA or new SRP