

Full Proposals for International Polar Year 2007-2008 Activities

Proposed IPY Activity Details

1.0 PROPOSER INFORMATION

(Activity ID No: 137)

1.1 Title of Activity

Evolution and Biodiversity in the Antarctic: the Response of Life to Change

1.2 Short Form Title of Proposed Activity

EBA

1.3 Activity Leader Details

Guido di Prisco

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Italy

1.4 Lead International Organisation(s) (if applicable)

SCAR, OBIS, ANDEEP-SYSTCO, CoML, MarBIN, CCAMLR (interaction)

1.5 Other Countries involved in the activity

Italy

Australia

Germany

The Netherlands

UK

Spain

Brazil

USA

Ukraine

Japan

New Zealand

Belgium

Russia

Norway

Canada

Argentina

Poland

Czech Republic

Malaysia

France

Chile

Sweden

1.6 Expression of Intent ID #'s brought together in this proposed activity

577, 80, 83, 109, 111, 153, 161, 189, 379, 405, 479, 533, 591, 714, 839

1.7 Location of Field Activities

Antarctic

1.8 Which IPY themes are addressed

1. Current state of the environment
2. Change in the polar regions
3. Polar-global linkages/tele-connections
4. Exploring new frontiers
5. The polar regions as vantage points

1.9 What is the main IPY target addressed by this activity

1. Natural or social science

2.0 SUMMARY OF THE ACTIVITY

The SCAR Programme EBA (so far, 22 nations, over 70 researchers) will explore the evolutionary history of selected modern Antarctic biota, examine how biological diversity in the Antarctic influences the way present-day ecosystems function, and thereby predict how the biota may respond to future environmental change. For the first time it will integrate understanding across the major realms of Antarctic biology (marine, terrestrial, freshwater) into the cohesive picture which is a pre-requisite of Earth-System Science. EBA will advance evolutionary and ecological theory using model systems and organisms from the Antarctic. Broad objectives:

1. to link with geoscientists to establish more clearly the evolutionary history of the Antarctic biota
2. to compare evolutionary adaptations to the Antarctic environment in a range of organisms, and thereby determine general principles
3. to explore patterns of geneflow and determine their consequences for population dynamics
4. to identify patterns and examine diversity of organisms, ecosystems and habitats, together with the ecological and evolutionary processes that control these
5. to study the impact of past, current and predicted environmental change on biodiversity and the consequences for Antarctic marine, terrestrial and limnetic ecosystem function.

The science thus extends over an entire biome on Earth, and by comparing the outcome of similar 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 at the biome level. The Antarctic environment offers a unique opportunity to address these globally significant questions in an interdisciplinary and multidisciplinary (molecular biology, ecophysiology, microbiology, taxonomy, organismal biology, etc) approach, essential for understanding the structure and functioning of the earth system. EBA will involve fieldwork and labwork, in Antarctica and home institutions. There are clear synergies with other projects, e.g. CAML and ICEFISH-2007 (an international and multidisciplinary programme centered on a Sub-Antarctic cruise). Exploration of some areas will require new technology (e.g. benthic landers or ROV for the deep-sea, AUV for work beneath ice shelves). EBA will liaise with the relevant physical and historical disciplines to ensure use of the most recent data and insights in interpreting the biological results. Combining these approaches with our increasing understanding of the tectonic, climatic and glacial evolution of Gondwana offers a uniquely powerful opportunity to advance our understanding of how evolutionary processes are related to the physical setting.

It is anticipated that the majority of the SCAR nations will participate in this programme, that it will act as a major route for capacity building in new SCAR members and those with a comparatively reduced logistic and financial resource base, and that it will contribute to a wide variety of international programmes. The study of latitudinal gradients requires extensive international collaboration, as was achieved for ICEFISH, the ongoing Victoria Land Transect study, and the IBMANT collaboration between European and South American countries on evolutionary connections between the Antarctic and South America. Such programmes will be wide ranging, including Sub-Antarctic islands, inland to the most remote nunataks as well as

northward to the Magallanes (and the Arctic), and stretching across the Southern Ocean down to the deep ocean as well as the shelves. This wide range will need significant support from COMNAP and national programmes.

Input from individual researchers and research teams has been solicited through a questionnaire, and the response has been beyond expectations. Researchers have registered their anticipated contributions to the programme through the EBA website.

The EBA science plan clearly shows that it will make a significant contribution to IPY by undertaking a focused initiative elucidating the evolutionary response of organisms, populations and communities to environmental change. EBA will leave a legacy of evolutionary and biodiversity information, which is the hallmark of IPY.

2.1 What is the evidence of inter-disciplinarity in this activity?

From a thematic point of view, EBA will bring together a wide range of disciplines to tackle a series of well focused questions. It will liaise with the relevant physical, geological and historical disciplines to ensure regular interactions and use of the most recent data and insights in interpreting the biological results. These disciplines include plate tectonics, climatology, glaciology, geophysics, oceanography, palaeontology, for collecting geochemical records, climatological parameters, glacial features, etc. A workshop will soon take place to establish cross-linkages between the Scientific Research Programmes of SCAR (ACE, AGCS, EBA, SALE). We will explore the potential interdisciplinary linkages between the programmes, establish what relevant data are already available, and set out a plan for acquiring data needed to develop linkages. The goal to investigate evolution, biodiversity, ecology and population dynamics will use the synergy of anatomy, physiology, biochemistry, biophysics, molecular biology, morphological and molecular systematics, cytogenetics, life-history strategies, taxonomy, phylogeny. With these backgrounds, EBA also tries to provide a broad view of biogeographical distribution and biochemical processes. In addition to conventional approaches, advanced and unique techniques (in particular at the molecular level) will be widely used to detect, determine and describe genetic signatures (DNA and RNA), biomarkers (lipids, carbohydrates, proteins and their constituents), biological index species. In view of the large number of participants, it is conceivable that EBA will include additional disciplines and research approaches.

2.2 What will be the significant advances/developments from this activity? What will be the major deliverables? What are the outputs for your peers?

EBA will address the impacts of climate change on species biodiversity, evolutionary adaptations, and also depletion of marine fisheries on community dynamics in the Southern Ocean. The work will contribute to a better understanding of the effect of such changes by investigating the severely restricted acclimatory responses available to high latitudes. It will also contribute to development of a baseline understanding of sensitive ecosystems, one against which future changes in species distribution and survival may be evaluated judiciously. Phylogeographical analyses of organisms and environmental DNA sequences will help to understand inter-relationships of geographical separation and species separation (i.e. speciation or micro-evolution). The study of evolution of ecosystems is useful to reconstruct past environmental climate changes, and provides key baseline information about the effect of past climate changes on polar organisms, and also on how these organisms may respond to future climate changes. EBA will use techniques dealing with the dynamic behaviour of complex systems, ranging from biochemistry to ecology. EBA will run three types of workshops: a) thematic, fostering cross-disciplinary interactions (e.g. with ACE, AGCS and SALE); b) interaction with non-polar experts in evolutionary biology; c) integrative, for the Antarctic community. Specific output will include: primary literature publication and books, conference proceedings and publications from workshops, reports, website, input to databases, advisory reports to ATCM and others (e.g. CEP, CCAMLR, COMNAP), exchanges with international programmes, training PhD graduates and post-doctoral research fellows, capacity development of students from developing Antarctic nations, outreach via National Programmes and in coordination with proposed SCAR Outreach Committee.

2.3 Outline the geographical location(s) for the proposed field work (approximate coordinates will be helpful if possible)

Locations	Coordinates
All of the Antarctic and sub-Antarctic	
Extensions and interactions with Arctic activities (e.g. Arctic CoML) are envisaged (Svalbard, Greenland, circum-Arctic)	

2.4 Define the approximate timeframe(s) for proposed field activities?

Arctic Fieldwork time frame(s)	Antarctic Fieldwork time frame(s)
03/07 - 12/07	03/07 - 12/07
01/08 - 12/08	01/08 - 12/08
01/09 - 03/09	01/09 - 03/09

2.5 What major logistic support/facilities will be required for this project?

Icebreaker
Helicopters
Ice strengthened research ship
Existing field stations
Autonomous Underwater Vehicle
Snow terrain vehicles
Remotely Operated Vehicle

Further details – Other ships. Zodiac inflatable boats. National source. Cost sharing. There are possibilities of interacting and providing/receiving support from other IPY projects, organising time links with other ventures, etc.

2.6 How will the required logistics be supplied? Have operators been approached?

Source of logistic support	Likely potential sources	Support agreed
Consortium of national polar operators	Y	
Own national polar operator	Y	
Another national polar operator	Y	
National agency	Y	
Military support	Y	
Commercial operator		
Own support		
Other		

2.7 If working in the Arctic regions, has there been contact with local indigenous groups or relevant authorities regarding access?

Coordinators of associated Arctic activities will establish contacts with local authorities for the necessary authorisations

3.0 STRUCTURE OF THE ACTIVITY

3.1 Origin of the activity

This is a pulse of activity during 2007-2009 within an existing programme

If part of an existing programme please name the programme – EBA is new in its wide structure, since SCAR 2004, Bremerhaven (EBA runs to 2013); it is also a component/umbrella of SCAR lapsed activities: EASIZ, EVOLANTA, RiSCC; it is related to other planned activities: e.g. CAML, ICEFISH, ANDEEP-SYSTCO, MarBIN, CLI

3.2 How will the activity be organised and managed? Describe the proposed management structure and means for coordinating across the cluster

EBA will be based on national and multi-national funding sources. Its main role is to provide a base for interdisciplinary and interdependent collaborations to increase chances for more data, samples, expeditions, logistics, etc. We are confident that EBA will be well managed, developed, and successfully realised internationally and interdisciplinarily as a part of IPY activities. EBA will be managed by a Project Steering Committee, selected to include expertise in each of the Broad Objectives, and in a range of habitats (marine, terrestrial/limnetic), organisms and scientific disciplines. The coordinator of CAML will also be included. The PSC will work by electronic mail but will also meet once a year. An important aspect will be liaising with other scientific disciplines. This will be achieved by a series of multidisciplinary workshops focused on specific topics and run in parallel with SCAR meetings and symposia. A workshop will soon explore the potential interdisciplinary linkages between the SCAR programmes EBA, AGCS, ACE, SALE.

3.3 Will the activity leave a legacy of infrastructure and if so in what form?

No major infrastructure will be left in Antarctica. Sampling sites will be identified and subsequently used to track changes in biodiversity. Collections of specimens will be made available to the scientific community and be deposited in museum collections around the world. Genomic resources will be archived for distribution to polar marine and terrestrial biologists, for example: collection of specimens of species, bulk DNA extracted in a wide range of habitats, PCR-based clone libraries (e.g. of 16S rRNA genes), meta-genomic libraries.

3.4 Will the activity involve nations other than traditional polar nations? How will this be addressed?

Malaysia, Ukraine, Czech Republic. In addition, workshops and other deliverables will be widely advertised, and participations of researchers from nations that have not traditionally engaged in polar research will be encouraged. The participation of students from developing Antarctic nations will also be encouraged. These interactions will also lead to further international collaborative work by scientists of many nations on the collected samples.

3.5 Will this activity be linked with other IPY core activities? If yes please specify

EBA is in the framework of SCAR international and multidisciplinary programmes. It is tightly linked with CAML (EoI 83) and ICEFISH (533). Synergy is planned with CCAMLR, ANDEEP-SYSTCO (111), MarBIN, CLICOPEN, HABIPOL, HERMES, IAI, etc

3.6 How will the activity manage its data? Is there a viable plan and which data management organisations/structures will be involved?

The web site will also serve as the conduit for data management. We will work closely with JCADM to ensure timely data release and metadata support. Marine data will be integrated into MarBIN, and terrestrial data into the RiSCC biodiversity database. Modelling of interactions between environmental change and organism responses will be performed, to facilitate change predictions. Data management will also be in accordance with the operating data management systems of the participating institutions. Processed data will be made available to IPY and other databases as required. Genomics, proteomics, sequences and other data will flow into a number of pertinent databases (e.g. Genebank, SwissProt).

3.7 Data Policy Agreement

Will this activity sign up to the IPY draft Data Policy (see website)

Yes

3.8 How will the activity contribute to developing the next generation of polar scientists, logisticians, etc.?

Participation will include experienced scientists (who will give lectures illustrating their field of research) and young students. The students will receive first-hand experience and training in the logistics of expeditionary polar biology, such as resource planning, sampling technologies, etc. They will continue their polar education by analysing cruise samples at their home institutions. These students will form the next generation that continues the development of polar marine and

terrestrial biology (see also 3.9). EBA will foster undergraduate and post-graduate education. This educational effort will increase interests and researchers in polar sciences and expeditions, and will thus stimulate policy decisions on polar programmes. Involvement into an international, multidisciplinary project will highly motivate young scientists. EBA has direct relevance to Global Change, and will encourage further research activities.

3.9 How will this activity address education, outreach and communication issues outlined in the Framework document?

The web site will support EBA. The site will serve as a gateway for general public, including young generations, to increase their awareness of Polar and Global environments; it will serve as well as a forum for partners to discuss incoming schedules and obtained outcomes, deposit data to share, offer/request laboratory uses, etc. PhD students will be trained. Conferences, seminars and workshops will be scheduled to disseminate knowledge to children/teachers. This will also be pursued through conference proceedings, media coverage, publication of books and production of images and videos. For input to databases, see 3.6 and 3.7. Synergy with CAML, ICEFISH, ANDEEP-SYSTCO, MarBIN, CCAMLR, CLICOPEN, HABIPOL, HERMES, IAI and interactions with other SCAR programmes, will provide additional outreach and communication to a worldwide audience. EBA has direct relevance to an important issue for the general public such as Global Change, and will encourage further research activities. In summary, the strategy involves development of high-quality communication products, targeting research scientists, decision-makers, media, the general public and school communities. It will involve attractive visual materials - carefully developed to interest and educate youth as well as wider audiences. Strong contribution to an EoI centered on a series of Volumes by Springer on the IPY outcomes is envisaged.

3.10 What are the proposed sources of funding for this activity?

Funding will be sought from national agencies, namely several contributions to EBA will be from projects currently financially supported by national institutions. Cost-sharing initiatives will be sought. International funding agencies (European Union, etc) will also be solicited for support.

3.11 Additional Comments

EBA will comprise a very large number of scientists from the majority of SCAR nations. Collaborations are expected to take place at all levels, within and between themes. EBA is open for collaborations with individuals and teams participating in other IPY activities. It will form an integral and important component of CAML, which covers all Antarctic marine organisms ICEFISH is one of EBA's activities, and is important to understanding the biogeography, evolution, and adaptation of fishes along the latitudinal gradient that extends from the Antarctic to the Arctic; as an intermediate geographical system between the polar extremes, study of the Sub-Antarctic and its marine fish fauna will provide vital information pertinent to a global synthesis of the characteristics of marine ecosystems. EBA will meet almost all (and probably all during implementation) of the 9+5 criteria. In the majority of cases, detailed commitment to research and logistics requires final decisions on funding.

4.0 CONSORTIUM INFORMATION

4.1 Contact Details

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4.2 Other significant consortium members and their affiliation

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