



SDM 13
 Agenda Item: 4.1.6
 Person Responsible: J Gutt et al.

**XXXV SCAR Delegates Meeting
 Davos, Switzerland, 25-26 June 2018**

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

Report Authors- Julian Gutt with contributions from SC members (from Argentina, Canada, Germany, Japan, New Zealand, Portugal, South Korea, Spain, UK, USA.

Summary of activities from 2016-18 and any other important matters

- **Scientific output.** Two papers published as a unique product of AnT-ERA. More than 500 additional papers fell into the scope of AnT-ERA.
- **Capacity building.** (a) Mini-workshop during OSC, 2016; (b) multiple support of the 2016 OSC and 2017 SCAR Biology Symposium; (c) approx. 10 additional events co-chaired by SC members, e.g. ANTOS and APECS.
- **Dissemination/products.** Key "tool" was the dynamic AnT-ERA webpage with ~100,000 hits between 2013 and 2017. At present announcements for events and job opportunities are sent regularly to the approx. 520 mailing list members. AnT-ERA contributed to a wide range of SCAR products, e.g. ACCE updates, SCAR strategy plan, and initiatives such as IPBES, UNFCCC, and SOOS.
- **Support for early-career scientists.** 16 mini-grants awarded to applicants from approx. 10 countries in 2016 and 6 travel-grants in 2017. Preparation of an **AnT-ERA Spring Course in 2018** is in an advanced stage of preparation.
- **Research.** Projects/expeditions under the leadership of AnT-ERA scientists: J. Xavier (JR16003), A. Takahashi (JARE-AP0922), D. Cowan (Dry Valleys, Jan 2018). G. di Prisco, TUNU Euro-Arctic Marine Fishes - Diversity and Adaptation (TEAM-fish), V. Cummings (*Resilience in Antarctic biota and ecosystems*”, expeditions in 2016/17 and 2017/18). L. Peck (*Effects of in situ warming on Antarctic benthic biofouling communities*, 2015/16, 2016/17).

Recommendations: no recommendations

Summary Budget 2017 to 2020

	2017	2018	2019	2020
	Spent	Allocated	Request	Request
(US\$)	4907*	21000	21000	21000

*US \$ 4960 carried forward from 2016. Almost the entire 2017/18 budget is to be used for the Spring Course in 2018 in Buenos Aires.



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Progress and Plans

Major Outcomes

1. Mini-workshop (discussion) on possible "final products" of AnT-ERA and AntEco as a **side event of the SCAR biology symposium 2017** in Leuven, co-convened by J. Gutt. Final products of AnT-ERA eventually in combination with AntEco should enhance the visibility of SCAR activities and be unique in a way that would not be possible without the SCAR background and support. These options were discussed:
 - a special volume with synthesis papers following the organisational structure of the SRPs,
 - a panel discussion with scientists and stakeholders,
 - data workshops,
 - assemble AnT-ERA and AntEco data sets,
 - proposals for amphipolar proposals,
 - multidisciplinary "final products" or final events,
 - art and illustrations,
 - a synthesis workshop embedded in a broader scientific and stakeholder orientated approach with panel discussion and scientific abstracts/fact sheets, which could provide the basis for a special volume with complete scientific articles.
2. Mini-workshop *Time for changes after COP21*, 2016 SCAR OSC, Kuala Lumpur. Chair: I. Schloss.
3. International *Festival della Scienza: Life at sea ice/water contact: what we may lose*. Organiser: G. di Prisco, C. Verde, Genova (Italy), Oct/Nov 2017.
4. Chaining sessions during *XII SCAR Biology Symposium*, Leuven, 2017: S08: Response to climate change: understanding bio-resilience (I. Hogg & C. Verde); S09: Adaptation and processes in top predators (J. Xavier & C. Verde); S10: Understanding Physiology (including '-omics' approaches) (C. Verde & G. di Prisco); Multidisciplinary studies in terrestrial and marine transition zones (V. Cummings), S11: How to live in extreme environmental conditions & Astrobiology (S. Ott & S. Onofri).
5. Ashley Shaw, an early career researcher, completing her PhD in May 2018 and advised by D. Wall. In 2017, she 1) published a chapter of her dissertation addressing the trophic structure of McMurdo Dry Valley soil communities; 2) completed biological and chemical analyses of soils; and 3) hosted J. Lee from Australia and then visited Hobart, Tasmania to work on an early-career collaborative side project.

Notable Papers

Gutt J, Isla E, Bertler N, Bodeker GE, **Bracegirdle TJ**, Cavanagh RD, Comiso JC, Convey P, **Cummings V**, De Conto R, DeMaster D, **di Prisco G**, d'Ovidio F, Griffiths HJ, Khan AL, López- Martínez J, Murray AE, Nielsen UN, **Ott S**, Post A, Ropert-



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Coudert Y, Saucède T, Scherer R, Schiaparelli S, **Schloss IR**, **Smith CR**, Stefels J, Stevens C, Strugnell JM, Trimborn S, **Verde C**, Verleyen E, **Wall DH**, Wilson NG, **Xavier JC** 2017. Cross-disciplinarity in the advance of Antarctic ecosystem research. Mar Genomics, online - The paper represents the output of a cross-programme brain-storming SCAR workshop organized under the leadership of AnT-ERA. It describes novel ideas of cross-disciplinary research concepts and research needs in Antarctica and the Southern Ocean and sets these in a global context.

Gutt J 2017. Research on climate-change impact on Southern Ocean and Antarctic ecosystems after the UN Paris climate conference – "now more than ever" or "set sail to new shores"? Polar Biol 40: 1481-1492, doi: 10.1007/s00300-016-2059-y - The paper is based on an opinion survey on future Antarctic research and showed a high priority to continue with climate-change related research and (other) applied aspects.

Ahn IY, Moon HW, Jeon M. & Kang SH 2016. First record of massive blooming of benthic diatoms and their association with megabenthic filter feeders on the shallow seafloor of an Antarctic fjord: Does glacier melting fuel the bloom? Ocean Sci J 51(2): 273-279. - The findings indicate a unique and efficient trophic structure built on the benthic diatoms, providing an insight on a negative feedback counteracting global warming by sequestering increased CO₂ into benthic diatoms and its herbivorous consumers.

Adriaenssens EM, Kramer R, Van Goethem MW, Makhalyane TP, **Hogg I**, **Cowan DA** 2017. Environmental drivers of viral community composition in Antarctic soils identified by metaviromics. Microbiome 5: 83. - The pattern of viral community structure with higher levels of diversity at lower altitude and pH, suggests that Antarctic cold desert soil viruses interact with each other, the host, and the environment, playing a potentially crucial role in maintaining host diversity and functioning of the microbial ecosystem.

Coppola D, Giordano D, Milazzo L, Howes BD, Ascenzi P, **di Prisco G**, Smulevich G, Poole RK, **Verde C** 2018. Coexistence of multiple globin genes conferring protection against nitrosative stress to the Antarctic bacterium *Pseudoalteromonas haloplanktis* TAC125. Nitric Oxide 73: 39-51.- The genome of the bacterium *Pseudoalteromonas haloplanktis* contains genes encoding three distinct globins, supporting the hypothesis of their crucial involvement in protection against oxidative and nitrosative stress in the cold and O₂-rich environment. The physiological role of one of the these globins was investigated by integrating *in vivo* and *in vitro* results. This role includes the involvement in the detoxification of reactive nitrogen and oxygen species that can cause oxidative damage of cells.

Xavier JC, Brandt A, Ropert-Coudert Y, Badhe R, **Gutt J**, Havermans C, Jones C, Costa ES, Lochte K, **Schloss IR**, Kennicutt II MC, Sutherland WJ 2016. Future challenges in Southern Ocean ecology research. Front Mar Sci 3, doi 10.3389/fmars.2016.00094. - This paper contains another output of the SCAR Horizon Scan. It highlights important Southern Ocean life and ecology research



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topics. This allows the identification of the challenges and future requirements in technological development, and priorities for research and funding strategies.

Takahashi A, Ito M, Nagai K, Thiebot JB, Mitamura H, Noda T, Trathan PN, Tamura T, Watanabe YY 2018. Migratory movements and winter diving activity of Adélie penguins in East Antarctica. *Mar Ecol Prog Ser* 589: 227-239. - This paper reports the first winter diving records of Adélie penguins and shows how their migration and diving behaviours are constrained by short day-length and heavy sea ice cover during the Antarctic winter.

Ashton G, Morley SA, Barnes DKA, Clark MS, **Peck LS** 2017. Warming by 1°C drives species and assemblage level responses in Antarctica's marine shallows. *Curr Biol* 27, 2698–2705. - Marine settlement panels were deployed in Antarctica that included heating of the surfaces and overlying water films by +1°C or +2°C to evaluate the effects of *in situ* warming on the biofouling community. Results were surprising with growth rates of bryozoan and polychaete worms doubling for a 1°C rise and large changes in community structure. These data show an unexpected ability to respond to a small warming combined with a high sensitivity to a very small temperature rise beyond 1°C.

Knox MA, Andriuzzi WS, Buelow HN, Takacs-Vesbach C, **Adams BJ**, **Wall DH** 2017. Decoupled responses of soil bacteria and their invertebrate consumer to warming, but not freeze–thaw cycles, in the Antarctic Dry Valleys. *Ecol Lett* 20: 1242-1249. - Daily freeze–thaw cycling negatively affected both trophic levels of the arid soil food webs of the McMurdo Dry Valleys, whereas warming without freezing disturbance negatively affected microbes but tended to promote their predator (microbial-feeding nematode). This leads to question of whether climate change could reinforce trophic interactions in this ecosystem.

Gooseff MN, Barrett JE, **Adams BJ**, Doran PT, Fountain AG, Lyons WB, McKnight DM, Priscu JC, Sokol ER, Takacs-Vesbach C, Vandegehuchte ML, Virginia RA, **Wall DH** 2017. Decadal ecosystem response to an anomalous melt season in a polar desert in Antarctica. *Nat Ecol Evol* 1: 1334-1338. - This paper reports a multidisciplinary assessment of how the extreme warming event in the austral summer of 2001-02 triggered, over the following decade, asynchronous physical and biological responses across soils, lakes, and streams of the McMurdo Dry Valleys.

Main Activities

Expeditions and projects under the leadership of AnT-ERA scientists:

- The JR16003 cruise with major contributions by J. Xavier had a SCAR AnT-ERA component looking at the role of trace metals in different marine systems within the Southern Ocean and adjacent waters, specifically zooplankton, squid and myctophid fish. Distribution patterns, ecological links (e.g. through stable isotopic and fatty acids analyses) in relation to environmental change were also investigated. Ecological key organisms of the midwater ecosystem such as squid and fish are, in addition to the most "famous" krill, important to understand trophic



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relationships and their vulnerability in the Southern Ocean but are so far not comprehensively studied.

- The Japanese research team conducted fieldwork during JARE-AP0922 with major contributions by A. Takahashi on higher-trophic level predators at their research station in East Antarctica for three austral summers and one winter. Such surveys covering inter-annual variability of ecological processes are still rare but important to assess the impact of climate change.
- The TUNU-VII Expedition, 14–26 September 2017, North-East Greenland, onboard the RV Helmer Hanssen (major contributions by G. di Prisco) provided an important basis for a comprehensive polar comparison of the ecology, physiology and adaptation of polar fish. Such comparisons are often recommended because they provide improved insights in the functioning of the biota of both Polar Regions, but they still very rare and, thus, this approach is of high scientific relevance.

Between autumn 2017 and spring 2018 high efforts have been put into the preparation of the **AnT-ERA Spring Course** for graduate, PhD students and early career scientists due to be run in September 2018 in Buenos Aires, Argentina. This course is planned to become one of the most comprehensive and important events organized by leading AnT-ERA scientists during the entire existence of AnT-ERA. The success of this course requires great efforts from both organizers, Julian Gutt and Irene Schloss. The expected success will also depend on the contributions of the 10 experienced AnT-ERA SC members acting as lecturers during the course.

Antarctic Science International Bursary Project: modelling the spatial distribution of invertebrate habitat and identifying areas of conservation priority with J. Lee. Lee visited Colorado State University where he worked with D. Wall to collect data from LTER databases. Next, Shaw visited Hobart, Tasmania to work with J. Lee and A. Terauds on habitat suitability models and conservation planning. This work will be presented at POLAR 2018 in Davos.

“LTER: Ecosystem Response to Amplified Landscape Connectivity in the McMurdo Dry Valleys, Antarctica” (NSF 1637708) and “The Role of Glacial History on the Structure and Functioning of Ecological Communities in the Shackleton Glacier Region of the Transantarctic Mountains” (NSF 1341736, both by D. Wall and B. Adams). The ice-free terrestrial ecosystems of continental Antarctica have remained fairly stable since the end of the Pleistocene, but anthropogenic drivers at the global level are staged for very rapid change. These projects explore ecosystem response to climate driven environmental change at both geological and contemporary time scales in an effort to identify fundamental principles associated with terrestrial ecosystem responses to large scale environmental changes over space and time.

Finalization Activities

It is planned to assemble **key findings** of research on predominantly but not exclusively climate-change related biological processes (major AnT-ERA objective) for the period 2013-2020. Following the major objectives of AnT-ERA these key findings should cover all levels of biological organization from genes and



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species/populations to communities and all major ecosystems, including marine, terrestrial and limnetic. They could have an already existing or expected high impact on the scientific community, should be of general societal relevance and are expected to increase the visibility of SCAR in the global scientific community and among stakeholders.

Key findings are planned to be identified in a **workshop** of the AnT-ERA SC in 2019/2020 with contributions from the wider community including early career scientists and specialists from emerging or small Antarctic programmes. The results are to be presented and discussed in a special session or key side event during the SCAR OSC in 2020, and stakeholders will eventually be invited to this event.

Expected Final Outcomes

The results of the identification of **key findings** on biological processes in Antarctica and the Southern Ocean (see *Finalization Activities*, above) should be published in short **review style** in a **scientific journal** with a wide readership and/or a popular scientific journal, eventually also or alternatively as kind of **fact sheets** to be made publicly available on the SCAR web page.

Significant Deviations from the Implementation Plan

The **Spring Course** for graduate, PhD students and post-docs to be held in Buenos Aires was not explicitly mentioned in the Implementation Plan but will become a key event and outcome for the second funding period of AnT-ERA and will account for a considerable proportion of our resources. This idea was developed to organize and carry out a unique event, from which especially early career scientists and representatives of small or emerging national programs benefit, and which would not happen without the specific SCAR support.

Budget

Planned use of funds for 2018 to 2020

Year (YYYY)	Purpose/Activity	Amount (in USD)	Contact Name	Contact Email
2016	Fjord Ecosystem Course	1,300	C. Smith	craigsmi@hawaii.edu
2016	OSC Kuala Lumpur	16,430	J. Gutt	Julian.gutt@awi.de
2016	IPBES	503	J. Gutt	Julian.gutt@awi.de
2016	Miscellaneous	975	J. Gutt	Julian.gutt@awi.de
2016	Internship	1,460	T. Marina	tomasimarina@gmail.com
2017	SCAR Biol. Symposium	4,907	J. Gutt	Julian.gutt@awi.de
2018	AnT-ERA Spring Course	42,000 (planned)	J. Gutt I. Schloss	Julian.gutt@awi.de ireschloss@gmail.com



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Briefly describe what the funds will be used for and the desired results

Fjord Ecosystem and Climate Change course by the University of Hawaii to cover travel costs of students participating in the summer course in 2018 at Friday Harbor Laboratories.

OSC Kuala Lumpur: All early career scientists presented a paper (oral or poster); AnT-ERA SC members participated in various side events including the AnT-ERA SC meeting.

IPBES: J. Gutt was nominated by SCAR/ICSU to become a IPBES lead-author. Travel funds were used to join the first author meeting.

SCAR Biology Symposium: The awardees of the travel funds participated in the mini-workshop (see above), SC members participated in the SC meeting, early career scientists presented papers (oral or posters).

AnT-ERA Spring Course (planned): The almost entire 2017/18 AnT-ERA budget will be used for the Spring Course.

Percentage of the budget to be used for support of early career researchers

2018: 60-100%; almost the total budget will be used for a Spring Course held in autumn 2018 in Buenos Aires to the benefit of graduate and PhD students as well as post-docs. Travel funds will also be provided to lecturers to part fund their attendance. In addition to non-SCAR support will be provided by the national Antarctic programs and the lecturer's institutes. Approx. 60% of the total will be provided directly to the students attending the course.

2019: In terms of funding priority should be given to invite early career scientists in addition to the SC members to the workshop to identify key findings of the AnT-ERA period.

2020: Support will be given to the presentation of key findings during the OSC 2020.

Percentage of the budget to be used for support of scientists from countries with developing Antarctic programmes

2018: All students receiving AnT-ERA travel funds for the Spring Course in Buenos Aires come from countries with a small or developing Antarctic program, incl. Ukraine, India, Malaysia, and a number of South American countries incl. Argentina, Brazil, Chile, Peru (Ecuador), Columbia.

2019 - 2020: A selection of early career candidates to contribute to the identification of key findings from the AnT-ERA across its whole existence is planned for the second half of 2018. Attention will be paid to include, in addition to experienced SC members, early career scientists and scientists representing SCAR countries with a developing or small national Antarctic program.



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Linkages

Direct support from outside organisations

- Field and logistics support from AntarcticaNZ and NZARI (D. Cowan)
- University of Pretoria, 3 University-supported postdoctoral positions (3-year posts) (D. Cowan)
- Antarctic Science International Bursary (2017) – awarded to A. Shaw and J. Lee for a collaborative project outside of PhD research. McMurdo Dry Valley LTER's long-term data used to assess the distribution of soil invertebrate biodiversity and identify areas of conservation priority (D. Wall).
- US National Science Foundation Grants: NSF 1637708, "LTER: Ecosystem Response to Amplified Landscape Connectivity in the McMurdo Dry Valleys, Antarctica" and NSF 1341736 "The Role of Glacial History on the Structure and Functioning of Ecological Communities in the Shackleton Glacier Region of the Transantarctic Mountains" (B. Adams)

Major collaborations

Within SCAR

- Cooperation between D. Cowan and C. Cary, University of Waikato
- J. Xavier as member of SCAR EGBAMM producing a book on crustaceans, under the trophic interactions working group and in cooperation with AntEco SC members.
- SCAR CBET advisory Body. J. Xavier coordinated with E. Griffin et al. coordinated a fellowship scheme for education (e.g. workshops in Italy and Portugal) and capacity building (that links indirectly to some aspects of his work at the ATCM)
- SCAR Development Council addressing new avenues for funding sources with P. Convey, K. Linse and colleagues.
- ANTOS Expert Group: V. Cummings and B. Adams are on the ANTOS committee (Cummings is co-chair). Aims of ANTOS are complementary to those of AnT-ERA. AnT-ERA contributed financially to ANTOS when it was a non-expert group
- J. Gutt and G. di Prisco provide contributions to the regular (yearly, with one exception) ACCE updates.
- SCAR Standing Committee on the Antarctic Treaty System. A. Takahashi provides input into documents submitted to ATCM.
- Antarctic Environments Portal. A. Takahashi work as a Editorial Group member nominated from SCAR SC-ATS.

Outside SCAR

- I. Schloss has recently been elected as SC member of the Southern Ocean Observations System (SOOS). J. Gutt has agreed to lead a SOOS Weddell Sea /



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Droning Maud Land regional working group. Both will provide linkages between expertise in the SCAR biology communities and SOOS activities.

- D. Wall and B. Adams represent AnT-ERA interests to the US National Science Foundation
- As a lead-author of IPBES J. Gutt is in charge of selected Antarctic and Southern Ocean aspects to be covered by the IPBES Global Assessment to be published in 2019.

Outreach and Capacity Building

- AnT-ERA **webpage**, temporarily not dynamic
- **Mailing list**, frequently used for distribution of valuable information
- Expedition JR16003 blog: <http://cientistapolarjxavier.blogspot.pt/>
- III Workshop nacional de educação e ciência: da investigação polar à sala de aula. Universidade de Coimbra, 2-3 March 2018 (J. Xavier)
- Education Meets science: Bringing polar research into the classroom. III PEI Workshop, 11-14 April, Roveretto, Italy (J. Xavier)
- II Workshop nacional de educação e ciência: da investigação polar à sala de aula. Instituto de Educação, Univ. de Lisboa, 2016, J. Xavier
- J. Xavier, member of the ATCM Intersessional Contact Group on Education and Outreach; contributions to various ATCM papers: ATCM XXXIX/IP24; ATCM XXXIX/WP24; ATCM XXXIX/IP7; ATCM XXXIX/WP24
- Event to elementary school students: 'Let's become a penguin biologist'. A. Takahashi, held at the NIPR, 2017. 20 participants.
- Multiple presentations to scientific and public audiences on challenges facing the Antarctic and research programmes (V. Cummings).
- D. Wall and B. Adams: Interacted with journalists for press releases on Antarctic research (such as <https://news.mongabay.com/2018/03/climate-change-imperils-tiny-animal-in-the-worlds-most-extreme-continent/>),
- D. Wall and B. Adams co-organized, Antarctic Lecture Series, Fort Collins Library, January – June and September-December ()
- D. Wall and A. Shaw: Blog writer (2017, 2016, 2015, 2013), *Nemablog*: wrote blog posts during Antarctic field season about our team's field and lab research activities <https://nemablog.wordpress.com/2017/01/>
- B. Adams: Performed Live from Antarctica Skype outreach sessions to over 250 elementary and junior high school students, Colorado & Utah
- B. Adams: Made Classroom visits to 85 elementary school students emphasizing AnT-ERA SRP.
- B. Adams: Delivered in-service workshop for 57 science teachers in local school districts using AnT-ERA SRP examples.



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SCAR Fellowship Reviewers

First Name	Last Name	E-mail	Principal Expertise
José	Xavier	jccx@cantab.net	marine ecology, food webs, trophic interactions
Akinori	Takahashi	atak@nipr.ac.jp	marine birds and mammals
Byron	Adams	bjadams@byu.edu	evolution and ecology of terrestrial Antarctic biota
Enrique	Isla	isla@icm.csic.es	geochemistry, pelagic-benthic coupling

Membership

Leadership

Role	First Name	Last Name	Affiliation	Country	Email	Date Started	Date Term is to End
CO	Julian	Gutt	AWI/HGF	Germany	Julian.gutt@awi.de	2012	2020
SC	Lloyd	Peck	BAS	UK	lspe@bas.ac.uk	2013	2020
SC	Cinzia	Verde	IBBR	Italy	cinzia.verde@ibbr.cnr.it	2013	2020
SC	Byron	Adams	Brigham Univ.	USA	byron_adams@byu.edu	2013	2020
SC	Ian	Hogg	Polar Knowledge	Canada	ian.hogg@polar.gc.ca	2015	2020
SC	Diana	Wall	Colorado State Univ.	USA	Diana.Wall@colostate.edu	2013	2020
SC	Akinori	Takahashi	NIPR	Japan	atak@nipr.ac.jp	2013	2020
SC	Vonda	Cummings	NIWA	NZ	v.cummings@niwa.co.nz	2013	2020
SC	In-Young	Ahn	KOPRI	South Korea	iahn@kopri.re.kr	2015	2020
SC	Craig	Smith	Univ. Hawaii	USA	craigsmi@hawaii.edu	2013	2020
SC	Enrique	Isla	ICM-CSIC	Spain	isla@icm.csic.es	2013	2020
SC	Irene	Schloss	Direccion Nacional	Argentina	ireschloss@gmail.com	2013	2020
SC	Jose	Xavier	Univ. Coimbra	Portugal/UK	xavier@zoo.uc.pt	2013	2020
SC	Sieglinde	Ott	Univ. Düsseldorf	Germany	otts@uni-duesseldorf.de	2015	2020

* Early Career Scientists



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Other members

First Name	Last Name	Affiliation	Country	Email
Thomas	Bracegirdle	BAS	UK	tjbra@bas.ac.uk
*Monika	Kedra	Inst. of Oceanology	Poland	kedra@iopan.gda.pl
Don	Cowan	Univ. Pretoria	South Africa	Don.cowan@up.ac.za
Eugene	Murphy	BAS	UK	ejmu@bas.ac.uk
Guido	di Prisco	IBBR, Napoli	Italy	guido.diprisco@ibbr.cnr.it
*Coleen	Suckling	Bangor Univ. APECS	UK	coleenclaire@yahoo.co.uk
*Trevor	McIntyre	Univ. Pretoria	South Africa	tmcintyre@zoology.up.ac.za

*Early Career Scientists

Requests to the Secretariat - No requests