



# Canadian Antarctic Research Network

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## Loquacious Weddell Seals

Jack Terhune

In collaboration with Harry Burton and others at the Australian Antarctic Division, my students and I have been studying Weddell seal in-air and underwater vocalizations since 1990. To date, we have conducted four summer field seasons at Davis and two students overwintered at Mawson in different years. The recordings have been used as raw data for six undergraduate Honours theses. The research costs were supported by NSERC grants and the Australian Antarctic Division provided full field support.

Weddell seals make more kinds of sounds than any other pinniped. During the winter and spring, they can be heard by humans through the 2 m thick sea ice. Using underwater microphones (hydrophones), a myriad of quieter calls can also be recorded. Individual call types, colloquially described as trills, tones, mews, whistles, chirps, chugs, grunts, roars, knocks, clicks etc., often merge into each other making classification difficult. Some calls last for over a minute and are extremely loud.

Weddell seals resting on the ice will often close their mouth, pinch their nostrils shut and make many of the underwater calls. Some seals also vocalize when they are dreaming. This is advantageous because we can determine which call types are made by each sex. So far one call type, a trill, has only been linked to males; the other common call types are made by both males and females.

Males make very loud trills; pure tones or frequency modulated whistles that start out at a high frequency (often above 20 kHz) and drop down to as low as 80 Hz. These calls have a theoretical detection range of over 25 km if the water is deep and covered by sea ice. The males use trills to defend breathing holes during the winter and breeding territories in the spring. Are they trying to attract distant females or just intimidate nearby competitors?



The majority of the calls are made between 10 and 40 m deep. By diving well under the sea ice the seals will avoid transmission interference associated with the undersurface of the ice. The relatively shallow calling depth suggests that most of the social interactions occur near the surface. During the winter at Mawson, a number of seals would often share breathing holes in the fast ice. Many seals made high pitched whistles as they came up to the hole. Perhaps this was to notify seals at the surface of their intention to come up and breathe, so please make way!

The shallow calling depth also suggests that during daylight many of the seals will be able to see the intended receiver of their call. At night the situation is not as well understood. During the winter, the calling rates were highest about an hour before the onset of dawn and an hour after the end of dusk. Calling rates at these times were as high as during the height of the breeding season. We do not understand why these high calling rates would occur in June and July, so far before the breeding season.

The maximum calling depth in deep water off Mawson was 126 m. The calls are produced in the larynx and do not change with depth. This suggests that a listener could

not determine how deep a seal was by its call. Another feature of the call is that it is broadcast in a very directional manner, beaming downward and forward from the throat. This should give the seals an opportunity to direct their calls towards specific listeners and could tie in with the ability to see them near the surface during daylight.

Weddell seals exhibit a pronounced site fidelity to the area near where they were born. This has led to the formation of “dialects”. The seals at Mawson, Davis, Casey, McMurdo Sound and the Weddell Sea all exhibit a few different call types and different usage patterns. These differences suggest that some aspects of the calls are learned and that the seal groups are not interbreeding.

Many of the calls have multiple elements and up to seven rhythm patterns. While some calls are simply repeats of the same sound in a regular manner, others will drop in pitch, become longer and more widely spaced as the call progresses. The predictability of the call will enhance the listener’s ability to detect it if ice noises or other seal calls are occurring at the same time. The structures of many calls have features that will reduce the likelihood of them masking each other. The seals space the timing and/or pitch of their calls so that they do not overlap each other. Like king penguins calling for their mates, Weddell seals seldom call at the same time or pitch when a neighbour is calling. Even when competing for mates, the males call in such a way that a listener could hear the caller and other callers at the same time.

One major problem with studying underwater Weddell seal vocal behaviours is that we usually cannot see the seals that are making the calls or the behavioural situation that is occurring. By eavesdropping, we can gain some information about where the seals are and perhaps what they are doing. For example, during the winter the seals do not vocalize very much between dawn and dusk, a time when they are likely feeding.

In the future, by pairing underwater recording techniques with underwater video and on-ice observations, we hope to learn more about the behaviour of Weddell seals in the winter and further develop vocalization monitoring as a natural tag to enable examination of aspects of their behaviour, distribution and possibly under-ice numbers.

Dr. Jack Terhune is Director of the Centre for Coastal Studies and Aquaculture at the University of New Brunswick in Saint John, New Brunswick (terhune@unbsj.ca).

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## Field Work at McMurdo Station, Antarctica, October–December 2004

Kathy Conlan

This was the last of a three-year National Science Foundation grant to determine whether McMurdo Station's installation of secondary sewage treatment in 2003 had improved waste-water quality sufficiently to restore the natural community of marine life to the station's coast. McMurdo Station had been dumping raw sewage for 48 years and about 1 km of the coast along the station front had been impacted. Preliminary results indicate that the community of bottom-living marine life, which consists of a diversity of clams, snails, worms, crustaceans, and starfish, is beginning to recover, but progress will be slow. The six team members wrote daily journals on <http://aspire.mlml.calstate.edu>, chronicling the challenges of dealing with 6 m thick ice to dive through and the near pitch-black conditions under the ice. Students from several US schools e-mailed questions and one student interviewed Kathy about life at the museum and her career choices. A teacher accompanied the team

for part of the season and involved her science classes in the day-to-day work. Kathy will identify the samples in the lab, looking for patterns of change, and present the results at the SCAR International Biology Symposium in Brazil this July.

Dr. Kathleen Conlan is a research scientist with the Canadian Museum of Nature in Ottawa (kconlan@mus-nature.ca).



Kathy Conlan preparing to dive at Cape Chocolate.

## Frozen Dunes: an Indicator of Climatic Variability, McMurdo Dry Valleys

John F. Orwin

This past austral summer, I was lucky enough to join Hamish McGowan (University of Queensland, Australia) in his project looking at geomorphic evidence for climatic variability in the Victoria Valley. The main objective of this project is to shed new light on local, regional and synoptic-scale atmospheric processes and their variability in the Dry Val-



leys/Ross Sea region. Previous research has indicated that this area is likely sensitive to low-amplitude climatic shifts. If so, then landforms in the Dry Valleys may preserve evidence for these shifts. Hence the focus of this project is the extensive barchan sand-dune system immediately down valley of the Packard Glacier in the lower Victoria Valley.

Changes over time in the orientation of the Victoria Valley sand-dune crests may be a response to climatic shifts. Repeat survey measurements of the sand-dune crests and morphology over the last three years will allow us to assess the rate of morphological change in the sand-dune system and what may be driving any changes. This data, along with weather pattern analysis, should result in identification of

any climate-driven morphological changes. Field methods included repeat surveys of the dune crests and stoss- and lee-slope transects and high-frequency ground-level weather-pattern monitoring. A transect of six Hobo weather stations was also established across the Victoria Valley floor and up to 600 m a.s.l. on the valley walls. A radiosonde, attached to a kite, was used to make repeat, high-level (up to 800 m), weather observations above the dune field. Analyses of these data are currently underway.

A secondary objective of the project was to determine the influence of extreme cold temperatures and snow and ice on sand-transport patterns. Field-based methods included sand traps on different dune and valley surfaces, repeat temperature measurements over different substrates, and high-frequency sand-transport measurements using a Sensit grain counter. Finally, a pilot study of fluvial sediment transport in the Packard Glacier proglacial stream was completed. The main objective here was to assess links between the timing of fluvial-sediment transfer and weather-pattern oscillations. An infra-red turbidimeter installed in the proglacial stream immediately downstream of the Packard Glacier provided turbidity measurements at a 10 second frequency over a seven-day period. Electrical conductivity and discharge were also measured. Collected sediment samples will be used to calibrate the turbidimeter output and also for grain-size analysis.

Ultimately, the results of this project may be useful for interpreting other Pleistocene 'sand-covers', *e.g.* in northern Europe and Canada, as well as Martian aeolian dune systems.

Dr. John Orwin is a Postdoctoral Fellow working with Prof. John Clague in the Department of Earth Sciences at Simon Fraser University, Burnaby, B.C. (jorwin@sfu.ca).

## Glacimarine Sedimentology of the Antarctic Peninsula

Robert Gilbert

The Antarctic Peninsula is undergoing rapid environmental change. Air temperature has warmed 3–11°C during the past several decades and ice shelves on both sides of the Peninsula have collapsed catastrophically in response. Since 1997, Robert Gilbert and his students at Queen's University have participated in NSF- and NSERC-funded research on glacimarine sedimentology around the Peninsula, at the invitation of American colleagues Eugene Domack, Amy Leventer and others. Our work from USAP research vessels *NB Palmer* and *LM Gould* (Fig. 1) has been directed to assessing these remarkable recent environmental responses and to understanding the long-term record of glaciation and climate change in the region.

In 1997, Master's student Åsa Chong deployed sediment traps at the front of Müller Ice Shelf, in Lallemand Fjord on the west side of the Peninsula. Recovered almost one year later, they provided a detailed record of physical and biological sedimentary processes at this retreating ice shelf which can be linked to the long-term record of cores

recovered from the region (Chong, 2000; Gilbert *et al.*, 2003). The other principal finding of that work was that, unlike Arctic fiords, some of the Antarctic fiords have greater sediment accumulation near their mouths associated with interaction with the ocean beyond and the extremely low sediment input at the head (Gilbert, 2000; Harris *et al.*, 1999).

Between 2000 and 2005, five cruises to the Antarctic Peninsula have been directed mainly to understanding the Larsen Ice Shelf and the changes it has undergone, especially since the mid-1990s (Domack *et al.*, 2001). Field operations included swath bathymetric mapping, coring (Fig. 2) and assessment of physical oceanography.

In 2000, we studied Greenpeace Trough and Prince Gustav Strait beneath the former Larsen A Ice Shelf, documenting some of the glaciation history in the region and similarities to landscapes created by the Laurentide glaciation in North America (Brachfeld *et al.*, 2003; Camberlenghi

Figure 1  
*LM Gould* at Deception Island 2003.





Figure 2  
Kasten core on deck before being taken to the on-board laboratory for analysis.

*et al.*, 2001; Gilbert *et al.*, 2004). In 2002, we extended the studies southward to the region of the Larsen B Ice Shelf very shortly before its catastrophic collapse. Precise surface coring allowed us to document the signal of the early phases of the break-up of the ice shelf (Gilbert and Domack, 2003) and to assess that the Larsen A was probably absent for much of the Holocene, whereas the Larsen B has persisted at least since the Last Glacial Maximum, and probably much longer.

Work in 2003, under the direction of Glenn Berger, Arizona State University, focused on improving the dating of glacial marine sediments. Queen's University post-doctoral fellow, Randy Dirszowsky (now of Laurentian University),

studied the provenance of sediments based on geochemical techniques. His results are being prepared for publication.

Severe weather and ice conditions in 2004 prevented the primary objectives from being met. However an active submarine volcano was discovered in Antarctic Sound, at the tip of the Peninsula, that generated considerable media attention.

The 2005 cruise was much more successful in that open water permitted research to be conducted deep in the embayments of both Larsen A and B ice shelves. Queen's Master's student Heather Tompkins, helped deploy sediment traps at critical places along the front of the residual ice shelf so we can assess the nature of the sedimentary processes there.

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Dr. Robert Gilbert is Professor of Geography at Queen's University, Kingston, Ontario (gilbert@lake.geog.queensu.ca).



## SCAR XXVIII Delegate's Report

Steven C. Bigras

The XXVIII meeting of the Scientific Committee on Antarctic Research (SCAR) Delegates was held in Bremerhaven, Germany, 4–8 October 2004. This was to be the first meeting of the Delegates under the newly restructured and revitalized SCAR. The President, J. Thiede, welcomed SCAR Delegates from 25 nations and stressed the importance of international collaboration in polar research. He also introduced the new Executive Director of SCAR, Dr. Colin Summerhayes.

The meeting began with applications from Switzerland for Full Membership and from Malaysia for Associate Membership in SCAR. Following a brief presentation and discussion both were accepted. The Czech Republic, which is also interested in becoming an Associate Member, sent representatives who then gave a short presentation. Delegates encouraged them to make a formal submission for consideration at the XXIX SCAR meeting in Hobart, Australia.

Two serving Vice-Presidents, Prof. Chris G. Rapley, British Antarctic Survey (U.K.) and Dr. Roland Schlich, École et Observatoire des Sciences de la Terre (France) have completed their terms of office. Dr. Mahlan (Chuck) Kennicutt, II, Office of the Vice President of Research, Texas A&M University (U.S.A.) and Dr. Hideki Shimamura, National Institute of Polar Research (Japan) were elected as Vice-Presidents for the period 2004–2008.

A key feature of the restructuring was the separation of the SCAR Delegates meeting from the SCAR Scientific Standing Groups (SSG) and subgroups. This allowed delegates sufficient time to review and reflect on the scientific proposals and recommendations put forward by the SSGs and Standing Committees.

At the SCAR XXVIII meeting, the three overarching SSGs (life sciences, physical sciences, and geosciences) submitted five Scientific Research Program (SRP) proposals:

Antarctic Climate Evolution; Antarctica and the Global Climate System; Evolution and Biodiversity in the Antarctic; Interhemispheric Conjugacy Effects in Solar- Terrestrial and Aeronomy Research (ICESTAR); and Subglacial Antarctic Lake Environments (SALE). Information on each was posted on the SCAR web site in advance of the Delegates meeting. The five SRPs had been in various stages of development over several SCAR meetings and seem to have all coalesced during the SCAR XXVIII Meeting and Open Science Conference held in July in Bremen, Germany. When they were discussed at the Delegates meetings, all five were well received and supported. They encapsulated the SCAR long-term vision and elucidated the pivotal roles Antarctica and the Southern Ocean play in the Earth system. These five SRPs will now become the flagship research programs for SCAR for the foreseeable future and will take SCAR into the International Polar Year 2007–2208.

Change, particularly the dramatic changes that SCAR has gone through over these last few years, is never easy or cheap. Restructuring, hiring an Executive Director, and providing adequate support to SCAR's new science programs, have a price. The national committees and the national funding agencies will have to consider how they will deal with an increase in SCAR's annual dues of 30%.

Considerable progress has been made since the restructuring document was tabled at the XXV SCAR Meeting in Chile. It is important that SCAR continue in its pursuit to become more responsive and effective. The SCAR Strategic Plan 2004–2010 will help SCAR stay the course, by developing strategies and plans for data and information management, education, outreach and communication, and by helping developing countries enhance their scientific capacity.

Arrangements for XXIX SCAR are well underway. The SCAR Science week, including the 2nd Open Science Conference and COMNAP XVIII, will be held in Hobart, Tasmania, 9–15 July 2006. Given the high cost of travel, serious consideration is being given to holding the Delegates Meeting back-to-back with the Science Week in Hobart. We wish the SCAR Executive continued success, and look forward to the SCAR XXIX Meetings in Australia.

Steven Bigras is Executive Director of the Canadian Polar Commission and Canada's Permanent Delegate to SCAR (bigras@polarcom.gc.ca).

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## **SCAR Life Sciences Standing Scientific Group (LSSSG)**

**Report of the meeting at SCAR XXVIII,  
25–31 July 2004, Bremen, Germany**

**Kathleen Conlan**

The Life Sciences Standing Scientific Group (LSSSG) advises the Scientific Committee on Antarctic Research (SCAR) on matters dealing with the life sciences, and reviews and develops new programs of international research in Antarctica. A new component of the biannual SCAR meeting was a three-day Open Science Conference consisting of keynote speakers and submitted papers. This was attended by over 1000 participants and enabled interaction among the diverse scientific disciplines that Antarctic research covers. Twenty countries were represented at the LSSSG meeting chaired by Dr. Steve Chown (South Africa) (Chief Officer), with Dr. Guido di Prisco (Italy) (Deputy Chief Officer), Dr. Larry Palinkas (USA) (Deputy Chief Officer) and Dr. Ad Huiskes (Secretary). Subjects discussed were:

(1) Environmental: impact of marine acoustics, bio-prospecting, Specially Protected Species and Specially Managed Areas, State of the Antarctic Environment, and Antarctic Conservation in the 21st Century;

- (2) Expert Group reports: Human Biology and Medicine, Seals, Bird Biology;
- (3) Action Group reports: Biological Monitoring, Subglacial Antarctic Lake Exploration;
- (4) Proposed new Scientific Programs: Evolution and Biodiversity in Antarctica, Antarctic Climate Evolution;
- (5) Existing Scientific Programs: EASIZ, RiSCC, EVOLANTA;
- (6) CCAMLR observer report;
- (7) Upcoming 9th SCAR Biology Symposium: Curitiba, Brazil, 25–29 July 2005;
- (8) Other meetings in the intersessional period 2004–2006;
- (9) Highlights of National Research Programs;
- (10) Plans for the International Polar Year (IPY), 2007–2009).

Highlights that may be of relevance to Canadian scientists in Life Sciences follow. For more information, the full reports, with contacts, can be found on the LSSSG website at [nioo.knaw.nl/projects/scarlsssg/](http://nioo.knaw.nl/projects/scarlsssg/).



### **Proposed new SCAR research program: Evolution and Biodiversity in Antarctica: the response of life to change (EBA)**

This is a proposed research program under the LSSSG which will explore the evolutionary history of selected modern Antarctic biota (marine, freshwater and terrestrial), examine how biological diversity in Antarctica influences the ways in which present-day ecosystems function, and thereby predict how the biota may respond to future environmental change. If approved, there will be a planning workshop at the next SCAR Biology Symposium (see below) and it will run from 2006 to 2013.

### **International Polar Year (IPY)**

The concept of the International Polar Year is of a time-limited international initiative comprising coordinated, interdisciplinary scientific research and observations in the Earth's polar regions. The official period of the IPY is March 2007 to March 2009 in order to enable two summer and winter field seasons in both the Arctic and Antarctic. The IPY Outline Science Plan is presented on [ipy.org](http://ipy.org). The LSSSG has proposed that its IPY project be a coordinated Circum-Antarctic Census of Marine Life. This will be a part of the international Census of Marine Life ([coml.org/coml.htm](http://coml.org/coml.htm)), a 10 year program to explore the Earth's oceans, and to assess and explain changes in its biological diversity, and the distributions and abundance of marine life.

### **Biological Indicators of Human Impacts in Antarctica**

A workshop is being planned for March–April 2005 at Texas A&M University, College Station, Texas, to consider biological indicators of human impacts that can be appropriately applied in the Antarctic setting, to assess their available history and data, to consider the value of keystone species and other biological monitoring protocols and to develop recommendations for biological monitoring.

### **Subglacial Antarctic Lake Exploration (SALE)**

One hundred and forty-seven subglacial lakes have now been identified in Antarctica. This program to explore subglacial lakes has been approved by SCAR for 2005–2013. Information on the program is available at <http://salegos-scar.montana.edu/>.

### **9th SCAR Biology Symposium**

The LSSSG hosts a biology symposium every four years. The 9th SCAR Biology Symposium will be in Curitiba, Brazil 25–29 July 2005. Its theme is “Evolution and Biodiversity in Antarctica”. Pre-symposium workshops will also be held for existing and planned LSSSG programs and will provide Canadian scientists with excellent opportunities to establish collaborations with scientists of other nations.

### **SCAR XXIX and Open Science Conference**

The next SCAR meeting is proposed for Hobart, Tasmania in July 2006. There will be an Open Science Conference similar to the three-day conference held this year. This will give Canadian scientists a valuable opportunity to attend an interdisciplinary, cross-science Antarctic meeting, as well as to meet SCAR delegates and Standing Scientific Group members.

### **New Executive for the LSSSG**

Dr. Steve Chown resigned following the meeting. Dr. Ad Huiskes (Netherlands) was elected president and Dr. Kathleen Conlan (Canada) secretary.

Dr. Kathy Conlan is a research scientist with the Canadian Museum of Nature in Ottawa ([kconlan@mus-nature.ca](mailto:kconlan@mus-nature.ca)).

## **SCAR Life Sciences Standing Scientific Group (LSSSG) Expert Group on Human Biology and Medicine Activities during SCAR XXVIII, Bremen, 25–30 July 2004**

**Peter Suedfeld**

What follows is a summary of some of the elements described in the report on the above group.

In the physiological area studies continue into cold adaptation, immune responses to isolation and the effects of life at altitude; also into human circadian rhythms, bone metabolism, and the effects of light, for which the Antarctic provides unique opportunities.

The Selection of Antarctic Personnel (SOAP) study, investigating how well psychometric testing predicts the suitability of candidates for Antarctic service, is nearing the end of data collection. Full results will be available next year. The Antarctic is considered as an analogue for space, in terms of human adaptation to isolated and confined environments.

Most Antarctic medical research is applied, designed to inform and promote the most effective healthcare. Projects range from investigations into e-health (telemedicine), through investigations of drug stability and efficacy in frozen environments, to investigation of the effects of UV radiation.

Although informed consent is critical, there are some observational and retrospective studies where individual informed consent is impossible. Appropriate measures must be taken to comply with statutory obligations and no identifiable individual data should be published. An information sheet for investigators to use in their ethics committee applications will be developed ([medicalantarctica.org](http://medicalantarctica.org)).

Plans of the Operational Medicine Subgroup include: preparation and dissemination of standards guidelines; a medical facility database format; baseline staffing and medical skills for medical personnel; medevac standards; a medical event database; and sharing of medical aspects of major incident plans.

The Psychology Subgroup is looking at selection and screening procedures to see how results from a standardized battery of tests compare with the actual selection of a non-screening national program: actual and predicted performances were compared. The study will be based on approx 400 datasets. No one knows what makes a perfect Antarctic Group; it may be different from astronaut requirements.

A multi-investigator study with social, cultural, psychology, anthropology and ethnology elements is taking place with eight French and eight Italians wintering-over at Concordia.

The EG proposed exploring areas where cooperation with others within the LSSSG would be of benefit. For example, little is known about the microbiological flora of seal mouths, yet seal finger is relatively common and seal bites are difficult to treat. It has the expertise to investigate this, but needs samples. Similarly, Ixodes ticks exist in southern bird populations, but the risk of transmission of Lyme disease to those who work with them is unknown. Conversely, is the shedding of viruses (such as CMV), known to increase in the Antarctic human population, likely to affect indigenous animals? The EG wants any interested members of LSSSG to contact its executive.

A study entitled “Taking the Polar Pulse – Human Biology and Medicine Research” was proposed for the International Polar Year. It would consider what physiological, psychosocial and clinical changes occur in humans interacting with the extreme Antarctica environment: whether the changes are comparable to those experienced in Arctic populations; how any of their adverse effects might best be prevented and treated; how the resulting understanding might enable us to improve healthcare, health and wellbeing of humans in the polar regions, at altitude, in space and other extreme environments, and in mankind in general.

It was recommended that the EG on Human Biology and Medicine, that reports to SCAR through the LSSSG, and MEDINET, which reports to COMNAP through COMED, should be merged, but continue to report to the two groups.

Dr. Peter Suedfeld is Emeritus Professor of Psychology at the University of British Columbia and a member of the SCAR Expert Group for Human Biology and Medicine and its Psychology Subgroup (psuedfeld@psych.ubc.ca).

## Some Recent Canadian Contributions to Antarctic and Bipolar Science

(Names of Canadian authors are underlined)

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## Antarctic Data Management and Geographic Information

Peter L. Pulsifer

### Joint Committee on Antarctic Data Management

As Canadian representative to the Joint Committee on Antarctic Data Management (JCADM), the author attended JCADM 8 in Bremen, Germany, 29–30 July 2004. Fifteen nations were represented, with seven others sending regrets. Key areas developed at the meeting included: communication and outreach to the Antarctic science community; expansion of the Antarctic Master Directory to increase holdings in the Earth, Life and Ocean Science information domains ([http://gcmd.gsfc.nasa.gov/Data/portal\\_index.html](http://gcmd.gsfc.nasa.gov/Data/portal_index.html)); and strategies to increase the number of datasets available to scientists directly over the Internet. The full meeting report can be found at [jcadm.scar.org/Reports/jcadm8/jcadm\\_8\\_report.doc](http://jcadm.scar.org/Reports/jcadm8/jcadm_8_report.doc). Subsequently, JCADM supported the development of a draft data-management plan for

the International Polar Year. A meeting reviewing JCADM activities will take place at the Royal Netherlands Institute for Sea Research, 31 March – 1 April 2005. The review will establish how JCADM can meet scientific requirements for data and information and advise on what it should be doing in the future.

### Antarctic Geographic Information

The Cybercartographic Atlas of Antarctica Project, with the Mapping and Geographic Information Centre of the British Antarctic Survey, co-organized a workshop in Cambridge, 29 November – 3 December 2004. Attendees further developed the SCAR Feature Catalogue, which provides a detailed description of the nature and the structure of spatial data. This SCAR Feature Catalogue is being developed as part of SCAR's Spatial Data Standards project of the Expert Group on Geographic Information. The project is led by Australia ([aad.gov.au/default.asp?casid=14645](http://aad.gov.au/default.asp?casid=14645)).

The workshop further developed an Internet service that will allow the Antarctic community to access digital topographic base information more easily. It will support access using tools ranging from a common Web browser to more sophisticated Geographic Information Systems.

On 7–8 March, the U.S. Geological Survey hosted a Workshop on Geospatial Solutions for Antarctic Research. Talks focused on the production, management and use of geospatial information in Antarctic Science. Peter Pulsifer made a presentation on the Cybercartographic Atlas of Antarctica; details can be found at: [http://usarc.usgs.gov/geo\\_info\\_conf/](http://usarc.usgs.gov/geo_info_conf/).

Peter L. Pulsifer, Deputy Chief Officer of SCAR's JCADM, is with the Geomatics and Cartographic Research Centre, Department of Geography and Environmental Studies, Carleton University, Ottawa ([pulsifer@magma.ca](mailto:pulsifer@magma.ca)).

### CCAR News

The Canadian Polar Commission is pleased to announce that **Prof. Martin Sharp, University of Alberta**, has been appointed a member of the CCAR and **Prof. Wayne Pollard** has been re-appointed as Chair: both for three-year terms.

CCAR thanks its Secretary, **Dr. Olav Loken**, for his outstanding services to this Newsletter both as a contributor and Editor. In February 2005, **Simon Ommanney** was appointed Editor. Simon recently retired after 10 years as Secretary General of the International Glaciological Society. Prior to that, he worked for Environment Canada for 27 years, including two years as Director of the Scientific Information Division of the Hydrology Research Institute in Saskatoon.

## King Penguins in the Crozet Archipelago

Steeve D. Côté

Our work on king penguins in the Crozet Archipelago, an eight-year collaboration with the Centre National de la Recherche Scientifique in Strasbourg, France, is on the energetics of their reproductive behaviour, particularly territorial behaviour and aggressiveness. Vanessa Viera, a student co-directed by René Groscolas (CNRS, Strasbourg) and me, is using heart-rate transmitters to estimate the energetic expenses of breeding king penguins according to their territorial position, timing in breeding (*i.e.* early *vs.* late breeders), and incubation *vs.* brooding stage, etc. She is also looking at the interactions between aggressiveness and reproductive success, and individual quality.

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Dr. Steeve Côté is Associate Professor of Biology at Laval University, Sainte-Foy, P.Q. (steeve.cote@bio.ulaval.ca).

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## Human-Induced Change in the Antarctic Circumpolar Current

Oleg Saenko

In a forthcoming note in the *Journal of Climate*, John Fyfe and I show that the Antarctic Circumpolar Current (ACC), the strongest ocean current, is shifting southward and accelerating in response to changes in the atmospheric circulation around Antarctica. This is associated with the ongoing release of greenhouse gases to the atmosphere from human activities. We used a climate model, developed at the Canadian Centre for Climate Modelling and Analysis, as well as a simple theory, to predict that the shift of the ACC will continue, reaching several degrees by the end of the 21st century. This may have far-reaching consequences for global ocean circulation and climate, since the ACC connects all three major ocean basins.

The Southern Ocean, besides being a region of intense interaction between the ocean and the atmosphere, is also the region of bottom-water formation, which fills some 50% of the ocean volume. Any change in the position of major oceanic frontal zones around Antarctica could have important consequences for both the local and global climate and needs to be understood.

Dr. Oleg Saenko is a research scientist with the Canadian Centre for Climate Modelling and Analysis, Meteorological Service of Canada, University of Victoria, Victoria, B.C. (oleg.saenko@ec.gc.ca).

## Canada and the Catch Documentation Scheme (CDS)

Chantal Lamadeleine

To protect the integrity of the ecosystems of the seas, and to help prevent, deter and eliminate illegal, unreported and unregulated fishing, Canada will be requiring importers and exporters of Patagonian toothfish (*Dissostichus eleginoides*) and Antarctic toothfish (*Dissostichus Mawsoni*) to submit, to the Department of Fisheries and Oceans, a catch document as of 1 April 2005.

Canada will report to the CCAMLR Secretariat on

landings and transshipments in ports in accordance with the required format. Requirement of the CDS will contribute significantly to Canada's strategy to combat over-fishing and IUU fishing.

For additional information contact: Chantal Lamadeleine, Pacific Fisheries and Special Species, International Affairs, Fisheries and Oceans Canada (Lamadelc@dfo-mpo.gc.ca).

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## Antarctic Research Opportunities

Olav Loken

As seen in Steven Bigras' report on the SCAR XXVIII Delegates meeting, SCAR has established five new Scientific Research Programs (SRPs), each lasting 5–10 years. These SRPs will be SCAR's flagship research programs from now until well after the end of the IPY. The SRPs are:

- Antarctic Climate Evolution (ACE)
- Subglacial Antarctic Lake Environments (SALE)
- Evolution and Biodiversity in the Antarctic (EBA)
- Antarctica and the Global Climate System (AGCS), and
- Interhemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research (ICESTAR).

The broad outlines of the SRPs are posted on the SCAR web site ([scar.org/researchgroups](http://scar.org/researchgroups)).

As the first step in the detailed planning, the national SCAR committees (CCAR here in Canada) have recently been asked to solicit the science community in their respective countries and to inform SCAR about how they would like to participate in the SRPs. SCAR also wants to know who will be the national point of contact for each of the five programs.

The SRPs offer Canadian scientists challenging and exciting opportunities to join first class international teams of scientists in planning, and later in conducting, leading-edge polar science relevant to Canada. If you have ideas you would like to pursue under the rubric of any of the SRPs, **please let the CCAR Secretariat know** (<mailto:oloken@sympatico.ca>) as soon as possible. Now is the time to get involved!

Note that now the focus is on planning details of the various science projects, and so you just need scientific interest to participate. The issue of obtaining resources to conduct the science project will only arise when the science plan is finalized.

Dr. Olav Loken is Secretary of the Canadian Committee for Antarctic Research ([oloken@sympatico.ca](mailto:oloken@sympatico.ca)).



## Chair's Message

W. Pollard

On behalf of CCAR and the Canadian Antarctic science community I would like to express sincere appreciation to Olav Loken for several years of outstanding service as the editor of the CARN Newsletter. I also wish to welcome Simon Ommanney as the new editor. Simon's wealth of international polar science experience will be a valuable addition to the CCAR team. Simon, welcome aboard.

The International Polar Year – or IPY as it is better known – will focus the attention of the world's science community on the polar regions for two years of intensive study (2007 and 2008) and, in some cases, several years of follow-up activity. IPY has significant implications for Canada as a polar nation, but will Canada be ready? This is not an easy question to answer because it involves not only the Canadian science community, science infrastructure, funding and logistical resources, but also Canada's northern regions including communities, commercial and charter transportation services, and licensing and permitting agencies. If the current situation is any indication, the answer is no. For example, Canadian scientists working in the Arctic struggle with a system choked by bureaucracy, high costs, uneven to non-existent science infrastructure, and sometimes unsupportive northerners. At the same time, Canadian researchers working in the Antarctic (most of whom also work in the Arctic) must rely on foreign programs for logistics and support. IPY is a rare opportunity for Canada to expand and showcase its polar expertise and technology, rebuild a failing logistics base, develop international partnerships, establish a national Antarctic presence, and provide opportunities for northern communities to benefit from high levels of research activity and international traffic. However, in all likelihood this opportunity will pass us by while other non-polar countries like the UK, Germany, Japan and Italy surge past us in their polar science capacity. Furthermore, if the status quo persists there is a real possibility that IPY could be an international embarrassment for Canada.

A problem that threatens Canada's polar science credibility is the fact that to many Canadians, including scientists and politicians, the term polar is synonymous with northern. Whether a function of our extensive northern geography or the fear that Antarctic science will subtract from existing support for northern science, these people believe that Canada should focus its polar science energies only on its north. This philosophy is parochial and scientifically unsound. Canada will benefit enormously from a more balanced approach to polar science that involves scientific studies in both polar regions. Recognition that the environment of any place on Earth, including Canada's north, is affected by interconnected global systems and cycles is the basis of the Earth system science paradigm that underlies all global change scenarios. It is well known that the polar regions are key drivers of global systems. By limiting our scientific research to northern Canada we run the risk of developing a myopic and incomplete understanding of the scientific issues that affect Canada and Canada's north as well as missing the opportunity to participate in large-scale international science programs.

The international and bipolar emphasis of IPY offers a unique opportunity to launch a Canadian Antarctic research program as well as developing partnerships with Antarctic nations interested in Arctic comparisons. With a narrow window of opportunity to prepare and launch IPY research initiatives, many of which are international and bipolar in nature, the failure to secure federal funding in the 2005 budget is a serious setback because existing funding sources are incapable of meeting the increased demand without an infusion of new money from the federal government. The national IPY steering committee presented a plan to Mr Martin's government and a request to Treasury Board early this year. A commitment of funding at the federal level is needed to be able to proceed with Canadian IPY activities and allow Canada to be able to hold its head up in the international research community.

## News in Brief

**Prof. Martin Sharp (University of Alberta)** and **Dr. Laurence Gray (Canada Centre for Remote Sensing)** represented the Canadian glaciological community at an Integrated Global Observing System (IGOS) Cryosphere Workshop in Kananaskis at the beginning of March 2005. The objective of the Workshop was to identify the major issues and needs for cryospheric information, and to begin the process of developing an IGOS Cryosphere Theme report. This is a combined initiative of the World Climate Research Program (WCRP) Climate and Cryosphere (CliC) Project, and the Scientific Committee on Antarctic Research (SCAR). The Theme intends to create a framework for improved coordination, execution and documenting of cryospheric observations from research, long-term scientific monitoring, and operational programs. The workshop, supported by the **Canadian Space Agency**, is a key first step in the development of the Cryosphere Theme Report. It brought together representatives from research institutions and government agencies to identify major issues regarding the best use of in-situ and remote-sensing observations. Canada was well represented with expertise from the sea-ice, permafrost, snow and glaciology communities. Background on IGOS, the workshop and the Cryosphere Theme report can be obtained from: [http://stratus.ssec.wisc.edu/IGOS-cryo/workshop1/first\\_wrkshp\\_0305.html](http://stratus.ssec.wisc.edu/IGOS-cryo/workshop1/first_wrkshp_0305.html). The preparation of the report will be coordinated by Jeff Key (NOAA/NESDIS, [jkey@ssec.wisc.edu](mailto:jkey@ssec.wisc.edu)) and a preliminary writing team has been identified. Further contributions would be welcomed. If you are interested in participating please contact Jeff or any of the other people identified in the workshop participants list.■

An NSF-sponsored **Workshop on Science Opportunities for a Multi-Disciplinary Research Aircraft for Antarctic Research** was held from 27–29 September 2004 in Herndon, Virginia. More than 60 scientists, representing Antarc-

tic solid earth sciences, glaciology, physics and chemistry of the atmosphere and oceanography, attended. The goal was to: (1) identify the key Antarctic scientific questions that cannot be addressed because of limited observational capabilities; and (2) develop a strong science justification for the required new research tools.

The clear conclusion was that the communities represented do require a multi-disciplinary, instrumented, long-range research aircraft. The many different sensors and measurements identified imply an operational complexity which needs a central management and operations facility.

Five mission profiles were defined: (1) regional aerogeophysical mapping; (2) continuous mapping of sea ice over the Ross and Weddell Seas and from the Antarctic Convergence to the continent; (3) regional scale measurements of atmospheric state variables as well as cloud microphysics, radiative fluxes, and turbulent fluxes from South Pole to  $\sim 65^\circ\text{S}$ ; (4) in-transit measurements of in-situ atmospheric chemistry and up- and down-looking lidar from South Pole to coastal sites and in the deep interior; and (5) localized aerogeophysical mapping of outlet glaciers and grounding lines around the Antarctic perimeter.

The preliminary report and more information can be seen at <http://polarmet.mps.ohio-state.edu/lara/>.■

The **Canadian Secretariat for the International Polar Year (IPY)** (2007–2008) is hosted at the **University of Alberta** and works with the Canadian Polar Commission and the IPY Federal Working Group to coordinate Canada's IPY initiatives. Its role is to ensure that Canadian IPY activities address both Arctic and Antarctic regions; the latter is somewhat lacking at present. The website ([ipy-api.ca/](http://ipy-api.ca/)), with a new newsletter, provides information about Canada's IPY efforts, discussion fora, and links to the main ICSU IPY website.■

**G.A.P Adventures**, a Toronto-based adventure company, (gapadventures.com), completed its inaugural expedition to the Antarctic last March. Following purchase of one of the original ice-strengthened ships, the Linblad *Explorer*, with a capacity of 108 passengers, it has just finished a very successful season that took some 1150 visitors to Antarctica, about 15% of whom were from Canada. The company has implemented a number of environmental programs for the expeditions. These include: using new, cleaner, 4-stroke Zodiacs; planting trees to offset CO<sub>2</sub> emissions from the ship; a donation to the WWF's *Antarctic and Southern Ocean Conservation Program*; and the use of only recycled paper products on board. With the austral winter approaching, the ship is now moving north through the Amazon and will be deployed in the Arctic. After visits to Iceland and Greenland it will sail to Iqaluit and then on to Resolute Bay.■

Further to the report by **Steven Bigras** (p. 7), Dr. Colin Summerhayes, the Executive Director of the **SCAR**, has reported in more detail in a recent issue of *Eos* (86(9), 1 March 2005, p. 90) on the major reform of that organization that has just been completed. Individuals interested in participating in any of the programs described are encouraged to contact the SCAR office. Full details are available on the new and improved SCAR website (scar.org/).■

**Dr. Steven Siciliano** and his Master's student **Alexis Schafer**, **University of Saskatchewan**, spent seven weeks (November and December 2004) at the Australian Antarctic Division in Kingston, Tasmania developing soil toxicity test guidelines for a contaminated site in the Antarctic. Preliminary laboratory work was conducted on soil from Macquarie Island to determine the toxicity of Special Antarctic Blend

(SAB) fuel to soil bacteria. The soil toxicity test will be applied to an existing SAB fuel spill at Casey station, Wilkes Land, Antarctica in the austral summer of 2005–2006.■

**Dr. Eric Blake (Icefield Instruments Inc.)** advises that three of the company's drills are currently deployed in Antarctica (one with the Australians and two with the Americans), as well as an unknown number of radar transmitters and at least one ice-core electrical conductivity meter (ECM) unit being used by the British Antarctic Survey.■

Argentine, British, French, Japanese, Italian and Uruguayan Antarctic biomedical organizations have agreed to carry out a psychological research project to explore the mood, coping strategies and subjective health of Antarctic wintering teams. The **Antarctic Multinational Psychological Research Project** requires expeditioners to administer PANAS, COPE and SHC (Subjective Health Complaints) three times during the winter (at the beginning, middle and end of the campaign). The questionnaires are short with no right or wrong answers. [psy.miami.edu/faculty/ccarver/sciCOPEf.html](http://psy.miami.edu/faculty/ccarver/sciCOPEf.html) has more information. Although the data will belong to the originating organization, the aim is to agree a common use for multicultural purposes and common statistical processing.■

**The Environment and Sustainable Development Relations Division of Foreign Affairs Canada** will be one of the organizations working on behalf of Canada at the Antarctic Treaty Consultative Meeting in Stockholm from 6–17 June 2005. This office has also been one of those involved during the first year that permits have been issued for Canadians visiting the Antarctic, e.g. to companies conducting tours there.■

The **Antarctic Treaty Secretariat** began operations on 1 September 2004 from offices in Buenos Aires, Argentina. The new website ([ats.org.ar/](http://ats.org.ar/)) contains information on Treaty membership, Treaty documents and related agreements, documentation on inspections, as well as details on requirements for the exchange of information, on the Committee for Environmental Protection (CEP), and a useful selection of links.■

**Dr. Laurence Gray (Canada Centre for Remote Sensing)** has just published a paper in *Geophysical Research Letters* (doi:10.1029/2004GL021387) describing how RADARSAT data from the 1997 Antarctic Mapping Mission have been used interferometrically to solve for three-dimensional surface ice motion in the interior of the West Antarctic ice sheet. It appears that the transient movement of pockets of subglacial water may be causing vertical surface displacements in the Kamb and Bindschadler Ice Streams. The Canadian RADARSAT may well prove to be an invaluable tool in revealing the key role of water in the subglacial environment and its important influence on ice dynamics.■

## CCAR/CCRA Members and Advisers

Wayne Pollard (Chair)  
Department of Geography  
McGill University  
805 Sherbrooke Street West  
MONTRÉAL, Quebec H3A 2K6  
Tel: (514)398-4454  
Fax: (514)398-7437  
[pollard@felix.geog.mcgill.ca](mailto:pollard@felix.geog.mcgill.ca)

Kathy Conlan  
Canadian Museum of Nature  
P.O. Box 3443, Station D  
Ottawa Ontario K1P 6P4  
Tel: (613)364-4063  
Fax: (613)364-4027  
[kconlan@mus-nature.ca](mailto:kconlan@mus-nature.ca)

Serge Demers  
Institut des sciences de la mer de  
Rimouski (ISMER)  
310, allée des Ursulines, C.P. 3300  
Rimouski Québec G5L 3A1  
Tel: (418)723-1986 x 1651  
Fax: (418)724-1842  
[serge\\_demers@uqar.qc.ca](mailto:serge_demers@uqar.qc.ca)

Marianne Douglas,  
Department of Geology  
University of Toronto  
22 Russell Street  
Toronto Ontario M5S 3B1  
Tel: (416)978-3709  
Fax: (416)978-3938  
[msvd@geology.utoronto.ca](mailto:msvd@geology.utoronto.ca)

Martin Sharp  
Earth and Atmospheric Sciences  
University of Alberta  
1-26 Earth Sciences Building  
Edmonton Alberta T6G 2E3  
Tel: (780)492-4156  
Fax: (780)492-2030  
[martin.sharp@ualberta.ca](mailto:martin.sharp@ualberta.ca)

Warwick F. Vincent (Past Chair)  
Département de biologie  
Université Laval  
[warwick.vincent@bio.ulaval.ca](mailto:warwick.vincent@bio.ulaval.ca)

Fred Roots (Antarctic Adviser CPC)  
Environment Canada  
351 St. Joseph Blvd, 1st Floor  
Ottawa Ontario K1A 0H3  
Tel: (819)997-2393  
Fax: (819)997-5813  
[fred.roots@ec.gc.ca](mailto:fred.roots@ec.gc.ca)

Olav Loken (CCAR Secretary)  
1170 Bonnie Crescent  
Ottawa Ontario K2C 1Z5  
Tel: (613)225-4234  
Fax: (613)225-4234  
[oloken@sympatico.ca](mailto:oloken@sympatico.ca)



## CARN Newsletter

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Network

Editor: C. Simon L. Ommanney

Please send contributions and  
correspondence to:  
C. Simon L. Ommanney  
Editor, CARN Newsletter  
27 Glen Davis Crescent  
Toronto Ontario M4E 1X6  
Tel: (416)686-6307  
[simon.ommanney@sympatico.ca](mailto:simon.ommanney@sympatico.ca)  
[www.polarcom.gc.ca/ccarhome.htm](http://www.polarcom.gc.ca/ccarhome.htm)



