National Reporting to
Scientific Committee on Antarctic Research (SCAR)
Annual Report on National Antarctic Scientific Activities
Contributing to SCAR Programme Activities

1 January 2005 to 31 December 2005
1. **Member Country**  
Country name: Canada

2. **National SCAR Committee**  
Committee title: Canadian Committee on Antarctic Research  
Address:  
Suite 1710, Constitution Square  
360 Albert Street  
Ottawa, Ontario, K1R 7X7  
CANADA  
Telephone: 1-613-943-8605  
Fax: 1-613-943-8607  
Email: mail@polarcom.gc.ca

Contact person  
Name: Simon Ommanney  
E-mail: simon.ommanney@sympatico.ca

3. **Representatives to SCAR**  
Permanent Delegate  
Name: Steven Bigras  
E-mail: bigrass@polarcom.gc.ca

Alternate Delegate  
Name: Simon Ommanney  
E-mail: simon.ommanney@sympatico.ca

4. **Representatives to SCAR Groups**

4.1 **Geosciences**  
4.1.1 **Scientific Standing Group**  
Names: Wayne Pollard, Thomas James, Kevin Hall, Peter Pulsifer  
E-mails: pollard@geog.mcgill.ca, hall@unbc.ca, tjames@nrcan.gc.ca, pulsifer@magma.ca

4.1.2 **Action Group(s) [select from Annex 1]**  
Group(s):
4.1.3 Expert Group(s) [select from Annex 1]
Group(s): Permafrost and Periglacial Environments (2)*, Antarctic Neotectonics, Geographic Information
Names: Wayne Pollard*, Kevin Hall*, Thomas James, Peter Pulsifer
E-mails: pollard@geog.mcgill.ca, hall@unbc.ca, tjames@nrcan.gc.ca, pulsifer@magma.ca

4.1.4 Scientific Research Programme(s) [select from Annex 1]
Group(s):
Names:
E-mails:

4.2 Life Sciences
4.2.1 Scientific Standing Group
Names: Kathleen Conlan, Peter Suedfeld
E-mails: kconlan@mus-nature.ca, psuedfeld@psych.ubc.ca

4.2.2 Action Group(s) [select from Annex 1]
Group(s) Birds, Human Biology and Medicine
Names Steeve D. Côté, Peter Suedfeld
E-mail steeve.cote@bio.ulaval.ca, psuedfeld@psych.ubc.ca

4.2.3 Expert Group(s) [select from Annex 1]
Group(s)
Names
E-mails

4.2.4 Scientific Research Programme(s) [select from Annex 1]
Group(s): Evolution of Biodiversity in Antarctica
Names: Kathleen Conlan, Edward Gregorich, Andor Kiss, Steven Siciliano, Alexis Schafer
E-mails: kconlan@mus-nature.ca, gregoriche@agr.gc.ca, andor@udel.edu, siciliano@sask.usask.ca, alexis.schafer@usask.ca

4.3 Physical Sciences
4.3.1 Scientific Standing Group
Names: Laurence Gray
E-mails: laurence.gray@ccrs.nrcan.gc.ca

4.3.2 Action Group(s) [select from Annex 1]
Group(s)
Names
E-mails
4.3.3 Expert Group(s) [select from Annex 1]
Group(s): Ice Sheet Mass Balance and Sea Level
Names: Laurence Gray
E-mails: laurence.gray@ccrs.nrcan.gc.ca

4.3.4 Scientific Research Programme(s) [select from Annex 1]
Group(s)
Names
E-mails

4.4 JCADM
Name: Peter L. Pulsifer
E-mail: pulsifer@magma.ca

4.5 SCAR Database
4.5.1 NADC
Name: Peter L. Pulsifer
E-mail: pulsifer@magma.ca

4.5.2 Database
Type [e.g. Composite Gazetteeer; Geodectic Control Database; etc]
Contact name
E-mail

5. National Operating Agency
Title: n/a
Address:
Telephone:
Fax:
Email:
Director/Manager
Name
Address

6. COMNAP Representative
Name: n/a
E-mail

7. SCALOP Representative
Name: n/a
E-mail

8. Wintering Stations
Name
Location
Coordinates lat.; long.

9. Summer only Scientific Stations
Name
Location
Coordinates lat.; long.

10. Report on recent or ongoing activities relevant to SCAR groups listed in Annex 1 [Please provide scientific highlights]

(include contact name, address etc, if different from above, for each activity)

LIFE SCIENCES

Evolution of Biodiversity in Antarctica (EBA)

Kathleen Conlan (Canadian Museum of Nature) participated in a NSF-
funded 3 year study of temporal changes in the benthic community along the coast of McMurdo Station and the effects of the installation of secondary sewage treatment. Fieldwork was conducted over 2002-2004. Preliminary results have been published. (Barnes and Conlan, in press; Conlan and Kvitek, 2005, Conlan and others, 2004; Conlan, in press; Kim and others, 2005; Pawlowski and others, 2005).

Edward Gregorich (Agriculture & Agri-Food Canada, Ottawa), in collaboration with scientists from New Zealand, Canada, UK, USA, Denmark, has investigated the magnitude and effect of resources transported from external sources by wind or water (i.e., spatial subsidies) to the dry valley plant-soil systems. These are likely to significantly influence community structure, ecosystem function and responsiveness to environmental change. Experiments were conducted (starting in 2003 with measurements in 2005 and 2006) in Garwood Valley, where lake-derived resources (microbial mats and water-surface foams derived from algae and cyanobacteria) enter the soil system by aerial redistribution. The spatial variability of soil C and N amongst landscape units in the valley was quantified. In a factorial experiment, microbial mat and foam collected from the lakeshore was applied, and their effects on the soil system contrasted with treatments of simpler substrates (e.g. glucose and NH4Cl). Soil respiration response to substrate addition in situ, and in laboratory incubations, was measured as well as biogenic gas production (CO2, N2O and CH4) in biologically-active areas near water. The experiments were framed as tests of a new model of landscape function in the dry valleys. (Elberling and others, in press; Gregorich and others, in press; Hopkins and others, 2005, in press)

Andor Kiss (Department of Animal Biology, University of Illinois at Urbana-Champaign) completed a dissertation on the eye lens of the Antarctic toothfish and is detailing the 23 lens crystallin cDNAs and the genomic organisation of its α, β and γ gene regions (Kiss, 2005; Kiss and others, 2004).

Soil toxicity tests for petroleum-contaminated Antarctic and sub-Antarctic soil have been developed by Steven Siciliano and Alexis Schafer (Department of Soil Science, University of Saskatchewan) using spiked soil from Macquarie Island. A paper based on the results of the activity of nitrification, denitrification, and substrate-induced respiration in response to petroleum hydrocarbon contamination is in progress. A field experiment was conducted at Casey Station during the austral summer of 2005-06 to examine the influence of soil liquid-water content and soil temperature to the toxicity of petroleum hydrocarbon contamination to nitrifying and denitrifying bacteria. This project is part of project 1163 of the AAD, “Remediation of petroleum...
contaminants in the Antarctic and subantarctic”.

Global Ocean Ecosystem Dynamics Programme (GLOBEC)

Evgeny A. Pakhomov’s group (Department of Earth and Ocean Sciences, University of British Columbia) participated in two research cruises (April–May 2004 and November–January 2005/2006) to the Lazarev Sea on the RV Polarstern. Both cruises were part of the German contribution to the SO-GLOBEC, with Dr Pakhomov participating as a Canadian collaborator on the pelagic tunicate Salpa thompsoni ecology. (Abrahamsson and others, 2004; Atkinson and others, 2004; Bushula and others, 2005; Chierici and others, 2004; Dubischar and others, in press; Froneman and others, 2004; Jacob and others, 2006; Pakhomov, 2004; Pakhomov and Froneman, 2004a, b; Pakhomov and others, 2004a, b, in press; Scolardi and others, in press; Turner and others, 2004)

Birds

In a cooperative programme with France (Centre d’Ecologie et Physiologie Energétiques (CEPE), CNRS), Steeve D. Côté (Département de biologie, Université Laval) has been working on the energetics of the reproductive behaviour of king penguins from the Crozet Archipelago, particularly their territorial behaviour and aggressiveness. Heart-rate transmitters were used 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. (Viera and others, in press)

Human Biology and Medicine

Peter Suedfeld (Department of Psychology, University of British Columbia) and the Expert Group on Human Biology and Medicine have been studying how to optimize telemedicine in the Antarctic, with obvious implications for other remote areas and spacecraft, and preparing a proposal for IPY that would study psychological, physiological, and medical issues concerning sojourners (i.e. non-permanent residents or natives) in the Arctic as well as in Antarctic stations. (Orre and others, 2005; Palinkas and Suedfeld, in press)

GEOSCIENCES

Geographical Information (GI)

During 2005, a series of baseline content modules were developed by
graduate students and researchers for the Cybercartographic Atlas of Antarctica Project (CAAP). These modules include treatments of the following aspects of the Antarctic: exploration, politics, environmental protection, sea ice, glacial morphology, biodiversity, ecology, territorial claims and others. The process of developing these modules has resulted in an Atlas development framework which supports integration of multimedia content and connection to geographic information services such as those being developed through the Expert Group on Geographical Information (EGGI) Antarctic Spatial Data Infrastructure program. CAAP members have been helping develop this program. Peter Pulsifer (Department of Geography and Environmental Studies, Carleton University) worked with members of the Antarctic Digital Database team to implement Web-based geographic information services for that database. In September 2005, the CAAP team hosted an EGGI meeting and teleconference. CAAP is also implementing Web-based geographic information services (e.g. sea-ice concentration, satellite-image coverage) using data from various sources. At present, these services are experimental: migration to production will require a small investment in server infrastructure and establishment of appropriate data sharing agreements. The preliminary release version of the Atlas is scheduled for July 2006. It is expected that the software framework will then be released under an open-source license to facilitate further development. Several publications are being developed, including a manuscript which reports innovations leading to the initial release version. Much effort is currently being expended on renewal of funding. (Baulch and others, 2005; Parush and others, in press; Pulsifer and Taylor, 2005; Pulsifer and Caquard, in press; Taylor, 2005; Taylor and Pulsifer, 2004)

Permafrost and Periglacial Environments (PPE)

Kevin Hall (Geography Programme, University of Northern British Columbia) carried out detailed studies of rock weathering at the grain scale coupled with investigation of light penetration of bedrock and the implications of this for weathering and the development of microbial endolithic communities, from October to December 2005 with the Italian National Program in the Terra Nova Bay area. (André and Hall, 2005; André and others, 2004, in press; Hall, 2004a, b, c; Hall and André, in press)

Antarctic Neotectonics (ANTEC)

Thomas James (Natural Resources Canada, Sidney, BC) is a collaborator in the Trans-Antarctic Mountains Deformation Network (TAMDEF) project which is nearing the end of its second phase. In
addition to providing glacio-isostatic modelling expertise to explain GPS observations of crustal uplift and stretching, he undertook fieldwork in the Transantarctic Mountains for 5 weeks in January and early February, 2006. He has also participated in the development of the POLENET IPY project. (Ivins and James, 2005; James and others, 2004; Raymond and others, 2004;

PHYSICAL SCIENCES

Ice Sheet Mass Balance and Sea Level (ISMASS)

Laurence Gray (Natural Resources Canada, Ottawa) and collaborators have been using data from the Canadian satellite RADARSAT to provide new information on ice movement, particularly in West Antarctica. The discovery of anomalous vertical surface motion, up to 2 cm/day, over relatively large areas in ice stream tributaries, has been interpreted as the result of a fill/purge cycle in the movement of subglacial water between dips in the bed where water may collect. Because surface topography is very important in dictating the variations in surface snow accumulation, near-surface stratigraphy from surface radars has been used to study the influence of ice dynamics on variations in subsurface layering patterns. (Bindschadler and others, 2005; Gray and others, 2005; Short and Gray, 2004)

Cryosphere Theme

Martin Sharp (Department of Earth and Atmospheric Sciences, University of Alberta) undertook fieldwork with Sean Fitzsimons (University of Otago) in the McMurdo Dry Valleys (November-December 2004) (Lower Wright, Upper Victoria and Suess Glaciers). He investigated organic matter, organic acid anions and bacterial communities in the basal ice of glaciers that do and do not terminate in ice-covered proglacial lakes. This was to test the hypothesis that a hydrological pump transfers lake water, nutrients and organic carbon to the glacier sole by flow through unfrozen sediments as cold-based glaciers advance into lakes, and that the ice accreted as a result represents a viable habitat for bacteria. (Barker and others, in press)

Antarctic and SCAR groups/projects
with which Canadians are affiliated
Ray Carlberg (Department of Astronomy and Astrophysics, University of Toronto) is linked to the IPY Astropoles proposal. He hopes to develop an Arctic astronomical observatory to partner one proposed for the Antarctic.

Garry K.C. Clarke (Department of Earth and Ocean Sciences, University of British Columbia) and Warwick F. Vincent (Département de biologie, Université Laval) are members of the US National Academy of Sciences’ committee on “Principles of Environmental and Scientific Stewardship for the Exploration and Study of Subglacial Lake Environments”.

Kathleen Conlan (Canadian Museum of Nature) is Secretary of the Standing Scientific Group on Life Sciences

Kevin Hall has been invited to serve on the Editorial Board of Antarctic Science from 2006.

Stephen R. Hicock is working on the Tertiary Sirius tillite project in the Allan Hills and on Table Mountain (Antarctica New Zealand event K-042)

Thomas James is a founding member of the Antarctic Neotectonics (ANTEC) Group of Specialists, which is now an Expert Group in the Geosciences SSG, a member of the scientific committee of the POLENET and Canadian representative to the Standing Scientific Group on Physical Sciences.

Evgeny A. Pakhomov is an Interim Steering Group Member for the Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean (ICCED). He is also an invited expert in the Pelagic realm group of the Census of Antarctic Marine Life (CAML).

Wayne Pollard is Coordinator of the Experts Group on Permafrost and Periglacial Environments

Peter Pulsifer is Canadian Representative and Deputy Chief Officer of the Joint Committee on Antarctic Data Management (JCADM)

Peter Pulsifer is a member of the Experts Group on Geographic Information and leader of the Antarctic Data Linkages project (#9)

D.R. Fraser Taylor is the leader of the Cybercartographic Atlas of Antarctica Project
Peter Suedfeld is the Canadian and International Union of Psychological Science Representative to the Expert Group on Human Biology and Medicine

11. Report on planned new activities relevant to SCAR groups listed in Annex 1 [Please provide main priorities]

(include contact name, address etc, if different from above, for each activity)

Proposed Canadian Antarctic Activities (2006-07)

LIFE SCIENCES

Evolution of Biodiversity in Antarctica (EBA)

Kathleen Conlan will be contributing to a US-Norwegian IPY proposal on “Flux and fate of organic matter across environmental gradients on the Antarctic continental shelf” (PI: Paul Renaud).

Steven Siciliano and Alexis Schafer will be assessing diesel-spiked soil from Truelove Lowlands, Devon Island, Nunavut, Canada, using the same toxicity endpoints as those applied in the Antarctic, to evaluate the use of these soil toxicity tests in soils from both polar regions.

Scientists from ISMER-UQAR, under the direction of Serge Demers, joined the oceanographic sailing vessel Sedna IV in the Antarctic in May 2006 for a one-year joint mission with Argentina (www.sedna.tv). The vessel complement includes a film crew that will be documenting the expedition. Current plans call for Radio-Canada and the Réseau de l’Information (RDI) to produce 13 half-hour segments on life aboard the Sedna during the winter. Gustavo Ferreyra affiliated with both ISMER and the Instituto Antártico Argentino and Sebastien Roy a doctoral student from ISMER will be measuring the effects of climate change and UV-B on the first links in the marine food chain and comparing results from two locations, as well as other studies on biology, marine chemistry, climatology and glaciology. In 2007, there will be a mission on an Argentinean vessel to take samples in the austral summer and winter to assess seasonal differences. NASA expects to use studies from the Sedna to investigate psychological stresses associated with the confinement of a team in a small space for a long time as they relate to their planned missions to Mars.
Global Ocean Ecosystem Dynamics Programme (GLOBEC)
Evgeny Pakhomov will participate in the winter (June–August 2006) RV Polarstern cruise to the Lazarev Sea. He may also participate in the British Antarctic Survey research cruise to the Scotia Sea in summer 2007. Both cruises are linked to SO-GLOBEC and ecological research on the pelagic tunicates, mainly Salpa thompsoni.

Census of Antarctic Marine Life (CAML)
Christine McClelland (Conlan’s student) will be participating in a benthic cruise conducted by the Alfred Wegener Institute (PI: Julian Gutt) from November 2006 to January 2007 investigating “Limits of marine life in the Antarctic”.

Birds
Steeve D. Côté plans to continue the king penguin project with a field season in November 2006 to March 2007.

Human Biology and Medicine
Peter Suedfeld will be participating in the multinational IPY project “Taking the Antarctic Arctic Polar Pulse”, designed to understand the biophysical, clinical, cultural, social and behavioural processes that shape the sustainability of circumpolar human societies. He is also an author of a forthcoming report on the international project to standardize the Selection of Antarctic Personnel.

12. Web site for description of national scientific programme activities
(Where possible give the address of the site page that introduces the scientific programme(s), rather than the address of the site homepage).

http://www.polarcom.gc.ca/english/antarctic/ccar.html

13. Full Address detail
Dr Gustavo A. Ferreyra
Departamento Ciencias del Mar
Instituto Antártico Argentino
Cerrito 1248
C1010AAZ Buenos Aires, Argentina
Phone: [54] 11-4-812-0071 x 118
Fax: [54] 11-4-812-1689
E-mail: gferreyra@dna.gov.ar

Dr Julia M. Foght
Department of Biological Sciences
University of Alberta
Edmonton, Alberta T6G 2E9
Phone: [1](780)492-3279
Fax: [1](780)492-9234
E-mail: julia.foght@ualberta.ca

Dr Hugh M. French
Department of Geography
University of Ottawa
140 Louis-Pasteur
Ottawa, Ontario K1N 6N5
Phone: [1](613)562-5800 x 1044
Fax: [1](613)562-5192
E-mail: hfrench@science.uottawa.ca

Dr John C. Fyfe
Canadian Centre for Climate Modelling and Analysis
Meteorological Service of Canada
University of Victoria, P.O. Box 1700
Victoria, British Columbia V8W 2Y2
Phone: [1](250)363-8236
Fax: [1](250)363-8247
E-mail: john.fyfe@ec.gc.ca

Dr Laurence Gray
Canada Centre for Remote Sensing
Natural Resources Canada
588 Booth Street
Ottawa, Ontario K1A 0Y7
Phone: [1](613)995-3671
Fax: [1](613)947-1383
E-mail: laurence.gray@ccrs.nrcan.gc.ca

Dr Charles W. Greer
Genomics for Enhanced Bioremediation and Phytoremediation, BRI
National Research Council of Canada
6100 Royalmount Avenue, Room L-234
Montréal, Quebec H4P 2R2
Phone: [1](514)496-6182
Fax: [1](514)496-6265
E-mail: charles.greer@nrc.ca

Dr Ed Gregorich
Eastern Cereal and Oilseed Research Centre (ECORC)
Agriculture and Agri-Food Canada
960 Carling Avenue (K.W. Neatby Bldg)
Ottawa, Ontario K1A 0C6
Phone: [1](613)759-1909
Fax: [1](613)759-6566
E-mail: gregoriche@agr.gc.ca

Michael Gretes
Dr Wayne Pollard
Department of Geography
McGill University
Burnside Hall, 805 Sherbrooke Street W.
Montréal, Quebec H3A 2K6
Phone: [1](514)398-4454
Fax: [1](514)398-7437
E-mail: pollard@geog.mcgill.ca

Peter Pulsifer
Department of Geography & Environmental Studies
Geomatics and Cartographic Research Centre
Carleton University
1125 Colonel By Drive
Ottawa, Ontario K1S 5B6
Phone: [1](613)520-2600 x 2252
Fax: [1](613)520-2395
E-mail: pulsifer@magma.ca

Dr Bernhard T. Rabus,
MacDonald Dettwiler
138000 Commerce Parkway
Richmond, British Columbia V6V 2J3
Phone: [1](604)231-2438
Fax: [1](604)278-2117
E-mail: brabus@mda.ca

Dr Philippe Rochette
Sainte-Foy Research Farm
Soil-Plant-Atmosphere Interactions
Agriculture and Agri-Food Canada
Sainte-Foy, Quebec G1V 2J3
Phone: [1](418)657-7980 x 267
Fax: [1](418)648-2402
E-mail: rochettep@agr.gc.ca

Dr Pierre-Simon Ross
E-mail: p_s_ross@hotmail.com

Sebastien Roy
Institut des sciences de la mer de Rimouski (ISMER)
Université du Québec à Rimouski (UQAR)
310, allée des Ursulines, C.P. 3300
Rimouski, Québec G5L 3A1
Phone: [1](418)724-1842
Fax: [1](418)724-1650
E-mail: oleg.saenko@ec.gc.ca

Dr Oleg Saenko
Canadian Centre for Climate Modelling and Analysis
Environment Canada
3964 Gordon Head Road, P.O. Box 1700
Victoria, British Columbia V8N 3X3
Phone: [1](250)363-8267
Fax: [1](250)363-8247
E-mail: oleg.saenko@ec.gc.ca

Dr Leonid V. Savitch
Eastern Cereal and Oilseed Research Centre (ECORC)
Genetic Enhancement and Food Safety
Agriculture and Agri-Food Canada
960 Carling Avenue (K.W. Neatby Bldg)
Ottawa, Ontario K1A 0C6
Phone: [1](613)759-1313
Fax: [1](613)759-6566
E-mail: simmondsja@agr.gc.ca
ANTARCTIC-RELATED PUBLICATIONS BY CANADIANS (2004-06)
(Canadian authors or those with Canadian affiliations in red)


Antarctic-Related Publications by Canadians (2004-06)  20


Delille, D., F. Coulon and É. Pelletier. 2004a. Biostimulation of natural microbial assemblages in oil-amended vegetated and desert sub- Antarctic soils. Microbial
Antarctic-Related Publications by Canadians (2004-06)


Kiss, A.J. 2005. Functional, biochemical and molecular analyses of the cold stable eye lens crystallins from the Antarctic toothfish *Dissostichus mawsoni*. Ph.D. thesis, Department of Animal Biology, University of Illinois at Urbana-Champaign, Urbana, IL


etc., Springer-Verlag, 219–233. (Advances in Astrobiology and Biogeophysics.)


Pienitz, R., M.S.V. Douglas and J.P. Smol, eds. 2004b. Long-term environmental change in Arctic and Antarctic lakes. Berlin, etc., Springer-Verlag, xxx + 562 pp. (Developments in Paleoenvironmental Research 8.)


Schmittner, A., O.A. Saenko and A.J. Weaver. 2004. Couplings of the hemispheres
in observations and simulations of glacial climate change. Response to the comments by Peter Huybers *Quat. Sci. Rev.*, 23(1-2), 210-212. (10.1016/j.quascirev.2003.08.002)


Annex 1. Main Scientific Research Projects of SCAR

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