

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

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Country name: Canada

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Committee title: Canadian Committee on Antarctic Research

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4.1.2 Action Group(s) [select from Annex 1]

Group(s):

Names:

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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
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4.1.4 Scientific Research Programme(s) [select from Annex 1]

Group(s):

Names:

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Group(s) Birds, Human Biology and Medicine

Names Steeve D. Côté, Peter Suedfeld

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4.2.3 Expert Group(s) [select from Annex 1]

Group(s)

Names

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4.2.4 Scientific Research Programme(s) [select from Annex 1]

Group(s): Evolution of Biodiversity in Antarctica

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Group(s)

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Group(s)

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Type [e.g. Composite Gazetteer; Geodetic Control Database; etc]

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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>

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Annex 1. Main Scientific Research Projects of SCAR

SCAR			
Disc.	Type	Acronym	Project Title
Biol	SRP	EBA	Evolution of biodiversity in Antarctica
	SRP	SALE	Subglacial Antarctic Lake Exploration
	EG	-	Best Practices for Conservation
	EG	-	Biological Monitoring
	EG	CAML	Census of Antarctic Marine Life
	AG	-	Birds
	AG	-	Seals
	AG	-	Human Biology and Medicine
Phys	SRP	AGCS	Antarctica in the Global Climate System
	SRP	ICESTAR	Interhemispheric Conjugacy in Solar-Terrestrial and Aeronomy Research
	AG	PASTA	Plateau Astronomy Site Testing in Antarctica
	AG	MOSAK	Modelling and Observational Studies of Antarctic Katabatic Winds
	EG	-	Oceanography
	EG	AAA	Antarctic and Astronomy and Astrophysics
	EG	-	Operational Meteorology in the Antarctic
	EG	ISMASS	Ice Sheet Mass Balance and Sea Level
	EG	-	Ice Drilling Technology
	partnership	IGOS	Cryosphere Theme
Geo	SRP	ACE	Antarctic Climate Evolution
	AG	-	Acoustics in the Marine Environment
	AG	-	Marine Survey Coordination
	EG	GI	Geographical Information
	EG	PPE	Permafrost and Periglacial Environments
	EG	GIANT	Geodetic Infrastructure of Antarctica
	EG	ANTEC	Antarctic Neotectonics
	EG	ADMAP	Antarctic Digital Magnetic Anomaly Project
	EG	IBCSO	International Bathymetric Chart of the Southern Ocean