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POLAR CONTINENTAL SHELF PROGRAM

SCIENCE REPORT 2010 | 2011

Logistical support for leading-edge scientific research in the Canadian Arctic

Canada

Polar Continental Shelf Program Science Report 2010–2011

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Photograph credits are indicated with each image in the report.

Cover photograph information: Scientists approach a helicopter on Belcher Glacier, which is located in the northeast part of the Devon Island Ice Cap in Nunavut. (Janice Lang, Polar Continental Shelf Program, Natural Resources Canada.)

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The mountainous terrain of Quttinirpaaq National Park on Ellesmere Island, Nunavut.

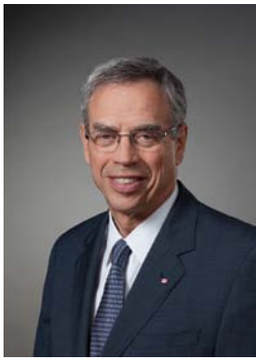
Janice Lang, PCSP/NRCan

Scott Lamoureux (*right*) and Emil Laurin (Queen's University) examine a stream and nearby slumping at Cape Bounty, Melville Island, Nunavut.

Janice Lang, PCSP/NRCan

Minister's Message

Every year, more than 1,100 scientists and researchers from Canada and around the world rely on the Polar Continental Shelf Program (PCSP), known internationally for providing safe, specialized and cost-effective logistical support in our country's Arctic.



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These accolades are due, in no small part, to former PCSP Director Marty Bergmann, who died in a tragic plane crash with 11 other people last summer. Marty was passionate about Canada's North and played a key role in the rejuvenation of Arctic infrastructure to support northern research. With a newly expanded and modernized facility in Resolute, Nunavut, the PCSP is building on Marty's legacy and continues to play a key role in our Government's Northern Strategy.

For over half a century, the PCSP has been providing air and ground support for a wide range of research that provides decision-makers with a better understanding of our northern world. Through initiatives such as the Traditional Knowledge Program, the PCSP provides logistical support to projects developed by or with Arctic communities that aim at preserving their traditional ways of life for the benefit of future generations. During the most recent International Polar Year, the largest ever interdisciplinary program of science that is focused on the earth's Polar Regions, PCSP's support enabled scientists from around the world to conduct research in the challenging and rewarding environment of the Canadian North.

As Minister of Natural Resources, I see tremendous value in supporting programs that open up new directions for economic development in the North. One such program, the Government of Canada Geo-mapping for Energy and Minerals (GEM) initiative, is providing the infrastructure for new public geoscience knowledge that will help attract investment and enable northerners to make informed decisions about their future economy and society. Natural resources are the foundation of our country's economy, and programs like GEM are helping the North realize its true potential.

As the immense resources and strategic importance of the region continue to attract international interest, the PCSP is also helping Canada maintain and defend its Arctic sovereignty. For the past few years, the program supported a series of Canadian Forces training exercises and assisted federal scientists in collecting data needed to establish the extent of Canada's extended continental shelf in the Arctic Ocean.

This Science Report highlights the ongoing work conducted and supported by the PCSP as we move toward unlocking the mysteries of Canada's North. The PCSP's efforts are allowing Canada to pursue new economic opportunities and to ensure that our North will continue to have all the benefits of environmental protection, good governance and national sovereignty. As a champion of the core goals of our Government's Northern Strategy, the PCSP truly stands at the centre of excellence for Arctic logistics and northern development.

Sincerely,

The Honourable Joe Oliver, P.C., M.P.
Minister of Natural Resources

A glacier flows toward Tanquary Fiord in Quttinirpaaq National Park on Ellesmere Island, Nunavut.

Janice Lang, PCSP/NRCan

ᒥᓂᔅᑕᒥᒃ ᑐᓴᒐᒃᓴᖅ - ᐅᑭᐅᖅᑕᖅᑐᒥ ᖁᑦᑎᒃᑐᓂᒃ ᓄᓇᐅᓂᖓᓂᒃ ᓱᕈᓂᖓᓂᒡᓗ ᖃᐅᔨᓴᖅᑏᑦ ᐅᓂᒃᑳᓕᐊᖏᑦ

ᐊᕿᒍᑕᒫᖅ, ᐅᖓᑖᓃᑦᑐᑦ 1,100 ᖃᐅᔨᓴᖅᑏᑦ ᑲᓇᑕᒥ ᓇᑭᑐᐃᓐᓇᕐᓗ ᓄᓇᕗᐊᕐᒥᒃ

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ᑐᖓᕕᖃᕆᖑᒪᑕ ᐅᑭᐅᖅᑕᖅᑑᑉ ᖁᑦᑎᒃᑐᕐᒥᐅᑕᖏᓐᓂᒃ ᓄᓇᒥᓂᒃ ᓱᑯᒥᒡᓗ ᖃᐅᔨᓴᕐᕕᐊᓗᖏᓐᒃ, ᖃᐅᔨᒪᔨᕆᔭᐅᓂᕐᒧᑦ ᐱᓕᕆᓂᖏᓐᓂᒃ ᐊᒃᓯᕈᕐᓇᖅᑐᒃᑯᑦ ᐊᒻᒪᓗ ᖁᕕᐊᓇᖅᑐᒻᒪᕆᐅᔭᒃᑐᒥᒃ ᐊᕙᑎᒥᒃ ᑲᓇᑕᐸ ᐅᐊᖕᓇᖅᐸᓯᐊᓂᒃ ᐅᑭᐅᖅᑕᖅᑐᒥᒃ. ᐊᑐᖅᑐᑎᒃ ᑭᓯᐊᓂᐅᕙᒃᑐᑦ ᖁᐊᖑᐃᓐᓇᐅᔭᖅᑐᒥᒃ ᐱᓕᕆᑎᑦᑎᔾᔪᑕᐅᔪᖅ, ᖃᐅᔨᒪᔭᐅᔪᖅ ᓄᓇᕗᐊᒥ, ᑐᓂᓯᓯᒪᕙᖕᓂᖓᓄᑦ ᐅᑐᕆᐊᓇᖅᑐᖃᕿᓂ, ᐋᕿᒃᑕᐅᓯᒪᓪᓗᓂ ᑕᒪᑐᒧᖓ, ᐊᑭᑐᓇᓂᓗ ᑭᓯᓕᕆᔾᔪᑕᐅᓂᐊᖅᑐᓂᒃ ᐱᓕᕆᔾᔪᑕᐅᓪᓗᓂ ᐃᑲᔫᑎᓄᑦ ᓄᓇᑦᑎᓂ ᐅᑭᐅᖅᑕᖅᑐᒥ.

ᑖᒃᑯᐊ ᐊᑐᖅᑕᐅᓂᖏᑦ ᐃᓕᑕᕆᔭᐅᒪᕗᑦ ᓄᓇᕗᐊᕐᒥᐅᓄᑦ, ᐊᑐᐃᓐᓇᐅᑎᑦᑎᓂᖏᓐᓄᑦ ᐅᓗᕆᐊᓇᖏᑐᒥᒃ, ᖃᐅᔨᒪᔨᒻᒪᕆᐅᔪᓂᒃ ᐊᒻᒪ ᐊᑭᑐᓗᐊᖅᑎᑕᐅᑕᐃᓪᓕᒪᔪᓂᒃ ᐸᕐᓇᒃᑕᐅᓯᒪᐃᓐᓇᕆᐊᖃᖅᑐᓂᒃ ᐃᑲᔪᖅᑕᐅᓂᕐᒥᒃ ᑲᓇᑕᐸ ᐅᑭᐅᖅᑕᖅᑐᖓᓂ. ᑕᒪᒃᑯᐊ ᐱᐅᔫᐊᓘᓂᖏᑦ, ᐊᖏᔪᒥᒃ, ᑕᐃᒪᐃᓕᖓᔪᑦ ᐊᐅᓚᑦᑎᔨᐅᓚᐅᖅᓯᒪᔪᒧᑦ ᐱᓕᕆᓂᖓᓄᑦ ᒫᕐᑎ ᐳᒻᒪᓐ, ᐃᓅᔪᓐᓃᓚᐅᖅᓯᒪᔪᖅ ᖃᖓᑕᓲᖅ ᑲᑖᒃᑐᐊᓘᑎᓪᓗᒋᑦ 11-ᓂᒃ ᐃᓅᕐᑲᑎᖅᑲᓚᐅᖅᓱᓂ ᑲᑦᖃᑕᐅᓚᐅᖅᑐᓂᒃ ᐊᐅᔭᐅᓚᐅᖅᑐᒥ. ᒫᑎ ᑖᓐᓇ ᐱᐅᒃᓴᖅᑐᒻᒪᕆᐊᓘᓚᐅᖅᑐᖅ ᑲᓇᑕᐸ ᐅᑭᐅᖅᑕᖅᑐᖓᓂᒃ ᐊᒻᒪᓗ ᐱᒻᒪᕆᐅᔪᓂᒃ ᐃᓚᒋᔭᐅᓚᐅᖅᑐᖅ ᓄᑖᕈᕆᐊᖅᑕᐅᒃᑲᓐᓂᕐᓂᖏᓐᓄᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᐱᖁᑎᖃᑦᑎᐊᕆᐊᖃᕐᓂᖏᑦ ᐃᑲᔪᖅᑕᐅᓂᖏᓐᓄᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᖃᐅᔨᓴᕐᕖᑦ. ᓄᑖᒥᒃ ᐊᖏᒡᓕᕆᐊᑦᑕᐅᓂᖏᑦ ᐱᓕᕆᕖᑦ ᖃᐅᓯᐃᑦᑐᕐᒥᒃ, ᓄᓇᕗᑦ, ᑕᐃᒃᑯᐊ ᖁᑦᑎᒃᑐᕐᒥᐅᓂ ᓄᓇᒥᒃ ᓱᑯᒥᒡᓗ ᖃᐅᔨᓴᖅᑎᓄᑦ ᐃᒡᓗᕐᔪᐊᖅ ᒪᓕᒃᐳᖅ ᒫᑎᓐ ᕿᒪᓚᐅᖅᑕᖓᓂᒃ ᐊᒻᒪᓗ ᓰᓕ ᐱᒻᒪᕆᐅᔪᒥᒃ ᐱᓕᕆᐊᕐᑲᖅᑕᐅᓪᓗᓂ ᒐᕙᒪᒃᑯᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᖃᓄᐃᓕᐅᕈᑎᒃᓴᓕᐊᕆᓯᒪᔭᕆᓐᓇᓄᑦ ᐃᓚᒋᔭᐅᓪᓗᑎᒃ.

ᐅᖓᑖᓂᒃ 50 ᐊᕿᒍᐃᑦ, ᖁᑦᑎᒃᑐᕐᒥᐅᓂ ᓄᓇᐃᑦ ᓱᑯᐃᓪᓗ ᖃᐅᔨᓴᖅᑎᖏᑦ ᐃᑲᔪᖅᑎᐅᕐᑲᑦᑕᖅᓯᒪᔪᑦ ᖃᖓᑖᓲᒃᑯᑦ ᓄᓇᒦᓐᓂᐊᖅᑐᓄᓪᓗ ᐃᑲᔪᖅᑕᐅᔭᓇᐊᕐᑲᖅᑐᓄᑦ, ᐊᒥᓯᓂᒃ ᖃᐅᔨᓴᖅᑕᐅᔪᓂᒃ, ᐃᓱᒪᓕᐅᖅᑎᓄᑦ ᐱᐅᓂᒃᓴᒥᒃ ᑐᑭᓯᐅᒪᓕᕈᑕᐅᕚᒃᑐᓂᒃ ᐅᑭᐅᖅᑕᖅᑐᒥ ᓄᓇᖃᖅᑐᓂᒃ. ᐊᑐᖅᑕᐅᔪᑦ ᑖᒃᑯᐊ ᑕᒪᐃᓐᓂ ᐅᑭᐅᖅᑕᖅᑐᒥᐅᑕᓂᒃ ᐊᖏᓂᖅᓴᒥᒃ ᐊᐅᓚᑦᑎᔨᕐᑲᐅᕗᑦ ᑐᕿᒐᖅᓯᕐᓂᒃ. ᐊᑐᖅᑕᐅᓕᖅᑎᓪᓗᒋᑦ ᓄᑖᑦ ᐱᓕᕆᐊᖑᓕᖅᑐᖅ ᓲᕐᓗ ᐃᓄᐃᑦ ᖃᐅᔨᒪᔪᕐᑲᖏᓐᓄᑦ, ᑖᒃᑯᐊ ᖁᑦᑎᒃᑐᕐᒥᐅᓂᒃ ᓄᓇᓂᒃ ᓱᑯᒥᒡᓗ ᖃᐅᔨᓴᕐᕕᒃᑯᑦ ᐃᑲᔪᖅᑎᐅᕐᑲᑦᑕᖅᐳᑦ ᐸᕐᓇᐅᑕᐅᓯᒪᔭᓇᐊᕐᑲᖅᑐᓂᒃ

ᐱᓕᕆᐊᖑᓂᐊᖅᑐᑦ ᐋᕿᒃᓱᖅᑕᐅᕙᓪᓕᐊᓕᖅᑎᓪᓗᒋ5ᑦ ᐅᑭᐅᖅᑕᖅᑐᒥᐅᓄᑦ ᐅᑭᐅᖅᑕᖅᑐᒥᐅᓂᓗ, ᓴᐳᓐᓂᐊᖅᑕᐅᓇᓱᐊᕐᓂᖏᓐᓂᒃ ᐱᐅᓯᑐᕐᑲᓇᔭᐅᔪᑦ ᐃᑲᔪᖅᑕᐅᖁᓪᓗᒋᑦ ᓯᕗᓂᒃᓴᒥ ᐃᓅᔫᒫᖅᑐᑦ. ᑕᐃᑲᓂ ᒫᓐᓇᓵᖅ ᐅᑭᐅᖅᑕᖅᑐᖅ ᑲᔾᔨᐊᑕ ᐊᕿᕋᒍᐊᓐᓂ, ᐅᓇ ᐊᖏᑖᖅ ᐱᓕᕆᐊᖑᓯᒪᔪᖅ ᐱᓕᕆᑎᑦᑎᔾᔪᑕᐅᔪᖅ ᖃᐅᔨᓴᕐᑎᒻᒪᕆᖕᓂᑦ ᓵᑎᓯᒪᕗᖅ ᓄᓇᕗᐊᐸ ᐅᑭᐅᖅᑕᖅᑐᖏᓐᓂᒃ ᐊᕕᒃᑐᖅᓯᒪᔪᓂ, ᐅᑯᐊ ᖁᐊᖑᐃᓐᓇᐅᔭᖅᑐᒥᒃ ᖃᐅᔨᓴᐃᓂᖅ ᐃᑲᔪᖅᓯᖅᑐᑦ ᐊᔪᕈᓐᓃᕐᑎᓪᓗᒋᑦ ᓇᑭᑐᐃᓐᓇᖅ ᓄᓇᕗᐊᒥᑦ ᖃᐅᔨᓴᖅᓯᓗᑎᒃ ᑕᓕᓂ ᐊᒃᓯᕈᓐᓇᖅᑐᒥ ᐊᒻᒪᓗ ᐃᑲᔫᑎᔪᓂᒃ ᓯᓚᑦᑎᓂᒃ ᐊᕙᑎᑦᑎᓂᒃ ᑲᓇᑕᐸ ᐅᑭᐅᖅᑕᖅᑐᖓᓂ.

ᒥᓂᔅᑕᓇᔭᐅᓪᓗᖓ ᓄᓇᒥᐅᑕᑐᖅᑲᖅᓄᑦ, ᐊᒃᓱᒻᒪᕆᓗᒃ ᑕᒪᓐᓇ ᐱᒻᒪᕆᐅᓂᖅᑲᖅᐸᖅ ᐃᑲᔪᖅᓱᖅᑕᐅᓂᖏᑦ ᐱᓕᕆᐊᒃᓴᐃᑦ ᒪᑐᐃᖅᓯᕚᓪᓕᕈᑕᐅᓂᐊᖅᑐᑦ ᐊᑐᓕᕈᓐᓇᕐᓂᐊᖅᑐᓂᒃ ᓄᑖᓄᑦ ᑮᓇᐅᔭᓕᐅᕐᕕᒃᓴᓄᑦ ᐱᕙᓪᓕᕈᑎᒃᓴᓄᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ. ᐃᓕᕆᔭᐅᕗᖅ ᑕᐃᒪ, ᒐᕙᒪᑐᕐᑲᒃᑯᓐᓄᑦ ᓄᓇᖑᐊᓕᐅᖅᐸᓪᓕᐊᓂᖏᑦ ᐅᔭᕋᖅᑲᕐᓂᐅᔪᓂᒃ ᐆᒪᕐᖁᓯᐅᕐᕕᒃᓴᐅᔪᓐᓇᖅᑐᓂᒃ ᐊᒻᒪᓗ ᐅᔭᕋᖕᓂᐊᓚᒃᓴᐅᔪᓐᓇᖅᑐᓂᒃ ᐱᓕᕆᐊᒃᓴᓂᒃ, ᐊᑐᓚᒃᓴᖃᓕᕐᓂᐊᕐᒪᑕ ᓄᓇᒥᒃ ᖃᐅᔨᓴᖅᑎᓄᑦ ᖃᐅᔨᒪᓂᖏᑦ ᐃᑳᕐᑕᐅᓂᐊᖅᑐᓂᒃ ᑮᓇᐅᔭᓕᐅᕈᑎᒃᓴᓄᑦ ᐊᒻᒪᓗ ᐅᑭᐅᖅᑕᖅᑐᒥᐅᑕᓄᑦ ᖃᐅᔨᒪᑦᑎᐊᕐᓂᖅᓴᐅᓗᑎᒃ ᐃᓱᒪᓕᐅᕈᑎᕈᓐᓇᕐᓂᖅ ᓯᕗᓂᒃᓴᒥ ᑮᓇᐅᔭᓕᐅᕈᑎᒃᓴᓄᑦ ᐊᒻᒪᓗ ᐃᓅᕐᑲᑎᒌᖕᓂᒥᓄᑦ. ᓄᓇᒥᐅᑕᑐᖃᐃᑦ ᑐᖓᕕᐅᒻᒪᕆᖕᒪᑕ ᓄᓇᕗᐊᑦᑎᓐᓄᒃ ᑮᓇᐅᔭᓕᐅᕈᓐᓇᕐᓂᖏᓐᓄᑦ, ᑕᒻᒪᑯᐊᓗ ᐊᑐᖅᑕᐅᔪᑦ ᓲᕐᓗ ᓄᓇᖑᐊᓕᐊᕈᑏᑦ ᐅᔭᕋᖕᓂᐊᓚᒃᓴᐅᔪᓐᓇᖅᑐᓂᒃ ᐃᑲᔪᕐᓂᖅᓯᑎᒃ ᐅᑭᐅᖅᑕᖅᑐᒥᐅᓂᒃ ᐱᓐᖑᖅᑎᑦᑎᔪᓐᓇᕐᓂᖅ ᐊᔪᕐᓇᓂᓪᓚᑦᑖᓱᑦᑎᓐᓂᒃ.

ᐊᖏᔪᐊᓗᐃᑦ ᓄᓇᒥᐅᑕᐃᑦ ᐊᒻᒪᓗ ᖃᓄᐃᓕᐅᕈᑕᐅᓂᖏᓐ ᐱᓪᓚᕆᐅᔫᓪᓗᑎᒃ ᐊᕕᒃᑐᖅᓯᒪᓂᖏᓐᓄᑦ, ᓯᓚᕐᔪᐊᕐᒥᐅᑕᓄᓪᓗ ᐆᒃᑐᖅᑕᐅᔪᒪᕙᓪᓕᐊᑐᐃᓐᓇᖅᑎᓪᓗᒋᑦ, ᑖᒃᑯᐊ ᖁᑦᑎᒃᑐᒥᒃ ᖃᐅᔨᓴᖅᑏᑦ ᐃᑲᔪᖃᑦᑕᕐᒥᔪᑦ ᑲᓇᑕᒥᒃ ᐋᕿᐅᒪᑎᑦᑎᓂᕐᒥᒃ ᐊᒻᒪᓗ ᓴᐳᓐᓂᐊᖅᑎᐅᓂᕐᒥᒃ ᐅᑭᐅᖅᑕᖅᑐᒥᐅᑦ ᓄᓇᖁᑎᖃᕐᓂᖏᓐᓂᒃ ᑲᓇᑕᒧᑦ. ᐊᕿᒍᒐᓴᐅᓯᒪᓕᖅᑐᓂ ᐊᓂᒍᖅᑐᓂ, ᐱᓕᕆᐊᖏᓐᓂᒃ ᐃᑲᔪᖅᑲᑦᑕᖅᓯᒪᔪᑦ ᐊᒥᓯᒐᓴᖕᓂᒃ ᑲᓇᑕᒥ ᐅᓇᑕᖅᑐᒃᓴᐃᑦ ᐊᔪᕈᓐᓃᖅᓴᕐᓂᖏᓐᓂᒃ ᐊᒻᒪᓗ ᐃᑲᔪᖅᑲᑦᑕᖅᓯᑎᒃ ᑲᓇᑕᒥᒃ ᖃᐅᔨᓴᖅᑎᓂᒃ ᑲᑎᖅᓯᐃᓂᖏᓐᓂᒃ ᖃᐅᔨᒪᔾᔪᑎᒃᓴᐅᓂᐊᖅᑐᓂᒃ ᓇᓗᓇᐃᖅᑕᐅᑎᐊᕈᑎᒃᓴᖏᓐᓂᒃ ᑲᓇᑕᐸ ᓄᓈᓗᐊᑕ ᐊᑕᓂᖓᓂᒃ ᑕᕆᐅᕐᔫᐸ ᐊᑖᓃᑦᑐᒥᒃ ᐃᕿᖓᓂ ᐅᑭᐅᖅᑕᖅᑑᐸ ᑕᕆᐅᕋᓗᐊᓂ.

ᐅᓇ ᖃᐅᔨᓴᕐᑎᒪᓃᑦ ᐅᓂᒃᑲᖓ ᐅᔾᔨᕐᓇᓗᐊᕐᓂᖏᑦ, ᑕᒪᒃᑯᐊ ᑲᔪᓰᓐᓇᖅᑐᑦ ᐱᓕᕆᐊᖑᓂᖏᑦ ᐊᒻᒪᓗ ᐃᑲᔪᐃᓐᓇᕐᓂᖏᑦ ᖁᑦᑎᒃᑐᕐᒥᐅᓂ ᖃᐅᔨᓴᖅᑏᑦ ᐱᔪᓐᓇᐅᑕᐅᕗᑦ ᑲᓇᑕᒧᑦ ᐱᓇᓱᐊᒃᑲᓂᕈᓐᓇᕐᓂᖅ ᓄᑖᓂᒃ ᑮᓇᐅᔭᓕᐅᕐᕕᒃᓴᓂᒃ ᐊᒻᒪᓗ ᐅᔾᔨᖅᑐᕐᓂᕐᒧᑦ ᑲᓇᑕᐸ ᐅᑭᐅᖅᑕᖅᑐᖓᓂ ᖃᑭᕚᓪᓕᐊᖕᓂᕐᓇᕐᓂᐊᕐᓂᖅ ᐊᕙᑎᒥᒃ ᓴᐳᓐᓂᐊᕐᓂᒃᑯᑦ, ᓅᑉᐸᓪᓕᐊᕗᒍᑦ ᓯᕗᓪᓗᑦ, ᒪᑐᐃᖅᓱᒋᑦ ᑲᒪᓇᖅᑐᑦ ᑲᓇᑕᐸ ᐅᑭᐅᖅᑕᖅᑐᐊᓂ, ᐅᑯᐊ ᖁᐊᖑᐃᓐᓇᐅᔭᖅᑐᒥᒃ ᖃᐅᔨᓴᕐᑎᑦ ᐱᓕᕆᓇᓯᐊᖅᑐᖏᑦᑎᒍᑦ ᐱᐅᔪᓂᒃ ᒐᕙᒪᖅᑲᕐᓂᑯᑦ, ᐊᒻᒪᓗ ᑲᓇᑕᒥᐅᑕᓕᒫᓄᑦ ᓄᓇᖁᑎᖃᕐᓂᕐᒧᑦ. ᐃᑲᔪᖅᑎᐅᓪᓗᑕ ᑐᕿᒐᖅᓯᐅᒪᓂᒃᑐᓂᒃ ᒐᕙᒪᒃᑯᑎᓐᓄᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᖃᓄᐃᓕᐅᕈᑎᒃᓴᓕᐊᖑᓯᒪᔪᓂᒃ, ᖁᑦᑎᒃᑐᕐᒥᐅᓂ ᖃᐅᔨᓴᖅᑎᒃᑯᖏᑦ ᓱᓕᔪᒥᒃ ᒪᑭᑕᕗᑦ ᐱᐅᓂᖅᐹᖑᕆᐊᖅᑎᑦᑎᓂᕐᒧᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᐸᕐᓇᐅᑕᐅᓯᒪᖃᑦᑕᓇᐊᖃᖅᑐᓂᒃ ᐊᒻᒪᓗ ᐅᑭᐅᖅᑕᖅᑐᒥ ᐱᕙᓪᓕᐊᑎᑦᑎᓂᕐᒥᒃ.

ᑎᑎᕋᖅᑐᖅ,

ᓂᕈᐊᖅᑕᐅᓯᒪᔪᖅ ᔫ ᐋᓕᕙ, ᒪᓕᒐᓕᐅᖅᑎ ᒥᓂᔅᑕᐃᑦ ᑲᑎᒪᔨᖏᓐᓂᒃ, ᑲᓇᑕᐅᑉ ᒪᓕᒐᓕᐅᕕᖓᓂ
ᒥᓂᔅᑕ ᓄᓇᒥᐅᑕᑐᖅᑲᓕᕆᓂᕐᒧᑦ

PCSP staff walk outside the PCSP Operations Centre on a snowy day.

Janice Lang, PCSP/NRCan

Polar Continental Shelf Program: Services and initiatives

Conducting field research in the Canadian Arctic involves many challenges, including weather conditions that are highly variable and sometimes extreme and the remoteness of study sites. The Polar Continental Shelf Program (PCSP) at Natural Resources Canada (NRCan) works to help scientists reach their field sites and work safely within the northern environment. Through providing logistical support to researchers from northern communities and national and international universities, government departments and agencies, and independent research organizations, the PCSP is contributing to ongoing and highly important research being conducted in the Canadian Arctic.

The new Dr. Roy M. "Fritz" Koerner Laboratory at the PCSP Resolute facility.

PCSP/NRCan

In addition to providing expert advice on Arctic logistics, the PCSP supports its clients through aircraft services; accommodations at the PCSP facility in Resolute, Nunavut; field equipment rental; and fuel for aircraft and camps. The PCSP also provides a communications network for field camps that includes scheduled checks with each field camp through high-frequency radios and satellite telephones. This network ensures that remote field camps and the PCSP can contact each other in emergency situations. The PCSP can also coordinate search and rescue operations when needed. Applications for PCSP logistical support are submitted annually in autumn for services required during the following field season.

Updates on the PCSP Resolute facility

From 2009 through 2011, the PCSP Resolute facility underwent significant renovations and expansion with funding from the Arctic Research Infrastructure Fund, which was overseen by Aboriginal Affairs and Northern Development Canada (AANDC) (formerly Indian Affairs and Northern Development). The facility grew by 2000 square metres, which nearly doubled its capacity to support researchers. It can now house up to 75 clients and has new dining, recreation and office areas, as well as a new, modern laboratory. The expansion of the PCSP Resolute facility is a major step for the PCSP to improve its abilities to support scientists requiring services in Resolute.

George Benoit moves equipment in the Operations Centre at the PCSP Resolute facility.

Janice Lang, PCSP/NRCan

PCSP FACTS FOR THE 2010 FIELD SEASON

PCSP Resolute facility

- Person nights: 3851
- People who stayed at the facility: 739
- Meals served: 11 553

PCSP aircraft

Twin Otter aircraft flew enough miles for PCSP-supported field work in 2010 to circumnavigate the equator 15 times!

Technical field support services

Through the PCSP's Technical Field Support Services (TFSS), researchers can request to use field equipment from a $9.3-million inventory that is housed in Ottawa and at the PCSP Resolute facility. From communications equipment and camping gear to snowmobiles and boats, researchers can rent nearly anything they might need for their Arctic field work from TFSS. The TFSS warehouse in Ottawa has five full-time employees, some of whom work at the PCSP Resolute facility during the PCSP operational season.

Spotlight on a PCSP employee: Kari Borris

Kari Borris aboard a flight during a trip to the Arctic.

Danielle Labonté

Anyone who has worked with the PCSP in the past nine years will undoubtedly know Kari Borris. Kari is the longest-standing employee in the PCSP Ottawa office, having joined the organization in 2003 as a Financial and Administrative Assistant. Now as PCSP's Office Manager, Kari plays an integral role for the PCSP and is responsible for overseeing, developing and providing administrative services on all issues pertaining to finance, human resources, material management and general administration. She is responsible for invoicing, managing procurement, developing agreements with other organizations, and communications with clients for each field season.

Kari's most memorable experience with the PCSP was a trip she took with former PCSP Director, Marty Bergmann, to the Canadian Arctic in 2007. They visited Iqaluit, Resolute and some PCSP-supported field camps in Nunavut, where they were warmly welcomed and even offered tea and cookies. They had the opportunity to tour an Arctic icebreaker, the CCGS *Louis S. St. Laurent*. Particularly because Kari did not like the Arctic cold, she was surprised to see turquoise water near Prince Leopold Island that made the area look tropical.

Kari is the office's "go-to" person for nearly anything because she has known the program and its files far longer than anyone else in the Ottawa office. As she says, "Every day is different at PCSP – I never know what to expect, and I am definitely never bored!"

PCSP outreach events

Arctic Reflections speaker series

The PCSP continued its speaker series in Ottawa with events in December 2010 and April 2011. On December 14, 2010, presentations within the theme of Canada's Shrinking Glaciers were provided by invited speakers Dr. Martin Sharp (University of Alberta) and Dr. David Burgess (Natural Resources Canada). On April 18, 2011, presentations within the theme of Measuring Change in the Canadian Arctic were presented by Dr. John Smol (Queen's University), Dr. Chris Burn (Carleton University) and Jessica Houston (artist). These successful events provided excellent opportunities for scientists, government officials and the general public to interact and learn about science and issues in the dynamic Canadian Arctic.

Dr. Chris Burn (Carleton University) gives a talk at the PCSP Arctic Reflections Speaker Series.

Roberta Gal, NRCan

PCSP 2011 Open House

On August 5, 2011, the PCSP hosted its fourth annual Open House at the PCSP Resolute facility. Community members from Resolute, government officials and invited guests enjoyed presentations, interactive displays, traditional throat singing and tours of the facility. They had the opportunity to interact and discuss ongoing Arctic science and the PCSP's logistical support for it. The research icebreaker CCGS *Amundsen* was in port at Resolute during the event, which allowed many guests from ArcticNet (a Canadian Network of Centres of Excellence) to participate in the event and discuss ship-based science activities.

A special event at the Open House was the official naming and opening of the new laboratory at the PCSP Resolute facility. The Director General responsible for the PCSP, Marian Campbell Jarvis, made the official opening announcement, and guests were then invited to tour the Dr. Roy M. "Fritz" Koerner Laboratory and see science activities in action in the building. This laboratory was named in honour of the late Dr. Koerner, an accomplished glaciologist who had a long career of Arctic and Antarctic research with the Geological Survey of Canada at NRCan. The PCSP's modern laboratory is now providing clients with the equipment and laboratory space required for many types of sample preparation and analysis at Resolute.

Marty Bergmann (former Director, PCSP), Mike Kristjanson (PCSP), Tabitha Mullin (Resolute Mayor), Sue Sim-Nadeau (PCSP), Brian Gray (Assistant Deputy Minister, Earth Sciences Sector, NRCan), and Marian Campbell Jarvis (Director General, NRCan) officially open the Dr. Roy M. "Fritz" Koerner Laboratory at the PCSP Resolute facility during a sealskin ribbon-cutting ceremony.

Danielle Labonté

PCSP connections to other Arctic organizations

The PCSP is closely connected to many organizations within the realm of Arctic science and support for research.

The PCSP has strong links with northern colleges and scientific licensing bodies to ensure PCSP's understanding of the processes that its clients must follow for obtaining permits and licences for their field work. The PCSP also works with federal government departments and agencies to develop initiatives that support Arctic science.

The PCSP receives advice and guidance on issues relevant to the program from the PCSP Advisory Board, whose members are from universities, federal government departments, provincial/territorial governments and agencies and Aboriginal groups. The PCSP Science Screening Committee, comprised of members from six Canadian universities, annually reviews requests for logistical support from a scientific merit perspective. The requests that are reviewed come from university, foreign and independent organization applicants. See the Annex for more information on the PCSP Advisory Board and Science Screening Committee.

Connection to the Northern Scientific Training Program

The PCSP works with other groups that focus on Arctic logistics and support for field research. One such group is the Northern Scientific Training Program (NSTP) (formerly the Northern Scientific Training Grants Program). It provides grants to students conducting field work in the Arctic, to help with logistics costs. The NSTP was established by AANDC in 1961 to encourage Canadian universities to participate in training northern specialists to meet national needs. In 2011, the NSTP celebrated its 50th anniversary.

The PCSP has a long-standing connection to the NSTP. Both organizations were established under the federal interdepartmental Advisory Committee on Northern Development, just three years apart. The PCSP has been a member of the NSTP committee that annually reviews student applications since the NSTP began. The committee evaluates the proposed field work and determines the allocation of grants, which are intended to help offset the high logistical costs involved with northern field work. The NSTP receives hundreds of applications each year from students who wish to conduct research in Canada's North and the circumpolar region. When NSTP grants were first awarded in 1962, they totalled only $21,000 and went to individuals at six universities across the country. The NSTP now provides $1 million in grants annually to approximately 400 students at 44 Canadian universities and northern colleges. The program also offers three awards in certain categories of research. One award is named in honour of the second PCSP director, Dr. George Hobson, a prominent geophysicist who sat on the NSTP committee for 29 years.

Over the years, the NSTP has grown substantially in its ability to support the northern work of young researchers in the social and natural sciences. A true testament to the importance and success of this program are the many NSTP-supported students who have gone on to have careers focused on the Canadian Arctic. These individuals continue to actively contribute to knowledge of the North and work to advocate for the region and the important work being conducted there with the support of organizations such as the NSTP and the PCSP.

Students unload supplies from a Twin Otter aircraft for a field camp at Alexandra Fiord, Ellesmere Island, Nunavut.

Janice Lang, PCSP/NRCan

The legacy of Marty Bergmann: A true advocate for Canada's Arctic

When it comes to advocates for the Canadian North, few compare to Martin "Marty" Bergmann. Whether convincing the uninitiated to take a trek northward or chatting with anyone around him about the wonders of the Canadian Arctic while en route to various places in his travels, Marty revelled in bringing the North to all and seeing it prosper.

Marty jumps on ice on the Northwest Passage.

Donald Ross, ARI

Martin "Marty" Bergmann

Janice Lang, PCSP/NRCan

Marty examines a rock while visiting a field camp on Baffin Island, Nunavut.

Sue Sim-Nadeau, PCSP/NRCan

Marty's connection to the Canadian Arctic began when he was a graduate student studying Arctic lakes. During his academic career, he spent many months conducting field work in the North and getting a true sense of the people and places in the region. His love of the Arctic stayed with him as he began working in 1983 as a research scientist, then later as manager and director of Arctic research, over the course of 24 years with Fisheries and Oceans Canada.

When an opportunity arose for Marty to become Director of the PCSP at Natural Resources Canada, he jumped at the chance. He joined the group in 2007, and under his leadership, the ability of the PCSP to provide Arctic logistical support increased dramatically, as did the PCSP's recognition, both domestically and internationally. In recent years, Marty was instrumental in developing strong outreach activities at the PCSP. The aim was to engage northern communities and communicate with scientists, government officials and the general public, nationally and internationally, about the Canadian Arctic and the world-class research that is conducted there with the logistical support of the PCSP. Marty's initial idea in 2008 to host an annual Open House at the PCSP Resolute facility resulted in four highly successful events that have built upon and strengthened the relationship among the PCSP, its Arctic research clients and the local residents of Resolute. Marty valued outreach initiatives and having the PCSP as a true part of the community of Resolute.

Throughout Marty's career, he was a mentor of the highest calibre to countless individuals. He helped many people gain their first work experience in the public service and guided them in developing their skills. He had a keen eye for seeing the potential in colleagues and generously supported their development and growth. Marty's infectious passion for his work and the Arctic was inspirational to all who knew and worked with him.

No matter what challenge was ahead for the PCSP, Marty had a vision for what would be best for the PCSP and its clients, and he inspired his team to find ways to make the seemingly impossible, possible. In 2009, the PCSP was successful in securing funding from the Arctic Research Infrastructure Fund to expand the PCSP Resolute facility. The work had to be completed within two years – a grand feat for construction in the North. Through the work of Marty and his team, the project was completed on time and on budget. In Marty's eyes, no obstacle was insurmountable with vision, a solid plan and good communication with all involved in a project. He could easily chat with people from any place or walk of life and used this great talent to develop strong collaborations and links throughout the Arctic and polar research community.

Marty was a true friend of the North and worked tirelessly in support of research in the region. A research vessel, named in his honour, now sails northern waters in search of more scientific knowledge about the Canadian Arctic. Although Marty is no longer with us, his vision for the PCSP and Arctic science lives on and continues to inspire the PCSP-Technical Field Support Services team, northern scientists and all who knew him.

PCSP-supported projects in the news

Important environmental, social and economic issues from the Canadian Arctic have been reported more frequently in mainstream media in recent years, as the region has emerged as a major area of national and international interest. Each year, several PCSP-supported projects receive media attention for their important activities and results. In this section of the report, we highlight some of these projects.

CENTRE D'ÉTUDES NORDIQUES CELEBRATES 50 YEARS OF RESEARCH EXCELLENCE IN CANADA'S NORTH

Warwick Vincent, Christine Barnard and Daniel Fortier (Centre d'études nordiques)

The Centre d'études nordiques (CEN: Centre for Northern Studies) is an inter-university research centre that involves Université Laval; Université du Québec à Rimouski; Centre Eau, Terre et Environnement of the Institut national de la recherche scientifique; and seven other institutions. In 2011, CEN celebrated its 50th anniversary. Since its establishment in 1961, CEN has grown from a dozen scientists to more than 280 researchers, students, postdoctoral fellows and professionals from diverse disciplines – including biology, geography, geology, engineering and archaeology – who conduct research within an extensive network of climate stations and research stations spanning a 4000-kilometre (km) transect from southern Quebec to the High Arctic. The centre aims to train highly qualified personnel in the analysis and management of cold region ecosystems and the evolution of northern environments in the context of climate and socio-economic change. CEN has developed a wealth of important scientific programs in Canada's North over its 50 years.

Anniversary celebrations have included talks by distinguished scientists, including CEN's founder, Louis Edmond Hamelin, and the inauguration of the tenth CEN research station: a research vessel that can be used in shallow freshwater and marine environments. The CEN also has recently completed upgrades to some of its other research stations with funding from the Arctic Research Infrastructure Fund. A special issue of *Écoscience* has been published to commemorate the 50th anniversary and highlight the work of CEN researchers.

One of the CEN's High Arctic research programs is the work of CEN scientist Daniel Fortier (Université de Montréal), who has been exploring links between the physical environment (landscape, climate and permafrost) and plants and animals on Bylot Island, Nunavut. Daniel and his research team have been studying ecosystem responses in periglacial environments (areas subject to freeze-thaw processes) to climate change, including the influences of thawing permafrost.

The CEN's Bylot Island Research Station in Nunavut.

CEN/Gilles Gauthier

The research team has found that permafrost thaw and snowmelt have caused rapid destruction of ice wedge polygon terrain (areas that are underlain by ice features that cause the ground surface to look like a series of joined polygons) and drainage of ponds and wetlands. As these areas drain, some locations have developed sunken areas that are kilometres in length. This landscape degradation is having notable effects on the area's ecosystems, including vegetation changes from plant species that prefer moist conditions to those that prefer dry environments. The effects of this changing vegetation on migratory birds, which use southern Bylot Island extensively for feeding and nesting, are being examined. By using open greenhouse chambers, the research team is also identifying potential future changes to vegetation in the area under warming conditions.

"Many of our projects at CEN depend on the expert logistic services provided by PCSP." – Warwick Vincent

In addition, the research team is studying past conditions on Bylot Island by using sedimentary records preserved in permafrost. The team has documented the oldest recorded glaciation in the eastern Arctic, approximately 2 million years ago, and has studied ancient remains of a forest that grew on the island for several centuries during subsequent warming conditions. The glacial period that followed the forest growth will be studied next as part of this ongoing research.

"Despite being oases of life in an often Spartan landscape, the phenomenon of contaminant biotransport by seabirds means that habitats around seabird colonies may be some of the more polluted, non-industrialized sites in the Arctic."
– Mark Mallory

ARCTIC SEABIRDS CARRY METAL CONTAMINANTS TO INLAND PONDS

Neal Michelutti and John Smol (Queen's University), Jules Blais (University of Ottawa), Mark Mallory (Acadia University) and Marianne Douglas (University of Alberta)

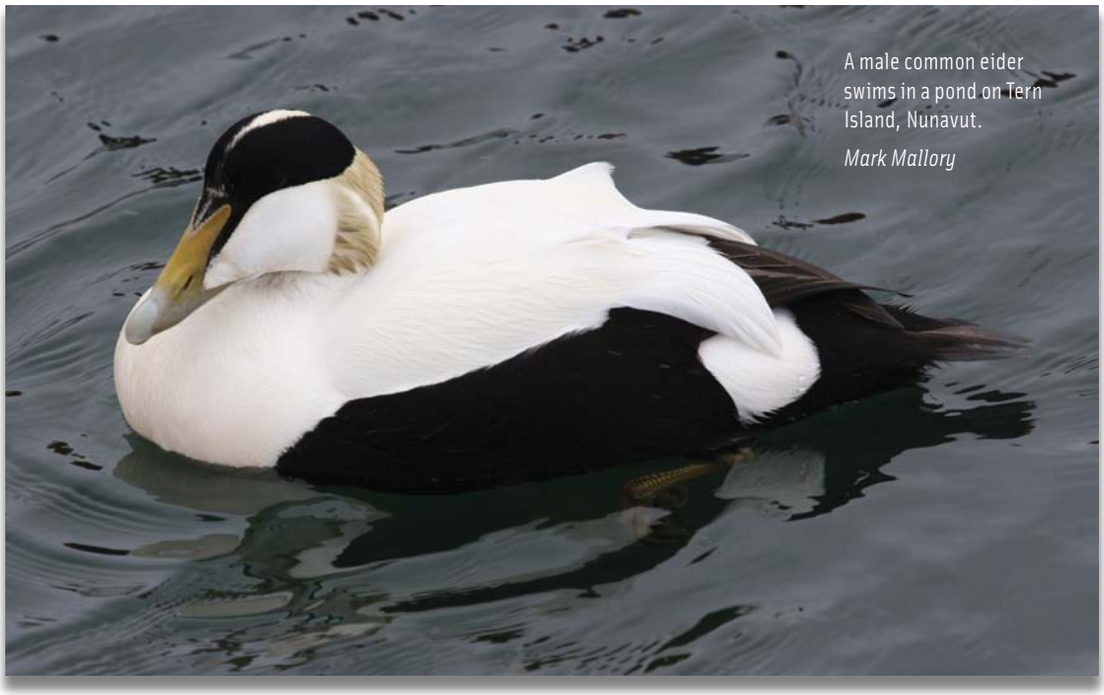
Seabirds in the Canadian Arctic carry toxic metal contaminants to inland ponds, where increasing metal pollutant levels are affecting freshwater ecosystems. Metals in ocean water can build up in the marine food web. When birds feed at sea and return to their nesting areas on land, they bring contaminants held within their ingested food and tissues, which is then released into ponds and surrounding land through fecal matter and animal remains.

Recently, a research team collected and examined sediment records and water samples from two ponds on Tern Island (unofficial name), Nunavut, to study changing metal concentrations and seabird activity over time. The team included Neal Michelutti, John Smol, Jules Blais, Mark Mallory, Marianne Douglas and several students. They wanted to determine if birds that feed at different levels of the marine food web release different metal mixtures at their nesting areas. Arctic terns and common eider ducks inhabit the study area and have diets based largely on fish and molluscs, respectively.

The research team found that the study pond inhabited by terns had higher levels of mercury and cadmium, whereas the pond inhabited by eider ducks had higher levels of lead, manganese and aluminum. The birds' different diets resulted in different contaminant mixtures being deposited in the ponds. These results suggest that sediment records can provide insights into seabird populations in a given area over time and details regarding the species of birds that use areas at different times.

Two Arctic terns on a rocky area of Tern Island, Nunavut.

Mark Mallory



A male common eider swims in a pond on Tern Island, Nunavut.

Mark Mallory

A sediment core collected from Eider Pond on Tern Island, Nunavut.

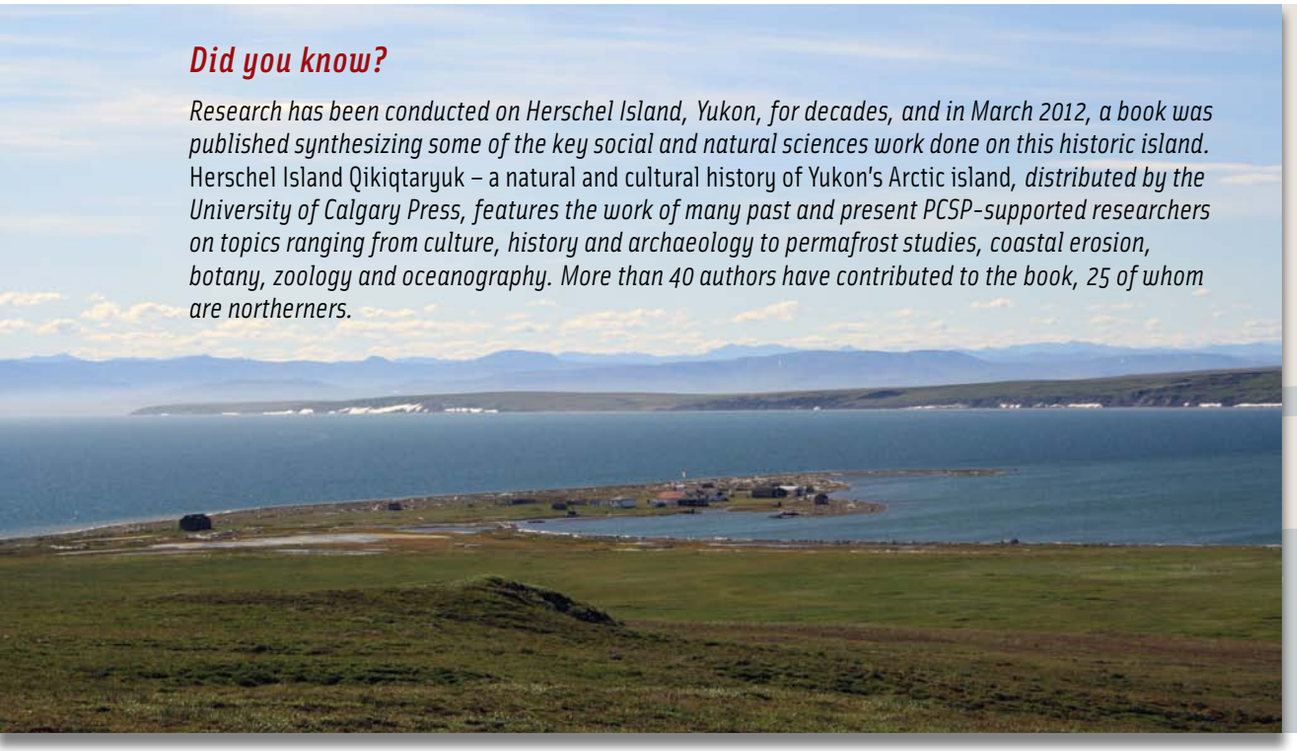
John Smol

Colonial seabirds have become unintentional carriers of contaminants through their natural activities, and increasing metal concentrations in pond ecosystems can adversely affect organisms at the study site.

Because seabird colonies exist on every continent, the researchers suggest that the same processes of metal contaminant transfer that occur in the Canadian Arctic are also active around the world. In places where large bird colonies congregate, increased levels of contaminants are likely to occur, which is of concern for the environmental integrity of many coastal areas. This work was published in the prominent journal *Proceedings of the National Academy of Sciences of the United States of America* in 2010.

Did you know?

Research has been conducted on Herschel Island, Yukon, for decades, and in March 2012, a book was published synthesizing some of the key social and natural sciences work done on this historic island. Herschel Island Qikiqtaryuk – a natural and cultural history of Yukon's Arctic island, *distributed by the University of Calgary Press, features the work of many past and present PCSP-supported researchers on topics ranging from culture, history and archaeology to permafrost studies, coastal erosion, botany, zoology and oceanography. More than 40 authors have contributed to the book, 25 of whom are northerners.*



Pauline Cove, Herschel Island, Yukon.

Graham Gilbert

PCSP-supported field camps in the Canadian Arctic (2010)

Legend

Field Camp Research Themes:

- Ecological Integrity
- Sustainable Communities and Culture
- Climate Change
- Sustainable Resources Management
- Planetary Science
- National Parks and Weather Stations
- Multiple project types

Location Type:

- Communities
- PCSP Resolute Facilities
- Military Outposts
- National Parks

Air Distances In Kilometres

			Iqaluit
		Alert	2091
	Inuvik	2274	2843
Resolute	1503	1090	1573

Air distances and directions follow great circle routes: the shortest distance between places on the globe, and the route most often taken by aircraft.

Community names derived from the Canadian Geographical Names Data Base and Furgal, C., Kalhok, S., Loring, E. and Smith, S. 2003. *Knowledge in action: Northern Contaminants Program structures, processes and products.* Indian and Northern Affairs Canada, Canadian Arctic Contaminants Assessment Report II, 90 pp.

Vertical Near Side Perspective Projection, height adjusted to 3000 km above Earth

A Twin Otter flies past a field camp in the East Bay Migratory Bird Sanctuary, Nunavut.

Grant Gilchrist

PCSP-supported projects in 2010

During the 2010 field season, the PCSP provided logistical support for 146 science projects that covered a wide range of topics in the natural and social sciences. This research is contributing to a better understanding of the Canadian Arctic and major issues in the region. In this section of the report, several projects are highlighted as representative studies within six main research themes: ecological integrity; sustainable communities and culture; climate change; sustainable resources management; planetary science; and national parks and weather stations. All PCSP-supported projects are listed within the themes, with the understanding that some fit into more than one category.

"Polar bears in the southern Beaufort Sea are responding to changing sea ice conditions in unexpected ways with movements far beyond the population boundaries determined from research in the 1980s. We have bears from Tuktoyaktuk moving westward to Russia and others moving well into Nunavut."
– Andrew Derocher

Ecological integrity

Despite challenging climate conditions, the Canadian Arctic contains a great diversity of animals and plants that are specialized to live in the region. A great range of ecosystems exist across the Arctic, and all are highly sensitive to environmental change. Each year, research is conducted at sites throughout the Canadian Arctic to better understand northern ecosystems; animal and plant populations, interactions and species changes over time; and responses to environmental contaminants. These studies are providing important information for monitoring ongoing changes, developing effective management programs and informing northern environmental policy discussions.

POLAR BEAR RESPONSE TO CHANGING SEA ICE CONDITIONS ON THE BEAUFORT SEA

Andrew Derocher (University of Alberta)

Polar bears are one of the most recognizable creatures of the Arctic. Like their main prey, seals, polar bears are high in the Arctic food web and are dependent on sea ice. As climate change affects sea ice distribution and thickness over time, populations of these top predators are experiencing large changes that will ultimately affect the entire Arctic marine ecosystem. An ongoing project has focused on monitoring polar bear movements and habitat use in response to changing ice conditions in the Beaufort Sea area of the western Canadian Arctic. Andrew Derocher leads the project, which includes graduate students Stephen Hamilton, Nick Pilfold, Marie Auger-Méthé, Alysa McCall and Jodie Pongracz.

The research team has obtained detailed information on the movement of bears over a five-year period by using satellite telemetry collars that are on

Andrew Derocher, Mike Woodcock and Nick Pilfold take measurements of an adult female polar bear as her cub watches.

Andrew Derocher

bears in the study area. These collars were placed on 64 juvenile and adult female bears during the springs of 2007 to 2011, through field work based from Tuktoyaktuk, Northwest Territories. The collars send tracking information via satellite to the research team that also documents seal kills to examine diet and hunting behaviours and changes to the boundaries of bear populations. The research team uses sea ice imagery techniques to examine sea ice changes and compare these dynamics to polar bear activities.

Data from the collars have provided insights to bear movements, site fidelity (returning to certain locations more than once) and habitat use in response to changing ice conditions. Habitat use and the distribution of polar bears are being mapped. Preliminary findings suggest that juvenile female polar bears may be slightly more active in their movement patterns than their adult counterparts, though their home ranges (normal areas of activity) do not appear to be substantially larger.

Understanding movement patterns and connections among polar bear populations is integral to understanding population dynamics and determining proper management strategies. This work is integrated into long-term monitoring programs of the Canadian Wildlife Service (Environment Canada) and the Northwest Territories Department of Environment and Natural Resources. Data from this research have been provided to the Government of the Northwest Territories and the United States Geological Survey in support of analyses for Inuvialuit-Inupiat Agreement meetings to examine polar bear populations in the western Arctic. This work also provides insight into the potential for bear population recovery in the event of an oil spill or other events that could reduce bear numbers and gives baseline information for onshore and offshore developments in the Beaufort Sea.

GOOSE POPULATION MONITORING ACROSS THE CANADIAN ARCTIC

Jim Leafloor (Canadian Wildlife Service, Environment Canada)

The Arctic Goose Joint Venture (AGJV) is a conservation partnership to support research and monitoring of northern-nesting goose populations in North America to ensure the long-term sustainability of geese and their habitats. Each year, large numbers of geese are captured and fitted with individualized leg bands to monitor them over time. The Canadian Wildlife Service (CWS) at Environment Canada is one of several AGJV partners, which include the Canadian and American federal governments, as well as provincial and state agencies. Jim Leafloor oversees the Arctic goose banding program on behalf of CWS at five northern sites (Mackenzie Delta in the Northwest Territories and Perry River, Karrak Lake, Southampton Island and Baffin Island in Nunavut).

Five species of Arctic geese are involved in the banding program: Atlantic Brant, Cackling Goose, Greater White-fronted Goose, Ross's Goose and Snow Goose. It is difficult to monitor the geese by using aerial surveys because of the large size and

Using a helicopter, the field team approaches a group of geese to be banded and examined as part of the Arctic Goose Joint Venture conservation program.

Murray Gillespie

extensive distribution of goose populations in remote areas. However, banding allows key information to be provided by waterfowl hunters who report banded geese that they encounter across the continent. Hunter involvement is critical to the successful management of goose populations. Hunters provide information on staging areas (for feeding and resting), wintering locations, goose harvest rates and distribution, population size, migration patterns, and annual survival rates. With this information, scientists can examine trends over time and assess population sustainability.

Much of the current banding program in northern Canada is focused on Lesser Snow Geese because they are considered to be overabundant. The data collected on these geese have been important for monitoring the impacts of increased harvest initiatives in Canada and the United States, which are intended to stabilize or reduce numbers and prevent further destruction of northern coastal habitats where they stage and nest.

Arctic ecosystems are expected to be impacted more than those in other regions by climate change, and geese act as sensitive indicators of environmental change. Alterations in species distribution, abundance and survival are expected as habitat conditions change over time, and long-term banding programs are integral for monitoring the response of each goose species to its changing environment. The research conducted by CWS and partners will ensure conservation of northern goose populations and sustainable management of harvests across North America.

MARINE ENVIRONMENT OF THE ANCIENT WESTERN INTERIOR SEAWAY IN CANADA'S NORTH

Steve Cumbaa (Canadian Museum of Nature) and Alison Murray (University of Alberta)

Did you know that more than 90 million years ago, most of the middle of North America was covered by a huge body of water called the Western Interior Seaway, which split North America in two from the Arctic Ocean to the Gulf of Mexico? Stephen Cumbaa and Alison Murray have found fossils of fishes that swam in Late Cretaceous seas in the Lac des Bois area, located northwest of Great Bear Lake, Northwest Territories.

Building upon fossil fish discoveries made more than 40 years ago, the research team visited the study area in 2010 to find additional fossils and samples to determine a more precise age of the rocks in the area and to gain additional information about the paleoenvironment (past environmental conditions). They split rocks to search for fossils and collected exposed specimens for laboratory study.

The research team found fossils of two new spiny-rayed fishes, which are part of a group of present-day fishes that includes cod, pike, perch and goldfish. Information on other fish and invertebrate fossils that were collected will be added to the descriptions of fossils collected at the study site in 1968. As analysis of the fossils continues, it is possible that new species will be identified. The fossil fishes found indicate previous open marine conditions and suggest that this northern part of the Western Interior Seaway was an important region for the evolution of marine fishes in the Late Cretaceous Period.

The Lac des Bois fossils provide a window on what was happening in the marine world at the time of the dinosaurs. The results of this work increase the understanding of connections between several ancient

A 90-million-year-old fossil of a fish that was collected at Lac des Bois, Northwest Territories. The scale bar is in centimetres.

Steve Cumbaa, Canadian Museum of Nature

ocean areas and relationships among different groups of marine fishes. The fossil fishes collected from Lac des Bois have similarities with fossils that have been found in northern Africa and Lebanon. These similarities suggest that an eastern branch of the Western Interior Seaway flowed through the modern-day Hudson Bay area to what was then a narrow Atlantic Ocean, allowing direct marine connections and exchanges of fishes and other marine creatures between northern Canada and the Mediterranean area.

"We feel very fortunate; fossils of this quality are rare in the northern part of what was once this vast interior sea, and now we will be able to learn so much more about marine life there and its connection to the rest of the world during the time of the dinosaurs."– Steve Cumbaa

ASSESSING THE IMPACTS OF AVIAN CHOLERA ON CANADIAN ARCTIC BIRD POPULATIONS

Grant Gilchrist (Science and Technology Branch, Environment Canada)

Avian cholera is a highly contagious bird disease that is often fatal, and recently, it has become more prevalent in Arctic bird populations. Because birds play an important role in northern ecosystems and are economically important to many northern communities, understanding health issues that threaten bird populations is necessary for developing effective bird management practices. Grant Gilchrist and his research team recently conducted work focused on understanding the survival and reproductive ecology of northern common eider duck populations during an avian cholera epidemic.

Over several years, the research team has been studying the largest known common eider colony in the Canadian Arctic, located on Mitivik Island, in the East Bay Migratory Bird Sanctuary of Nunavut. Since 1996, more than 6950 adult common eiders and 2396 ducklings have been banded, and each year the research team has monitored the return of birds to the colony, egg laying, egg loss, hatching and departure of ducklings. Avian cholera was first detected at this site in 2005. Since then, the team has collected blood and tissue samples, as well as carcasses and pond water samples.

Avian cholera has reduced survival rates and reproductive success, which has resulted in a colony decline. In 2011, the colony's female eider population reached its lowest level (2390 birds) since population monitoring began in 1996. Recently, the disease appears to be abating. In 2011, the research team recovered only 34 eiders that died of avian cholera, as compared with 222 birds recovered in 2010 and 3722 birds recovered in 2007. Adult female survival rates at the colony have also improved since the lowest numbers were detected in 2008.

Ongoing research with collaborators Catherine Soos (Environment Canada) and Mark Forbes (Carleton University) is examining how the cholera bacterium persists in the environment and how some birds have the ability to be carriers of the disease and/or to acquire immunity to it. This information will help to explain disease transmission, bird susceptibility to illness, and response of the population to the ongoing avian cholera outbreak. This work is integral for developing effective plans for predicting and mitigating the influence of avian cholera on northern bird species.

The research team also undertook work with northern students as part of the team's studies on Arctic marine birds. In November 2011, a four-day workshop was held at Nunavut Arctic College in Iqaluit to provide hands-on experience and training for students, who had the opportunity to learn about ongoing bird health studies and to participate in tissue sampling.

Students at Nunavut Arctic College learn about bird health.

Environmental Technology Program, Nunavut Arctic College

"The project began as an assessment of eider duck harvest. We didn't foresee that we would be studying an emerging disease issue with such importance to Arctic birds."
– Grant Gilchrist

Projects focused on ecological integrity

KARRAK LAKE ASSESSMENT ON CONTINENTAL EFFORTS AT POPULATION REDUCTION OF LIGHT GEESE

Principal investigator: Ray Alisauskas (Canadian Wildlife Service, Environment Canada)

Locations: Karrak Lake and Perry River, N.W.T.

SURVIVAL IN ARCTIC GEESE (PERRY RIVER, QUEEN MAUD GULF BIRD SANCTUARY)

Principal investigator: Ray Alisauskas (Canadian Wildlife Service, Environment Canada)

Locations: Perry River and Atkinson Point River, N.W.T.

A young polar bear on sea ice north of the Tuktoyaktuk Peninsula.

Andrew Derocher

BAFFIN BAY POLAR BEAR SUBPOPULATION ASSESSMENT

Principal investigator: Stephen Atkinson (Wildlife Research Section – Wildlife Management, Government of Nunavut)

Location: Qikiqtarjuaq, Baffin Island, NU

POLAR BEAR AERIAL SURVEY DEVELOPMENT IN FOXE BASIN, NUNAVUT

Principal investigator: Stephen Atkinson (Wildlife Research Section – Wildlife Management, Government of Nunavut)

Locations: Kimmirut (Baffin Island), Coates Island, Chesterfield Inlet, Coral Harbour (Southampton Island), Cape Dorset (Baffin Island), Repulse Bay, Nikko Island, Bray Island and Igloolik (Igloolik Island), NU

BIOGEOCHEMICAL TRANSFORMATIONS OF ANCIENT WOOD BENEATH A HIGH ARCTIC GLACIER, ELLESMERE ISLAND, CANADA

Principal investigator: Joel Barker (Byrd Polar Research Center, Ohio State University)

Location: Ekblaw Lake (Ellesmere Island), NU

2010 FIELD OPERATIONS

Principal investigator: Luc Beland (Arctic Field Operations, Fisheries and Oceans Canada)

Location: Resolute (Cornwallis Island), NU

ECOLOGY OF ARCTIC AND RED FOX ON BYLOT ISLAND

Principal investigator: Dominique Berteaux (Canada Research Chair in Northern Ecosystem Conservation, Université du Québec à Rimouski)

Location: Cape Hay (Bylot Island), NU

HORNADAY RIVER WATER MONITORING PROGRAM

Principal investigator: Jean-Francois Bisaillon (Western Arctic Field Unit, Parks Canada)

Location: Hornaday River, N.W.T.

THE IMPACT OF THAWING PERMAFROST ON METALLIC AND ORGANIC CONTAMINANTS IN LAKES OF THE MACKENZIE DELTA

Principal investigator: Jules Blais (Department of Biology, University of Ottawa)

Location: Inuvik, N.W.T.

ECOLOGICAL STRUCTURE OF NORTHERN ARTHROPODS: ADAPTATIONS TO A CHANGING ENVIRONMENT

Principal investigator: Christopher Buddle (Natural Resource Sciences, McGill University)

Location: Lake Hazen (Ellesmere Island), NU

OCEANOGRAPHY OF CANADIAN HIGH ARCTIC IN WINTER: A CONTINUATION OF IPY C30 PROJECT

Principal investigator: Eddy Carmack (Ocean Sciences Division, Fisheries and Oceans Canada)

Locations: Arctic Ocean, locations near Borden Island, N.W.T.

CONNECTING IMPORTANT BIRD AREAS ALONG THE CANADIAN-EUROPEAN FLYWAY: STUDIES OF SHOREBIRDS AND BRANT IN THE CENTRAL QUEEN ELIZABETH ISLANDS

Principal investigator: Kendrew Colhoun (Wildfowl & Wetlands Trust Limited)

Locations: Cornwallis Island and Polar Bear Pass (Bathurst Island), NU

FAUNA AND PALEOENVIRONMENT OF A TURONIAN (LATE CRETACEOUS) WESTERN INTERIOR SEAWAY LOCALITY IN ARCTIC CANADA

Principal investigator: Stephen Cumbaa (Canadian Museum of Nature)

Location: Lac des Bois, N.W.T.

PEARY CARIBOU AND MUSKOXEN ABUNDANCE AND DISTRIBUTION ON NORTHWEST VICTORIA ISLAND, BANKS ISLAND, MELVILLE ISLAND AND PRINCE PATRICK ISLAND, NORTHWEST TERRITORIES

Principal investigator: Tracy Davison (Wildlife Management, Government of Nunavut)

Locations: Ulukhaktok (Victoria Island), Sachs Harbour, Polar Bear Cabin (Aulavik National Park – Banks Island) and Cape Providence (Melville Island), N.W.T.

MOVEMENT PATTERNS AND DISPERSAL OF JUVENILE POLAR BEARS IN THE BEAUFORT SEA

Principal investigator: Andrew Derocher (Department of Biological Sciences, University of Alberta)

Location: Tuktoyaktuk, N.W.T.

ESPACE – EMERGENCY SPATIAL PRE-SCAT OF ARCTIC COASTAL ECOSYSTEMS

Principal investigator: Jason Duffe (Canadian Wildlife Service, Environment Canada)

Locations: Inuvik, Anderson River and Sachs Harbour (Banks Island), N.W.T.

PALEOECOLOGY AND PALEOCLIMATE RECONSTRUCTIONS OF THE BYLOT ISLAND FOSSIL FOREST, CANADIAN ARCTIC

Principal investigator: Daniel Fortier (Département de Géographie, Université de Montréal)

Location: Bylot Island, NU

POPULATION STUDIES OF ARCTIC SEABIRDS

Principal investigator: Tony Gaston (Canadian Wildlife Service, Environment Canada)

Locations: Coats Island and Digges Islands, NU

BIOLOGY OF TUNDRA BIRD POPULATIONS: DEMOGRAPHICS, TROPHIC INTERACTIONS AND CLIMATE CHANGE

Principal investigator: Gilles Gauthier (Centre d'Études Nordiques, Université Laval)

Location: Bylot Island, NU

EAST BAY SHOREBIRDS (PRISM TIER 2 SITE)

Principal investigators: Grant Gilchrist and Jennie Rausch (Canadian Wildlife Service, Environment Canada)

Location: East Bay (Southampton Island), NU

POPULATION STUDIES OF COMMON AND KING EIDER DUCKS BREEDING IN EAST BAY, SOUTHAMPTON ISLAND, NUNAVUT, 2009

Principal investigator: Grant Gilchrist (Canadian Wildlife Service, Environment Canada)

Location: Southampton Island, NU

FLORA OF THE CANADIAN ARCTIC: DIVERSITY AND CHANGE

Principal investigator: Lynn Gillespie (Parks Canada)

Locations: Winter Cove, Minto Inlet and Kuujjua River (Victoria Island), N.W.T.

DISTRIBUTION OF BOWHEAD AND BELUGA WHALES IN THE SOUTHEAST BEAUFORT SEA: BATHURST POLYNIA, TUKTOYAKTUK PENINSULA/DELTA AND WEST COAST OF BANKS ISLAND, 2010

Principal investigator: Lois Harwood (Ocean Sciences Division, Fisheries and Oceans Canada)

Locations: Locations near Inuvik, N.W.T.

DOLLY VARDEN POPULATION ASSESSMENT

Principal investigator: Kimberly Howland (Arctic Aquatic Research, Fisheries and Oceans Canada)

Locations: Rat River, Big Fish River and Babbage River, N.W.T.

THE BIOLOGY AND ECOLOGY OF SYMPATRIC POLYMORPHIC LAKE TROUT, SALVELINUS NAMAYCUSH, IN GREAT BEAR LAKE, N.W.T.

Principal investigator: Kimberly Howland (Arctic Aquatic Research, Fisheries and Oceans Canada)

Location: Great Bear Lake, N.W.T.

ECOLOGICAL AND CULTURAL RESOURCE SURVEYS IN THE CASTEL BAY REGION, AULAVIK NATIONAL PARK

Principal investigator: Molly Kirk (Western Arctic Field Unit, Parks Canada)

Locations: Polar Bear Cabin and Aulavik National Park (Banks Island), N.W.T.

TERRESTRIAL TROPHIC INTERACTIONS INVOLVING LEMMING POPULATION CYCLES ON HERSCHEL ISLAND, YUKON

Principal investigator: Charles Krebs (Department of Zoology, University of British Columbia)

Location: Herschel Island, Y.T.

THE GIANT OF THE ARCTIC

Principal investigator: Yves Lafontaine (Productions Nova Média)

Locations: Pangnirtung, Clyde River, Pond Inlet and Arctic Bay (Baffin Island), Igloolik (Igloolik Island) and Resolute (Cornwallis Island), NU

BAFFIN ISLAND GOOSE BANDING

Principal investigator: Jim Leafloor (Canadian Wildlife Service, Environment Canada)

Locations: Bowman Island, Southern Baffin Island, Koukdjouak River and Taverner Bay (Baffin Island) and Nikko Island, NU

SOUTHAMPTON ISLAND GOOSE BANDING

Principal investigator: Jim Leafloor (Canadian Wildlife Service, Environment Canada)

Location: Coral Harbour (Southampton Island), NU

POPULATION DYNAMICS OF THE GREATER SNOW GOOSE IN RELATION TO HABITAT

Principal investigator: Josée Lefebvre (Canadian Wildlife Service, Environment Canada)

Location: Bylot Island, NU

ECOLOGY OF ROSS'S GULLS AND IVORY GULLS IN PENNY STRAIT, NU

Principal investigator: Mark Mallory (Canadian Wildlife Service, Environment Canada)

Locations: Pond Inlet (Baffin Island) and Tern Island, NU

SEABIRD AND CONTAMINANT MONITORING, PRINCE LEOPOLD ISLAND

Principal investigator: Mark Mallory (Canadian Wildlife Service, Environment Canada)

Location: Prince Leopold Island, NU

THE YUKON NORTH SLOPE GRIZZLY BEAR PROJECT

Principal investigator: Ramona Maraj (Yukon Environment/Fish and Wildlife, Government of Yukon)

Location: Shingle Point, Y.T.

A field team member examines geese in a temporary enclosure as part of the Arctic Goose Joint Venture conservation program.

Murray Gillespie

DEMOGRAPHY, BEHAVIOUR AND PREY RELATIONS OF ARCTIC WOLVES

Principal investigator: David Mech (United States Geological Survey, University of Minnesota)

Location: Eureka (Ellesmere Island), NU

HAZARDOUS SEA ICE IN THE CANADIAN ARCHIPELAGO

Principal investigator: Humfrey Melling (Arctic Aquatic Research, Fisheries and Oceans Canada)

Location: Resolute (Cornwallis Island), NU

SEA ICE BIOTA (BIOLOGICAL IMPACTS OF TRENDS IN THE ARCTIC)

Principal investigator: Christine Michel (Arctic Aquatic Research, Fisheries and Oceans Canada)

Location: Resolute Passage, NU

IN-STREAM FLOW NEEDS FOR NORTHERN FORM DOLLY VARDEN IN THE CANADIAN WESTERN ARCTIC

Principal investigator: Neil Mochnacz (Arctic Aquatic Research, Fisheries and Oceans Canada)

Locations: Fish Creek and Firth River, Y.T. and Little Fish Creek, N.W.T.

RELATIVE ABUNDANCE AND HABITAT USE OF BULL TROUT IN THE MACKENZIE MOUNTAINS, NORTHWEST TERRITORIES

Principal investigator: Neil Mochnacz (Arctic Aquatic Research, Fisheries and Oceans Canada)

Location: Gayna River, N.W.T.

DYNAMICS AND HABITAT USE BY LEMMINGS UNDER CLIMATE CHANGE

Principal investigator: Douglas Morris (Department of Biology, Lakehead University)

Location: Walker Bay, NU

ECOLOGY AND ECOPHYSIOLOGY OF HIGH ARCTIC SHOREBIRDS

Principal investigator: Guy Morrison (Canadian Wildlife Service, Environment Canada)

Location: Alert (Ellesmere Island), NU

INVESTIGATING POTENTIAL REGIONAL EFFECTS OF CLIMATE WARMING ON MERCURY AND OTHER CONTAMINANTS IN LANDLOCKED ARCTIC CHAR

Principal investigator: Derek Muir (Aquatic Ecosystem Protection Research, Environment Canada)

Locations: Resolute (Cornwallis Island), Cape Bounty (Melville Island) and Lake Hazen (Ellesmere Island), NU

AUTONOMOUS MICROSCOPY FOR IN SITU BACTERIAL DETECTION

Principal investigator: Jay Nadeau (Department of Biomedical Engineering, McGill University)

Location: Expedition Fiord (Axel Heiberg Island), NU

A large female eider sits on her nest.

Grant Gilchrist

ECOLOGICAL DYNAMICS OF TUNDRA ECOSYSTEMS IN RESPONSE TO ARCTIC WARMING

Principal investigator: Linh Nguyen (Resource Conservation, Parks Canada)

Locations: Green Cabin and Aulavik National Park (Banks Island), N.W.T.

THE GEOCHEMICAL ECOLOGY OF CRYPTOENDOLITHIC MICROORGANISMS: RELATIONSHIPS BETWEEN CYANOBACTERIA AND SANDSTONE WEATHERING IN THE CANADIAN HIGH ARCTIC

Principal investigator: Christopher Omelon (Department of Earth Sciences, University of Western Ontario)

Location: Eureka (Ellesmere Island), NU

FACTORS AFFECTING GROWTH VARIABILITY AND MERCURY TISSUE CONCENTRATIONS IN ANADROMOUS ARCTIC CHAR IN EASTERN ARCTIC CANADA

Principal investigator: Michael Power (Department of Biology, University of Waterloo)

Locations: Iqaluit, Pangnirtung and Pond Inlet (Baffin Island), NU

ARCTIC SHOREBIRD MONITORING PROGRAM (PRISM) – KING WILLIAM AND VICTORIA ISLANDS

Principal investigator: Jennie Rausch (Canadian Wildlife Service, Environment Canada)

Locations: Malerualik Lake and Gladman Point (King William Island) and Cage Enterprise and Ferguson Lake (Victoria Island), NU

ADMIRALTY INLET NARWHAL AERIAL SURVEYS

Principal investigator: Pierre Richard (Arctic Aquatic Research, Fisheries and Oceans Canada)

Location: Arctic Bay (Baffin Island), NU

HIGH ARCTIC NARWHAL, BOWHEAD AND KILLER WHALE SATELLITE TAGGING STUDY

Principal investigator: Pierre Richard (Arctic Aquatic Research, Fisheries and Oceans Canada)

Locations: Admiralty Inlet and Milne Inlet (Baffin Island), NU

ECOLOGY AND MANAGEMENT OF WATERFOWL POPULATIONS FROM THE WESTERN CANADIAN ARCTIC

Principal investigator: Myra Robertson (Canadian Wildlife Service, Environment Canada)

Location: Inuvik, N.W.T.

WALRUS SURVEY, FOXE BASIN

Principal investigator: Rob Stewart (Arctic Aquatic Research, Fisheries and Oceans Canada)

Location: Igloolik (Igloolik Island), NU

ECOLOGICAL MONITORING IN VUNTUT NATIONAL PARK

Principal investigator: Leila Sumi (Vuntut National Park, Parks Canada)

Location: Peregrine Falcon River, Vuntut National Park Monitoring Base Camp, Y.T.

After waiting a week for permafrost to thaw at an excavation pit, Pam Gross of Cambridge Bay lifts a complete polar bear skull from a Dorset period midden (an ancient dumping area for domestic waste) dating to about 1000 years ago (*left*).

Max Friesen

Sustainable communities and culture

The Canadian Arctic has a long and rich history of human habitation involving several groups of people over time, and understanding this cultural history is important for northern communities. Community-led scientific programs and involvement of northern residents in research projects continues to increase, and the sharing and collection of Traditional Knowledge continues to be a key focus for many studies. Each year, the PCSP provides logistical support for a range of projects in areas such as archaeology, the monitoring of animals that are of particular interest to communities and sustainable infrastructure development.

DYNAMIC INUIT SOCIAL STRATEGIES IN CHANGING ENVIRONMENTS: A LONG-TERM PERSPECTIVE

Max Friesen (Department of Anthropology, University of Toronto)

The Canadian Arctic has been occupied by various peoples for millennia, and this vast region holds many clues on how various cultures lived and interacted over time. As part of an International Polar Year project, Max Friesen has been studying the timing and nature of Thule Inuit migration, the interaction between Dorset and Thule peoples, and the chronology of cultural history in the central Canadian Arctic.

This project, conducted in partnership with the Kitikmeot Heritage Society since 1999, has involved archaeological studies and Traditional Knowledge interviews at a location near Cambridge Bay, Nunavut, called *Iqaluktuuq* (place of many fish). Archaeological sites, ranging in age from the Pre-Dorset period (approximately 1300 BC) to recent times, were surveyed, mapped and excavated, and Traditional Knowledge interviews were conducted to gain perspectives on past and present use of the area. Major project results include the excavation of the earliest known Thule Inuit site in the region (AD 1350); the mapping and excavation of the largest annual meeting site ever recorded for Dorset people; the mapping of the largest caribou drive system ever documented, with more than 1000 inuksuit (stone cairns) identified; and the development of a large set of dated artifacts that provide information on early population movements and adaptations to environmental and social changes in the area.

Over several field seasons, camps were held to bring together elders, archaeologists and Inuit students at research sites to discuss Traditional Knowledge of the area, including hunting and fishing methods, place names and cultural changes. As a result of this collaboration, information has been incorporated into Web sites and booklets, as well as exhibits at the Cambridge Bay Museum.

Research conducted at *Iqaluktuuq* is leading to a better understanding of the various cultures that lived in the central Canadian Arctic over the past 3300 years and changes that occurred in the region over time. The Traditional Knowledge collected during this project was important for interpreting the results from the archaeological sites. Taken together, the data provided a much better understanding of how earlier peoples, such as Early Dorset or Thule Inuit, might have lived in the area.

"Conversations with elders at the Iqaluktuuq *archaeological sites, as well as years of mapping and digging, have yielded an amazingly detailed picture of how several very different cultures used the area over time." – Max Friesen*

This relatively large ice patch in the Selwyn Mountains of the Northwest Territories is several hundred metres long, 50 m wide and 4 m thick.

Tom Andrews

"If ice patches are not monitored on an annual basis, the well-preserved artifacts and biological specimens melting out of them would be lost." – Tom Andrews

This 3200-year-old ice patch was 2 m thick in 2007, but it has since melted rapidly as exposed caribou dung layers caused more heat to be absorbed and more melt to occur.

Tom Andrews

NORTHWEST TERRITORIES ICE PATCH STUDY

Tom Andrews (Prince of Wales Northern Heritage Centre), Glen MacKay (Prince of Wales Northern Heritage Centre) and Leon Andrew (Tulita Dene Band)

A series of alpine ice patches (accumulations of snow approximately 1600 metres above sea level that do not melt each year and harden into ice) containing well-preserved artifacts from ancient hunters and their prey have been discovered in Yukon and the Northwest Territories. Caribou have long used ice patches to escape summer heat and insects, and ancient hunters in Canada's Northwest used this caribou behaviour to their advantage to find food. Through these activities, ice patches became repositories for hunting tools and caribou dung. These artifacts and animal waste have remained frozen for thousands of years. They tell the story of ice patch use over time by both human and caribou populations and provide a glimpse into life in the area long ago.

Through a partnership with the Tulita Dene Band, Tom Andrews, Glen Mackay and Leon Andrew have been investigating archaeological and paleoenvironmental (past conditions) records spanning more than 5000 years at ice patches in the Selwyn and Mackenzie Mountains of the Northwest Territories. Through Traditional Knowledge and aerial surveys, the research team has identified ice patch archaeological sites and collected exposed artifacts and caribou dung for laboratory analyses. Considering that the ice patches in northwest Canada are shrinking, the newly exposed artifacts and biological specimens could be lost if they are not collected, so this research is timely.

The research team has found that ancient hunters gathered their food and other resources in valleys during summer and visited alpine ice patches periodically to hunt caribou. This work indicates that alpine environments were more important to subarctic hunter-gatherer societies than previously understood. Archery artifacts also suggest there were extensive social networks across a large area of northwest Canada centuries prior to European contact in the area.

With funding from the International Polar Year program, the research team hosted science camps in 2007 and 2008 for Tulita high school students, which included Traditional Knowledge sharing between Shúhtagot'ine Elders and youth about past land use in the Selwyn Mountains and instruction about scientific methods of the ice patch research. Information from these camps has been incorporated into a Northwest Territories high school science program curriculum and a book for students, *Hunters of the Alpine Ice*. An exhibit on the ice patch work is open at the Prince of Wales Northern Heritage Centre, and another exhibit is currently being installed at the Tulita school. The results of this research will be published in a supplement to the journal *Arctic* in 2012.

A Thule archaeological site near Resolute, Nunavut.

David Ashe, NRCan

Projects focused on sustainable communities and culture

NORTHWEST TERRITORIES ICE PATCH STUDY

Principal investigator: Tom Andrews (Prince of Wales Northern Heritage Centre, Government of the Northwest Territories)

Location: Mackenzie Mountains, N.W.T.

THE HMS INVESTIGATOR REDISCOVERY PROJECT

Principal investigator: Henry Cary (Western Arctic Field Unit, Parks Canada)

Locations: Mercy Bay and Polar Bear Cabin, Aulavik National Park (Banks Island), N.W.T.

DYNAMIC INUIT SOCIAL STRATEGIES IN CHANGING ENVIRONMENTS: A LONG-TERM PERSPECTIVE

Principal investigator: Max Friesen (Department of Anthropology, University of Toronto)

Location: Ekalluk River (Victoria Island), NU

LINKING SCIENTIFIC AND TRADITIONAL KNOWLEDGE TO DEVELOP EFFECTIVE ENVIRONMENTAL INDICATORS OF CHANGE FOR ARCTIC CHAR COMMUNITY-BASED MONITORING

Principal investigator: Chris Furgal (Trent University)

Locations: Tahiryuak Lake, Titak Lake, Raddi Lake and Capron Lake (Victoria Island), N.W.T.

VAN TAT GWICH'IN CULTURAL TECHNOLOGY PROJECT, YEAR 4

Principal investigator: Shirleen Smith (Vuntut Gwitchin First Nation, Traditional Knowledge Program)

Locations: Rock River and Ch'itsal Dik Geek'ii, Y.T.

NON-INVASIVE INUIT POLAR BEAR MONITORING – INFRASTRUCTURE DEVELOPMENT AND COMPONENT EVALUATIONS

Principal investigator: Peter Van Coeverden de Groot (Queens University)

Locations: Boothia Peninsula, Gateshead Island and Prince of Wales Island, NU

Field camp and a weather station on a blustery day on Barnes Ice Cap, Baffin Island, Nunavut.

Florent Dupont

Climate change

Climate change has emerged in recent years as a major issue for the Canadian Arctic, where ongoing environmental change is affecting northern ecosystems and communities alike. The region is highly sensitive to changes in temperature and precipitation, and much research is being conducted to understand the responses of plants, animals, sea ice and water bodies to ongoing change and adaptation to new conditions. Studies of past climate conditions are also helping to develop a better understanding of how current conditions compare with those of the past.

IDENTIFYING WINTER CONDITIONS AND THEIR IMPACTS ON RECESSION AT THE BARNES ICE CAP, NUNAVUT

Alain Royer (Centre d'Applications et de Recherches en Télédétection [CARTEL], Université de Sherbrooke), Ghislain Picard (Laboratoire de Glaciologie et Géophysique de l'Environnement, Université de Grenoble/ CNRS, France) and Alexandre Langlois (CARTEL, Université de Sherbrooke)

"Our research using satellite data has indicated a 33 percent increase in the annual melt period at Barnes Ice Cap since 2000. However, discrepancies between satellite and ground-based surface temperature measurements were observed, which highlights the need for the development of an improved method for characterizing the links between melting ice caps and related local climate variables." – Alain Royer

The Barnes Ice Cap, located on Baffin Island, Nunavut, is one of the southernmost ice caps in the Canadian Arctic, and recent summer observations of this ice feature indicate increased melting and thinning due to warming conditions in the region. However, limited information has been available on winter conditions at the Barnes Ice Cap, including the state of the winter snowpack. More detailed information about winter snowpack thickness can provide a better understanding of snow conditions at the start of the melt season and how they affect melt processes each summer. Alain Royer, Ghislain Picard, Alexandre Langlois and their research team recently began a project to examine and monitor winter conditions at the Barnes Ice Cap and to develop a better understanding of seasonal impacts on observed ice cap recession.

The research team used remote sensing data from satellites as the key tool to measure ice cap characteristics in winter and develop models of ice cap conditions. They visited the site in March 2011 to gather data and acquire new remote sensing measurements on site for calibrating (adjusting for accuracy) their models. A meteorological station collected data on air temperature, ice cap surface temperature and the amount of incoming and reflected solar energy, which are key factors in determining surface snow and ice melt. Snow pits were dug to collect data on snow grain size, density and temperature.

The research team found a mean winter snow depth above the ice surface of approximately 1 metre, and no firn (snow in transition to ice) was present. These conditions were similar to those found during the first major scientific program at the ice cap in 1950. The snowpack completely melted during spring 2011, but by using a short ice core record, the research team found that some of the melt water refroze in the fall on the plateau at the ice cap's summit. This process of melt water refreezing may play an important role in ice accumulation on this ice cap. The team also found that surface temperatures collected at the ice cap differed somewhat from those determined by satellite, which indicated the need to adjust the satellite data set by using ground measurements to ensure accuracy in their analyses.

Preliminary results of satellite data analysis, covering 1979 to 2010, show that the annual melt season on the Barnes Ice Cap has lengthened by 33 percent, from

A stark contrast is evident between vegetation killed by the 1999 storm surge (*brown areas*) and vegetation along the edges of waterways that survived the damage caused by saltwater intrusion (*green areas*).

Trevor Lantz

an average of 65.4 days at the beginning of the study period (1979–1990) to 87.1 days during the later part of the period (2002–2010). This project's integrated approach to studying seasonal ice cap conditions by using both satellite data and measurements recorded on site indicates that both types of observations are required to gain a complete perspective of melt conditions on the ice cap. Although satellite data were useful for showing stronger melt conditions during the past 30 years, discrepancies were found between temperature measurements recorded on site and by satellite, and processes such as melt water refreezing were not captured by satellite data. Combining satellite and site measurements will allow for a better understanding of the changing melt conditions and processes on Barnes Ice Cap as the changing climate continues to impact the region.

THE IMPACTS OF A MAJOR STORM SURGE ON COASTAL ECOSYSTEMS OF THE MACKENZIE RIVER DELTA

Michael Pisaric (Department of Geography and Environmental Studies, Carleton University), Joshua Thienpont (Department of Biology, Queen's University), John Smol (Department of Biology, Queen's University), Steve Kokelj (Renewable Resources and Environment, Aboriginal Affairs and Northern Development Canada), Trevor Lantz (Department of Environmental Studies, University of Victoria) and Douglas Esagok (Inuvik Hunters and Trappers Committee)

A storm surge occurs when exceptionally strong onshore winds cause water to build up, move toward land and flood low-lying areas. These events can cause significant damage to coastal ecosystems and infrastructure. The Mackenzie River Delta is an area of cultural, ecological and economic significance, and understanding the magnitude (size), frequency and consequences of major hydrological events in the area, such as storm surges, is important for assessing environmental change over time and planning for potential development. In a project that involved a partnership between university and government researchers and community Hunters and Trappers Committees of the Mackenzie Delta region, research team members have been examining the ongoing effects of a recent storm surge that brought saline water onto 100 square kilometres of the outer Delta and the historical occurrence of such events.

"The broad scale ecological changes to the outer Mackenzie Delta caused by the 1999 storm surge have implications for wildlife and in the assessment, monitoring and management of the cumulative impacts of development. This study highlights the need for coordinated monitoring and research that is multidisciplinary, regionally relevant and locally informed." – Research Team Members, from their upcoming paper in the journal Arctic

This project was developed after a 2009 workshop led by the Inuvialuit, where local land users worked with members of the research team to identify major landscape impacts from a storm surge and estimated that it had taken place in 1999. Their timeline of events was supported through studies by the research team using satellite imagery, tree ring records and lake sediment records from the outer Delta region. They found that the September 1999 storm surge and its impacts on outer Delta lakes were unprecedented in over a millennium and that ecological recovery from this event has been slow. After a decade, some areas along the river channels have recovered nearly completely, while other

A lake sediment core is collected by using a small raft on a lake on the Mackenzie River Delta.

Joshua Thienpont

NRCan scientist James Zheng collects snow samples for trace metal analysis on Devon Ice Cap, Nunavut (*right*).

Jocelyne Bourgeois, GSC/NRCan

Delta surfaces still have saline soils and little to no vegetation cover. Additionally, the research team found that the freshwater lake that was most impacted by the storm surge has had dramatic changes to its primary producer community (organisms at the bottom of the food chain). Also, several zooplankton species appeared not to be able to tolerate the new, saltier environment and are no longer present. These ecological changes are likely to have broader impacts on other parts of the ecosystem, including wildlife.

As sea level continues to rise, sea ice extent decreases and storm activity increases in the western Canadian Arctic, the impacts of storm surges on coastal areas are expected to increase. This work highlights the need for multidisciplinary research, including local community involvement, to understand and monitor environmental change in the Mackenzie Delta region and to assess potential development. Inuvialuit knowledge of storm surge events and their impacts has been documented as a key part of this project, and a program has been developed for long-term monitoring of the outer Delta region that is built on ongoing community observations.

TRENDS IN ARCTIC CLIMATE AND AIR POLLUTION FROM SNOW AND ICE CORES

Jocelyne Bourgeois, James Zheng, Christian Zdanowicz and David Burgess (Geological Survey of Canada, Natural Resources Canada) and David Lean (University of Ottawa)

A major International Polar Year (IPY) project led by Natural Resources Canada (NRCan) aimed to document past and recent changes in climate and in air pollution in the Canadian Arctic and neighbouring regions of Greenland and Svalbard (Norway) by using snow samples and ice cores collected on polar glaciers. This project, led by Jocelyne Bourgeois, involved field seasons on glaciers and ice caps across the Canadian Arctic.

One goal of the study was to use glacier ice cores to identify trends in summer temperature and glacier evolution over recent decades. Many indicators suggest a recent acceleration of warming in the Arctic. Findings from this IPY project showed that summer melt rates on Canadian Arctic glaciers have accelerated since the 1980s and have now reached levels not seen in thousands of years. These results are supported by parallel research conducted by other NRCan scientists using satellite imagery. They also agree with a reconstruction of sea ice cover over the past 1450 years, based largely on glacier ice-core data as a proxy (indirect measurement), which suggests that the recent sea-ice cover decline in the Arctic may be unprecedented over the past millennium, if not longer. This work was recently highlighted in an article in the prestigious journal *Nature*.

Another goal of the IPY study was to document changing rates of atmospheric mercury deposition in various areas of the Arctic over recent decades. Mercury is a contaminant of top concern among northern indigenous populations because of its tendency to bioaccumulate (build up) in some foods of the traditional Inuit diet. There remains much debate in the scientific community about the dominant pathways (air or sea) by which mercury enters the northern food chain. To begin to assess this question, snow and ice samples representing 1 to more than 50 years of accumulation were obtained from 10 sites in the Canadian Arctic and subarctic, as well as from Svalbard in Norway and northern Greenland, through collaborations with European IPY projects (KINNVIKA, NEEM).

The hundreds of samples collected to study mercury and other contaminants were analysed at federal and university laboratories in Ottawa, and results are now being compiled for publication in the upcoming third *Canadian Arctic Contaminants Assessment Report*, which is being prepared by Aboriginal Affairs and Northern Development Canada's Northern Contaminants Program.

Over its five-year course, this IPY project involved nine undergraduate and graduate students, including three from Nunavut College's Environmental Technology Program. Field work in Canada was carried out with the invaluable support of Parks Canada staff and residents of the northern communities of Churchill, Manitoba; and Resolute and Pangnirtung, Nunavut.

ARCTIC CLIMATE OF THE EOCENE EPOCH

Jaelyn Eberle (University of Colorado – Boulder), Hope Jahren (University of Hawaii), Brian Schubert (University of Hawaii), Roger Summons (Massachusetts Institute of Technology) and Leonel Sternberg (University of Miami)

The Arctic was not always a polar desert. During the early Eocene Epoch (approximately 50 to 55 million years ago), this region was much warmer than today and supported lush rain forests with very different plants and animals. Their remains, preserved as fossils in Canada's North, provide insights into an ice-free Arctic in a greenhouse world (much warmer than present) and help scientists to understand and predict future Arctic conditions if current warming trends continue.

Jaelyn Eberle, Hope Jahren, Brian Schubert, Roger Summons, Leonel Sternberg and their students and colleagues have been studying Eocene fossils and sediments in the Canadian Arctic during a multiyear project to better understand ancient climate in the region. They have collected samples from Ellesmere Island, Nunavut; Banks Island, Northwest Territories and Alaska. Fossils of vertebrates, such as ancient alligators and giant tortoises, found since the 1970s on Ellesmere Island, and the paleobotanical (past vegetation) record of the Arctic indicate that the Eocene Epoch was much warmer than today. However, questions remain regarding how much warmer climate conditions were and how variable the temperatures were between seasons.

The research team used oxygen isotope records from fossil bones and tooth enamel to estimate a mean annual temperature of approximately 8°C on Ellesmere Island during the early Eocene, compared with a frigid -19°C today. It also estimated a mean temperature of 19°C to 20°C for the Eocene Arctic summer and at or just above freezing for the coldest months of the year. This comprehensive data set is unprecedented for Arctic temperature records from the early Eocene. Knowledge of seasonal temperatures is integral for understanding how ancient alligators, turtles and hippopotamus-like creatures called *Coryphodon* lived in the region.

Additional work with collaborators focused on carbon isotopes within tree rings from well-preserved fossil wood to examine ancient precipitation. The results suggest that Arctic Eocene forests had three times more precipitation during summer than winter, which is similar to the precipitation pattern in modern-day temperate forests in East Asia. Work on fossil pollen by Guy Harrington (University of Birmingham, United Kingdom) also indicates that the diversity of plants in the Eocene Arctic was similar to Eocene plant diversity in the Western Interior of the United States (including Wyoming and Colorado), and the richness of the ancient Arctic forests most closely resembles that of southeastern United States forests today. The research team recently published a major synthesis paper on more than a century of discoveries in Canadian Arctic paleontology in the *Geological Society of America Bulletin*, and it is planning presentations on this research to northern communities in 2012.

Field team members examine remains of ancient trees at the Strathcona Fossil Forest, Ellesmere Island.

Jaelyn Eberle

Tree rings, which show annual tree growth, can be seen in this fossilized tree stump at the Strathcona Fossil Forest, Ellesmere Island.

Jaelyn Eberle

"The knowledge that we gain through the study of fossil animals and plants from Canada's Arctic is critical to understanding and predicting the effects of future climate change in the Arctic, including its impact on the people living in this region." – Jaelyn Eberle

Projects focused on understanding climate change and its impacts

ASSESSING THE ROLE OF LANDSCAPE CHARACTERISTICS IN INFLUENCING COMMUNITY RESPONSE TO ENVIRONMENTAL CHANGE

Principal investigator: Shelley Arnott (Department of Biology, Queen's University)

Location: Wapusk National Park, Man.

OASIS-CANADA/O-BUOYS

Principal investigator: Jan Bottenheim (Air Quality Research Division, Environment Canada)

Location: Arctic Ocean sea ice, N.W.T.

GLACIER MASS BALANCE AND SNOW POLLUTION STUDIES ACROSS THE QUEEN ELIZABETH ISLANDS, CANADA

Principal investigator: David Burgess (Geological Survey of Canada, Natural Resources Canada)

Locations: Devon Island Ice Cap (Devon Island), Grise Fiord and Agassiz Ice Cap (Ellesmere Island) and Meighen Ice Cap (Meighen Island), NU; Melville Ice Cap (Melville Island), N.W.T.

PERMAFROST AND CLIMATE CHANGE, WESTERN ARCTIC CANADA

Principal investigator: Chris Burn (Department of Geography and Environmental Studies, Carleton University)

Locations: Old Crow Flats and Herschel Island, Y.T.; and Garry Island and Illisarvik, N.W.T.

MASS BALANCE, ICE DYNAMICS AND RECENT CHANGES OF THE KASKAWULSH GLACIER, YUKON

Principal investigator: Luke Copland (Department of Geography, University of Ottawa)

Location: Kaskawulsh Glacier, Kluane National Park and Reserve, Y.T.

NORTHERN ELLESMERE ICE SHELVES, ECOSYSTEMS AND CLIMATE IMPACTS

Principal investigator: Luke Copland (Department of Geography, University of Ottawa)

Location: Ward Hunt Island, NU

THE POLAR ENVIRONMENT ATMOSPHERIC RESEARCH LABORATORY (PEARL)

Principal investigator: James Drummond (Department of Physics, University of Toronto)

Location: Eureka (Ellesmere Island), NU

The Mackenzie River Delta, Canada's largest Arctic delta, is dominated by freshwater lakes and channels.

Joshua Thienpont

TRANSARCTIC PALEOCLIMATE OF THE EOCENE

Principal investigator: Jaelyn Eberle (University of Colorado Museum of Natural History, University of Colorado)

Locations: Muskox River, Polar Bear Cabin, east Nangmagvik Lake and Log River (Banks Island), N.W.T.; and Strathcona Fiord Fossil Forest and Clinker Airport (Ellesmere Island), NU

MASS BALANCE OF WHITE AND BABY GLACIERS, AXEL HEIBERG ISLAND, NUNAVUT

Principal investigator: Miles Ecclestone (Department of Geography, Trent University)

Location: Expedition Fiord (Axel Heiberg Island), NU

ENVIRONMENTAL CHANGE ACROSS NORTHWEST NORTH AMERICA: ICE AGE TO PRESENT

Principal investigator: John England, (Department of Earth & Atmospheric Sciences, University of Alberta)

Locations: Cape Treadwell, Upper Kellett River, Worth Point and Bar Harbour (Banks Island), N.W.T.

GLACIER MASS BALANCE VARIABILITY IN A SMALL SUBARCTIC MOUNTAIN RANGE, SOUTHWEST YUKON TERRITORY

Principal Investigator: Gwenn Flowers (Department of Earth Sciences, Simon Fraser University)

Locations: Kaskawulsh Glacier, Kluane National Park and Reserve, Y.T.

SUBSIDENCE, FLOODING AND EROSION HAZARDS IN THE MACKENZIE-BEAUFORT REGION

Principal Investigator: Donald Forbes (Geological Survey of Canada – Atlantic, Natural Resources Canada)

Location: Inuvik, N.W.T.

PAST MODES OF ARCTIC CLIMATE VARIABILITY FROM VARVED SEDIMENTS

Principal investigator: Pierre Francus (National Institute of Scientific Research, Université du Québec)

Locations: Strathcona Lake and south Sawtooth Lake (Ellesmere Island), NU

OLD CROW BASIN, NORTHERN YUKON: DEVELOPING ANALOGUES FOR A FUTURE WARMER ARCTIC

Principal investigator: Duane Froese (Department of Earth and Atmospheric Sciences, University of Alberta)

Location: Old Crow, Y.T.

ARCTIC MARINE ICE-ASSOCIATED ECOSYSTEM IN A CHANGING ENVIRONMENT (ARCTIC-ICE)

Principal investigator: Michel Gosselin (Institute of Ocean Sciences, Université du Québec à Rimouski)

Location: Resolute Passage, NU

CANADIAN ARCTIC SEA ICE MASS BALANCE OBSERVATORY (CASIMBO)

Principal investigator: Christian Haas (Earth and Atmospheric Sciences & Geophysics, University of Alberta)

Location: Alert (Ellesmere Island), NU

IMPACTS AND IMPLICATIONS OF CLIMATE VARIABILITY AND CHANGE ON HIGH ARCTIC TUNDRA ECOSYSTEMS

Principal investigator: Greg Henry (Department of Geography, University of British Columbia)

Locations: Alexandra Fiord, Sverdrup Pass, Princess Marie Bay, Eastwind Lake and Lake Hazen (Ellesmere Island), NU

HYDRO-ECOLOGICAL RESPONSES OF ARCTIC TUNDRA LAKES TO CLIMATE CHANGE AND LANDSCAPE PERTURBATION

Principal investigator: Edward Hudson (Meteorological Services Branch, Environment Canada)

Location: Sea ice near Borden Island, N.W.T.

SEA-LEVEL CHANGE IN WESTERN HUDSON BAY

Principal investigator: Thomas James (Geological Survey of Canada – Pacific, Natural Resources Canada)

Location: Arviat, NU

DOCUMENTING CHANGES IN THE TEMPERATURE AND THICKNESS OF MULTIYEAR ICE ALONG ITS MIGRATION ROUTE

Principal investigator: Michelle Johnston (Canadian Hydraulics Centre, National Research Council)

Location: Belcher Channel, NU

HIGH ARCTIC PERMAFROST LANDSCAPE STABILITY AND WATER QUALITY, SABINE PENINSULA, MELVILLE ISLAND, NUNAVUT

Principal investigator: Scott Lamoureux (Department of Geography, Queen's University)

Location: Drake Point (Melville Island), NU

INTEGRATED LANDSCAPE AND RIVER RESEARCH: THE IMPACT OF PERMAFROST DISTURBANCE ON LANDSCAPE STABILITY AND SURFACE WATERS, CAPE BOUNTY, CHEVALIER BAY AND SHELLABEAR POINT, MELVILLE ISLAND

Principal investigator: Scott Lamoureux (Department of Geography, Queen's University)

Locations: Shellabear Point and Chevalier Bay (Melville Island), N.W.T.; and Cape Bounty (Melville Island), NU

GREENHOUSE GAS AND METHYLMERCURY PRODUCTION IN ARCTIC MARSHES FORMED BY MELTING PERMAFROST

Principal investigator: Isabelle Laurion (National Institute of Scientific Research, Université du Québec)

Locations: Bylot Island and Baffin Island, NU

LIMNOLOGY AND BIOGEOCHEMISTRY OF ARCTIC DELTA LAKES

Principal investigator: Lance Lesack (Department of Geography, Simon Fraser University)

Location: Inuvik, N.W.T.

IMPACT OF CLIMATE CHANGE AND BIOTIC INTERACTIONS ON VEGETATION DYNAMICS AT BYLOT ISLAND

Principal investigator: Esther Lévesque (Centre for Northern Studies, Université du Québec à Trois-Rivières)

Location: Bylot Island, NU

HYDROLOGICAL STUDIES, MACKENZIE DELTA REGION

Principal investigator: Philip Marsh (National Water Research Institute, Environment Canada)

Locations: Inuvik, Trial Valley and Richards Island, N.W.T.

DISAPPEARING ARCTIC ICE CAPS

Principal investigator: Gifford Miller (Institute of Arctic and Alpine Research, University of Colorado)

Location: Barnes Ice Cap (Baffin Island), NU

TESTING THE REGOLITH HYPOTHESIS FOR THE MID-PLEISTOCENE TRANSITION

Principal investigator: Gifford Miller (Institute of Arctic and Alpine Research, University of Colorado)

Location: Allen's Cabin (Baffin Island), NU

CHARACTERISATION OF THE LINK BETWEEN THE SURFACE DYNAMICS AND THE BASAL WATER STORAGE OF A POLYTHERMAL ARCTIC GLACIER USING A COMBINATION OF REMOTE SENSING AND IN SITU MEASUREMENTS

Principal investigator: Brian Moorman (Department of Geography, University of Calgary)

Location: Fountain Glacier (Bylot Island), NU

OCEANIC STORM SURGE ANALYSIS OF THE COASTAL MACKENZIE DELTA, N.W.T.

Principal investigator: Brian Moorman (Department of Geography, University of Calgary)

Location: Inuvik, N.W.T.

ICE ISLAND DRIFT TRACKING

Principal investigator: Derek Mueller (Canadian Ice Services, Environment Canada)

Location: Sea ice near Borden Island, N.W.T.

PALEOCLIMATES AND LIMNOLOGY OF THE FOXE BASIN AND SURROUNDING REGIONS (NUNAVUT)

Principal investigator: Reinhard Pienitz (Department of Geography, Université Laval)

Location: Koukdjuak (Nikko Island), NU

IMPACTS OF WARMING CLIMATIC CONDITIONS ON FRESHWATER ECOSYSTEMS VIA THAWING PERMAFROST, INUVIK, NORTHWEST TERRITORIES

Principal investigator: Michael Pisaric (Department of Geography and Environmental Studies, Carleton University)

Location: Inuvik, N.W.T.

A field team member uses an auger to drill through 2 m of winter ice cover on a lake on a Mackenzie River Delta lake so that a lake sediment core can be collected.

Michael Pisaric

Ross Glenfield (Parks Canada), Steven Akeeagok (Nunavut Arctic College) and Viktor Ter-Emmanualyian (Carleton University) assist with snow sampling on Penny Ice Cap, Auyuittuq National Park, Nunavut.

Christian Zdanowicz, GSC/NRCan

THE BIOPHYSICAL SIGNIFICANCE OF GROUNDWATER AND GROUND ICE IN COLD POLAR ENVIRONMENTS

Principal investigator: Wayne Pollard (Department of Geography, McGill University)

Locations: Expedition Fiord (Axel Heiberg Island) and Eureka (Ellesmere Island), NU

AN INTEGRATED STUDY OF PERMAFROST CONDITIONS ON HERSCHEL ISLAND

Principal investigator: Wayne Pollard (Department of Geography, McGill University)

Location: Herschel Island, Y.T.

CLIMATE CHANGE EFFECTS ON THE HYDRO-ECOLOGY OF NORTHERN LAKES

Principal investigator: Terry Prowse (Aquatic Ecosystem Impacts Research Division, Environment Canada)

Locations: Colour Lake (Axel Heiberg Island), Lake Resolute (Cornwallis Island), Lower Dumbell Lake and Lake Hazen (Ellesmere Island), NU

LANDSCAPE EVOLUTION, PALEOECOLOGY, AND PALEOCLIMATOLOGY OF THE TERTIARY HIGH ARCTIC

Principal investigator: Natalia Rybcynski (Earth Sciences / Research, Canadian Museum of Nature)

Locations: Mallak Dome (Ellef Ringnes Island) and Beaver Pond (Ellesmere Island), NU

SATELLITE REMOTE SENSING OF TEMPERATURE CHANGES IN ARCTIC SNOW COVER

Principal investigator: Alain Royer (Centre for Research and Applications in Remote Sensing, Université de Sherbrooke)

Location: Barnes Ice Cap (Baffin Island), NU

OBSERVATIONAL CONSTRAINTS ON GLACIER SLIDING

Principal investigator: Christian Schoof (Department of Earth and Ocean Sciences, University of British Columbia)

Locations: Kaskawulsh Glacier, Kluane National Park and Reserve, Y.T.

DYNAMICS AND CHANGE OF THE DEVON ISLAND ICE CAP

Principal investigator: Martin Sharp (Department of Earth and Atmospheric Sciences, University of Alberta)

Location: Devon Island Ice Cap (Devon Island), NU

THE BIOGEOGRAPHY OF POLAR DESERT SOIL ECOSYSTEMS

Principal investigator: Steven Siciliano (Department of Soil Science, University of Saskatchewan)

Locations: South Brodeur Peninsula and North Brodeur Peninsula (Baffin Island), Greely, Alert (Ellesmere Island) and central Devon Island, NU

PERMAFROST MONITORING IN MACKENZIE VALLEY

Principal investigator: Sharon Smith (Geological Survey of Canada, Natural Resources Canada)

Location: Inuvik, N.W.T.

NET ECOSYSTEM EXCHANGE OF THE GREENHOUSE GASES CO_2 AND CH_4 IN THE VERY HIGH ARCTIC

Principal investigator: Vincent St. Louis (Department of Biological Sciences, University of Alberta)

Location: Lake Hazen (Ellesmere Island), NU

THE CANADIAN ARCTIC BUOY PROGRAM

Principal investigator: Bruno Tremblay (Atmospheric and Oceanic Sciences, McGill University)

Location: South of Byam Channel, NU

RADARSAT OBSERVATIONS OF RIVER ICE AND FLOOD PATTERNS IN THE MACKENZIE RIVER DELTA

Principal investigator: Joost van der Sanden (Canada Centre for Remote Sensing, Natural Resources Canada)

Location: Inuvik, N.W.T.

NORTHERN ELLESMERE ISLAND IN THE GLOBAL ENVIRONMENT (NEIGE)

Principal investigator: Warwick Vincent (Department of Biology, Université Laval)

Location: Resolute (Cornwallis Island) and Ward Hunt Island, NU

HYDROECOLOGY OF NORTHERN THERMOKARST LANDSCAPES (OLD CROW FLATS, Y.T. AND WAPUSK NATIONAL PARK, MAN.)

Principal investigator: Brent Wolfe (Department of Geography and Environmental Studies, Wilfred Laurier University)

Locations: Churchill, Man. and Old Crow, Y.T.

HYDRO-ECOLOGICAL RESPONSES OF ARCTIC TUNDRA LAKES TO CLIMATE CHANGE AND LANDSCAPE PERTURBATION

Principal investigator: Frederick Wrona (Aquatic Ecosystem Impacts Research Division, Environment Canada)

Locations: Noell Lake and Lake 5A, N.W.T.

HYDROLOGY OF EXTENSIVE LOW GRADIENT HIGH ARCTIC WETLANDS: AN EXAMINATION OF SUSTAINABILITY

Principal investigator: Kathy Young (Department of Geography, York University)

Locations: Cape Bounty (Melville Island) and Polar Bear Pass (Bathurst Island), NU

GLACIER MASS BALANCE AND SNOW POLLUTION MONITORING, AUYUITTUQ NATIONAL PARK

Principal investigator: Christian Zdanowicz (Geological Survey of Canada / Northern Division, Natural Resources Canada)

Location: Penny Ice Cap (Baffin Island), NU

Sustainable resources management

The Canadian Arctic holds a wealth of natural resources, including energy reserves, minerals and water. With much resource interest now focused on Canada's North, sustainable development and management of northern resources is integral to ensure that they remain viable into the future and benefit northern communities. Each year, research is conducted across the Canadian Arctic to develop a better understanding of the types, locations and formation processes of northern resources.

GEM MULTIPLE METALS – MELVILLE PENINSULA PROJECT

David Corrigan, Léopold Nadeau, Janet Campbell, Natasha Wodicka, Isabelle McMartin, Michel Houlé, Pierre Brouillette, Rob Berman, Pierre Keating and Maurice Lamontagne (Geological Survey of Canada, Natural Resources Canada); and Tommy Tremblay, Gabriel Machado and Rosemary Khoun (Canada-Nunavut Geoscience Office)

Since 2008, Natural Resources Canada's Geo-Mapping for Energy and Minerals (GEM) Program has been developing a wealth of knowledge about the geology and energy and mineral deposits of many areas in the Canadian Arctic. The GEM Multiple Metals – Melville Peninsula Project, co-led by David Corrigan and Léopold Nadeau, involves the study of the geological evolution and economic metal endowment (natural wealth) of the Canadian Shield on Melville Peninsula, Nunavut, an area of 180 kilometres by 300 kilometres.

This multidisciplinary project has involved mapping and chemical analysis of bedrock formations (the solid rock under surface sediment) and ground surface sediments of the Canadian Shield on the Melville Peninsula, with the aim of developing improved data and updated geological information over this broad, potentially economically valuable area. Bedrock studies have focused on correlating (matching) specific rock layers in different parts of the study site to gain a better understanding of the geological structure in the area and to determine zones where mineral resources might be found. Aeromagnetic and radiometric surveys (measurements of Earth's magnetic field and emitted energy, respectively) were taken across Melville Peninsula to gain further insight into rock structure. Specific rock formations were also studied in detail to determine their age, mineral composition and economic interest. Thus far, the project activities have led to the discovery of important new iron, nickel, platinum group elements, gold, rare-earth minerals, silver, and base metal (copper, zinc, lead) deposits and anomalies (unusual amounts) in soils. Importantly, these discoveries have been linked to specific geological or tectonic processes (processes in Earth's lithosphere), making it easier for mining companies to assess the potential size and nature of the deposits.

Field team members discuss a nickel deposit discovery at a study site on the Melville Peninsula, Nunavut.

David Corrigan, GSC/NRCan

Another component of the project involved studying more recent geological processes. By using surface sediments and landforms, the research team examined the history of ice flow during the last major glaciation, which ended approximately 4000 years ago at that location. Glacial sediments can contain minerals that may indicate the proximity of base and precious metal deposits, including gem minerals such as diamond or topaz. Moreover, geochemical analyses done on these loose sediments and on lake-bottom sediments not only benefit exploration but also provide an inventory of naturally occurring toxic metals that can be used as environmental baselines.

This ongoing project is providing important background geological information for northern communities and industry groups who would like to better understand the potential for economically valuable minerals in the Melville Peninsula region. The project has also benefitted from much community involvement from residents of Hall Beach and Repulse Bay, Nunavut, through school visits, community consultations and employment opportunities for local youth at field camps.

"It has been a privilege to be given the opportunity to work with the Inuit of Repulse Bay and Hall Beach, in helping them understand better the nature, geological history and economic potential of their land." – David Corrigan

A helicopter carries field equipment in a sling near a field camp on Raanes Peninsula, Ellesmere Island.

Helen Smyth, CASP

DEVELOPMENT OF THE SVERDRUP BASIN OF THE CANADIAN ARCTIC ARCHIPELAGO

Helen Smyth, Steve Rippington, Robert Scott and Simon Kelly (CASP, United Kingdom)

Millions of years ago, the islands of the Canadian Arctic and the water channels around them did not look as they do today. Geological processes and landscape changes have altered the positions and structures of the islands over time. Weathering and erosion have also changed land surfaces, which resulted in the transport of sediments from one area to another, where they were deposited and eventually hardened into rock. Today, these layers of rock can be examined to determine detailed information on the geological and landscape processes that formed them.

Over several years, Helen Smyth and her CASP (formerly the Cambridge Arctic Shelf Programme) colleagues have been studying sedimentary rocks within a major geographical formation called the Sverdrup Basin, which crosses several islands in the Canadian Arctic Archipelago. The sedimentary rocks (e.g. sandstones and mudstones) were deposited over a 300 million-year period, cover an area 1300 kilometres by 400 kilometres and are more than 10 kilometres thick in the basin centre. The research team is examining the sedimentary rocks of the Sverdrup Basin to understand past environments in the region and to identify from where the minerals that formed the rocks came.

The research team collected sandstone samples to examine the composition of minerals in different layers of Sverdrup Basin rocks at locations on Axel Heiberg Island and Ellesmere Island, Nunavut, over several years. In the Slidre Fiord area near Eureka, Ellesmere Island, they identified four different layers of sand deposits. Each sand type corresponds to a different sand source area. The four sand types found were from the Triassic Period, near the Triassic-Jurassic boundary, the Early Cretaceous Period and the Late Cretaceous-Paleogene Periods, respectively, which cover a range of ages between 28 million and 260 million years. By studying the composition of each sand type, the researchers were able to trace the source area of each (e.g. Canadian Shield, Greenland or a specific mountain range) and determine the processes that led to the transport of each sand type from its source area to the Sverdrup Basin.

Through ongoing studies, the research team plans to develop a broader perspective of the geological development and history of the Sverdrup Basin by comparing the sand types from Slidre Fiord with those elsewhere in the Canadian Arctic and with sediments from other Arctic basins. This information will contribute to a better understanding of the opening of the Arctic Ocean and ancient sediment deposition processes. Because sedimentary basins are also common locations for hydrocarbon reserves, this project is also developing information that will be useful for examining resource potential in the region. The research team presented findings from their work to audiences in Iqaluit, Nunavut, in 2010.

"Our data provide an important timeline for the geological evolution not only of the Sverdrup Basin but of adjacent regions such as Baffin Bay, West Greenland, the Sverdrup Rim and the Barents Shelf, which helps us to understand how the region as a whole developed over time." – Helen Smyth

Projects focused on sustainable resources management

OCEANS ACIDIFICATION AND ARCTIC CARBONATES – SW ELLESMERE ISLAND

Principal investigator: Benoit Beauchamp (Department of Geoscience, University of Calgary)

Locations: West Blind Fiord and East Blind Fiord (Ellesmere Island), NU

GEM NORTHERN BASE AND PRECIOUS METAL POTENTIAL, VICTORIA ISLAND (N.W.T.) AND NUNAVUT

Principal investigator: Jean Bédard (Geological Survey of Canada – Québec, Natural Resources Canada)

Location: Victoria Island, N.W.T.

GEM DIAMONDS PROJECT: CHURCHILL DIAMOND CORRIDOR ACTIVITY

Principal investigator: Janet Campbell (Geological Survey of Canada – Central and Northern Canada, Natural Resources Canada)

Location: Repulse Bay, NU

GEOLOGY AND GEOCHRONOLOGY OF THE QUEEN MAUD BLOCK, WESTERN NUNAVUT

Principal investigator: Thomas Chacko (Department of Earth and Atmospheric Sciences, University of Alberta)

Location: Cambridge Bay (Victoria Island), NU

GEM – MULTIPLE METALS – MELVILLE PENINSULA (FORMERLY MELVILLE PENINSULA GEOSCIENCE PROJECT)

Principal investigator: David Corrigan (Geological Survey of Canada – Continental Geoscience Division, Natural Resources Canada)

Locations: Repulse Bay and Barrow River, NU

GEM IOCG/MULTIPLE METALS – GREAT BEAR REGION (N.W.T.) PROJECT

Principal investigator: Louise Corriveau (Geological Survey of Canada – Québec, Natural Resources Canada)

Locations: Lou Lake, Rebesca Lake, Hottah Lake, Exmouth Lake, Grouard Lake, Port Radium, Hepburn Lake and Terra Mine, N.W.T.

INVESTIGATIONS OF METHANE RELEASE FROM DEEP PERMAFROST AND GAS HYDRATES IN THE MACKENZIE DELTA AREA

Principal investigator: Scott Dallimore (Geological Survey of Canada – Pacific, Natural Resources Canada)

Locations: Mackenzie Delta and North Richards Island, N.W.T.

GEM GEOLOGY AND HYDROCARBON POTENTIAL OF ELLEF RINGNES ISLAND, NUNAVUT

Principal investigator: Keith Dewing (Geological Survey of Canada – Calgary, Natural Resources Canada)

Location: Ellef Ringnes Island, NU

GEM HYDROCARBON POTENTIAL OF THE WESTERN ARCTIC ISLANDS

Principal investigator: Keith Dewing (Geological Survey of Canada – Calgary, Natural Resources Canada)

Location: Victoria Island, N.W.T.

GEM BEDROCK MAPPING AND STRUCTURAL ANALYSIS OF MACKENZIE PLAIN AND FRANKLIN MOUNTAINS

Principal investigator: Karen Fallas (Geological Survey of Canada – Calgary, Natural Resources Canada)

Location: Norman Wells, N.W.T.

FERROPICRITES AND ARCHEAN CRUSTAL REWORKING OF THE UNGAVA CRATON IN THE LAC DUQUET AREA, NUNAVIK

Principal investigator: Donald Francis (Earth and Planetary Sciences, McGill University)

Locations: Lac Couture and north of Lac Duquet, Que.

GEOPHYSICAL STUDIES OF GROUND ICE IN THE EUREKA SOUND LOWLANDS

Principal investigator: Rebecca Ghent (Department of Geology, University of Toronto)

Location: Eureka (Ellesmere Island), NU

UNCLOS BATHYMETRY SURVEY, WARD HUNT ISLAND

Principal investigator: Julian Goodyear (Canadian Hydrographic Service, Fisheries and Oceans Canada)

Locations: Arctic Ocean Ice Camp and sea ice camp near Borden Island, N.W.T.

GEM NORTHERN URANIUM FOR CANADA: NORTHEAST THELON COMPILATION

Principal investigator: Charles Jefferson (Geological Survey of Canada – Central Canada Division, Natural Resources Canada)

Location: Baker Lake, NU

REGIONAL GEOSCIENCE STUDIES AND PETROLEUM POTENTIAL OF MACKENZIE PLAIN AREA, MAINLAND NORTHWEST TERRITORIES

Principal investigator: Adrienne Jones (NWT Geoscience Office, Government of the Northwest Territories)

Location: Norman Wells, N.W.T.

GEM YUKON SEDIMENTARY BASINS PROJECT

Principal investigator: Larry Lane (Geological Survey of Canada – Calgary, Natural Resources Canada)

Location: Eagle Plains, Y.T.

GEM HYDROCARBON POTENTIAL OF THE HUDSON BAY AND FOXE BASINS

Principal investigator: Denis Lavoie (Geological Survey of Canada – Québec, Natural Resources Canada)

Location: Coral Harbour (Southampton Island), NU

GEM field studies at a rock outcrop on the Melville Peninsula, Nunavut.

David Corrigan, GSC/NRCan

Field team members Helen Smyth (CASP), Dan Slidel (Royal Holloway University of London), Steve Rippington (CASP) and Chris Hachkowski (Carleton University) on the Raanes Peninsula, Ellesmere Island in 2010.

Helen Smyth, CASP

SELWYN-MACKENZIE SHALE BASINS PROJECT

Principal investigator: Edith Martel (ITI/Mineral, Oil and Gas, Government of Northwest Territories)

Locations: Mackenzie Mountains and Willow Handle Lake, N.W.T.

NORTHERN WATCH

Principal investigator: Jim Milne (Defence Research and Development Canada, Department of National Defence)

Location: Gascoyne Inlet (Devon Island), NU

GEM BAFFIN BAY BASINS PROJECT: BYLOT SAMPLING

Principal investigator: Gordon Oakey (Geological Survey of Canada, Natural Resources Canada)

Location: Pond Inlet (Baffin Island), NU

GEM ELLESMERE ISLAND TELESEISMIC EXPERIMENT

Principal investigator: Gordon Oakey (Geological Survey of Canada, Natural Resources Canada)

Locations: Eureka and Tanquary Fiord (Ellesmere Island), NU

GEM HELICOPTER AEROMAGNETIC SURVEY FROM GRISE FIORD

Principal investigator: Gordon Oakey (Geological Survey of Canada, Natural Resources Canada)

Locations: Philpots Island and Grise Fiord (Ellesmere Island), NU

GEM MULTIPLE METALS – CUMBERLAND PENINSULA (NUNAVUT)

Principal investigator: Mary Sanborn-Barrie (Earth Sciences Sector – Central and Northern Canada Branch, Natural Resources Canada)

Location: Padle Fiord (Baffin Island), NU

PROVENANCE OF CLASTIC SEDIMENTS IN THE SVERDRUP BASIN, CANADIAN ARCTIC ISLANDS

Principal investigator: Helen Smyth (CASP, Cambridge University)

Locations: Baumann Fiord and Trold Fiord (Raanes Peninsula), NU

COASTAL GEOSCIENCE FOR ARCTIC ECONOMIC DEVELOPMENT

Principal investigator: Steven Solomon (Geological Survey of Canada – Atlantic, Natural Resources Canada)

Location: Inuvik, N.W.T.

STRUCTURAL, THERMAL AND MAGMATIC EVOLUTION OF BAFFIN BAY AND DAVIS STRAIT AND ADJACENT CONTINENTAL MARGINS

Principal investigator: Randell Stephenson (School of Geosciences, University of Aberdeen)

Location: Qikiqtarjuaq (Baffin Island), NU

Twin Otter aircraft rest at a field camp in the Haughton Impact Structure on Devon Island, Nunavut, where planetary analogue research has been conducted.

Janice Lang, PCSP/NRCan

Planetary science

Some of the harshest climate conditions on Earth are found in the Canadian Arctic. Animals and vegetation in the region have adapted over time to living in extreme conditions, and each year, research projects are conducted in the Canadian Arctic to examine how life on Earth may have begun and how life could exist on other planets. Additionally, certain Canadian Arctic locations present similarities to the environments that may exist on other planets. Studies at these sites often involve examining the unique landscapes present and evaluating technologies that could be used on space missions in the future.

Projects focused on planetary science

ARTHUR CLARKE MARS GREENHOUSE PROJECT

Principal investigator: Alain Berinstain (Planetary Exploration Space Astronomy, Canadian Space Agency)

Location: Haughton Impact Crater (Devon Island) NU

HAUGHTON-MARS PROJECT (HMP): PLANETARY ANALOGUE FIELD STUDIES AT HAUGHTON CRATER AND SURROUNDING TERRAIN, DEVON ISLAND, NUNAVUT, CANADIAN HIGH ARCTIC

Principal investigator: Pascal Lee (Mars Institute)

Location: Haughton Impact Crater (Devon Island), NU

PALEOENVIRONMENTAL RECONSTRUCTION OF THE HAUGHTON IMPACT STRUCTURE AND SURROUNDING TERRAINS OVER THE PAST 39 MA

Principal investigator: Gordon Osinski (Department of Earth Sciences, University of Western Ontario)

Location: Haughton Impact Crater (Devon Island), NU

THE BIOPHYSICAL SIGNIFICANCE OF GROUNDWATER AND GROUND ICE IN COLD POLAR ENVIRONMENTS

Principal investigator: Wayne Pollard (Department of Geography, McGill University)

Location: Expedition Fiord (Axel Heiberg Island), NU

MICROBIAL INVESTIGATIONS OF COLD SALINE SPRINGS AND PERMAFROST IN THE HIGH ARCTIC

Principal investigator: Lyle Whyte (Department of Natural Resource Sciences, McGill University)

Location: Expedition Fiord (Axel Heiberg Island), NU

Field equipment is unloaded from a Twin Otter aircraft at Lake Hazen, Ellesmere Island, Nunavut.

Janice Lang, PCSP/NRCan

National parks and weather stations

Large expanses of Canada's North are protected within 11 national parks and numerous conservation areas. These preserved areas not only conserve a great diversity of habitats for plants and animals but also offer unique and valuable educational experiences for visitors. As the Canadian Arctic continues to undergo substantial environmental change, national parks are becoming increasingly important areas for researching ecosystems and their responses to change. Each year, Parks Canada conducts scientific studies, monitoring programs and operations to ensure maintenance of infrastructure used by visitors. Additionally, Environment Canada and several university groups maintain weather stations across the Canadian Arctic that require annual servicing. These weather stations collect data that are of great value to many scientific studies and monitoring programs.

CULTURAL RESOURCE MANAGEMENT IN QUTTINIRPAAQ NATIONAL PARK: DEFENCE RESEARCH BOARD HISTORY

Lynn Cousins (Parks Canada, Nunavut Field Unit) and Lyle Dick (Parks Canada, Western and Northern Service Centre)

Cultural resources in Quttinirpaaq National Park, Nunavut, are co-managed by Inuit people and Parks Canada through the Joint Park Management Committee (JPMC). Under JPMC direction, Parks Canada recently worked in partnership with Defence Research and Development Canada (DRDC) on a project to protect, present and promote Defence Research Board history in the High Arctic.

The Defence Research Board was formed in 1947 and later became the DRDC, a part of the Department of National Defence. The Board's High Arctic scientific activities began in 1953, when Board glaciologist Geoffrey Hattersley-Smith organized a series of reconnaissance trips along the northern coast of Ellesmere Island. The group then established a research base camp at Lake Hazen, Ellesmere Island, in 1957 to conduct a multinational research program during the International Geophysical Year. In 1959, the Board collaborated with the United States Air Force and the Arctic Institute of North America to establish another base camp on Ward Hunt Island, where the group studied the Ward Hunt Ice Shelf to determine its suitability as an aircraft landing surface and researched much of the region's climatic history. In 1962, another base camp was established at Tanquary Fiord, Ellesmere Island, where the Board carried out a wide range of scientific studies until 1978. This extensive work by Board scientists in Quttinirpaaq National Park resulted in a wealth of knowledge that was of both scientific and military value to Canada.

The scientific work of the Defence Research Board in the Canadian Arctic left behind three main camps and hundreds of artifacts that document the major interdisciplinary research programs conducted in Quttinirpaaq National Park. These remarkable sites

Emily Cowall (DRDC volunteer) and Lynn Cousins (Parks Canada) document Defence Research Board camp artifacts at Tanquary Fiord, Ellesmere Island.

Miguel James, DRDC

chart the development of Canada's capacity to carry out large-scale operations in the High Arctic and provide an important historical record of the Defence Research Board's contributions, not only to the logistics of High Arctic science but also to the science of logistics.

To preserve and interpret this rich research history, Parks Canada Conservator Sandra Hollender and Emily Cowall and Miguel James (DRDC volunteers) carried out heritage resource conservation efforts to inventory, evaluate and stabilize DRB artifacts and to create an exhibit at Tanquary Fiord in summer 2009. Parks Canada Historian Lyle Dick also interviewed Geoffrey Hattersley-Smith to document the fascinating story of Defence Research Board High Arctic scientific work. The interpretive program consists of on-site exhibits, interpretive panels and a booklet. Copies of the booklet can be obtained by contacting Lynn Cousins, Cultural Resource Management Advisor, Parks Canada – Nunavut Field Unit (lynn.cousins@pc.gc.ca).

Projects focused on national parks and weather stations

SIRMILIK NATIONAL PARK OPERATIONS

Principal investigator: Carey Elverum (Sirmilik National Park, Parks Canada)

Locations: Oliver Sound, Pond Inlet, Mala River (Baffin Island) and Bylot Island, NU

QUTTINIRPAAQ NATIONAL PARK OPERATIONS

Principal investigator: Tyler Harbidge (Nunavut Field Unit, Parks Canada)

Locations: Eureka, Fort Conger and Lake Hazen (Ellesmere Island), Tanquary Fiord and Ward Hunt Island, NU

YEARLY SERVICING OF AUTOMATIC WEATHER STATIONS AT ISACHSEN, MOULD BAY, STEFANSSON ISLAND, RAE POINT AND GRISE FIORD

Principal investigator: Jeff Sowiak (Meteorological Service of Canada, Environment Canada)

Location: Resolute (Cornwallis Island), NU

UKKUSIKSALIK NATIONAL PARK OF CANADA

Principal investigator: Monty Yank (Ukkusiksalik National Park, Parks Canada)

Locations: Douglas Harbour, Sila Lodge, Wager Bay, Snowbank River and Repulse Bay, NU

Annex

PCSP advisory board

The PCSP advisory board provides the PCSP and senior managers in Natural Resources Canada with guidance and advice on the following:

- logistical services and directions for the PCSP to meet the needs of Arctic science
- screening processes of project proposals
- consideration of Traditional Knowledge and Arctic communities' interests
- membership of the PCSP Science Screening Committee, which reviews university based, non-Canadian or independent applications, to ensure fairness, equity and transparency

PCSP Advisory Board Members – 2011

Dr. Martin Fortier (Chairperson)
Executive Director, ArcticNet
Université Laval

Dr. Marianne Douglas
Professor, Department of Earth and Atmospheric Sciences
Director, Canadian Circumpolar Institute
University of Alberta

Ms. Siu-Ling Han
Head, Eastern Arctic Unit
Canadian Wildlife Service, Environment Canada

Dr. David Hik
Professor and Canada Research Chair in Northern Ecology, Tier 2
Department of Biological Sciences, University of Alberta

Mr. Michael Jordan
Acting Director, Polar Continental Shelf Program
Earth Sciences Sector, Natural Resources Canada

Dr. Mario Lamarca
Director, Life Sciences and Geosciences Division
Natural Sciences and Engineering Research Council of Canada

Dr. Scott Lamoureux
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Queen's University

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Planetary Exploration and Space Astronomy
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Mr. Scot Nickels
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Yukon College

Ms. Pippa Seccombe-Hett
Director, Aurora Research Institute
Aurora College

Ms. Mary Ellen Thomas
Senior Research Officer and Government of Nunavut Science Advisor
Nunavut Research Institute

Dr. Robert Young
Division Manager, Arctic Aquatic Research Division
Fisheries and Oceans Canada

PCSP Science Screening Committee

The PCSP Science Screening Committee annually reviews academic, non-Canadian and non-government organization proposals from a scientific merit perspective. The committee's evaluation is based on the following:

- the scientific merit of the project, clarity of the project's objectives and project feasibility
- the applicant's scientific productivity based on the record of publications for the past five years
- in the case of university programs, the involvement of students. The Committee may consult other scientists if required.

The recommendations of the Science Screening Committee are an essential part of the PCSP's allocation decisions for logistical support, which include consideration of project scientific merit, resource availability and logistics feasibility.

PCSP Science Screening Committee – 2011

Dr. Scott Lamoureux (Chairperson)
Associate Professor, Department of Geography
Queen's University

Dr. Benoît Beauchamp
Professor, Department of Geoscience
University of Calgary

Dr. Luke Copland
Associate Professor, Department of Geography
University of Ottawa

Dr. Gilles Gauthier
Professor, Department of Biology and Centre for Northern Studies
Université Laval

Dr. Vincent St. Louis
Professor, Department of Biological Sciences
University of Alberta

Dr. Peter Whitridge
Associate Professor, Department of Archaeology
Memorial University of Newfoundland