# Canadian National Implementation Plan for Contaminants under AMAP 2007/08

Three major Canadian programs will be conducting research relevant to AMAP in 2007/08. These include the Northern Contaminants Program (NCP), ArcticNet, and a national research program under International Polar Year (IPY).

The bulk of Canada's National Implementation Plan for contaminants under AMAP comprises 57 projects being conducted under the NCP. These projects are organized under three categories: Human Health, Environmental Trends Related to Human Health and International Controls, and Education and Communications. Tables 1a, 1b, and 1c list the titles of each project and Annex 1, contains full plain language summaries for each of these projects.

Canada's IPY program consists of 44 projects related to two priority areas: science for climate change impacts and adaptation, and the health and well-being of Northern communities. These projects are listed in Table 2 and a brief description of each is given in Annex 2.

ArcticNet is a broad based network of researchers with the central objective to translate our growing understanding of the changing Arctic into impact assessments, national policies and adaptation strategies. A list of projects with relevance to AMAP objectives are listed in Table 3. Elements of those projects that might be relevant to an AMAP are provided in Annex 3.

Additional updates may be provided over the course of the year to reflect any new projects, particularly as they may relate to issues of interest to AMAP.

## Table 1a, Projects being carried out under the Northern Contaminants Program related to Human Health

| Project Number | Project Title | Project Leader |
|---|---|---|
| H-01 | Monitoring Temporal Trends of Human Environmental Contaminants in Nunavut (Qikiqtaaluk Region) | Mary Potyrala<br>Janet Brewster |
| H-02 | Monitoring Spatial and Temporal Trends of Environmental Pollutants in Maternal Blood in Nunivak | Daria Pereg |
| H-03 | Nunivak Cohort Study on Exposure to Environmental Contaminants and Child Development | Gina Muckle |
| H-04 | Effects of Perinatal Exposure to Environmental Contaminantson activity, attention and emotionality in Inuit Children: statistical analyses at 1 and 5 years of age and data colection of video recordings at 10 years of age | Pierrich Plusquellec |
| H-05 | Neurobehavioural Effects in Rats after Perinatal Exposure to a Arctic Contaminant Mixture: Validating Neurobehavioural Measures in Rodents against Neurobehavioural Measures in the Inuit Child Cohort | Wayne Bowers |
| H-07 | Identification of novel persistent, bioaccumulative, and potentially toxic organic contaminants in Arctic food commodities | Sheryl Tittlemier<br>Gregg Tomy |
| H-08 | Assessment of Contaminant and Dietary Nutrient Interactions in Inuit Health Survey: Nunavut, Nunatsiavut and Inuvialuit (Was focused in Iqaluit in 2006/07) | Laurie Chan |
| H-10 | Evaluation of Interactions Between Contaminants and Nutrients: Effects of Polychlorinated Biphenlys and Organochlorine Pesticides or Labrador Tea (Rhododendron Tomentosum Extract) on MeHg Induced Toxicity | Guillaume Pelletier |
| H-12 | Contaminant Nutrient Interaction Issues as part of a public Health Intervention Study of Inuit Children in Nunavik | Huguette Turgeon-O'Brien |
| H-14 | Regionally Relevant Health Risk Assessments for Mercury Levels in Fish in the Yukon | Cindy Dickson |
| H-15 | Monitoring Temporal Trends of Human Environmental Contaminants in the NWT (MOMs) | B. Armstrong |

**Table 1b, Projects being carried out under the Northern Contaminants Program related to Environmental Trends Related to Human Health and International Controls**

| Project Number | Project Title | Project Leader |
|---|---|---|
| M-01 | Northern Contaminants Air Monitoring: Organic Pollutant Measurements | Hayley Hung |
| M-02 | Air Measurements of Mercury at Alert | Alexandra Steffen |
| M-03 | Contributing to International Controls on POPs and Mercury: Further Applications of Global Mass Balance Models | Don Mackay |
| M-04 | Temporal Trends of Persistent Organic Pollutants and Metals in Ringed Seals from the Canadian Arctic | Derek Muir |
| M-05 | Temporal and Spatial Trends of Organic and Metal Contaminants in Canadian Polar Bears: Part III | Robert Letcher |
| M-06 | Geographical and time-trend studies on new and emerging persistent halogenated compounds in marine mammals from the Canadian Arctic | Greg Tomy |
| M-07 | Temporal Trends of Heavy Metals and Halogenated Organic Compounds in Arctic Marine Mammals (Beluga, Narwhal and Walrus) | Gary Stern |
| M-08 | Temporal Trends of Contaminants in Arctic Seabird Eggs: Inter-year Variability | Birgit Braune |
| M-09 | Temporal Trends of Spatial Variations in Persistent Organic Pollutants and Metals in Sea Run Char from the Canadian Arctic | Marlene Evans |
| M-10 | Temporal Trends of Persistent Organic Pollutants and Mercury in Landlocked Char in the High Arctic | Derek Muir |
| M-11 | Spatial and Long-term Trends in Persistent Organic Contaminants and Metals in Lake Trout and Burbot from the Northwest Territories | Marlene Evans |
| M-12 | Temporal Trend Studies of Trace Metals and Halogenated Organic Contaminants (HOCs), Including New and Emerging Persistent Compounds in Mackenzie River Burbot, Fort Good Hope, NT | Gary Stern |
| M-13 | Long Term Trends of Halogenated Organic Contaminants and Metals in Lake Trout from Yukon Lakes | Gary Stern |
| M-14 | Caribou and Moose Contaminant Monitoring Program | Mary Gamberg |
| M-15 | Pathways and processes of new and emerging halogenated contaminants in a lower marine food web in the Beaufort Sea | Gregg Tomy |
| M-16 | Air Measurements of Mercury at Little Fox Lake, Yukon | Alexandra Steffen |
| M-18 | Long Term Trends in HCH and PCDD/F in Holman Ringed Seals: Testing Past Predictions of Current and Future Trends | Richard Addison |
| M-19 | Bioaccummulation of Persistent Organic Pollutants in the Lower Food Web of the Western Arctic Ocean | Brendan Hickie |
| M-20 | Characterizing Contaminant-Related Health Effects in Beluga Whales (Delphinapterus leucas) from the Western Canadian Arctic | Peter Ross |

**Table 1c, Projects being carried out under the Northern Contaminants Program related to Education and Communications**

| Project Number | Project Title | Project Leader |
|---|---|---|
| C-01 | Yukon Contaminants Committee Communications in 2007/2008 | Cindy Dickson |
| C-02 – C-05 | Participation in the Northwest Territories Environmental Contaminants Committee (DehCho, Gwich'in Tribal Council, Tlicho, NWT-MN, NSMA and Akaitcho) | Lee Thom, M.Semmler, Lloyd Woloshyn, Chris Heron, Valerie Meeres, and Patrick Simon |
| C-06 | Developing Communications and Research Monitoring Infrastructure for the Inuvialuit Settlement Region | Nellie Cournovea |
| C-07 | Communicating on Nutrition, Health and Contaminants in Nunavik | Elena Labranche |
| C-08 | NTI Inuit Research Advisor | TBA |
| C-09 | Nunatsiavut Inuit Research Advisor | TBA |
| C-10 | Communicating on Contaminants and Health in Labrador: Continuing to Meet the Information Needs of Nunatsiavummiut | Mary Denniston |
| C-11 | International Inuit Contaminant Activities in Support of Global Instruments and Activities | Stephanie Meakin |
| C-12 | Human Perceptions, Comprehension and Awareness of Contaminants in Sanikiluaq | Jill Oakes |
| C-13 | Caribou and Moose Contaminant Monitoring Program Training and Capacity Building Workshop | Lorna Skinner |
| C-14 | Caribou and Moose Contaminant Monitoring Program Training Video | Mary Gamberg |
| C-16 | Sahtu Participation in the Northwest Territories Environmental Contaminants Committee | Freda Taniton (Sahtu) |
| C-17 | NWTMN Participation in the Northwest Territories Environmental Contaminants Committee | Chris Heron (NWT-MN) |
| C-18 | Distribute and Communicate NCP Relevant Information to Yukon First Nations and CYFN General Assembly | Cindy Dickson (CYFN) |
| C-19 | Community Based Northern Contaminants Program Workshops | Cindy Dickson (CYFN) |

**Table 2. Project being carried out under Canada's IPY program**

| Project Title | Project Leader |
|---|---|
| Arctic Freshwater Systems | Environment Canada |
| Arctic Resiliency and Diversity | Inuit Tapiriit Kanatami with universities and Northern organizations |
| Arctic Weather and Environmental Prediction Initiative | Gilbert Brunet |
| Beluga Tagging in the Arctic | Mike Hammill |
| C3O - Canada's Three Oceans | Eddy Carmack, |
| The Carbon Cycle in the Canadian Arctic and Sub-Arctic Continental Margin | Charles Gobeil |
| Carbon, Microbial and Plant Community Dynamics in Low-Arctic Tundra | Suzanne Simard |
| Changing Forests and Peatlands along the Mackenzie Valley, Northwest Territories | Jagtar Bhatti |
| The Circumpolar Flaw Lead System Study | David Barber |
| Climate Change Impacts on Canadian Arctic Tundra | Greg Henry |
| Climate Variability and Change Effects on Chars in the Arctic | James Reist |
| Communities in the Changing Arctic | Barry Smit |
| Constructed Wetlands for Treatment of Wastewater in Arctic Communities | Mark Williamson |
| Coordinated Effort to Clear Hepatitis Viruses from the Canadian North | Gerald Minuk |
| Determining the Diet of the Greenland Shark in a Changing Arctic | Aaron Fisk |
| Dynamic Inuit Societies in Arctic History | Trevor Friesen |
| Effects of Global Warming on Polar Bears, Seals and Whales | Steven Ferguson |
| Engaging Communities in the Monitoring of Country Food Safety | Manon Simard |
| Environmental Change and Traditional Use in the Old Crow Flats in Northern Canada | Shel Graupe |
| Environmental Change in the High Arctic from Snow and Ice Cores | Jocelyne Bourgeois |
| Evaluating the Effectiveness of Vaccination against Respiratory Infections for Young Children of the Nunavik Region | Philippe DeWals |
| How Seabirds Can Help Detect Ecosystem Change in the Arctic | William Montevecchi |
| Human Papillomavirus (HPV) and Cervical Disease in the Northwest Territories | Judy Niles |
| Impacts of a Changing Arctic Tree Line | Karen Harper |

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| The Impact of Climate Change on Tundra Wildlife | Gilles Gauthier |
| The Impacts of Oil and Gas Activity on Peoples in the Arctic | Dawn Bazely |
| Impacts of Severe Arctic Storms and Climate Change on Coastal Areas | William Perrie |
| An Integrated Research Program on Arctic Marine Fat and Lipids | Éric Dewailly |
| Inuit Health Survey: Inuit Health in Transition and Resiliency | Grace Egeland |
| Inuit History: Climatic Change and Historical Connections in Arctic Canada | Patricia Sutherland |
| Inuit Sea Ice Use and Occupancy Project | Claudio Aporta |
| Investigation of the Effect of Climate Change on Nutrient and Carbon Cycles in the Arctic Ocean | Roger Francois |
| Kwaday Dan Ts'inchi Discovery - Expanding our Understanding through Linked Scientific and Community Studies Project | Sheila Greer |
| Measuring the Impact of Climate Change on Landscape and Water Systems in the High Arctic | Scott Lamoureux |
| Monitoring the Impacts of Global Change on Caribou and Wild Reindeer and their Link to Human Communities | Don Russell |
| Northwest Territories Ice Patch Study | Thomas Andrews |
| Ocean Currents of Arctic Canada | Humfrey Melling |
| Ocean Production of Trace Gases in the Arctic and their Impact on Climate | Maurice Levasseur |
| The PEARL near the Pole – Atmospheric Research in the High Arctic | James Drummond |
| Permafrost Conditions and Climate Change | Antoni Lewkowicz |
| Polar Ecosystems in Transition: An Interdisciplinary Investigation into the Impacts of Climate Change on Polar Bears | Elizabeth Peacock |
| Pollutants Travelling in the Air to the Arctic | Hayley Hung |
| OASIS-CANADA: Understanding Ozone and Mercury in the Air Over the Arctic Ocean | Jan Bottenheim |
| Variability and Change in the Canadian Cryosphere (Snow and Ice) | Anne Walker |

**Table 3. Projects being carried out under ArcticNet**

| Project Title | Project Leader |
|---|---|
| Theme 1. Climate Change Impacts in the Canadian High Arctic (North Water, Central Archipelago, Mackenzie Shelf): a Comparative Study Along the East-West Gradient in Physical and Societal Conditions | |
| Project 1.1 Warming Coastal Seas & Shrinking Sea Ice | Yves Gratton, David G Barber |
| Project 1.2 Coastal Vulnerability in a Warming Arctic | Donald Forbes, Wayne Pollard, Trevor Bell |
| Project 1.3 Contaminant Cycling in the Coastal Environment | Robie Macdonald, Gary Stern |
| Project 1.4 Marine Productivity & Sustained Exploitation of Emerging Fisheries | Jean-Eric Tremblay |
| Project 1.5 Changes in Dietary Pattern and Impacts on Chronic Diseases Emergence | Éric Dewailly |
| Project 1.6 The Opening NW Passage: Resources, Navigation, Sovereignty & Security | John Hughes Clarke, Steve Blasco |
| Project 1.7 Canada's Arctic Waters in International Law and Diplomacy | Micheal Byers |
| Theme 2. Food, Water and Resources in the Shifting N-S Thermal Gradient of the Terrestrial Eastern Canadian Arctic | |
| Project 2.1 Changing Food Diversity, Wildlife Patterns and Exploitation | Dominique Berteaux, Gilles Gauthier |
| Project 2.2 Water Quality, Supply and Indicators of Change | Warwick Vincent, Éric Dewailly |
| Project 2.3 Emerging New Infectious Diseases in Humans and Wildlife | Benoit Lévesque, Éric Dewailly |
| Project 2.4 Climate and Coastal Landscape Instability: Socio-Economic and Ecological Impacts | Michel Allard, Wayne Pollard |
| Project 2.5 Cultural Self-Determination, Endogenous Development and Environmental Changes | Mark Nuttall |
| Project 2.6 Warming the Tundra: Health, Biodiversity, and Greenhouse Gas Implications | Greg Henry, Yves Bégin |
| Project 2.7 Climate impacts on the sentinel species Arctic char (*Salvelinus alpinus*) in northern Canada | Michael Power, Bill Doidge |
| Theme 3. Managing the Largest Canadian Watershed in a New Climate: Land-ocean Interactions in Sub-Arctic Hudson Bay | |
| Project 3.1 Ocean-Ice-Atmosphere Coupling and Climate Variability | David Barber |
| Project 3.2 The Hudson Bay Coastal Zone in a Changing Climate System | Tim N. Papakyriakou |
| Project 3.3 Climate Variability / Change and Marine Ecosystem Resources in Hudson Bay | Michel Gosselin |
| Project 3.4 Carbon & Contaminant Cycling in the | Stern, Gary A. |

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| Coastal Environment | |
| Project 3.5 Persistent Organic Pollutants and Human Health | Pierre Ayotte, Laurie Chan |
| Project 3.6 People and Environmental Change: Linking Traditional and Scientific Knowledge | Jill Oakes, Rick Riewe |
| Project 3.7 Nunatsiavut Nuluak: Baseline Inventory and Comparative Assessment of Three Northern Labrador Fiord-based Marine Ecosystems | Ken Reimer, Marina Biasutti |
| Theme 4. Adapting to Change in the Canadian Arctic: Knowledge Transfer, Policies & Strategies | |
| Project 4.1 Projecting into the Future: the Canadian Arctic Environment, Tomorrow to 2100 | David Barber |
| Project 4.2 Reducing Human Vulnerability to Environmental Changes in the Canadian Arctic | Barry Smit |
| Project 4.3 Vulnerabilities and Adaptation to Meteorological and Related Hazards | Ronald Stewart |
| Project 4.4 Climate Change, Key Traditional Food Species and Community Health in the Arctic | Laurie Chan, Christopher Furgal |
| Project 4.5 Surveillance and Management of Climate Change Impacts in the North: Implications for Northern Public Health Policy and Infrastructure | Pierre Gosselin |
| Project 4.6 Conservation, economic development and community values: legal, policy and ethical perspectives | Milton Freeman |
| Project 4.7 Science-Policy Interaction | Gordon McBean |
| Project 4.8 Strengthening Climate Cooperation, Compliance & Coherence | Richard Janda |

## Annex 1 – Summary of projects conducted under the Northern Contaminants Program

| **Program Category: Human Health** | **H-01** |
|---|---|
| **Project Title:**<br><br>**Monitoring Temporal Trends of Human Environmental Contaminants in Nunavut (Qikiqtaaluk Region)**<br><br>The study is known locally as: **The Anaana Project or Maternal Health Survey.** | |
| **Project Leader(s):** Mary Potyrala, Janet Brewster, Nunavut Department of Health and Social Services | |

**Plain Language Summary**

The aim of this multi-year program (2003-2007) is to monitor temporal trends of maternal exposure to selected environmental contaminants using blood and hair as biomarkers in the Qikiqtaaluk region of Nunavut. The region was identified as a priority due to its historically high levels of most contaminants of the five regions of NWT and Nunavut that conducted baseline studies between 1994 and 2000. The findings will inform international contaminant monitoring initiatives such as the Global Monitoring Plan under the Stockholm Convention.

Pregnant Inuit women over 36 weeks gestation were invited to participate in the study. A questionnaire collected demographic information, country food consumption (1 year recall) and other lifestyle factors during pregnancy. Blood samples were analysed for POPs, heavy metals, some emerging contaminants, vitamins and nutrients. Mercury exposure was measured per trimester from collected hair samples.

Initially proposed as a four-year program, multiple constraints including delays in identifying a coordinator have required an extension to a fifth year.

Objectives for the final year (2007-2008) include the completion of data analyses, an exposure and nutrition risk-benefit assessment, the development of a public message or advisory, communication materials, and the delivery of results to the various stakeholders.

| **Program Category: Human Health** | **H-02** |
|---|---|
| **Project Title:**<br><br>**Monitoring spatial and temporal trends of environmental pollutants in maternal and cord blood in Nunavik** | |

**Project Leader(s):**

- Daria Pereg, Public Health Research Unit, CHUL-CHUQ,

**Plain Language Summary**

The Inuit are exposed to a wide range of environmental contaminants through their traditional diet, which includes significant amounts of fish and sea mammal fat. During the past fifteen years, several studies monitored the exposure of Nunavik's Inuit to persistent organic pollutants and heavy metals. This project proposes to focus on exposure assessments in Nunavik, to compare current exposure levels and profiles with those prevailing ten to fifteen years ago based on our last surveys, and additionally, to assess exposure to emerging environmental contaminants for which increasing concentrations in wildlife and human samples have been reported worldwide. Data from pas surveys will be harmonized and integrated into functional databases. Sample collection from the Module du Nord (Montreal) and Nunavik Health Centers hosting pregnant women in Nunavik are either ongoing or will be implemented in the course of the current funding year. Analyses will be conducted on maternal and cord blood collected recently from Nunavik women, as well as on archived samples from past surveys. This study will provide 1) an update of geographical patterns of exposure; 2) information about whether exposure levels to different classes of contaminants are increasing, decreasing or remaining the same in northern populations, as well as how exposure profiles are changing through time; 3) information about the efficiency of intervention programs implemented following earlier surveys.

**Program Category: Human Health** **H-03**

**Project Title:**

## Nunavik cohort study on exposure to environmental contaminants and child development

**Project Leader(s):**

- Gina Muckle, Unité de recherche en santé publique, Centre de recherche du CHUQ; École de psychologie, Université Laval

**Plain Language Summary**

Prenatal Exposure to PCBs and mercury were associated to growth and developmental effects in children. The Inuit from Nunavik are among the most highly exposed populations to these environmental pollutants due to their bioaccumulation in fish and marine mammals, which are consumed by the Inuit. However, consumption of fish and marine mammals also provides nutrients such as omega-3 fatty acids, which are known to enhance early brain development. We have conducted three studies in Nunavik since the last decade: monitoring of prenatal exposure from cord blood sampling, effect study with infants up to 12 months of age, and effect study at preschool age. The proposed study will follow-up these three cohorts of children at 10 years of age. The aims are to document the long term effects of pre- and postnatal exposure to these contaminants, as well as to new emerging contaminants, and to evaluate if omega-3 fatty acids and selenium can protect against adverse effects. This 5-year study will involve about 300 school age children from the 14 Nunavik communities. The proposed

work will support the health risk assessment process and meets the NPC blueprint priorities.

**Program Category: Human Health - Epidemiological Research** | **H-04**

**Project Title:**

## Effects of perinatal exposure to environmental contaminants on activity, attention and emotionality in Inuit children: *statistical analyses at 1 and 5 years of age and data collection of video recordings at 10 years of age*


**Project Leader(s):**

- Pierrich Plusquellec, Unité de recherche en santé publique
  Centre de recherche du CHUL-CHUQ



**Plain Language Summary**

Traditional Inuit diet is contaminated by environmental pollutants such as organochlorines (Ocs), methylmercury (MeHg), and lead (Pb). Prenatal exposure to such contaminants has been linked to developmental and cognitive effects in many epidemiological studies but behavioural effects have not been extensively studied. Although subtle, behavioural effects may have considerable consequences in a developmental perspective. However, directions of such effects are often controversial, probably because tools used to assess behaviour are often indirect and lack of sensibility. We thus proposed to carry out an innovative study, based on direct observations of behaviours, including activity, attention and emotionality, from video recordings taken in two ongoing cohort studies of Canadian Inuit children currently followed at 10 years of age. Those studies include extensive collection of data on various aspects, and thus will allow to control for confounding variables through multiple regression linear modeling. Recent results show that our method is really effective in detecting subtle behavioural effects to low-level prenatal lead exposure in 11 month-old Inuit children. Analyses with other environmental contaminants (MeHg, PCB) and at other stage of development (5 years of age) remain to be done. Furthermore, the follow-up of the children from these two cohorts is ongoing and we propose to document the long term behavioural effects of pre- and postnatal exposure to environmental contaminants through collecting video recordings, and starting their behavioural coding. Our objectives for year 2007/2008 are to continue analyzing the relations of environmental contaminants to observed behavioural outcomes (activity, attention, and emotionality) already coded in 11-month-old and 5 year-old children, and to start a new data collection in 10 year-old children by collecting video recordings and starting their behavioural coding. This study will take place at CHUQ/Laval University, Québec City. Those innovative methods will provide strong evidence of the existence of behavioural effects across child development (long-term effects), following developmental exposure to environmental contaminants in Inuit populations. The proposed work meets the NPC blueprint priorities.

| Program Category: Human Health: Toxicological Studies | H-05 |
|---|---|
| **Project Title:**<br><br>**Neurobehavioural effects in rats after perinatal exposure to an Arctic contaminant mixture: validating neurobehavioural measures in rodents against neurobehavioural measures in the Inuit Child cohort** | |
| **Project Leader(s):**<br>Dr Wayne Bowers, Healthy Environments and Consumer Safety Branch, Health Canada | |

**Plain Language Summary**

We have conducted a number of studies examining the neurotoxicological and other health effects of exposure to a mixture of 26 chemical pollutants after perinatal exposure in rodents. The mixture that we employed was developed on the basis of the profile of chemicals found in the maternal blood of Arctic Inuit populations. Results from these studies have demonstrated that this chemical mixture produces a profile of contaminants in the blood of rodent mothers that is very similar to the profile in Inuit maternal blood. Moreover, we have found that the relative levels of PCB congeners and organochlorine pesticides in the mixture are comparable to the profile found in Inuit maternal blood. Thus, our results provide strong evidence that the exposure model (i.e., this mixture) we use has strong face validity as a model of contaminant exposure in Arctic populations. Recent data from these mixture studies indicates that PCB tissues levels (blood and brain) are higher in animals given PCBs as a component of the Arctic mixture compared to animals given only PCBs. Results from tests of motor function as well as learning and memory indicate the effects of the mixture appear to reflect the additive effects of primarily the PCB and methylmercury components of the mixture. The current study will provide a detailed, focussed analysis of neurobehavioural measures used to assess the neurobehavioural toxicity. By employing both new test methods as well as existing, established neurobehavioural test procedures the results will facilitate the application of neurobehavioural test results from animal toxicology studies to characterizing health effects in human populations. This work will adapt tests used in human studies in order to measure comparable neurobehavioural capacities in animals. The first goal of this proposal is to incorporate measurements of the underlying functional capacity evaluated in human studies into a toxicological study of the effects of the chemical mixture in order to validate neurobehavioural outcome measurements. The second goal of this proposal is to directly compare the effects of exposure to the PCB+methylmercury (MeHg) components of the mixture against the effects of the complete chemical mixture. Existing studies of PCB/MeHg interactions typically use dose profiles that are considerably different from the dose profile found in Arctic populations. We and others have found that MeHg toxicity is reduced when MeHg exposure occurs as part of the complete chemical mixture. The proposed work will evaluate the combined PCB/MeHg exposure relative to the whole mixture to determine the relevance of existing PCB/MeHg studies for Arctic populations with unique exposure profiles.

| Program Category: Human Health – Exposure Assessment | H-07 |
|---|---|
| **Project Title:**<br><br>**Identification of novel persistent, bioaccumulative, and potentially toxic organic contaminants in Arctic food commodities** | |
| **Project Leader(s):**<br>Sheryl Tittlemier, Food Research Division, Health Canada,<br>Gregg Tomy, Department of Fisheries and Oceans | |

**Plain Language Summary**

Many chemical contaminants accumulate in traditional food commodities. Traditional food consumers, particularly those that often consume large predators, can be exposed to more of these accumulative contaminants. Current surveys of contaminants in traditional foods, Arctic animals, and northern residents use selective methods; therefore many contaminants are inadvertently ignored during analyses. Recent work has observed contaminants in addition to those currently included in monitoring programs in animals such as beluga and polar bear. This exploratory project will investigate various food commodities (caribou, Arctic char, ringed seal, beluga, and polar bear) for unknown contaminants that are: 1) persistent, bioaccumulative, potentially toxic, and likely to undergo long range transport to the Arctic, and 2) not currently being analyzed by NCP monitoring and surveillance activities. This work will help guide future human health and environmental monitoring activities and will complement ongoing research studying temporal and geographical trends of known contaminants. In addition, the proposed work will provide good value and an efficient use of samples collected by previous NCP supported studies.

| Program Category: Human Health | H-08 |
|---|---|
| **Project Title:**<br><br>**H-08 - Assessment of contaminant and dietary nutrient interactions in Inuit Health Survey: Nunavut, Nunatsiavut and Inuvialuit** | |
| **Project Leader(s):**<br>Laurie H.M. Chan, BC Leadership Chair in Aboriginal Environmental Health Community Health Program, University of Northern British Columbia | |

**Plain Language Summary**

The proposal responds to the NCP Blueprint for Human Health priorities related to epidemiologic research which seeks to incorporate contaminants research within broader health research studies rather than fund stand alone contaminants projects. The planned Inuit Health Survey is a major study that will provide a snapshot and baseline data on the health status of Inuit in Nunavut and Inuvialuit for the first time. We are planning to expand the project to include Nunatsiavut. The Inuit Health Survey has obtained partial funding from the Canadian Institute for Health Research ($1.5 million over 5 years), and from Government of Canada Program for International Polar Year (IPY) (tentatively $6 million over 5 years pending final approval). We seek funding support to measure the amount of environmental contaminants in the bodies of the participants, the risks and benefits associated with the traditional food diet and the relationship between contaminants and health outcomes of the participants. A planning grant was obtained last year to plan for the Nunavut study this year. Survey and sample collection will be conducted in Nunavut on board of the research vessel "Amundsen" while consultation and planning will continue in Inuvialuit and Nunatsiavut in 2007-2008. This is a participatory research with full partnership with the Inuit organizations and the regional health departments. All necessary measures will be undertaken to increase the capacity of the communities and local health professionals. The key research question is "How do the diets and contaminants affect the health of the Inuit?" Results of the study will provide useful information to assist health professionals and policy makers at the territorial, national and international levels in developing environmental health policies and aid Inuit in making informed dietary choices.

| Program Category: Human Health Toxicological Research | H-10 |
|---|---|
| **Project Title:**<br><br>**H-10 - Evaluation of interactions between contaminants and nutrients: Effects of polychlorinated biphenyls and organochlorine pesticides or Labrador tea (*Rhododendron tomentosum* extract) on MeHg induced toxicity** | |
| **Project Leader(s):**<br>Guillaume Pelletier, Healthy Environments and Consumer Safety Branch, Health Canada | |

**Plain Language Summary**

The Northern Contaminant Mixture (NCM) was designed to reproduce the serum contaminant profile of Canadian Arctic populations and its effects on rat neurodevelopment were characterized by Dr. Bowers at Health Canada. The effects of this mixture on brain molecular endpoints were also assessed: Our investigations revealed that the list of individual components can not be used to accurately predict the health and neurodevelopment consequences resulting from NCM exposure (i.e. interactions between contaminants occur) and that methylmercury plays a significant role in NCM toxicity.

In this study, we propose to measure and investigate the correlation between molecular endpoints and perturbations of neurodevelopment, health and neuromotor functions of rat pups exposed to MeHg, either alone or as part of mixtures with PCBs and OCs or Labrador tea extract. Data generated will allow us to (1) evaluate the robustness of biomarkers of MeHg exposure/effects at low doses and for different co-exposure scenarios, (2) better understand the molecular mechanisms underlying the interactions between contaminants and nutrients, and (3) assess nutritional approaches to mitigate methylmercury neurotoxicity, using locally available and culturally relevant country food. This knowledge will lead to better risk assessment and strategies to minimize the impact of environmental contaminants on the health of Canadian Arctic populations.

| Program Category: Human Health | H-12 |
|---|---|
| **Project Title:**<br><br>**H-12 - Contaminant Nutrient Interaction Issues as part of a public Health Intervention Study of Inuit Children in Nunavik** | |
| **Project Leader(s):**<br>Huguette Turgeon-O'Brien, Faculté d'Agriculture et des Sciences de l'Alimentation, Laval University<br>Doris Gagné, Public Health Research Unit, Centre Hospitalier Universitaire de Québec<br>Carole Vézina, Public Health Research Unit, Centre Hospitalier Universitaire de Québec | |

**Plain Language Summary**

The present study has been conducted in Nunavik since 2006 and should continue until the end of 2009 within the framework of the «Nutrition Program in Child Care Centres of Nunavik». This program aims to provide healthy meals to the preschool aged children who are registered in these Centres. The menu includes country/traditional foods, selected market foods and is particularly high in dietary absorbable iron.

The objectives of the study are:

1) Document the contaminant- nutrient interaction issues in childhood;

2) Implement a verification process with biomarkers, dietary intakes and some clinical information;

The present study will provide the Northern Contaminant Program essential information about the impact of contaminants on nutritional status and potential risk of health problems in preschool Inuit children. For Nunavimmiut parents and authorities, this study will provide clearer information about the use of country foods among preschool age children.

| Program Category: Human Health | H-14 |
|---|---|
| **Project Title:**<br>**H-14 - Regionally relevant health risk assessments for mercury levels in fish in the Yukon** | |
| **Project Leader(s):**<br>Cindy Dickson, Council of Yukon First Nation | |

**Plain Language Summary**

This project proposes to complete regionally relevant health risk assessments (HRAs) for mercury levels in fish in the Yukon lakes. In the Yukon, the Chief Medical Officer (CMO) is responsible for providing health advice to its residents. In the case of health advice or specific health advisories pertaining to environmental contaminants such as mercury, the CMO undertakes this responsibility in consultation with the Yukon Contaminants Committee (YCC) and Health Canada (as required). The CMO is an active member of the YCC, and will therefore be a team member for this project. Mercury data will be compiled, analyzed and presented to the CMO in conjunction with northern health experts and YCC representatives.

The long term goal of the project is to ensure the HRAs are relevant and applicable to the consumers of fish in the Yukon. In the process of conducting HRAs, attention will be focused on key factors for the species being considered in each lake, namely, the traditional and current use of the lake for gathering fish for human consumption, known levels of consumption for high risk groups (women of childbearing age/pregnant women and children), species of fish being consumed, and seasonal consumption patterns. The only way to determine this necessary information is to involve members of the Aboriginal governments and communities residing nearest the effected lakes in the HRA and health advisory dissemination process from the outset. (The points of contact for Aboriginal government representatives will be regional Aboriginal government representatives on the YCC).

As a first step, this project seeks to update all current HRAs, as well as outstanding HRAs for Yukon lakes, using existing Health Canada guidelines. Secondly, 4-5 lakes chosen by representatives from Aboriginal governments will be selected to undertake a detailed HRA based on subsistence consumption levels in these lakes. This proposal addresses the following 2007/08 NCP Health Blueprint objective: "Improve methods for comparing and balancing benefits and risks from country foods and their alternatives, and to assist individuals to make informed decisions" (Section 4.1 – NCP Health Blueprint). The methodology will be straightforward, discussing the use of various lakes with regional representatives of the YCC and community members they represent. NCP personnel, the CMO and the HRA consultant will be able to discuss the HRA process (including terms such as recommended maximum weekly intake), and steps taken for developing and releasing health advice, with the YCC members. YCC representatives will be provided with detailed information on HRAs during an in-person meeting in February 2008 and thus will be better equipped to relay information pertaining to HRAs to Yukon communities in the future. Ultimately a grassroots approach (rather than a top down approach) should be considered to address each HRA on a community/regional basis.

In this case of fish consumption, the benefit/risk discussion pertains to not only the risks of consuming mercury, but also the risks which might result from not eating one or more fish species (e.g. may be replaced by less

nutritious market foods) while balancing the benefits of eating these fish, including nutrient, social and cultural benefits. In the past advisories have been released without any background or contextual information, thereby leading to misinterpretation, and in the worst case, residents ceasing to consume important traditional foods such as fish.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** NORTHERN CONTAMINANTS AIR MONITORING: ORGANOCHLORINE | **M-01** |
| **Project Leader(s):** Hayley Hung, Environment Canada | |

**Plain Language Summary**

The atmosphere is the main pathway for organochlorine contaminants to enter Arctic ecosystems. This project involves the measurement of these contaminants in Arctic air. It is part of a continuing monitoring program started in 1992. The measurement of amounts and types of contaminants involves collecting large volumes of air through filters. The filter samples are then analyzed in a laboratory. Results from this continuing project are used to negotiate international control agreement and to test atmospheric models that explain the transport of contaminants from sources in the South to the Arctic. In this phase of the project, measurements will continue at the baseline site of Alert, Nunavut. With the upcoming of the International Polar Year (IPY) (2007-2009), monitoring data from Alert will be fed into major IPY programs for studying contaminant transport, distribution and input into the Arctic environment. This information is invaluable due to the long-term monitoring history at this location which can be used as a reference for background levels and contaminant transport history in the Arctic. Starting in Dec 2005, we have extended the program to screen for emerging chemicals, such as current-use pesticides, brominated and organophosphate flame retardants and perfluorinated compounds in Arctic air and we would like to continue this effort in the coming fiscal year. In addition, a newly-developed passive air sampler specifically designed for use in cold environments will be tested at Alert. Contaminant air concentrations measured using this passive air sampler will be compared with those generated from the long-term monitoring program. The purpose is to test the use of this new passive air sampler for its performance under Arctic conditions in preparation for its use in the future to supplement the baseline air monitoring program.

**Program Category:** Environmental Trends Related to Human Health and International Controls

| **Project Title:** AIR MEASUREMENTS OF MERCURY AT ALERT | **M-02** |
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| **Project Leader(s):** Alexandra Steffen**,** Environment Canada | |


**Plain Language Summary**

Mercury (Hg) is a contaminant found at elevated levels in the tissues of aquatic animals in the Arctic. The goal of this study is to continue measuring the levels of Hg in the Arctic air from Alert, Nunavut and to determine whether these levels change with time. As well, this study aims to understand what role the atmosphere plays in how Hg gets to the Arctic and how it gets into the Arctic ecosystem. Mercury is found in the air as a gas or is attached to airborne particles. Globally, gaseous elemental mercury stays in the air for long periods of time (up to 2 years) mercury found on particles and other forms of mercury can quickly fall onto the snow/ice surfaces. Once it falls, this mercury may enter the food chain. This study will provide data to assess how much mercury is transported to the Arctic by the air and how much is falls onto the snow/ground surfaces. This information supports national and international control initiatives. The information generated from this study will also contribute to understanding the impact that climate change will have on mercury contamination in the Arctic ecosystem and ultimately its effect on human health.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** Contributing to International Controls on POPs and Mercury: Further applications of global mass balance models | **M-03** |
| **Project Leader(s):** Don Mackay, Trent University | |


**Plain Language Summary**

It is now clear that contamination of the Arctic ecosystem is largely a result of long-range transport (mainly in the atmosphere) of chemical substances from the temperate industrial and agricultural regions of the northern hemisphere. An inevitable consequence of this contamination is exposure of the resident population to these substances through diet, air and water. It is recognized that the only feasible approach for reducing levels of these contaminants in the Arctic ecosystem in general, and human foods in particular, is to reduce emissions from all global sources and allow global and Arctic levels to fall by natural removal processes. Negotiations to encourage such reductions on an international scale require that foreign governments be convinced that they are one of the sources of these substances and that they must act to reduce or eliminate sources. These actions require information such as:

- Where do the contaminants originate?
- How are they transported?
- Are there new substances of concern for which preventative and monitoring measures should now be implemented?
- How long will it take for reductions to become effective?

The objective of this proposal is to provide answers to these questions based on sound science thereby enhancing Canada's ability to influence international negotiations and agreements. These answers can be provided, in part, by developing and applying global-scale dynamic mass balance models of contaminant sources and fate.

In this 2007 proposal, we will focus on evaluating contaminant levels in different parts of the Arctic, on improving evaluations of existing contaminants such as PCBs, mercury and hexachlorocyclohexanes, on extending the work to organo-fluorine substances, on searching systematically for "new" or "emerging" contaminants and on devising a synoptic indicator of ecosystem contamination. These new emphases are largely in response to directions suggested at the Annual NCP Results Workshop held in Victoria, BC in December 2006.

Building on previous work accomplished under NCP contracts, we intend to cooperate fully with those responsible for monitoring by conventional and passive sampling techniques in the North, thus adding a complementary modelling element to the monitoring program. The work will be done at the Canadian Environmental Modelling Centre (CEMC) at Trent University in collaboration with DMER Ltd.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** Temporal trends of persistent organic pollutants and metals in ringed seals from the Canadian Arctic | **M-04** |
| **Project Leader(s):** Derek Muir, Environment Canada | |

**Plain Language Summary**

The objective of this project is to determine changes in concentrations of legacy contaminants, such as PCBs and other persistent organic pollutants (POPs), and mercury, as well as new contaminants, in ringed seals. This project builds on previous work led by our team which collected ringed seal samples with help of the HTAs in 15 communities (Arctic Bay, Arviat, Gjoa Haven, Grise Fiord, Kangiqsujuaq, Kangiqsualujjuaq, Holman, Inukjuaq, Mittimatalik (Pond Inlet), Makkovik, Nain, Pangnirtung, Quaqtaq, Resolute, Sachs Harbour) between 1998 and 2006. Annual sampling will be carried out in order to improve our ability to detect changes in concentrations over time, especially for mercury and for new contaminants. Following the NCP Blueprint recommendations we are conducting annual sampling at Sachs Harbour, Resolute and Arviat. Sampling on a 5 year cycle is continuing at 10 other communities (2 per year); this year (2007) at Inukjuaq and Kangiqsualujjuaq in Nunavik. Thus over the 5 year period, contaminant trends will be extended for POPs and for mercury at 13 communities altogether. We will use samples of blubber of female seals to study trends in concentrations of POPs and liver and kidney of male and female seals to examine trends in mercury and other heavy metals as well as fluorinated chemicals. Muscle samples are analysed for stable isotopes of carbon and nitrogen to assess seal diets and is also archived for possible future dietary contaminant studies. As legacy chemicals, such as PCBs and DDT, continue to decline in most locations, we are focussing increasingly on new classes of chemicals which we have shown are increasing rapidly in the Arctic particularly brominated flame retardants and fluorinated stain repellents. Mercury shows much more year to year variation although the overall trend at most locations has been towards lower mercury concentrations compared to results from the 1970s-1990s. All sampling is being done with the help of HTAs in each community who are supplied with sampling kits and instructions. Hunters are paid for each animal collected and HTAs receive funding to cover coordination and administrative costs.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** Temporal and spatial trends of organic and metal contaminants in Canadian polar bears: Part III | **M-05** |
| **Project Leader(s):** Robert Letcher, Environment Canada | |


**Plain Language Summary**

The polar bear (Ursus maritimus) is the apex predator of the arctic marine ecosystem and marine food web, and an integral component of Inuit culture. In the 2001-2002 study period, we determined persistent organic pollutants (POPs), including legacy (e.g., PCBs, chlordanes and DDTs) and "new or emerging" chemicals (e.g., polybrominated diphenyl ethers (PBDEs), hexabromocyclododecanes (HBCDs) methylsulfone PCB metabolites and polyfluoroalkyl compound (PFCs)), and elements (e.g., metals) in tissues of bears from the 7 management zones in the Canadian arctic (Nunavut and the Northwest Territories). POPs such as PFCs, PBDE and other BFRs were determined for the first time in bears from Canadian populations, and spatial patterns and in some cases region-specific differences and trends were observed for all the POPs and metals that were monitored. With the exception of PFCs in one Canadian bear population (northern Baffin Bay), there are as yet no temporal assessments of, e.g., PFCs and BFRs in Canadian polar bears. After approximately 5 years since this last 2001-2002 assessment, we began in 2006-2007 we began a new core monitoring trend cycle on the spatial and temporal trends of legacy and emerging POPs and metals in polar bears from the Canadian populations. Expected results include the first circumpolar temporal trend and spatial change assessments in polar bears for emerging POPs such as PBDEs, HBCDs and PFCs in fat or liver tissue. Stable carbon and nitrogen isotopes, and for the first time fatty acid profiles are being determined as ecological tracers of trophic level and diet, respectively, are will be used to in the examination of the contaminant trend data. The contaminant trends data will address the significant and continued concerns regarding risk assessment of the potential changes and location-specific exposure and effects to polar bear, which are top predators in the arctic marine food web. This study will benefit aboriginal peoples and other northerners as they consume similar types of country foods as polar bears, and at the community level are involved in sample collection.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** Geographical and time-trend studies on new and emerging persistent halogenated compounds in marine mammals from the Canadian Arctic | **M-06** |
| **Project Leader(s):** Gregg Tomy, Department of Fisheries and Oceans | |

**Plain Language Summary**

This project attempts to answer the question: are 'new' contaminants that have only recently been detected in Arctic animals increasing or decreasing in beluga from Hendrickson Island and Pangnirtung? These animals were selected for this study because (i) they represent an important part of the traditional diet of northern people and, (ii) we have a large time window in which animals were collected from Hendrickson Island. Findings from this study will be delivered to the NWT and Nunavut Contaminants committees and working in partnership with them will develop communication material appropriate from each communities.

During the course of the study, we will communicate our findings to the NWTECC and work closely with the representative from the Inuvialuit game council and ITK to develop community communication material on contaminants levels in the beluga from Hendrickson Island. We will take directions from the IGC and the NWTECC on how, what, and when to verbally communicate our findings to the community. A PowerPoint presentation will be prepared that describes, very simply and clearly, the results of our research. A plain language summary of the results generated will also be made available to the communities if advised to do so.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** Temporal trends of heavy metals and halogenated organic compounds in Arctic marine mammals (beluga, narwhal and walrus) | **M-07** |
| **Project Leader(s):** Gary Stern, Department of Fisheries and Oceans | |

**Plain Language Summary**

The objectives of this project are to maintain current data on contaminant levels in marine mammals and to continue to assess the temporal trends of bioaccumulating substances such as heavy metals and halogenated organic compounds (HOCs). This will allow us to determine whether contaminant levels in the marine mammals, and hence exposure to Arctic people who traditionally consume them, are changing with time. These results will also help to test the effectiveness of international controls and, in conjunction with projects such as CASES (Canadian Arctic Shelf Exchange Study) and ArcticNet, to understand the effects that climate variation may have on these contaminant levels. Climate variation has been attributed to observed changes to atmospheric sea-level pressure, wind fields, sea-ice drift, ice cover length of melt season, precipitation patterns, hydrology and ocean currents and water mass distribution. It is almost certain that these primary changes have altered the carbon cycle, trophic relationships between species, and biological systems but the difficulty of observing these changes together with existing irregular, incomplete time series measurements makes it exceedingly difficult to discern what these changes have been (Macdonald 2005). Because contaminants enter global systems and transport through the air and water, the changes listed above will clearly alter contaminants pathways and ultimately the levels observed in the Arctic marine ecosystem.

**Program Category:** Environmental Trends Related to Human Health and International Controls

| **Project Title:** Temporal Trends of Contaminants in Arctic Seabird Eggs: Inter-year Variability | **M-08** |
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| **Project Leader(s):** Birgit Braune, Environment Canada | |


**Plain Language Summary**

Contaminants have been monitored in arctic seabird eggs collected from Prince Leopold Island in the Canadian High Arctic since 1975. Those data have shown declines in most of the legacy organochlorines (e.g. PCBs, DDT) as well as dioxins and furans. Contaminants such as hexachlorocyclohexanes (i.e. B-HCH), polybrominated diphenyl ethers and mercury, however, have been increasing, and the presence of new chemicals such as polychlorinated naphthalenes (PCNs) and perfluoro acids (PFAs) has been confirmed. In order to examine inter-year variation in the temporal trend data series, we have proposed to collect eggs from each of two species of seabirds (northern fulmar, thick-billed murre) from Prince Leopold Island annually for five years starting in 2005. As well, for comparative purposes, we are also making annual collections of thick-billed murre eggs from Coats Island in northern Hudson Bay (our Low Arctic monitoring colony since 1993) in parallel with the High Arctic collections. The collections for 2005 and 2006 from both Prince Leopold Island and Coats Island have been successfully completed.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** Temporal trends and spatial variations in persistent organic pollutants and metals in sea-run char from the Canadian Arctic | **M-09** |
| **Project Leader(s):** Marlene Evans, Environment Canada | |

**Plain Language Summary**

We are measuring contaminant levels in sea-run Arctic char as they return from feeding in the ocean and for two reasons. First, this information is needed because Inuit communities are being advised that char is a very good alternate food source to seal, beluga, and walrus. Our study has sampled several coastal communities and we have been finding that contaminant levels are very low in their sea-run char, especially in comparison to marine mammals. Our study also is part of a bigger study which is finding out whether contaminant levels are changing in Arctic animals. Since contaminants have been measured in char at some locations in the past, we can compare our new data with the older data to see if there are any differences.

The main focus of our study is to find out if contaminant levels are changing in sea-run char with long-term sampling planned for four sites. These are in different parts of the Arctic and may be experiencing different changes in conditions with global warming. These long-term sites are Sachs Harbour (a warming trend may be occurring here), Cambridge Bay (which has some of the oldest contaminant data in char), Pond Inlet (the most northerly location and also with some good older data) and Nain (in the previous global warming period, this area actually got colder).

We also are sampling other communities less frequently to find out how much contaminant concentrations differ from community to community. These communities will be revisted in another five years or so. In 2007, we want to measure chemical levels in sea-run char from Hall Beach and Kangirsuk.

All fish will be collected by community members from areas where they do most of their fishing. Length, age, weight, lipid (fat) content, and sex will be determined for each fish along with stable isotope measures of feeding. These data are proving to be very valuable in investigating why contaminant levels are or are not changing in fish over time. We will focus our studies on organic contaminants such as PCBs, DDT, and toxaphene and on mercury, but also will obtain information on a broad suite of 31 other metals and on new compounds of interest such as brominated flame retardants and perfluoro alky compounds.

We plan to visit some communities in summer 2007 to explain the study, collect or arrange for sample collections, and explain previous contaminant results in char and marine mammals. Other communities will be visited by our collaborators. Study results will be communicated back to the communities in 2008.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** Temporal trends of Persistent Organic Pollutants and Mercury in Landlocked char in the High Arctic | **M-10** |
| **Project Leader(s):** Derek Muir, Environment Canada | |

**Plain Language Summary**

This purpose of this project is to investigate changes in concentrations of contaminants over time in landlocked Arctic char from lakes in Nunavut. Our approach is to measure concentrations of pollutants such as persistent organic pollutants (POPs) and mercury in the fish each year to see if levels are decreasing or increasing. The project began in 1999 by studying Char and Resolute Lakes because samples had been previously collected from both lakes in 1993. Since then we have continued to sample Resolute Lake each year and have added Amituk Lake, and Hazen Lake in northern Ellesmere Island which were originally sampled in the early 1990s. All of the fish collected so far have been analysed for mercury and other metals. A smaller number have been analysed for PCBs and other persistent organic pollutants (POPs). Levels of mercury in the fish are relatively low in Resolute Lake compared to some of the other lakes in the area. Average concentrations of mercury in the char in Resolute Lake declined by 10 to 20% from 1993 to 2002 but have increased by 20-30% from 2003-2006. Mercury concentrations have increased in Char Lake and Amituk Lake over the same period by 30-50% and are above guidelines for human consumption. PCBs and other POPs have declined overall in all four study lakes over the period 1992/93 to 2006. We have also found that concentrations of brominated flame retardants (BFRs) are increasing in char in Resolute Lake. For 2007-08 we plan to continue annual sampling of Amituk, Hazen,and Resolute lakes and propose to continue at least through 2011 as suggested by the NCP Blueprint. We will analyse samples for mercury and POPs (PCBs, chlorinated pesticides such as DDT as well as BFRs. Sampling will be carried out by hand methods or gill netting. The fishing effort on the lakes near Resolute will utilize the traditional knowledge of local people in the community. Results of the project will be reported to the Hamlet council of the HTA of Resolute Bay in 2007.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** Spatial and long-term trends in persistent organic contaminants and metals in lake trout and burbot from the Northwest Territories | **M-11** |
| **Project Leader(s):** Marlene Evans, Environment Canada | |

**Plain Language Summary**

Our study is designed to find out whether contaminant levels are changing in fish in the Northwest Territories with a focus on Great Slave Lake. We have been looking at lake trout in two regions of Great Slave Lake since 1993 and propose to continue this research monitoring in 2007. We are looking at lake trout in the West Basin because it receives contaminants from the Slave River and the air, because fish grow faster, and because of its importance in the commercial and domestic fisheries. We are looking at lake trout from the East Arm because this region of the lake receives most of its contaminants from the air, because the fish grow slow, and as a consequence, are not harvested commercially as in the West Basin. Lake trout would be collected at Lutsel K'e (East Arm) and from the commercial fisheries at Hay River (West Basin) as in past years.

We also propose to continue our monitoring of contaminant levels in burbot liver from Fort Resolution. Lake trout are uncommon at Fort Resolution and so burbot is a good fish to monitor for this community. We have been looking at burbot at Fort Resolution since 1993.

The NCP also calls for 1-2 additional lakes to be sampled on a five year period in the Northwest Territories with a focus on lake trout and mercury. We propose to sample Great Bear Lake and Lac Ste. Therese in 2007. Mercury levels were measured in Great Bear Lake trout in 1978, 1979, and 2001 and in Lac Ste. Therese in 1980, 1992, 1993, and 2001. Great Bear Lake is very important to the community of Deline who live on the lake shoreline and fish it regularly. Lac Ste. Therese was used by Deline until the late 1990s when very high mercury levels were reported in the lake trout, walleye, and pike living in this lake. We want to find out if mercury levels have changed.

All fish will be collected by community members. Length, age, weight, lipid (fat) content, and sex will be determined for each fish along with stable isotope measures of feeding. These data are proving to be very valuable in investigating why contaminant levels are or are not changing in fish over time. We will focus our analyses on contaminants such as PCBs, DDT, toxaphene and mercury but also measure 30 other metals and organic compounds of emerging concern.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** Temporal trend studies of trace metals and halogenated organic contaminants (HOCs), including new and emerging persistent compounds, in Mackenzie River burbot, Fort Good Hope, NWT. | **M-12** |
| **Project Leader(s):** Gary Stern, Department of Fisheries and Oceans | |

**Plain Language Summary**

The objective of this project is to maintain current data on contaminants levels in Mackenzie River burbot and to continue to assess the temporal trends of bioaccumulating substances such as trace metals (e.g. mercury, selenium, arsenic, lead and cadmium), organochlorine contaminants (e.g. PCBs, DDT, toxaphene and selected current use chemicals such as brominated flame retardants (e.g. PBDEs, HBCDD), and fluorinated organic compounds (e.g. PFOS and it's precursors) so as to determine whether the levels of these contaminants in fish (health of the fish stock) and thus exposure to people living in Arctic communities who consume them as part of their traditional diet, are increasing or decreasing with time. These results will also help to test the effectiveness of international controls.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** Long term trends of halogenated organic contaminants and metals in lake trout from two Yukon lakes; Kusawa and Laberge | **M-13** |
| **Project Leader(s):** Gary Stern, Department of Fisheries and Oceans | |

**Plain Language Summary**

The objective of this project is to maintain current data on contaminants levels in lake trout from two Yukon lakes (Laberge and Kusawa) to continue to assess the temporal trends of bioaccumulating substances such as trace metals (e.g. mercury, selenium, arsenic), organochlorine contaminants (e.g. PCBs, DDT, toxaphene), selected current use chemicals such as brominated flame retardants (e.g. PBDEs, HBCDD), and fluorinated organic compounds (e.g. PFOS and it's precursors) so as to determine whether the levels of these contaminants in fish (health of the fish stock) and thus exposure to people who consume them are increasing or decreasing with time. These results will also help to test the effectiveness of international controls.

**Program Category:** Environmental Trends Related to Human Health and International Controls

| **Project Title:** Pan-Arctic Caribou and Moose Contaminant Monitoring Program | **M-14** |
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| **Project Leader(s):** Mary Gamberg, Yukon Conservation Society | |

**Plain Language Summary**

The objective of this project is to determine contaminant levels in caribou and moose in the Canadian Arctic to determine if the animal populations remain healthy (in terms of contaminant loads), whether these important resources remain safe and healthy food choices for northerners and to see if contaminant levels are changing over time. Monitoring populations across the Arctic will also give scientists a better understanding of how contaminants get to the Arctic, and how they behave in different parts of the Arctic.

Studies in the Yukon have found that cadmium levels in moose and caribou liver and kidney, and mercury in caribou kidneys are higher than in some other parts of Canada, and higher than in domesticated animals grown for food consumption. This has prompted a health advisory from Yukon Health, based on a health assessment from Health Canada. Although a CINE study confirmed that traditional foods are safe to eat, they did recommend that a trend-monitoring program be established to ensure that the levels are not rising from local or international inputs and that new contaminants be addressed as they arise.

Two caribou herds, the Porcupine (YT) and the Qamanirjuaq (NU) herds, will be sampled each year while five caribou herds and two moose populations will be sampled every five years. This year, in addition to the annual sampling, the George River Herd (QC/NL) and the Beverly Herd (NWT) will be sampled.

In the Yukon, the moose and Porcupine caribou will be sampled as part of an on-going Hunter Survey conducted in cooperation with Environment Yukon, in which local hunters donate tissue samples from their moose and caribou. In Nunavut, the Qamanirjuaq Caribou herds will be sampled as part of the traditional fall harvest in cooperation with the Department of the Environment, Government of Nunavut. In NWT the Beverly Caribou herd will be sampled as part of a winter camp run by the Natural Resources Technology Program of Aurora College in Fort Smith, NWT. In Labrador, the George River herd will be sampled as part of the traditional fall harvest in cooperation with the Nunatsiavut Government, and the Government of Newfoundland and Labrador.

Results of this project will be communicated to each Territorial Contaminants Committee in the form of a year-end report, including a plain-language summary and will be presented at NCP symposia annually. All data will be incorporated into the existing database for Canadian Arctic moose and caribou contaminants, currently maintained by INAC, Whitehorse. Plain language summaries, brochures and/or posters focussing on individual herds/populations will be prepared and circulated to stakeholder groups in cooperation with each Territorial Contaminants Committee. Results will be made available via the Internet where appropriate. Special presentations may be made as the results dictate, or upon request, in cooperation with the Territorial Contaminants Committees.

**Program Category:** Environmental Trends Related to Human Health and International Controls

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| **Project Title:** | Pathways and processes of new and emerging halogenated contaminants in a lower marine food web in the Beaufort Sea. | **M-15** |
| **Project Leader(s):** | Gregg Tomy, Department of Fisheries and Oceans | |

**Plain Language Summary**

This project focuses on understanding the bioaccumulation processes and pathways of new and emerging halogenated contaminants at low trophic levels in arctic marine food webs. Knowledge of concentrations and bioaccumulation processes at the bottom of the food web will assist in understanding the levels and trends observed in top predators (e.g. beluga) and provide information needed for mitigation. Here we propose to examine the critical initial processes involved in bioaccumulation and transfer of new and emerging contaminants at the base of an Arctic marine food web. Our food web analysis will focus in the Eastern Beaufort Sea, a region that offers an important habitat to marine mammals and birds that is undergoing rapid environmental and industrial change. We will use archived samples of zooplankton and fish previously collected from this region. The work described in this project will be carried out at the DFO, which has the necessary personnel and equipment to successfully complete the work. Information generated from this study will be of significant value to northerners who lead subsistence lifestyles because bioaccumulative processes occurring at the bottom of the food web will drive contaminant concentrations in country foods.

**Program Category:** Environmental Trends Related to Human Health and International Controls

| **Project Title:** AIR MEASUREMENTS OF MERCURY AT LITTLE FOX LAKE, YUKON | **M-16** |
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| **Project Leader(s):** Alexandra Steffen, Environment Canada | |

**Plain Language Summary**

Mercury (Hg) is a contaminant found at elevated levels in the tissues of aquatic animals in the Arctic. The goal of this study is to measure the levels of Hg in the air from a site near Little Fox Lake, Yukon. The release of mercury from Asian sources has increased from 1990 to 2000 and yet there are no mercury measurements from the air made in the Canadian Arctic to monitor this potential pollution entering Canada. Jointly, with proposed research under the International Polar Year (IPY), this study aims to make measurements of mercury in the air at Little Fox Lake during the IPYs to assess the impact of pollution from Asia to the Canadian Arctic. The IPY program that we are joining is called "Intercontinental Atmospheric Transport of Anthropogenic Pollutants to the Arctic (INCATPA)". It will bring together an international team of scientists to measure Hg and POPs in Canada, US, Asia and Russia. This created an intercontinental network capable of measuring pollution at the source and receptor ends. This unique program will include global transport modelers to best interpret the data and to look at long-range transport of these contaminants – especially during times of high releases. The information produced from this program will support national and international control initiatives and air in understanding the impacts of atmospheric mercury in the Arctic ecosystem and ultimately its effect on human health.

**Program Category:** Environmental Trends Related to Human Health and International Controls

| **Project Title:** Long-term trends in HCH and PCCD/F in Holman ringed seals: testing past predictions of current and future trends. | **M-18** |
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| **Project Leader(s):** Richard Addison | |

**Plain Language Summary**

In analysing trends of organochlorine contaminants in ringed seals from Holman, NWT, between 1972 and 1991, Addison and Smith (1998) predicted that after about the mid-1990's α-hexachlorocyclohexane (α-HCH) concentrations in these animals should decline, and should do so probably faster than concentrations of other HCH isomers, especially γ-HCH (also called lindane). These predictions were based on what was known then about the partitioning of α-HCH and γ-HCH between the Arctic atmosphere and surface waters. In the work proposed here, we aim to test these predictions by analysing samples, and/or data from previously analysed samples, of Holman ringed seals sampled in 1978, 1981, 1991, 1996 and 2002. These results will be combined with HCHs data from samples collected in 2001 and 2006 under the NCP. In testing these predictions, we will, of course, take into account the fact that we now know more about the physical and biological factors which control HCH distribution in the Arctic than was the case a decade ago. Extracts of selected samples that are going to be processed for HCHs analysis will also be analyzed for dioxins. In combination with existing data we will be able to establish a comprehensive time series for dioxin concentrations in this ecosystem for the time period 1978 to 2006.

**Program Category:** Environmental Trends Related to Human Health and International Controls

| **Project Title:** **Bioaccumulation of Persistent Organic Pollutants in the Lower Food Web of the Western Arctic Ocean** | **M-19** |
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| **Project Leader(s): Brendan Hickie, Trent University** | |

**Plain Language Summary**

Persistent organic pollutants (POPs) such as PCBs, DDT and other organochlorine pesticides are delivered to Arctic ecosystems by ocean currents, rivers and long range atmospheric transport and deposition. Once in the Arctic, many of these chemicals accumulate readily through food webs, resulting in concentrations in high trophic level organisms such as seals and beluga whales that can lead to health concerns for northern people and wildlife. Characterizing the extent to which concentrations of POPs increase in food chains is a vital component linking contaminant loadings into the Arctic environment with human exposure to potentially harmful concentrations of pollutants. A clear understanding of these processes is also supports efforts to negotiate international treaties to reduce or eliminate contaminants of concern to northern people.

The purpose of this project is to determine how well a variety of POPs move from sea water into small organisms at the bottom of the marine food web (bioaccumulation) and then how well they are passed up through the food web (biomagnification) to fish such as Arctic cod and halibut, and eventually to beluga whales. Our study will use chemical data collected from the western Arctic Ocean during a research project that took place in 1997-98. This study is unique in that samples of water and animals were collected over an entire year, and it includes many species from lower and intermediate levels of the food web. While the samples were collected nearly ten years ago, the data from this study are still useful today because they will help us

understand how chemicals accumulate through food webs, and will help us to determine whether concentrations in the western Arctic Ocean are decreasing.

**Territorial Contaminants Committee Comments**

**Program Category:** Environmental Trends Related to Human Health and International Controls

**Project Title:** Environmental Trends Related to Human Health and International Controls

**M-20**

**Project Leader(s): Peter Ross, Department of Fisheries and Oceans**

**Plain Language Summary**

Beluga whales are at the top of the Arctic food web, rendering them vulnerable to contamination by a variety of persistent environmental contaminants that are transported from distant sources. Studies have shown that persistent contaminants, including polychlorinated biphenyls (PCBs), have caused effects on reproduction, development and mortality in marine mammals inhabiting industrialized coastal regions. However, it is become increasingly evident that even those animals living in remote regions, such as the Canadian Arctic, are also prone to environmental contaminants. So far, no studies have been conducted on the effects of environmental contaminants on the health of Arctic beluga whales. We propose to conduct a study which will evaluate the risk of adverse health effects associated with exposure to several classes of persistent organic pollutants, as well as mercury, in beluga whales in the western Canadian Arctic.

We will:
- compare contaminant levels and patterns in prey with those in the beluga;
- determine whether these contaminant levels are cause for concern using government guidelines and published threshold values;
- determine if new chemicals present an emerging threat to beluga by conducting a risk-based assessment of contaminants in their tissues;
- measure the hormone and immune systems of western Arctic beluga to see if contaminants are affecting their health;
- develop models to determine how changes in contaminant concentrations over time in beluga relate to changes in health risks;
- incorporate climate change into these health-based models to see if changes in food supply or in the body condition of beluga add to the stress caused by contaminants.

Beluga may be viewed as ‘sentinels’ of Arctic food web contamination. Contaminants in their tissues may reduce the size of their population, with negative consequences for those who rely on them for food. In addition, contaminant-related health effects in beluga may signal an emerging health concern for humans that rely on country foods. By documenting the relationship between contaminant exposure and health effects in beluga, this project will provide local, national and international managers and regulators with some of the information needed to make wise decisions about the use of different types of chemicals. If we are able to use such information to protect beluga whales from toxic contaminants, then we will be helping to protect the Arctic food web for all consumers, including humans.

**Program Category:** Education and Communications

| **Project Title:** Yukon Contaminants Committee Communications in 2007/2008 | **C-01** |
|---|---|
| **Project Leader(s):** Yukon Contaminants Committee, contact Chair; Brett Hartshorne | |

**Plain Language Summary**

The Yukon Contaminants Committee has operated since 1991 and continues to keep Yukon people aware and informed on the Northern Contaminants Program progress. There is a need to renew the awareness of the YCC and the NCP in the minds of the Yukon people. We have emerging issues related to the consumption of fish with elevated mercury levels, research during International Polar Year, local concerns about mine sites and old dumps, nutrition, and climate change impacts on traditional foods. The YCC recently completed a meeting with a representative of the NCP Management Committee seeking YCC input to the re-write of the Educations and Communications Blueprint. In addition the YCC is also waiting to complete the consultation process with the most affected First Nations with respect to mercury in fish and on a communications strategy with the Yukon Government. The current call for proposal suggests that while new proposals will be considered that the status quo is being observed at present pending the new Blueprint.

In light of all of these issues the YCC has decided to submit for their annual communication funding but keep their options open. To that end, we do not yet have a definite communications strategy for the 2007 fiscal year, but one is currently under development. The community workshop presentations that CYFN and the YCC are delivering are not seen as sufficient for the delivery of certain timely information to the whole of the Yukon in 2007. The YCC has employed radio, tv, printed materials, and the CYFN web site to successfully communicate in the past and some of these vehicles will be employed in the coming year as our strategy develops. The surveys conducted in 2003 by CYFN in the schools and communities indicated that we have had good success in using media for communicating messages. Fact sheets have been extremely popular at workshops and as hand-outs since we began using them in 1992. They are used in all the community workshops hosted by CYFN and is another example of the close working relationship between the YCC and CYFN.

This strategy will be developed by the Yukon Contaminants Committee in close consultation with the First Nations, Yukon Health, and Health Canada and will be structured to make use of the new Blueprint when it becomes available.

**Program Category:** Education and Communications

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|---|---|
| **Project Title:** Deh Cho Participation in the Northwest Territories Environmental Contaminants Committee. | **C-02** |
| **Project Leader(s):** Lee Thom | |

**Plain Language Summary**

The Dehcho First Nations will Educate and communicate to members and address their concerns and questions related to environmental contaminants and the effects of long range contaminants in traditional foods. The community governments of the Dehcho First Nations have expressed their concern and request more information about contaminants.

Information about the NCP, NWTECC, and contaminants will be the responsibility of the regional representative. The effects of contaminants, mercury and debris left behind from users that may cause pollution to the environment, plants and animals continue to be a major concern. The Dehcho members continue to gather, harvest and consume traditional foods. The Elders, youth and women of child bearing years are most at risk of being exposed to long range contaminants such as mercury, arsenic and PCB's. In partnership with the communities, Dehcho First Nations will ensure research results can be communicated in a manner that is understandable and useful. Issues and questions are answered in order for northerners to assess and make informed decision of traditional food consumption.

Dehcho First Nations will participate on the NWT ECC through monthly meetings and will continue to cooperate and communicate with other regional representatives, government departments and sponsors.

**Program Category:** Education and Communications

| **Project Title:** Gwich'in Tribal Council Participation in the Northwest Territories Environmental Contaminants Committee (NWT ECC) | **C-03** |
|---|---|
| **Project Leader(s):** Mardy Semmler | |

**Plain Language Summary**

Continued funding for Gwich'in Tribal Council participation in the NWT Environmental Contaminants Committee (NWT ECC) will ensure continued regional representation on the committee. This involves preparing for monthly conference calls or in-person meetings to discuss matters related to contaminants in the NWT and the contaminant concerns within the Gwich'in Settlement Region.

By attending the annual Northern Contaminants Program Results Workshop the GTC will continue to be informed of current environmental monitoring, human health, and education and communication projects related to long-range contaminants, as well as meeting with individuals involved in the NCP to create future working partnerships.

**Program Category:** Education and Communications

| **Project Title:** North Slave Metis Alliance (NSMA) Participation in the Northwest Territories Environmental Contaminants Committee | **C-04** |
|---|---|
| **Project Leader(s):** Sheryl Grieve | |

**Plain Language Summary**

The North Slave Métis Alliance (NSMA) requests funding for the upcoming 2007/08 year to ensure continued regional representation on the committee. This involves preparing for monthly conference calls or in-person meetings to discuss matters related to contaminants in the NWT, including socio-cultural and traditional knowledge reviews of research proposals submitted under the Northern Contaminants Program.

The funding will enable NSMA staff to answer the questions of NSMA members and environment committee participants regarding environmental contaminants, and will facilitate NSMA's ability to bring community concerns to the attention of the NWTECC.

By attending the annual Northern Contaminants Program results workshop the NSMA will continue to be informed of current environmental monitoring, human health, and education and communication projects related to long-range contaminants, as well as meet individuals involved in the NCP and potential create future working partnerships.

**Program Category:** Education and Communications

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|---|---|
| **Project Title:** Akaitcho Territory Government Participation in the Northwest Territories Environmental Contaminants Committee | **C-05** |
| **Project Leader(s):** Patrick Simon | |

**Plain Language Summary**

By seeking funding to the Northern Contaminants Program (NCP), the Chiefs of the Akaitcho Territory Government would like to continue our meaningful relationship with the Northern Contaminants Program and the ongoing working partnership with the Northwest Territories Contaminants Committee, by making available the leadership and administration resources of the Akaitcho Territory Government to this proposal.

We wish to continue our participation and partnerships with the Northwest Territories Contaminants Committee by: Participating in monthly conference calls. Attending in-person meetings. Attending in-person training sessions. Attending and reporting NCP and NWTECC activities and results to the annual general assembly of the Akaitcho Territory Government. Providing and reporting NCP and NWTECC activities, materials and results to the Akaitcho Chiefs and their respective First Nations as directed.

We wish attend the Annual Northern Contaminants Results Workshop to continue to: Build on our relationship and partnerships with the Northern Contaminants Program. Enhance our education and capacity to understand and adapt to contaminant issues, realities, impact, results and activities. Continue to build partnerships with participants of the Northern Contaminants Program.

**Program Category:** Education and Communications

| | |
|---|---|
| **Project Title:** Developing Communications and Research Monitoring Infrastructure for the Inuvialuit Settlement Region | **C-06** |
| **Project Leader(s):** Nellie Cournoyea | |

**Plain Language Summary**

The main objective of this proposal developed by the Inuvialuit Settlement Region is to continue with the five year regional strategy for communications on long range contaminants and northern research, with a primary focus on nutritional and health issues relating to country food consumption. To do this, IRC will continue to review existing communications material on contaminants like the CACAR II and the Monitoring our Mothers Study (MOMS), which show that people who rely on marine mammals may be at greater risk for exposure from environmental contaminants. This year, we want to create new projects to assist in this effort including the development of separate research and training data bases for the Inuvialuit Settlement Region. This will allow the IRA to assist ISR communities in monitoring all research in the region, and ensure training and work opportunities for beneficiaries. IRC also wants to create new communications material like the proposed Inuvialuit cookbook series and the development of a regional research newsletter to be distributed to all Inuvialuit communities to make sure beneficiaries have a concise idea of what is happening in their region. Other important tasks will be to build the links for the transfer of information through various partnerships in our goal of building capacity in the region with regional and local health authorities, committees and organizations. Responsibilities as IRA will continue to be promotion of research organizations, monitoring research, the development of communications materials, and information dissemination and administration of Inuit Health and Changing Environments initiatives. A priority will also be given to assist researchers in making appropriate community contacts, giving advice on consultation, helping researchers with interpreting and delivering results to communities, and inputting community priorities and concerns at this level of communication.

**Program Category:** Education and Communications

| **Project Title:** Communicating on Nutrition, Health and Contaminants in Nunavik | **C-07** |
|---|---|
| **Project Leader(s):** Suzanne Brunea | |

**Plain Language Summary**

Planned activities by the committee in 2007-08 will continue much needed ongoing education and communication activities in Nunavik as well as work to strengthen the region's capacity to address these ongoing and emerging issues related to legacy POPs and new contaminant exposure. The committee will conduct a small workshop to discuss the integration of contaminants and nutrient data from the Regional Health Survey and plan communications on these topics, hire and train a full time coordinator, and continue the production of a once a year NNHC research newsletter for the region (initiated in 06-07) as well as a regional Health Newsletter communicating information on health, nutrition and contaminants.

**Program Category:** Education and Communications

| **Project Title:** Inuit Research Advisor for Nunavut | **C-08** |
|---|---|
| **Project Leader(s):** TBA | |

**Plain Language Summary**
ArcticNet and Nasivvik Centre for Inuit Health and Changing Environments have together co-funded an Inuit Research Advisors (IRA) in each of the four Inuit land claim regions of the Arctic-the Inuvialuit settlement region, Nunavut, Nunavik and Nunastiavut. These four regional representatives are a first step in a more coordinated approach to community involvement and coordination of Arctic science and represent a new way of knowledge sharing and engagement of Inuit in Arctic science.

**Program Category:** Education and Communications

| **Project Title:** Inuit Research Advisor, Nunatsiavut | **C-09** |
|---|---|
| **Project Leader(s):** TBA | |

**Plain Language Summary**
ArcticNet and the Nasivvik Centre for Inuit Health and Changing Environments have together co-funded an Inuit Research Advisor (IRA) in each of the four Inuit land claim regions of the Arctic-the Inuvialuit settlement region, Nunavut, Nunavik and Nunatsiavut. These four regional representatives are a first step in a more coordinated approach to community involvement and coordination of Arctic science and represent a new way of knowledge sharing and engagement of Inuit in Arctic science.

**Program Category:** Education and Communications

| **Project Title:** Communicating on Contaminants and Health in Labrador: Continuing to meet the information needs of Nunatsiavummiut. | **C-10** |
|---|---|
| **Project Leader(s):** Mary Denniston, Nunatsiavut Government | |

**Plain Language Summary**

The current proposal is for the ongoing activities of the Nunatsiavut Government Research Office in their efforts to communicate and educate the Labrador Inuit population on contaminant, wild foods and health issues so that they may make informed decisions in their daily lives as well as facilitate information flow from research programs like the Northern Contaminants program. This office is also a base in the region for researchers to help them build the necessary contacts and links with communities as well as to help them communicate results. The proposal activities will continue, in cooperation with ITK and other Inuit regions, the development of regional and national long term communication strategies to ensure that communication activities are coordinated at various levels and done in the most responsible and accessible way known. The Research Office staff will continue to be involved in a regional case study project, to follow-up on past communication survey work in the region to assess levels of awareness and understanding of contaminant messages to now identify the factors that influence the outcomes of a specific communication event on the issue of contaminants, wild foods and health in the region. Ultimately, the project will support the ongoing provision of support of Labrador Inuit to make informed decisions on these issues in their daily lives.

**Program Category:** Education and Communications

| **Project Title:** International Inuit Contaminant Activities in Support of Global Instruments and Activities | **C-11** |
|---|---|
| **Project Leader(s):** Stephanie Meakin, ICC-Canada | |

**Plain Language Summary**

The Arctic ecosystem is internationally described as “the barometer of global environmental health”. It has taken over 20 years of science and advocacy to create a global awareness that what happens to the world happens in the Arctic first. We need only to look at the issue of long-range transport of persistent organic pollutants (POPs), emerging new chemicals and heavy metals. Carried by the global forces of wind and water, these chemicals find their way to the Arctic “sink” and make their way into Arctic animals and Inuit. Contemporary science, traditional knowledge and observation together can help inform the world of the effects of these chemicals. The threat of these POPs, emerging chemicals and heavy metals has eroded the confidence Inuit have in country food. Access to safe food is a fundamental human right

After playing a central role in the negotiation of the global Stockholm Convention on the Elimination of Persistent Organic Pollutants, ICC continued to lobby states to ratify the Convention in their national legislatures. The Convention entered into force in May 2003 and ICC continues to work to ensure that the Convention obligations are implemented. Through national science programmes, International Polar Year (IPY) and AMAP, ICC actively participates in the designing and undertaking of the research that monitors legacy

POPs and new and emerging chemicals of concern in the Arctic. ICC uses this data to lobby for the addition of new substances to the Stockholm Convention.

Since 2004, ICC has taken a more holistic approach to safeguarding the Arctic environment by telling the world, including scientists, industry, and policy-makers to look at the POPs threat not in isolation, but to understand the cumulative effect that POPs, other contaminants and climate change is having on the Arctic environment, Inuit and ultimately the global environment.

ICC has worked with many partners to educate, research, advocate and focus local, national, circumpolar and global attention on POPs, emerging chemicals and heavy metals entering the environment. Sheila Watt Cloutier the former Chair of the Inuit Circumpolar Council was nominated for the Nobel Peace Prize for her advocacy on behalf of the Arctic environment and Inuit. The world is listening to the Arctic and we must continue to advocate on behalf of all Arctic peoples to ensure a safe and sustainable future for all.

**Program Category:** Education and Communications

| | |
|---|---|
| **Project Title:** Human Perceptions, Comprehension and Awareness of Contaminants in Sanikiluaq | **C-12** |
| **Project Leader(s):** Jill Oakes, University of Manitoba | |

**Plain Language Summary**

This project will determine Inuit perceptions comprehension and awareness of contaminants in the community of Sanikiluaq. In addition to this, it will assess how the community weighs the risks and benefits associated with the consumption of traditional foods, as well as the impacts of contaminants on community lifestyles. Interviews will be conducted with community members and the compilation and analysis of results will be used to aid in future education and communication regarding contaminants.

Specifically, this project will:
-Determine community perceptions, comprehension and awareness of contaminants through one-on-one interviews.
-Examine linkages between Traditional Knowledge and Scientific Knowledge regarding Arctic contaminants.
-Develop information that can be used by the community as well as health and environmental planning professionals.
-Include Inuit youth in the research process to promote awareness of northern research
-Deliver and discuss the results to the community
-Produce a community information sheet and or booklet of results

**Program Category:** Education and Communications

| **Project Title:** Caribou and Moose Contaminant Monitoring Program training and capacity building workshop | **C-13** |
|---|---|
| **Project Leader(s):** Lorna Skinner (on behalf of the NWTECC) | |

**Plain Language Summary**

The objective of this project is to train community members from the Sahtu region, Dehcho region and Nunavut on sample processing for studying contaminant levels in caribou and moose in the Canadian Arctic. This proposed capacity building project will aid community members in gathering a better understanding of the process in analyzing contaminants found in caribou and moose.

This Education Communications proposal is directly linked to the proposed NCP Environmental Trends 'Metals Uptake from Vegetation to Caribou in the Canadian Arctic' project. Under this project four caribou herds, the Porcupine (YT) and the Qamanirjuaq (NU) herds, the George River herd in northern Labrador and the Bathurst herd (as an adjunct to the program) will be sampled.

Through the environmental trends project local hunters will donate tissue samples from their moose and caribou. In Nunavut, the Qamanirjuaq In NWT the Bathust herd will be sampled.

In 2006/2007 two high school students were identified four days before the workshop to participate. Unfortunately logistics would not allow their participation with such short notice. This year by opening up the workshop to high school students they will have an understanding of why tissue sampling is done, how it is done and have hands on experience to take back to their peers.

Results of this project will be communicated to each the NWT Environmental Contaminants Committee and will be presented at NCP results workshop in 2008.

**Program Category:** Education and Communications

| **Project Title:** Caribou and Moose Contaminant Monitoring Program Training Video | **C-14** |
|---|---|
| **Project Leader(s):** Mary Gamberg (Yukon Conservation Society to administer the funds) | |

**Plain Language Summary**

Under the Arctic Moose and Caribou Contaminants Monitoring Program, two caribou herds are scheduled to be sampled annually (Porcupine and Qamanirjuaq) and five caribou herds and two moose populations are scheduled to be sampled once every five years. This sampling relies on local hunters that are already hunting for food, in an effort to minimize the effect of this project on the animal populations. Often hunters have questions about how samples should be taken and stored, and have asked for training to be provided. The objective of this project is to provide participating communities with a short training video or DVD that will demonstrate how tissues should be sampled for this contaminants program. These videos will be made available at regional offices that normally provide services such as hunting licenses, and arrangements will be made to have the video available for viewing at these offices.

The training video will be presented at the annual NCP Results workshop in the fall of 2008.

**Program Category:** Education and Communications

| **Project Title:** Sahtu Participation in the Northwest Territories Environmental Contaminants Committee | **C-16** |
|---|---|
| **Project Leader(s):** Freda Taniton, Sahtu Secretariat Incorporated | |

**Plain Language Summary**

A contaminants coordinator, (under the direct supervision of the President of the Sahtu Secretariat Incorporated), would participate in the NWT Environmental Contaminants Committee (NWTECC). Continued funding for the Sahtu Secretariat Incorporated's participation will ensure continued regional representation on the committee, while allowing for much needed capacity building under this direct one-on-one mentorship. This involved preparing for monthly conference calls or in-person meetings to discuss matters related to contaminants in the Sahtu Settlement Area and the NWT.

By attending the annual Northern Contaminants Program results workshop, the Sahtu Secretariat Incorporated, (SSI), will continue to be informed of current environmental monitoring, human health and education and communications projects related to long-range contaminants, as well as meet individuals involved in the NCP and potentially create future working partnerships. It is also anticipated that these opportunities will benefit the Sahtu participant pursuing a career in the natural sciences.

**Program Category:** Education and Communications

| | |
|---|---|
| **Project Title:** Northwest Territory Metis Nation Participation in the Northwest Territories Environmental Contaminants Committee | **C-17** |
| **Project Leader(s):** Chris Heron, NWT-MN | |

**Plain Language Summary**

Continued funding for the Northwest Territory Metis Nation's (NWTMN) participation in the NWT Environmental Contaminants Committee (NWT ECC) will ensure continued regional representation on the committee. This involves preparing for monthly conference calls or in-person meetings to discuss matters related to contaminants in the NWT.

The NWTMN membership is quite aware of the long-range transport of contaminants; their focus is on the immediate area surrounding their communities and their region. In the region there is great concern over the cancer issue, is this related to contaminants, or is there something else that is contributing to this problem? Another of the major concerns for the NWTMN membership is the industrial development that is taking place in their back yard. What are the effects going to be in the future from these developments? The aboriginal world values their environment, it can supply all of their needs; from spiritual to physical; hence the importance that is placed when dealing with environmental issues. The water, land, and the wildlife have supplied all that was required for existence in the past, and would like to protect these activities for the future generations so they may enjoy what was had in the past.

By attending the annual Northern Contaminants Program results workshop the NWTMN will continue to be informed of current environmental monitoring, human health, and education and communication projects related to long-range contaminants, as well as meet individuals involved in the NCP and potential create future working partnerships.

**Program Category:** Education and Communications

| | |
|---|---|
| **Project Title:** Distribute and communicate NCP relevant information to Yukon First Nations and CYFN General Assembly | **C-18** |
| **Project Leader(s):** Cindy Dickson, CYFN | |

**Plain Language Summary**

The Northern Contaminants Program was established in 1991 in response to concerns about human exposure to elevated levels of contaminants in fish and wildlife species that make up the traditional diets of northern Indigenous peoples.

Under NCP Phase I research was conducted to determine the levels, geographic extent and source of contaminants that were entering the north. Results from NCP I was published in the 1997 Canadian Arctic Contaminants Assessment Report (CACAR). NCP II began in 1998 and focused on the impacts and risks to human health that may result from current levels of contamination in key Arctic food species. The results of NCP II have been published in CACAR II.

The current focus of the program is to address high priority areas, such as communities where people are being exposed to contaminant levels of concern to health authorities. Although the Yukon Territory is not a high priority area, The Council of Yukon First Nations is still a part of the Northern Contaminants Program and will need to provide input to NCP Management for Yukon.

Currently CYFN provides the opportunity for NCP to discuss issues with the Leadership Board and provides the opportunity to seek direction from Leadership and the Grand Chief of CYFN. Information from the CYFN is also given to the First Nations via reports, mail-outs of new information, phone-calls, emails

**Program Category:** Education and Communications

| **Project Title:** Community Based Northern Contaminants Program Workshops | **C-19** |
|---|---|
| **Project Leader(s):** Cindy Dickson, CYFN | |

**Plain Language Summary**

The purpose of this project is to deliver two community-based workshops on the work and progress of the Northern Contaminants Program (NCP), from the local to the national and international. To date their have been four community workshops. This type of workshop is a result of the NCP survey that was conducted in the Yukon. The NCP program has been in existence for over ten years. A huge amount of work has been conducted in the Yukon during this time, ranging from research & monitoring to regional and large-scale workshops. It was time to evaluate how the NCP program was perceived in the communities and what messages were being heard. We also wanted to re-familiarize communities with the changes that have taken place within the program as a result of traditional foods being found to be safe to eat and having high nutrient levels.

The two workshops will be delivered as a one-day workshop.

## Annex 2. Canadian International Polar Year Science and Research Projects

A total of 44 Canadian science and research projects were selected for International Polar Year (IPY) 2007-2008 funding from the Government of Canada. The projects focus on science and research activities related to two priority areas: science for climate change impacts and adaptation, and the health and well-being of Northern communities.

**Project Descriptions**

The following 44 science and research projects were selected for International Polar Year 2007-2008 federal government funding (listed alphabetically):

**Project Title:** Arctic Freshwater Systems
**Project Leader:** Environment Canada
**Description:** Field studies and laboratory analyses will be carried out to develop new knowledge and information to assess the hydrology and ecology of northern freshwater ecosystems.
**Locations:** Numerous field sites and communities across Canada's North (Yukon, Northwest Territories, Nunavut, Nunavik, Nunatsiavut)

**Project Title:** Arctic Resiliency and Diversity
**Project Leader:** Inuit Tapiriit Kanatami with universities and Northern organizations
**Description:** Northern Aboriginal organizations will guide the development of a study on Arctic resiliency and diversity to examine the factors that determine resiliency in northern communities, and how northern communities are adapting to a changing world. This study will consider how the health of northern communities is expected to evolve with the changing climate, as well as environmental, technological and social changes in the North.
**Location(s):** Northern Canada

**Project Title:** Arctic Weather and Environmental Prediction Initiative
**Project Leader:** Gilbert Brunet, Environment Canada
**Description:** This initiative involves numerical modeling and data assimilation studies of various components of Arctic weather and climate systems, such as snow processes, polar clouds, sea-ice and ozone layer. The objective of this initiative is to develop and validate a regional Numerical Weather Prediction model over the Arctic. This model will help enhance our weather and environmental forecasting capabilities in polar regions, and improve our understanding of the Arctic and its influence on world weather.
**Location(s):** In several provinces, through collaboration between government, university and northern communities

**Project Title:** Beluga Tagging in the Arctic
**Project Leader:** Mike Hammill, Fisheries and Oceans Canada
**Description:** The project will provide information on beluga movements, critical habitat and distribution. This information will be used in ocean forecast models to learn more

about water currents and masses. Interactions with hunters will improve understandings of beluga habits and combine traditional and western scientific knowledge.
**Location(s):** Hudson Bay waters surrounding Nunavik

**Project Title:** C3O - Canada's Three Oceans
**Project Leader:** Eddy Carmack, Fisheries and Oceans Canada
**Description:** C3O will use two Canadian Coast Guard icebreakers, whose current mission tracks encircle Canada, to obtain a snapshot of large-scale ocean and ecosystem properties, and thus establish a scientific basis for sustained monitoring of Canada's Sub-Arctic and Arctic seas in the wake of global warming.
**Location(s):** C3O will measure ocean and ecosystem properties from Vancouver Island to Nova Scotia, including the Gulf of Alaska, the Bering, Chukchi and Beaufort Seas, the deep Canada Basin, the Northwest Passage from Amundsen Gulf to Lancaster Sound, Baffin Bay and the Labrador Sea. In all, approximately 12,000 km of ocean track will be covered.

**Project Title:** The Carbon Cycle in the Canadian Arctic and Sub-Arctic Continental Margin
**Project Leader:** Charles Gobeil, Université du Québec
**Description:** The intent of this project is to collect sediment cores along sections on the margin of Canada's three oceans, with the view that these sections span the present-day marginal ice zone. The change in the ice conditions of the Arctic Ocean's margin can then be assessed against other margins that will exhibit no such change. With this work, the Canadian science community will take a leadership role in understanding the interactions between climate change and elemental cycles in the Arctic Ocean.
**Location(s):** The study area includes the sub-Arctic Pacific (margin leading up to the Aleutians), the Bering, Chukchi and Beaufort Seas, the Baffin Bay and Davis Strait, and the Canadian Archipelago

**Project Title:** Carbon, Microbial and Plant Community Dynamics in Low-Arctic Tundra
**Project Leader:** Suzanne Simard, University of British Columbia
**Description:** Arctic ecosystems store large amounts of carbon in organic matter that may contribute to carbon dioxide production as climate warms, further enhancing the greenhouse effect. This research will expand on cutting-edge technology involving the use of stable isotopes and molecular methods to: 1) examine the role of mycorrhizal fungal networks in facilitating below ground transfer of carbon among tundra plants; 2) determine how carbon flux within plant-mycorrhizal systems varies during the growing season; 3) identify key microbial groups involved in the cycling of carbon in arctic tundra; and 4) examine how soil microbial communities respond to warmer climate conditions.
**Location(s):** Alaska

**Project Title:** Changing Forests and Peatlands along the Mackenzie Valley, Northwest Territories
**Project Leader:** Jagtar Bhatti, Natural Resources Canada

**Description:** The Mackenzie Valley region of northwestern Canada is undergoing the most warming of any region, which is likely causing important changes in forests and peatlands. A five-year study of the Mackenzie Valley region in northwestern Canada will determine how thawing permafrost will affect greenhouse gas emissions and how warming will affect vegetation.
**Location(s):** The study will take place in four regions spread along a latitudinal gradient in the Mackenzie Valley

**Project Title:** The Circumpolar Flaw Lead System Study
**Project Leader:** David Barber, University of Manitoba
**Description:** This project will examine the importance of climate processes in changing the nature of a flaw lead system (a unique area where open water persists throughout the winter) in the Northern Hemisphere, and the effect these changes have on the marine ecosystem, contaminant transport, carbon fluxes and greenhouse gases. The project requires the Canadian Research Icebreaker *CCGS Amundsen* to spend the winter in the Banks Island flaw lead in the Southern Beaufort Sea.
**Location(s):** Southern Beaufort Sea

**Project Title:** Climate Change Impacts on Canadian Arctic Tundra
**Project Leader**: Greg Henry, University of British Columbia
**Description:** The project will examine how tundra ecosystems respond to climate variation using warming experiments and transects across a wide variety of tundra landscapes. It will provide the most complete assessment of tundra ecosystems in Canada, which can be used to evaluate climate changes in the future. The information from this project will be useful to Northerners, land and wildlife managers, and policy makers who need to understand the role of tundra in carbon populations.
**Location(s):** Canadian Arctic

**Project Title:** Climate Variability and Change Effects on Chars in the Arctic
**Project Leader:** James Reist, Fisheries and Oceans Canada
**Description:** This project is focused on understanding the effects of climate change on char (species of freshwater fish) biodiversity, how this responds to climate change, and the consequences of this to human beings. The work also examines linkages between climate change and mercury bioaccumulation.
**Location(s):** Nunavut, Nunavik, Labrador and the Northwest Territories

**Project Title:** Communities in the Changing Arctic
**Project Leader:** Barry Smit, University of Guelph
**Description:** The aim of this project is to systematically assess the vulnerability of communities across the Arctic to changing environmental conditions and identify opportunities to enhance adaptive capacities to sustain their natural resources, livelihoods and well-being. The research will draw on scientific, local and traditional knowledge to identify conditions that contribute to more sustainable northern communities in the circumpolar region.
**Location(s):** Labrador, Northwest Territories and Nunavut

**Project Title:** Constructed Wetlands for Treatment of Wastewater in Arctic Communities
**Project Leader:** Mark Williamson, Fleming College
**Description:** This project will develop new engineering and technology solutions to assist Northern people to adapt to changing settlement patterns and the associated wastewater treatment health issues that arise. Constructed wetland systems for wastewater treatment are an example of a sustainable, environmentally progressive technology that is in its infancy in polar regions. The research activities at the Centre for Alternative Wastewater Treatment at Fleming College will focus on arriving at a prototype design specific to Arctic needs.
**Location(s):** Kivalliq Region, Nunavut

**Project Title:** Coordinated Effort to Clear Hepatitis Viruses from the Canadian North
**Project Leader:** Gerald Minuk, University of Manitoba
**Description:** Viruses that cause long-term infections of the liver are very common among Canadians living in the North (5-15 per cent of the general population). This project brings together scientists, doctors, nurses, administrators and community leaders who have an interest in this problem, and seeks to develop strategies that will lead to a better understanding of how the viruses cause liver disease (such as cirrhosis or liver cancer). The project also examines what can be done to prevent these outcomes. The group's efforts will start with an examination of the most dangerous liver virus – the Hepatitis B virus.
**Location(s):** Northwest Territories, Nunavut

**Project Title:** Determining the Diet of the Greenland Shark in a Changing Arctic
**Project Leader:** Aaron Fisk, University of Windsor
**Description:** This project will determine the role of the Greenland shark in Arctic ecosystems, particularly its predation on marine mammals during winter ice cover and summer open water periods. This information is critical for managing other important animal populations in the Arctic such as ringed seals.
**Location(s):** Nunavut

**Project Title:** Dynamic Inuit Societies in Arctic History
**Project Leader:** Trevor Friesen, University of Toronto
**Description:** Archaeologists and other scientists from across Canada will collaborate with Inuit community and heritage organizations to better understand how Inuit culture has developed and changed over the past 1,000 years. Research teams will bring together Inuit knowledge, the excavation of important archaeological sites, and information about changing Arctic environments.
**Location(s):** across the Canadian Arctic

**Project Title:** Effects of Global Warming on Polar Bears, Seals and Whales
**Project Leader:** Steven Ferguson, Fisheries and Oceans Canada
**Description:** This research project will find out how marine mammals will adapt to global warming and whether they will be able to survive into the future. The project team will study the relationship between warming temperatures and changes in where polar bears, seals, and whales will survive and reproduce, and how many will remain. The team will use satellite telemetry to tell us how they move, tissue samples from hunters to tell us what they eat, and new technologies like genetics and modeling to tell us what the future will be like. Knowing how polar bears, seals, and whales adapt to shrinking sea ice may help save them and the Inuit culture that relies on them for food.
**Location(s):** Hudson Bay

**Project Title:** Engaging Communities in the Monitoring of Country Food Safety
**Project Leader:** Manon Simard, Makivik Corporation
**Description:** This project has three goals: to document known international and national distribution and abundance of *Trichinella* and *Toxoplasma pathogens* in Arctic wildlife; to provide regional infrastructure, equipment and training for wildlife sampling, coordinating and diagnosing diseases of food safety interest; and to develop/refine simplified (field) diagnostic tests for *Toxoplasma* and E.coli 0157:H7. This project will provide basic facilities, training of Northern personnel for future wildlife monitoring and disease diagnostics, as well as increase local knowledge on food safety.
**Location(s):** Labrador, Nunavik, Northwest Territories, and the Yukon

**Project Title:** Environmental Change and Traditional Use in the Old Crow Flats in Northern Canada
**Project Leader:** Shel Graupe, Vuntut Gwitch'in First Nation
**Description:** This project will study the impacts of climate change on the environment in the Vuntut Gwitch'in First Nation's traditional territory. This includes looking at the changes in the health of members of the Vuntut Gwitch'in First Nation and the food they eat (Porcupine Caribou Herd), vegetation, water quality, volcanic soil, muskrat populations, moose populations, and permafrost in comparison to the climatic changes since time immemorial.
**Location(s):** Yukon

**Project Title**: Environmental Change in the High Arctic from Snow and Ice Cores
**Project Leader:** Jocelyne Bourgeois

**Description:** International teams of scientists will collaborate to retrieve ice cores and snow pit samples from the Canadian High Arctic and Greenland to study past climate, contaminants concentrations and environmental change. The overall objectives are to understand past climate variability in the High Arctic, with a particular focus on summer temperature; concentration variability of contaminants entering the High Arctic regions; and, the role of Greenland's ice sheet with respect to sea level change.
**Location(s):** Nunavut and northern Greenland

**Project Title:** Evaluating the Effectiveness of Vaccination against Respiratory Infections for Young Children of the Nunavik Region
**Project Leader:** Philippe DeWals, Centre de Recherche du Centre hospitalier de l'Université Laval
**Description:** This project will analyse medical records of approximately 3000 children born in Nunavik between 1994 and 2005 to verify whether vaccination of young children reduces the number of respiratory infections, prescriptions for antibiotics, hospitalizations and hearing disorders. The results of this study could be used to inform vaccination programs for all populations living in the Arctic.
**Location(s):** Nunavik

**Project Title:** How Seabirds Can Help Detect Ecosystem Change in the Arctic
**Project Leader:** William Montevecchi, Memorial University
**Description:** Climate changes that have been underway for several decades are influencing marine life in Arctic waters. Diving and surface-feeding seabirds (murres, fulmars, gannets, storm-petrels) will be studied during summer and when migrating throughout the High and Low Arctic during fall, winter and spring. The project will use previous surveys of seabird diets throughout Nunavut and Newfoundland and Labrador during the 1970s and 1980s to assess changes that have occurred in High and Low Arctic marine food webs and to establish a current baseline against which future change can be assessed.
**Location(s):** Nunavut, Newfoundland and Labrador

**Project Title:** Human Papillomavirus (HPV) and Cervical Disease in the Northwest Territories
**Project Leader:** Judy Niles, Public Health Agency of Canada
**Description:** The high occurrence and mortality rate of cervical cancer in Aboriginal populations of the Northwest Territories has led to concerns about current screening methods. This research will determine the prevalence of type specific HPV infection and cervical dysplasia (precancerous cells) in women of the Northwest Territories and provide scientific evidence for policy makers and local public health workers in the Northwest Territories to plan and implement more effective cancer control programs.
**Location(s):** Northwest Territories

**Project Title:** Impacts of a Changing Arctic Tree Line
**Project Leader:** Karen Harper, Dalhousie University
**Description:** Together with its international partners, this project will establish a network of long term monitoring and experimental plots to track future changes in the vegetation at the forest limit in the Canadian Arctic. This project is expected to link

recent changes in tree and shrub distributions at the tundra border to environmental change, and demonstrate how these changes will impact the health and well-being of northern communities.
**Location(s):** Yukon, Northwest Territories, Nunavut, Manitoba, Ontario, Quebec, Newfoundland and Labrador

**Project Title:** The Impact of Climate Change on Tundra Wildlife
**Project Leader:** Gilles Gauthier, Université Laval
**Description:** This project aims to document direct and indirect impacts of climate change on terrestrial animal biodiversity (insects, mammals, birds), and forecast future impacts on these populations and the Arctic ecosystem. The project will evaluate how arctic biodiversity will be impacted by climate change and will develop strategies to adapt to it.
**Location(s):** The project will take place at several sites in the Canadian Arctic, including national/ territorial parks in Nunavut, Yukon and Manitoba

**Project Title:** The Impacts of Oil and Gas Activity on Peoples in the Arctic
**Project Leader:** Dawn Bazely, York University
**Description:** Over centuries, people in the Arctic have learned to adapt and thrive in an uncertain, harsh environment. Today, change is occurring at an unprecedented rate. Local peoples' capacity to cope and adapt is under pressure. Natural and social scientists will join with members of Arctic communities in Canada, Norway, Alaska and Russia to study the impacts of oil and gas activity on the health, traditional livelihoods, economic development and ecosystem change in the Arctic. The research will develop a broad range of community-driven grassroots indicators and methods to assess future change. The research will also broaden international collaboration and communication among circumpolar communities through focus group workshops on oil and gas impacts in local communities.
**Location(s):** Various locations throughout Canada's territories

**Project Title:** Impacts of Severe Arctic Storms and Climate Change on Coastal Areas
**Project Leader:** William Perrie, Fisheries and Oceans Canada
**Description:** The focus of this project is to understand coastal oceanographic processes in the Southern Beaufort Sea, and the related waters of the Western Canadian Arctic, driven by intense storms and severe weather. This area is important because the use of the coastal marine and terrestrial environment by Canadian Northerners is an integral part of their life style, and these environments are being impacted by coastal erosion processes, related to marine storms that tend to be growing stronger.
**Location(s):** Beaufort Sea, and coastal areas of the Yukon and Northwest Territories

**Project Title:** An Integrated Research Program on Arctic Marine Fat and Lipids
**Project Leader:** Éric Dewailly, Centre de Recherche du Centre hospitalier de l'Université Laval
**Description:** This program will involve the collection and analysis of data in four regions through three projects that examine the importance of marine fat (omega-3) in the prevention of cardio vascular and mental disorders among Canadian Inuit. The bad

influence of trans-fat acids from junk food will also be examined. A fourth project involves conducting interviews and focus groups on the changing value of traditional fats and contemporary fats in communities at different levels of westernization.
**Location(s):** Nunavut, Nunatsiavut, Nunavik, and the Northwest Territories

**Project Title:** Inuit Health Survey: Inuit Health in Transition and Resiliency
**Project Leader:** Grace Egeland, McGill University
**Description:** Inuit have concerns regarding the health impact of the pressures of change that have occurred and continue to occur in all dimensions of life and culture, from changing physical and natural environments to changes in sustenance, social life, and health and well-being. In the face of these rapid changes, Inuit have proven to be a resilient and adaptive people. A health survey will form baseline information for future comparisons and provide opportunities for improving our understanding of the changes that are occurring and how they affect the health and well-being of Inuit.
**Location(s):** Nunavut, Nunatsiavut, and the Inuvialuit Settlement Region of the Northwest Territories

**Project Title:** Inuit History: Climatic Change and Historical Connections in Arctic Canada
**Project Leader:** Patricia Sutherland, Canadian Museum of Civilization
**Description:** Archaeologists and palaeo environmental researchers will collaborate in investigating archaeological sites occupied during the period between AD 1000 and 1900, when ancestral Inuit first arrived in Arctic Canada. The sites have been selected in order to shed light on the interactions between Inuit, their Tuniit (Dorset culture) predecessors, and early Europeans.
**Location(s):** Nunavut and the Northwest Territories

**Project Title:** Inuit Sea Ice Use and Occupancy Project
**Project Leader:** Claudio Aporta, Carleton University
**Description:** This project's aim is to provide a broad snapshot of Inuit knowledge and use of sea ice in the Canadian Arctic. The project also allocates resources to contribute to scientific, educational, and policy initiatives that seek to incorporate Inuit and scientific knowledge in investigating, or addressing environmental phenomena and/or change.
**Location(s):** Nunavut, Nunavik

**Project Title:** Investigation of the Effect of Climate Change on Nutrient and Carbon Cycles in the Arctic Ocean
**Project Leader:** Roger Francois, University of British Columbia
**Description:** This study will provide crucial information that will enable scientists to better predict the effect of changes in temperature, ice cover and fresh water discharge on the productivity, ecosystem structure and carbon sequestration capacity of the Arctic Ocean. This information will also help predict the impact of climate change on the socio-economic sustainability of northern Canadian communities.
**Location(s):** Two oceanic research cruises in the Beaufort Sea and the Chukchi Sea

**Project Title:** Kwaday Dan Ts'inchi Discovery - Expanding our Understanding through Linked Scientific and Community Studies Project
**Project Leader:** Sheila Greer, Champagne and Aishihik First Nation
**Description:** To address the information gaps in our understanding related to the remains of a young adult aboriginal male found eroding out of a receding glacier in Tatshenshini-Alsek Park in northern British Columbia in 1999, a research program focusing on the artefacts recovered as well as on the discovery site landscape and setting will be initiated. This will include studying the DNA of animal parts on the artifacts to establish the species represented; analysis of pigments on artifacts to determine their source/origin; and producing both detailed site and local context maps, including maps of former glacial extent. The community-based studies will include: documenting traditional knowledge regarding the find; reproducing the gopher robe, one of the key artifact finds; investigating local indigenous paint sources; and investigating aboriginal travel routes in the area of the find, to tie in with the reconstructed glacial extent maps; and place names research.
**Location(s):** northern British Columbia

**Project Title:** Measuring the Impact of Climate Change on Landscape and Water Systems in the High Arctic
**Project Leader:** Scott Lamoureux, Queen's University
**Description:** This research will investigate how climate change effects Arctic rivers, soils and vegetation, and provide an understanding of the hydrological and ecosystem processes that are sensitive to climate change. The research also seeks to predict and anticipate future climate change effects. There are plans to train young adults in environmental science methods and educate them about the research. In addition, the research team will work with community leaders to develop a science learning program for elementary students in northern communities.
**Location(s):** Nunavut

**Project Title:** Monitoring the Impacts of Global Change on Caribou and Wild Reindeer and their Link to Human Communities.
**Project Leader:** Don Russell, Yukon College
**Description:** An international network of scientists, managers and community representatives will work to improve our understanding of the impacts of changes in the Arctic on caribou and wild reindeer herds, as well as the people that depend on them for survival.
**Location(s):** Northwest Territories

**Project Title:** Northwest Territories Ice Patch Study
**Project Leader:** Thomas Andrews, Prince of Wales Northern Heritage Centre
**Description:** The Northwest Territories Ice Patch Study combines archaeology, biology and geology to investigate ancient hunting artifacts and animal remains preserved in alpine ice patches. The field research will focus on recovering artifacts and biological samples from ice patches in the Mackenzie Mountains. This information will help manage caribou populations in the Northwest Territories and contribute to the sustained health and cultural well being of Aboriginal communities that rely on caribou for traditional subsistence activities.
**Location(s):** Mackenzie Mountains, Northwest Territories

**Project Title:** Ocean Currents of Arctic Canada
**Project Leader:** Humfrey Melling, Fisheries and Oceans Canada
**Description:** This project will measure how much fresh water, salt water and sea ice pass from the Arctic Ocean to the Labrador Sea through the Canadian Archipelago each year. It will also determine what drives this flow, and how it will change with changing climate. Fresh water mixed into ocean surface water is critical to: (1) protecting Arctic ice from warm ocean water; (2) the productivity of Arctic marine ecosystems; and (3) the occurrence of ocean overturning in the Labrador Sea that removes climate-warming carbon dioxide from the atmosphere. Because a warmer climate may deliver much more fresh water to the Arctic, this research will clarify climate change impacts on local marine ecosystems and human activities, and also the impact of climate change on global deep ocean circulation.
**Location(s):** Qikiqtaaluk Region in Nunavut

**Project Title:** Ocean Production of Trace Gases in the Arctic and their Impact on Climate
**Project Leader:** Maurice Levasseur, Université Laval
**Description:** The biological and photochemical production of a number of climate-active trace gases and related atmospheric compounds, including aerosols, will be measured during two autumn expeditions on board the ice-breaker *CCGS Amundsen* in 2007 and 2008. This project's goal is to provide critical knowledge on the interactions between sea ice, gas circulations and emissions, and particles in the Arctic. The end goal is to help reduce uncertainties surrounding these climate processes.
**Location(s):** an East-West transect across Baffin Bay and Lancaster Sound/Barrow Strait in Nunavut

**Project Title:** The PEARL near the Pole – Atmospheric Research in the High Arctic
**Project Leader:** James Drummond, University of Toronto
**Description:** PEARL is a new atmospheric research laboratory at Eureka, Nunavut. International Polar Year observations at this site will be intensified and several specific research projects will be conducted. Coordinated atmospheric experiments will be run in conjunction with other similar laboratories around the Arctic. The Arctic atmosphere is expected to undergo many changes in the coming years, many of them much larger and faster than will occur at lower latitudes.
**Location(s):** Nunavut

**Project Title:** Permafrost Conditions and Climate Change
**Project Leader:** Antoni Lewkowicz, University of Ottawa
**Description:** The goal of this project is to provide a snapshot of permafrost conditions during the International Polar Year that we can use to make predictions about the future. Permafrost and the ice it contains make it difficult to build houses, roads and pipelines in the North. However, if the permafrost thaws this may cause new problems. Research is needed to understand how quickly change is happening and to help prepare northern residents and communities – as well as industry and governments – for the future.
**Location(s):** Yukon, Northwest Territories and Nunavut

**Project Title:** Polar Ecosystems in Transition: An Interdisciplinary Investigation into the Impacts of Climate Change on Polar Bears
**Project Leader:** Elizabeth Peacock, Government of Nunavut
**Description:** This project's objective is to gather scientific and Inuit knowledge on changes in the polar bear ecology. The project will examine foraging ecology (changes and variations in terrestrial feeding, and the correlation of seal and polar bear growth) in four populations. The study will also record Inuit knowledge related to the subject in one of the populations. Finally, the study will examine how the accumulation of contaminants in one population has changed with increasing temperatures.
**Location(s):** Nunavut, Manitoba, Nunavik, Nunatsiavut

**Project Title:** Pollutants Travelling in the Air to the Arctic
**Project Leader:** Hayley Hung, Environment Canada

**Description:** This project will measure toxic chemicals produced from human activity and carried through the air to the Arctic. The chemicals will be measured in the air around the Pacific Rim to find out where they have come from and how they ended up in the Arctic. As these chemicals reach the Arctic, they fall to the ground, potentially affecting the health of both humans and animals. This project will help to determine where these chemicals have come from and how the weather influences their presence in the Arctic.
**Location(s):** Little Fox Lake, Yukon (closest community: Whitehorse), and Alert, Nunavut (closest community: Grise Fjiord).

**Project Title:** OASIS-CANADA: Understanding Ozone and Mercury in the Air Over the Arctic Ocean
**Project Leader:** Jan Bottenheim, Environment Canada
**Description:** When the sun rises in the Arctic, both tropospheric ozone gas and toxic chemical mercury mysteriously disappear from the air in the lowest layers of the atmosphere. OASIS-CANADA aims to understand the causes of their disappearance while investigating the effects of reduced ozone on Arctic's environment and whether the disappearing mercury ends up in the Arctic food supply. It will also look at how this might contribute to climate change.
**Location(s):** The Arctic Ocean

**Project Title:** Variability and Change in the Canadian Cryosphere (Snow and Ice)
**Project Leader:** Anne Walker, Environment Canada
**Description:** Research activities involve investigating the current state and past change of the cryosphere (snow, lake and river ice, sea ice, frozen ground, glaciers and ice caps) through analysis of satellite data and images, field measurements, and historical data. Projections of future climate change will be evaluated and enhanced by improving the representation of the cryosphere in Canadian climate models. This project will provide new satellite derived information products to meet the needs of a wide variety of users including northern communities and water resource management and operations. It will also support climate impact studies and the development of adaptation strategies.
**Location(s):** Yukon Territory**,** Northwest Territories, Nunavut, northern Quebec

## Annex 3. Summary of ArcticNet projects potentially related to AMAP

**Broad Objective:** The central objective of the Network is to translate our growing understanding of the changing Arctic into impact assessments, national policies and adaptation strategies.

Activities under ArcticNet are organized into projects that fit within one of four Themes. Some general information about specific projects and the elements of those projects that might be relevant to an AMAP are provided below.

**Associations with AMAP**: All of the projects described below are associated with AMAP and its climate change science related mandate. Some project (e.g. projects 1.3 and 3.4) are directly related to AMAP contaminants monitoring with links to the Northern Contaminants Program.

**ArcticNet Activities with potential relevance to a AMAP**

**T**heme 1. Climate Change Impacts in the Canadian High Arctic (North Water, Central Archipelago, Mackenzie Shelf): a Comparative Study Along the East-West Gradient in Physical and Societal Conditions

Project 1.1 Warming Coastal Seas & Shrinking Sea Ice
Project Leader(s): Yves Gratton, David Barber

This project will correlate sub-surface ocean properties recorded by moored instruments to satellite records of surface temperature, chlorophyll, suspended sediments and sea ice type and thermodynamic state. The objectives are 1) to provide long-term detailed observations of the ocean-sea-ice-atmosphere coupling in the Canadian High Arctic, 2) to identify the oceanic/atmospheric processes underlying changes in these variables and 3) to provide baseline physical information required to understand the complexities of physical-biological coupling in the high arctic marine environment.

Project 1.2 Coastal Vulnerability in a Warming Arctic
Project Leader(s): Donald Forbes, Wayne Pollard, Trevor Bell

Coastal change in the Arctic has been ongoing for thousands of years and human adaptation has been a constant imperative for Inuit occupying this region. The extent of this change can be seen in prominent raised shorelines and former human occupation sites landward of the present coast. In marginal areas of the eastern and western Canadian Arctic, former shorelines are submerged below present sea level, coastal retreat is the dominant form of change, and cultural and archaeological resources, as well as community infrastructure, are sometimes at risk of damage or loss. Coastal change processes and hazards in the Arctic are regulated by climate factors such as sea ice, storm surges and waves, and ground surface temperatures, as well as geological conditions, coastal dynamics, sediment

supply, and relative sea-level change (including regional sea levels and crustal uplift or subsidence). The project objectives include (1) improved understanding and prediction of relative sea-level change and associated coastal hazards in the Arctic; (2) measurement and prediction of coastal sensitivity to a range of climate-change effects; and (3) assessment of community and habitat vulnerability to coastal change in a warming Arctic.

Project 1.3 Contaminant Cycling in the Coastal Environment
Project Leader(s): Robie Macdonald, Gary Stern

The overriding question Project 1.3 (Contaminants) hopes to answer is how climate variability in physical forcing and the biogeochemical response to this primary forcing will affect organohalogen and trace metal contaminant cycling at strategic locations across an east-west section of the high Arctic. Ultimately, we propose to relate changes in delivery and biogeochemical cycling of these contaminants to their levels in fish, marine mammals and the people who consume these tissues as part of their traditional diets. Mercury, a high priority northern contaminant, is potentially also an ideal "climate" tracer and will therefore be the object of detailed investigation.

Project 1.4 Marine Productivity & Sustained Exploitation of Emerging Fisheries
Project Leader(s): Jean-Eric Tremblay

The main objective of this project is to assess the impacts of sea-ice cover reduction, increasing sea temperatures and altered ocean circulation on the biological productivity, fisheries resources and marine mammal populations of the coastal Canadian High Arctic. The goals are (1) to link seasonal microalgal production to oceanic properties and the seasonal extent and type of sea-ice across the study area (North Water, Central Archipelago, Mackenzie Shelf); (2) to relate key indices of ecosystem maturity at the end of the biological production season to the spring-summer pattern of sea ice distribution and sea surface temperature; (3) to inventory and track the availability of fish and marine mammal resources; and (4) to monitor fisheries harvest by Northerners.

Project 1.5 Changes in Dietary Pattern and Impacts on Chronic Diseases Emergence
Project Leader(s): Éric Dewailly

In recent decades, many changes in lifestyle and dietary patterns have been observed among Inuit populations. The shift away from traditional lifestyle and diet has been associated with increased prevalence of cardiovascular risk factors such as obesity, high blood pressure, and elevated blood lipids. Our main objectives is to evaluate the impact of a changing environment (climate, contaminants, globalization, diet, etc.) on the health of Canadian Inuit. The study began in Nunavik (2004) and will be expanded to NWT and Nunavut. Dr. Grace Egeland is the recipient of the International Polar Year Inuit Health Survey grant award to conduct the Inuit Health Survey throughout Nunavut in 2007 and 2008

with additional communities in Nunatsiavut and Inuvialuit joining in 2008 pending discussions and approvals. All work proceeds with an invitation from municipalities and all Coastal communities from Sanikiluaq in the Southern Hudson Bay to Resolute in the High Arctic of Baffin have invited the CCGS Amundsen and the Inuit Health Survey work to be conducted in Aug and Sep of 2007. The project also represents an opportunity to link with Greenlandic, Nunavik and Alaskan health surveys in a collaborative International Inuit Health study. The health survey work evaluates nutritional health among children, aged 3-5 years with a focus on dietary transition and early health impacts. For adults, the survey design focuses on the health impacts of the rapid changes (dietary, social, environmental including climate change) on the health of the population.

Project 1.6 The Opening NW Passage: Resources, Navigation, Sovereignty & Security
Project Leader(s): John Hughes Clarke, Steve Blasco

This project will map the bottom topography and geological structure of the NW Passage and other regions of the Canadian Archipelago as a first step towards the management of increased intercontinental ship traffic and resource exploration as ice conditions improve, and will contribute invaluable information to assess the economic, sovereignty and security implications of an ice-free NW Passage. The objectives of the project include: 1) to compile corridors of precise high resolution bathymetry, and seabed geomorphology; 2) to improve the mapping of the surficial geological environment of the Canadian Archipelago channels; 3) to obtain sediment cores and grabs of the Holocene record for paleoceanographic analyses at optimal sites in the region.

Project 1.7 Canada's Arctic Waters in International Law and Diplomacy
Project Leader(s): Micheal Byers

Global warming is affecting the Arctic more dramatically than the rest of the planet, with the most apparent impact being on the sea-ice which is shrinking, thinning and changing composition in scientifically complex ways. While scientists focus on the changing character of the ice, political scientists worry about other consequences: 12,600 is the distance in nautical miles between Asia and Europe using the Panama Canal; 7,900 nautical miles is the distance using a navigable Northwest Passage. For decades, Canada has asserted its sovereign right to control activities in the Arctic waters off its northern coast, which, since 1986, it claims as internal waters. Canada's claim has not often been put to the test. However, with the melting ice and growing interest in Arctic shipping, Canada's claim to sovereignty and control over the Northwest Passage will likely soon be subject to serious challenge. The Government of Canada, in conjunction with other interested actors, will need to make some difficult policy choices that would benefit from the best interdisciplinary analysis possible. This multidimensional project brings together experts in the law of the sea, sovereignty, the politics of international law, Canadian foreign policy, diplomacy, the science of climate change and sea-ice. Collaboratively, they will

analyze the legal weight of Canada's claim to the Northwest Passage, the likely effects of changing ice conditions on the practical possibility of maritime navigation through the Passage, and the potential for persuading other countries, particularly the United States, to support the Canadian legal claim or otherwise cooperate in regulating the use of the Passage by vessels from all countries. The history of Canada's foreign relations concerning the issue will be of importance here, as well as the newly apparent openness of the United States (or at least former U.S. ambassador Paul Cellucci) to recognize the Canadian position. Finally, the project will address the question of enforcement. Even if Canada's current claim does not hold up, it will still have important regulatory powers and prerogatives as a coastal state under the 1982 Law of the Sea Convention. How would it best exercise those rights, and what sort of planning now needs to be done?

Theme 2. Food, Water and Resources in the Shifting N-S Thermal Gradient of the Terrestrial Eastern Canadian Arctic

Project 2.1 Changing Food Diversity, Wildlife Patterns and Exploitation
Project Leaders: Dominique Berteaux, Gilles Gauthier

Effects of climate change on the phenology of populations, the distribution of species, and the food web dynamics of wildlife communities are now apparent. Yet, as Arctic climate continues to warm up, our capacity to measure and predict the responses of biological systems and their cascading effects through food webs, and ultimately their effects on humans, is very limited. We are lacking baseline data on natural systems and are faced with complex interactions among wildlife and humans. Our objectives are first to assess the effects of climate change on wildlife (through effects on the phenology and distribution of species, and the food web dynamics of wildlife terrestrial communities) and then to assess the effects of changing wildlife patterns on the diet and health of humans. (1) Compare and integrate traditional and scientific indicators of change in wildlife populations. This part of the project will concentrate on wildlife species of interest to local communities, such as large mammals, furbearers, and migratory birds; (2) Determine climate change impacts on traditional and recreational fishing. This part of the project will place emphasis on Arctic Char, Atlantic Salmon and Lake Trout, and will establish a network of information exchange with northern communities and northern outfitters who are centrally involved in the recreational fishing industry. (3) Evaluate the potential for changes in the nutritional properties of northern wildlife and implications of a changing climate for the health of northern communities

Project 2.2 Water Quality, Supply and Indicators of Change
Project Leader(s): Warwick Vincent, Éric Dewailly

Environmental change is likely to have major repercussions in Nunavik and Nunavut for the supply of safe drinking water, freshwater habitats for aquatic wildlife and water resources for industrial needs, notably hydro-power generation.

The central objective of this project is to develop an integrated environmental and health framework for water supplies in the Northern RiSCC sector, a 30 degree span of latitudes from Hudson Bay to Ellesmere Island in which there appears to be a striking north-south disparity in climate trends and sensitivity. The icebreaker Amundsen will play a key role in this project, with ship-based sampling planned for eastern Hudson Bay (2004); Foxe Basin (2005); Kuujuarapik to Ellesmere Island (2006); and Labrador-western Greenland (2007). The project has three detailed objectives: (1) Develop limnological and paleolimnological indicators of freshwater quality in the northern environment, including physico-chemical measurements and contaminants. This will be undertaken in collaboration with the catchment studies on melting permafrost (Project 2.6) (2) Assess health indicators of water quality such as colilert analysis, their relationship with limnological indicators, and suitability for local community monitoring and management. (3) Develop and analyze climate and paleoclimate indicators of changes in water supply in this sector.

Project 2.3 Emerging New Infectious Diseases in Humans and Wildlife
Project Leaders(s): Benoit Lévesque, Éric Dewailly

Climate changes have the potential to affect the epidemiology of infectious diseases through a variety of indirect mechanisms. Possible climate-related impacts include changes in the range and activity of vectors, the appearance and extent of infectious agents and modifications in the availability, production and use of food and water supplies. Arctic regions are likely to be among the first affected by climate change, with serious implications for the 150,000 Inuit who live within the circumpolar zone. As a result of their traditional hunting and fishing practices, aboriginal people including the Inuit are likely to be especially sensitive to zoonoses (infectious diseases found in animal hosts and transmissible to humans) and to other diseases transmitted via food and water. This research project will centre on four components within the overarching objectives of identification, survey and prevention of health risks associated with infectious diseases in northern Canada. The first four years of research activities (2004-8) will concentrate on Nunavik given the existing strong linkages between researchers, communities and public health authorities in that region, but we hope that the work will have much broader significance and will be subsequently applicable to elsewhere in Northern Canada.

Project 2.4 Climate and Coastal Landscape Instability: Socio-Economic and Ecological Impacts
Project Leader(s): Michel Allard, Wayne Pollard

The Arctic coastline is a highly dynamic environment where many landscape processes take place. Erosion, sedimentation, coastal progradation and retreat lead to sediment and carbon transfers as dissolved and particulate carbon are released into the near-shore zone. These processes are regulated by climate-controlled factors such as duration of the ice season, the dynamics of shore-fast ice, waves,

tides and surges. Erosion of coastal permafrost is a fast process with many consequences for both the ecology of the landscapes and the coastal communities. The Inuit having traditionally harvested the major part of their living resources from the sea and from the coastal regions, they are a coastal people. In addition to new knowledge of the dynamics of the coastal landscape for preserving the quantity and the quality of their traditional food resources, the need to better understand permafrost dynamics in coastal regions stems from the recent modernisation that has created new requirements in public services for construction, housing and transportation, leading to development of civil engineering structures such as roads, airports, port and harbour facilities, water supply, and waste disposal facilities. The objectives of this project are: (1) to quantify the potential impact of climate change on northern landscapes and shorelines around communities and in areas of traditional land use, including evaluation of thaw subsidence, mass wasting and coastal retreat. This will include detailed study of surficial geology, permafrost and ground ice conditions around communities and seasonal camp areas and will compliment studies on coastal sensitivity (Project 1.5), water quality (Project 2.2) and carbon and contaminant cycling (Project 3.4). (2) To compare anticipated climate and landscape change with the Holocene paleoclimatic record, particularly from lakes that had their sedimentological regime affected by permafrost thawing in their catchment, and from oral histories. Recent climate variation and landscape changes will be identified through time-lapse mapping of selected sites affected by thermokarst and through cryostratigraphic investigations of changes at the active layer/permafrost boundary. This project will also be undertaken in concert with Project 2.2. (3) To evaluate the impact of landscape change on the activities of northern people, northern communities and northern resource development. (4) Through teaching, science camps, public lectures and student supervision promote a better understanding of the impact of climate change on northern peoples.

Project 2.5 Cultural Self-Determination, Endogenous Development and Environmental Changes
Project Leader(s): Mark Nuttall

The impacts of climate change on wildlife and vegetation, as well as on people, are considerable and have been little documented in the Canadian Arctic, especially on a local and regional level. Is wildlife harvesting under threat in Inuit villages? What resources can Arctic communities harness to face these challenges? The peoples of the Arctic have undergone enormous change over the last few decades including transformations in the political arena; social structures; economic diversification; approaches to land occupancy; land use; resource use; and diet. The aim of this sub-project is to enhance understanding of the extent of the environmental issues and challenges faced by indigenous peoples in a rapidly changing milieu. The project is first seeking to acquire a deeper understanding of the variables fundamental to the social, cultural, political and economic viability of Arctic communities in the Canadian North, and is exploring the avenues of concern highlighted by the communities themselves. Since April 2005 the project

team has continued to develop an innovative research program on understanding climate change impacts on local livelihoods in Nunavut and Nunavik. This will result in the development of a new conceptual framework for understanding social-ecological systems in the coastal Canadian Arctic. Our project is determining, through a variety of methods, the extent to which climate change – as well as the levels of contaminants in water and wildlife -- threatens local abilities to sustain an appropriate human/food resource relationship in Inuit communities. We have continued our analysis of wildlife management regimes and the effects of social and legal institutions that circumscribe the lives of indigenous peoples. A comprehensive analysis of wildlife management policies in Nunavut has been underway and is expected to be published in 2006. We have been examining socio-economic aspects of resource use and resource management needed to provide basic data for integrated assessment modelling by focusing on institutional factors, such as user rights and regulation, paying particular attention to their influence over the past few decades. Our work is breaking new ground in the integration of traditional ecological knowledge and the environmental sciences, especially with regard to wildlife, and will have tremendous significance for wildlife management and the management of parks. Our work has yielded important new data on ecosystem processes, socio-economic systems and human-environment relations, and we are increasing our knowledge and understanding of the spatial and temporal trends of contaminants in Arctic char, ringed seals, lake waters and sediments. Furthermore we are making significant progress towards IRIS integration.

Project 2.6 Warming the Tundra: Health, Biodiversity, and Greenhouse Gas Implications
Project Leader(s): Greg Henry, Yves Bégin

Terrestrial ecosystems in the Arctic play important roles in the global climate system as heat sinks (through permafrost, snow, and ice) and as carbon stores. They provide living resources for communities throughout the North, and they are also stores of airborne pollutants; hence, they play important roles in human health and culture. Tundra and taiga ecosystems are expected to respond strongly to the predicted climate warming, although there will be regional differences. In the western North American Arctic, there have been noticeable changes in permafrost temperature and melting, in vegetation and in carbon fluxes. These changes will affect feedbacks between the ecosystems and the climate and human systems. Improved understanding of the role of high-latitude ecosystems in the climate system requires a concerted research effort focused on geographical variation in processes controlling land-atmosphere and land-water exchanges, species composition, and ecosystem structure. This project addresses some of the implications of these changes in terrestrial environments of the eastern Arctic with the major objectives to: (1) Assess the organic carbon content, potential exchange of greenhouse gases (CO2, CH4) relative to differences in moisture and nutrient dynamics along gradients at key sites. (2) Determine the effect of local and regional environmental gradients (e.g. temperature and moisture) on genetic

and functional plant biodiversity. These comparative studies will provide correlations between climate, biodiversity and biomass production which will aid in forecasting future trends in vegetation, and provide baseline data for future changes. The results will be especially relevant for studies in Project 2.1. (3) Reconstruct historical climate variability at sites along the latitudinal gradient from dendrochronological analyses of long-lived woody plants. The instrumental climate record for the region is short and sparse. Using proxy climate date from tree-rings at treeline sites and stem growth in a long-lived arctic shrub (Cassiope tetragona) beyond treeline, we will provide a needed temporal perspective (150+ years) for the climate variability and changes in the region. Through the use of stable isotope analyses, these studies will be linked to similar studies in Project 2.2 to help extract proxy precipitation data, and allow an examination of variability in precipitation patterns. (4) Measure permafrost temperatures and active layer depths at key sites along the transect and reconstruct Late Holocene climate changes from the sequential analysis and dating of organic and mineral layers in appropriate sites of syngenetic permafrost in order to complement paleoclimate knowledge above the treeline (Allard, Pollard – see Project 2.4). Permafrost temperatures and maximum thaw depths provide information on regional temperature trends. (5) Determine the contaminant content of permafrost in watersheds of drinking water supplies and the extent to which these materials are mobilised by melting and leaching. (6) Determine the CO2, DOC, colour and bacterial content of permafrost in water supply catchments for assessing the potential release of greenhouse gases and to evaluate the transfer of microbiota and optically active materials to waterbodies. These projects are linked to the water quality research proposed in Project 2.2 and will lead to a better understanding of future water quality, and the role that terrestrial systems play in storage and release of contaminants and greenhouse gases.

Project 2.7 Climate impacts on the sentinel species Arctic char (*Salvelinus alpinus*) in northern Canada
Project Leader(s): Michael Power, Bill Doidge

This project will have four interlinked components nested within the overall ArcticNet Integrated Regional Impact Studies (IRIS) framework of climate change in the Canadian Arctic. The first component will address practical issues of Arctic char management of specific interest to Inuit participants in Nunavik as they pertain to the construction and dissemination of an Arctic char management database useful for planning and co-ordinating local stream and stock enhancement initiatives. Coupled with database construction will be a detailed follow-up study on the environmental effects of introducing Arctic char to suitable river and lake systems where they were not previously found. This portion of the study will examine the ecological effects of an Inuit initiative to introduce and manage an Arctic char population in a river system previously unused by Arctic char. Data from the study will help the Inuit of Nunavik understand the full implications of pro-active management to increase available Arctic char resources in the territory and provide a critical information base for

future introduction decisions. Samples obtained from the impact effects study will further be used to improve the scientific database for complementary ArcticNet funded studies of climate induced change in the biological characteristics of Arctic char populations and the consequences of climate-change for possible changes in the rates of mercury (Hg) accumulation in fish. A final component of the study will match studies being conducted in Nunavik with a detailed analysis of climate-related changes in the biological characteristics of an Arctic char resource fishery in the Inuvialuit land claims region, thereby enhancing scientific understanding of the spatial trends and the rates of change occurring in the biology of Arctic char as a result of changing northern conditions. Essentially the research will help equip Inuit organizations with the tools to address key questions of concern and begin to address those questions. [1] In the face of climate change will Arctic char populations continue to exist at abundance levels suitable for local exploitation? [2] Can existing Arctic char populations be enhanced by local communities as an adaptive management strategy in an environmentally sound way? And, [3] will the resulting fish be safe to eat?

Project 2.8 Climate Change in Northern Québec and Nunavik: Access to Territory and Resources
Project Leader(s): Christopher Furgal, Martin Tremblay

Traditional and scientific knowledge are used to find solutions to adapt to climate variability in Northern Quebec communities. This research project is based on interviews with elders and active hunters, ice and snow monitoring activities by local researchers and supporting analysis of local climate data. The project goal is to provide tools that will help northern communities in coping with the climate changes that they are facing regarding to traditional trail use and safety (with particular attention being given to ice trails). These local trails are extremely important for Inuit communities providing the access to critical natural resources throughout the year and preserving the traditional style life. The project objectives are to: • Document climate change impacts on the trail networks in northern communities that have reported climate related changes; • Develop and conduct a community-based monitoring strategy for ice safety and use in Nunavik communities; • Document individuals' and communities' responses / adaptations to changes in light of any impacts on the access to resources or impacts to human safety; cooperatively develop strategies with communities to adapt to these changes; • Evaluate the potential impacts of climate change on access to land and resources by filling the gap between the coarse temporal and spatial scales of climate scenarios and the local scale at which subsistence-based activities are conducted. Results to date show that Kangiqsujuaq, Umiujaq, and Kangiqsujuaq are reporting a medium to medium-high level of impact on trail systems associated with environmental change. The residents from these communities are already using new trails during the winter to adapt to increasingly risky areas or inaccessible trails. In summer they report using water routes closer to the shore to mitigate the hazards of less predictable climate conditions on the sea as well. The ice monitoring carried out by local researchers has supported the identification of

quantitative climate indicators with the help of Ouranos that are both useful to assess ice thickness during the winter and also representative of Inuit observations of ice conditions and safety. The development / identification of such indicators will help better link climate scenario data with local conditions relevant to community activities.

Theme 3. Managing the Largest Canadian Watershed in a New Climate: Land-ocean Interactions in Sub-Arctic Hudson Bay

Project 3.1 Ocean-Ice-Atmosphere Coupling and Climate Variability
Project Leader(s): David Barber

Project 3.1 will focus on the connection between freshwater quality and quantity on marine processes within Hudson Bay. Observational data will include a complete suite of oceanographic, hydrographic, snow/sea ice geophysical, and surface energy balance variables collected at a range of spatial and temporal scales. Project 3.1 will concentrate the sampling around two "Supersites" in the Churchill and Nelson River estuaries. We also participate in the development of the Community Based Monitoring (CBM) program where communities are involved in the science by collecting samples and maintaining/operating meteorological towers. Freshwater fluxes, both magnitude and timing, will be provided through project 3.2. The impacts of variable freshwater fluxes and the consequences of the timing of these fluxes on marine ecosystem function (project 3.3) will be evaluated for a variety of climate and anthropogenic change scenarios. These observational data will be examined within a framework of model prediction fields and remote sensing information of climate state variables throughout the annual cycle as a means of defining a baseline for freshwater-marine coupling and as a means of separating climate change from variability induced from anthropogenic sources (e.g., Hydroelectric development, shipping, etc). This project integrates two primary industry partners within ArcticNet, namely Omnitrax (owner operator of the Port of Churchill) and Manitoba Hydro.

Project 3.2 The Hudson Bay Coastal Zone in a Changing Climate System
Project Leader(s): Tim N. Papakyriakou

Southwestern Hudson Bay and its coastal zone is a sensitive habitat for a large range of flora and fauna, contains the second largest contiguous peat accumulation and third largest wetland in the world, and is increasingly becoming the focus of economic development and northern identity. Its importance on the regional and global scale is disproportionate to its geographic footprint in relationship to global climate, habitat and cultural preservation. The current generation of global climate models indicates that this region will experience large increases in temperature and changes in precipitation amount and patterns associated with elevated levels of greenhouse gas. Any change in the microclimate of Hudson Bay, due to climatic forcing and its associated effects on

the sea ice regime and local water balance, will impact local hydrology (water quantity and quality) through: effects on permafrost and nutrient cycling within the peatland and climate's effect on water budget, heat budget, permafrost extent, and vegetation dynamics. It is our goal to better understand these linkages. The overarching objective of our proposed research is an assessment of the impacts of climate change on watershed processes in the Hudson Bay Lowlands (HBL) and their downstream effects (particularly those associated with freshwater and carbon) on Hudson Bay (HB). Two questions arise: 1) How does the state of HB affect biogeophysical and biogeochemical processes that describe the nature, occurrence and transport of water and carbon within the terrestrial (and aquatic) systems of the HBL? 2) How do watershed processes (biogeophysical and biogeochemical) feedback to affect the state of HB?

Project 3.3 Climate Variability / Change and Marine Ecosystem Resources in Hudson Bay
Project Leader(s): Michel Gosselin

The Climate Variability/Change and Marine Ecosystem Resources in Hudson Bay subproject will quantify the response of the marine ecosystem to climate-induced variability and change in sea temperature, the timing of the river freshet and ice cover dynamics as documented in projects 3.1 and 3.2. In collaboration with projects 3.4, the impacts of climate forcing on biogeochemical fluxes, biological production, fish recruitment and marine mammal distribution will be addressed. The overarching objective of the project is to assess how climate-induced variability and change in sea temperature, sea-ice cover dynamics (project 3.1) and the timing and intensity of river freshet (project 3.2) affect marine biological productivity, fish stocks and marine mammals in Hudson Bay. Previous landbased studies of the inshore-offshore coastal gradient in biological productivity have demonstrated the central importance of under-ice river plumes in determining primary production, zooplankton dynamics and the feeding success and survival of fish larvae in this immense estuarine system. The oceanography of central Hudson Bay has yet to be studied in detail. In particular, the reach of river plumes (and their ecological impacts) into central Hudson Bay in spring is unknown. To fill these gaps, project 3.3 will repeat coastal observations of primary production and zooplankton and extend them to the offshore zone. This will enable us to assess the extent of the effect of climate-induced modifications of the hydrologic and sea ice annual cycles on Hudson Bay as a whole.

Project 3.4 Carbon & Contaminant Cycling in the Coastal Environment
Project Leader(s): Gary A Stern

Hudson Bay is a shelf sea with a coastal freshwater corridor supported by strong inputs of fresh water from land runoff. This freshwater corridor is the most the important location for primary production and subsequent energy transfer to higher trophic levels (seals, bears, belugas) in the Bay. Recent studies suggest that Hudson Bay and its drainage basin are the recipients of enhanced loadings of

contaminants such as organohalogens and Hg – a circumstance that has probably existed for decades. Given that Hudson Bay is in the vanguard of change both in its sea ice cycle and in the basin's permafrost, it seems certain that Hg will become the most important contaminant in the system through release of Hg historically archived in frozen basin soils and through changes in wetland distribution and/or hydro reservoir flooding both of which are known sites of enhanced microbial methylation of inorganic Hg (II) to methyl Hg (MeHg is a toxic form of Hg that accumulates through food webs). The projected climate changes and their consequences to the organic carbon cycle seem likely not only to release Hg but they probably also enhance the efficiency of the production of methyl Hg (MeHg) within the basin and within Bay sediments. In addition, preliminary studies suggest that Hg depletion events (MDEs; the oxidation of tropospheric Hg (0) to Hg (II)), a phenomenon commonly observed in the high Arctic, may also be occurring over Hudson Bay in the spring, making Hg an ideal "tracer" for climate variation. The overarching objective of this project is to examine how the physical processes and climate associated variability being investigated in projects 3.1 and 3.2, and the biogeochemical response to this primary forcing (project 3.3), will affect organohalogen and trace metal contaminant cycling in the Hudson Bay ecosystem and ultimately, their levels in fish, marine mammals and the people who consume these tissues as part of their traditional diets (projects 3.5 and 3.6). In addition, links between sea-ice dynamics and extent of coverage (project 3.1), mercury depletion events (oxidation of Hg (0) to Hg (II)), feeding patterns, movements and dive behavior of beluga, narwhal and ringed seal (project 3.3) and contaminant up-take will be quantified.

Project 3.5 Persistent Organic Pollutants and Human Health
Project Leader(s): Pierre Ayotte, Laurie Chan

Persistent organic pollutants (POPs) are presently being targeted globally for environmental regulation because of their characteristics of accumulation, persistence, toxicity and potential for long-range movement. The classic examples of POPs are PCBs and DDTs. However, brominated diphenyl ethers (BDEs), perfluorinated acids (PFAs) and halogenated phenolic compounds (HPCs) are emerging as the next generation of pollutants, particularly in the Arctic ecosystem. BDEs, which are used as flame-retardants in various commercial products, have recently been shown to occur in both environmental and biotic media in the Arctic. PFAs have been widely used as cosmetics, fire fighting foams, and water and grease repellent coatings for fabrics and food packaging. These compounds mainly perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) have been detected in biota in the Arctic. HPCs comprise hydroxylated metabolites of PCBs, chlorophenols and other compounds that have been detected in blood samples from Inuit adults and neonates from Nunavik. Our project focuses on health effects possibly resulting from exposure to these compounds and other POPs in the Arctic, including methylmercury. Results from our project will be useful to assess the health impacts on residents in

coastal communities of Hudson Bay that may results from an increase in POPs exposure, a possible consequence of climate change. Information on effects of climate change on the physical environment (project 3.1 and 3.2) will be used to predict changes in food availability in the communities and results on changes in contaminant concentrations in fish and wildlife (project 3.4) will be used to assess the risk of traditional food consumption. We will integrate dietary data collected in communities in Manitoba, Quebec and Nunavut in the past few years and use the new information on food availability and safety to predict changes in diet composition of the populations in Hudson Bay. Using our existing databases on nutrient composition and contaminant concentrations and new data from project 3.4, we will calculate the subsequent changes in nutrient and contaminant intakes. Health status is being assessed by analysing existing secondary data from past surveys and new data from recent and ongoing surveys, including biomarkers of effects, and health care databases. The relationship between the environmental determinants and health status will be investigated. We will collaborate with members of project 3.6 to communicate our results and to develop programs and services to meet changing health needs.

Project 3.6 People and Environmental Change: Linking Traditional and Scientific Knowledge
Project Leader(s): Jill Oakes, Rick Riewe

Purpose: To identify and model the linkages between traditional knowledge and 'western' science regarding environmental change in Hudson Bay coastal communities.

Parameters: Traditional knowledge includes local knowledge and ecological knowledge respectively. Environmental change includes climate and non-climate driven change.

Study area: Hudson Bay coastal communities

Objectives: Collect traditional knowledge and 'western' science on aspects of environmental change. Determine linkages between traditional knowledge and 'western' science. Model and analyze linkages to identify ecological problems created by environmental change. Develop possible recommendations for reducing potential ecological problems based on the insights gained by understanding the linkage between traditional knowledge and 'western' science. Include topics such as the impact of changes in environmental events, such as freeze up, break up, thermokarst activity, flora, fauna, land forms, freshwater flow, and water/snow/ice conditions on Inuit lifestyles; traditional terms for environment and environmental change, and weather phenomena; and the impact of environmental change on people's food, shelter, lifestyles, health, economy, culture, land claims, tourism (to name a few examples).

Research Projects: All research within Theme 3.6 is required to include the above purpose, parameters and objectives. The aspect of environmental change selected by individual or group researchers could range from a wide variety of people-centered topics in ecology including: social impacts, environmental health, co-management, wildlife populations, and community-based monitoring to name a few.

Project 3.7 Nunatsiavut Nuluak: Baseline Inventory and Comparative Assessment of Three Northern Labrador Fiord-based Marine Ecosystems
Project Leader(s): Ken Reimer, Marina Biasutti

In partnership with the Nunatsiavut Government, the Royal Military College, Parks Canada, the Department of National Defence, Environment Canada, the Department of Fisheries and Oceans, and Voisey's Bay Nickel Company Ltd., this project will conduct a baseline inventory and comparative assessment of three northern Labrador fiord-based marine ecosystems. The purpose of the project is to address Inuit concerns regarding the ecological integrity of the marine environment of northern Labrador by acquiring a better understanding of the effects of climate change, modernization and contaminants. An integrated regional approach has been initiated to ensure concerns from all stakeholders, including major industrial and governmental organizations are adequately addressed. The three marine ecosystems that will be studied are Anaktalak Bay (the shipping route to the Voisey's Bay nickel mine), Saglek Bay (affected by a historical source of PCB contamination) and Nachvak fiord (a pristine ecosystem adjacent to the Torngat Mountains National Park Reserve). These studies complement each other and, with the addition of northern Labrador to the ArcticNet program, provide good comparative data for other systems currently being investigated by ArcticNet. The study involves the use of the CCGS Amundsen as well as shore based sampling operations (from longliner) in each of the fiords. The study integrates Inuit and Inuit Knowledge throughout the entire process including selection of indicators, analyzing and interpreting data and conducting field research, and will help build capacity among Inuit in Labrador and strengthen partnerships through collaboration.

Theme 4. Adapting to Change in the Canadian Arctic: Knowledge Transfer, Policies & Strategies

Project 4.1 Projecting into the Future: the Canadian Arctic Environment, Tomorrow to 2100
Project Leader(s): David Barber

Model projections, our best means of estimating future weather and sea ice conditions, suggest, should the present observed warming continue, that as early as 2050 an ice-free arctic can be expected at the summer minimum (Flato and Boer, 2001). This projection, evaluated in light of changes observed by

northerners over the past three decades, has fuelled an increasing interest in polar science and research studies to be conducted during International Polar Year. In project 4.1 the goal is not to reproduce previous investigations, but rather to improve on the credibility and utility of Arctic climate model results by: 1) employing novel means of evaluating model performance over the ArcticNet focus regions, and 2) developing means to integrate the arctic modelling community with process scientists, northern residents, and decision makers (at all levels of government from hamlet to hemispheric). Project 4.1 will focus on expanding existing partnerships and integrating labs with proven excellence in modeling into the broad focus areas of ArcticNet. The project will focus on four regional scale models: Baffin Bay (Tang), Beaufort Sea (Maslowski), Canadian Archipelago (Holland), and Hudson Bay (Saucier). These models are high-resolution coupled ocean-sea ice-atmosphere models that will examine marine and coastal processes to investigate how changes in the sea ice regime may affect people. In addition, two hemispheric/regional scale modeling efforts will also be supported in project 4.1: a) statistical downscaling of the Canadian Centre for Climate Modeling and Analysis (CCCMA) General Circulation Model (GCM) to drive a regional scale model of the Canadian Arctic Archipelago (UVic) and b) the MM5 regional scale model to examine climate surface coupling of terrestrial, coastal and sea ice regions (Hanesiak and Barber). These larger scale models will be used to examine the context of regional climate change relative to hemispheric and global scale changes under various climate change scenarios. Selected outputs from the model datasets will be archived and made available to the broader ArcticNet community.

Project 4.2 Reducing Human Vulnerability to Environmental Changes in the Canadian Arctic
Project leader(s): Barry Smit

Project 4.2 builds on work in the climate hazards literature which conceptualizes vulnerability as a function of the exposure of a community to risks and the adaptive capacity of the community to deal with the exposure ( Vsij= f(Esit, Asit) ). This approach begins with an identification of the conditions the community identifies as risks and the community's abilities to prepare for, avoid, moderate and recover from the effects of exposure to changing conditions. This adaptive capacity is identified through systematic iterative participatory methods involving community members. Traditionally, indigenous peoples in the Arctic have been highly adaptive in the face of stresses, including environmental changes. However, there is evidence that the nature and speed of some changes, beyond the control of Arctic people, may already be approaching or exceeding adaptive capacity thresholds. In its first phase, this project assesses vulnerability of coastal Inuit communities through empirical documentation and analysis of communities' experiences with environmental (including climatic) exposures and risks, and identifies adaptive options and resource management strategies to deal with these risks. Inuit representatives are active partners, through facilitation, field research design, key informant selection, translation and interpretation. This phase

incorporates TEK/IQ with other data sources from ethnographic methodologies and government and scientific records. In the second phase, changes in environmental conditions (including climate) will be estimated (future exposure) from climate science and scenarios (4.3 and 4.1), as the basis for characterizing the nature of risks estimated to be faced by communities in the future. Further community fieldwork will be undertaken to determine the degree to which the adaptive capacity of the communities can accommodate these risks and what changes in policy or management might facilitate improved future adaptive capacity, and consequently decrease future vulnerability.

Project 4.3 Vulnerabilities and Adaptation to Meteorological and Related Hazards
Project Leader(s): Ronald Stewart

This project is concerned with the analysis of meteorological and related hazards, how they impact on the local communities, and how these hazards will change with the climate. This project will proceed through three steps. First, it will identify some of the meteorological extremes that occur in the present climate that lead to significant impacts on humans. This includes, for example, blizzards, blowing snow, strong winds, severe wind chill and reduced visibility, as well as storms producing snow and mixed phase precipitation with significant accumulation. Second, it will identify the key factors leading to such extremes. This will include atmospheric as well as surface conditions. Third, it will examine whether the contributing factors and their associated extremes are expected to occur in the future and, if so, whether their frequency, magnitude and location may change. In collaboration with others in ArcticNet (mainly projects in Theme 4), we will carry out discussions with the local communities to identify hazards from their perspective. We will also discuss this issue with forecasters at the Arctic Weather Centre in Edmonton and the Canadian Ice Service in Ottawa. We will compile and examine climatologies for various weather phenomena at different locations in Nunavut. As feasible, we will also discuss this issue with the transportation, insurance and other industries. During the first and second years, we will conduct small pilot field projects as preparation for a more extensive field study during year three. The purpose of these field projects is to gather more data on the nature of the above mentioned and other meteorological hazards.

Project 4.4 Climate Change, Key Traditional Food Species and Community Health in the Arctic
Project Leader(s): Laurie Chan, Christopher Furgal

Traditional food is well documented as a critical resource to northern populations for its nutritional, economic, social and cultural benefits. However, these important foods are also the main source of exposure for many environmental contaminants among northern Aboriginal people via their traditional diet based on land and sea species. Climate related changes in the North have been associated with alterations in animal, fish and plant populations and ice and snow conditions which influence their availability and northerners' access to them. Therefore,

climate has the potential to influence nutrition and health status in relation to such things as the incidence of disease, contaminant affected health outcomes (e.g. child development) and general individual and community health related to aspects of diet and lifestyle. This project will investigate health impacts of climate change in 5 major regions in the Canadian Arctic (Yukon, NWT, Nunavut, Nunavik and Labrador) in relation to traditional food consumption. Specifically the project will focus on: 1) nutrition and potential changes in intake of nutrients; 2) exposure to contaminants; and 3) levels of food security (availability and access to traditional foods). The research seeks to investigate to what extent, and how climate change is affecting the traditional diet profile of northern Aboriginal residents presently and potentially into the future and what implications this may have for individuals' health? Modelling and qualitative approaches will be used, integrating both scientific and local/traditional knowledge. In combination with ArcticNet project 2.1 (resources), the results will be used to propose regional harvesting regimes that are informed by the health implications / needs of alterations in the local food security situations.

Project 4.5 Surveillance and Management of Climate Change Impacts in the North: Implications for Northern Public Health Policy and Infrastructure
Project Leader(s): Pierre Gosselin

The vision for the project is that improved Community Health and Environmental Surveillance (CHES) programs for each northern region (and preferably across all regions) be planned, designed, put in place and made operational over the next decade. The Programs will be designed to be sensitive to climate related health effects and enable the prospective evaluation and management of health impacts associated with major ecological shifts including the eventual opening of the northern passage. The purpose is to work with Northern managers, organisations and individuals to build capacity to support surveillance and management of climate change health impacts in the North. Capacity building includes working to augment and/or improve human, technological, organisational and financial resources needed to accomplish the long term vision. The approach to the initiative is one of action research, deemed to be appropriate and functional for a capacity building initiative in the Canadian North. The project is seeking to inform and mobilize the necessary human and other resources to move towards the building/development of surveillance systems and programs, through education and training, partnerships and information sharing, pilot projects, fund mobilization and other mechanisms. The initial phase of the project has developed case studies describing the current state of health and environment surveillance with respect to climate impacts and their links to public health action for each of the Inuit regions from East to West: Nunatsiavut (due in 2007), Nunavik (2006), Nunavut (due in 2007) and Inuvialuit (due in 2007). Pilot projects have been initiated in Nunavik (syndromic surveillance of some infectious diseases) and Nunatsiavut (drinking water surveillance); a pilot is being planned for one other region within a PhD project.

Project 4.6 Conservation, economic development and community values: legal, policy and ethical perspectives
Project Leader(s): Milton Freeman

This project will examine the legal, policy, administrative and ethical framework within which an economically-important sustainable use of wildlife, namely sport hunting, is practiced in Nunavut and the Inuvialuit Settlement Region. The term 'conservation hunting' is now increasingly applied to sport or recreational hunting where those hunts result in demonstrable conservation and social benefits. Conservation hunting, most commonly for polar bear (but also for muskox and caribou) began in the early 1970s in the Canadian Arctic, and today provides a number of Inuit communities in Nunavut and the NWT with seasonal employment and a significant source of new income. Conservation hunting requires communities to reallocate scarce (quota-controlled) culturally-valued (subsistence) resources to non-resident hunters. This reallocation is sometimes a matter of intense debate reflecting changing cultural values, changes that may coincidentally affect various other customary beliefs and practices relating to, e.g., wildlife management/stewardship, Inuit entrepreneurship, and interpersonal community relations. This project will investigate these potential changes and their implications, and how the impacts of any adverse impacts are being mediated. The research program involves a number of Inuit organizations as partners, and will: (1) document and analyze variations in the practice of conservation hunting in the Canadian Arctic, (2) critically assess the conservation and social benefits and costs associated with this type of resource use, (3) examine the legal and policy framework within which these conservation-hunting programs operate, and (4) examine the future of conservation hunting in light of predicted environmental changes affecting the Canadian Arctic. To the extent that such predicted environmental changes in the Arctic may adversely impact these economically, socially, culturally and nutritionally important wildlife populations and hence people dependending upon these resources, greater understanding of evolving human-wildlife relationships in the North should contribute to formulating enlightened policy responses directed to mitigating any negative consequences of such environmental changes. An important goal of the project is to contribute to building capacity in northern communities and indigenous organizations so that northerners can fully participate in policy and program developments affecting their present and future wellbeing.

Project 4.7 Science-Policy Interactions
Project Leader(s): Gordon McBean

An overarching objective of ArcticNet is to translate a growing understanding of a changing Arctic into impact assessments, governmental policies and adaptation strategies. In order for research conducted by ArcticNet scientists and their partners to affect change there must be a process by which relevant information is brought to the attention of policy and decision-makers. Similarly, there must be a mechanism for governments and organizations to communicate concerns,

priorities and information needs to ArcticNet researchers. For this transfer to occur, an open dialogue must exist. An open-dialogue goes beyond simply providing accessible research results to engaging in a two-way transfer of knowledge. The focus of Theme 4 is to provide directly relevant information to aid policy and decision makers in the development of policies and strategies for adapting to a changing Arctic environment. It is Project 4.7 that will create and maintain an open-dialogue providing a means of communicating ArcticNet research results of relevance and priority to the north. Essential to achieving this open-dialogue is an understanding of the processes of knowledge transfer and its use by policy and decision makers. Collaborating with ArcticNet scientists and partners, governments, and organizations, Project 4.7 will be able to put research findings in the appropriate societal and political framework addressing identified priorities and information needs. With this understanding, Project 4.7 Network Investigators can make recommendations and assist with implementing means to improve the knowledge transfer process in ways that result in positive actions being taken. ArcticNet aims to make a difference for people of the coastal Canadian Arctic; through communication and collaboration Project 4.7 will assist in the achievement of this objective.

Project 4.8 Strengthening Climate Cooperation, Compliance & Coherence
Project Leader(s): Richard Janda

This project, “Strengthening Climate Cooperation, Compliance & Coherence” will conduct a legal and policy analysis of the impacts of climate change in the Canadian Arctic by studying the implications of a changing climate in governance and interactions with Inuit Land-claims organizations; environmental protection and human rights; and international sovereignty and diplomacy. It will develop, debate and disseminate legal and policy knowledge needed to formulate adaptation strategies and national and international policies to address the impacts and opportunities of climate change and globalization in the Arctic; and build new partnerships and capacity between national and international legal researchers, and Northern researchers, organisations and communities, especially from indigenous peoples and scientific communities, working on law and policy issues related to climate change and the Arctic. The project focuses on three streams related to climate change law and policy: - Cooperation: Analysis of intersections between global and domestic climate regimes, and other international regimes (environmental protection, human rights and international economic investment law), as these relate to indigenous peoples concerns in the Arctic. - Coherence: Survey of recent developments in land tenure law within Canada and around the world, with a focus on identifying examples of innovative new governance practices, and identifying key legal and policy priorities of relevance to Inuit Land-Claims organizations and agreements; and - Compliance: Analysis of international sovereignty and diplomacy issues related to international climate law and policy, and how interpretation of key terms and doctrines could address the implications of climate change for vulnerable regions such as the North. As the impact of climate change will be most acute in the Northern Regions of Canada,

the project will contribute to the development and dissemination of the knowledge needed to formulate adaptation strategies and national policies to help Canadians, and more specifically northern aboriginal communities, face the impacts and opportunities of climate change and globalization in the Arctic. In Phase I, the CISDL, McGill University and the University of Montreal, with partners, will host an International Law Symposium from Dec 02 – 04 on Sustainable Developments in Law and Policy on Climate Change in Montreal during the COP 11/MOP 1 Meeting, a special Workshop on Law and Policy Implications of a Changing Climate for Northern Communities with ArcticNet experts and speakers, and will link in with activities organised around 'Arctic Day' (Dec 06, 2005) in Montreal at the COP 11 /MOP 1 and parallel events. In Phase II, the CISDL and partners will conduct consultations, then research, write and review 6 – 10 working papers on key topics in climate law and policy, and will develop an on-line, interactive manual on law and policy issues related to climate change in Canada's North. In Phase III, the CISDL and partners will organise a National Seminar on Arctic Climate Law and Policy, engaging young people and students, as well as learned law and scientific experts and aboriginal organizations, in discussions, debates and peer review of the working papers, before publishing them. In developing participatory research and dialogue in this area, the CISDL aims at increasing presently limited knowledge in this rapidly emerging field. Increased knowledge and awareness will contribute to the development of better focused legal and policy strategies for coping with the impact of global warming and developing an adequate socio-economic response. It will provide practical, useful legal research and advice for the development of practical legislations and regulations for Canada's North by the northern inhabitants. Please see the CISDL Arctic Climate Law Project web-site at http://www.cisdl.org/arctic/ for more information.