Crown-Indigenous Relations and Northern Affairs Canada
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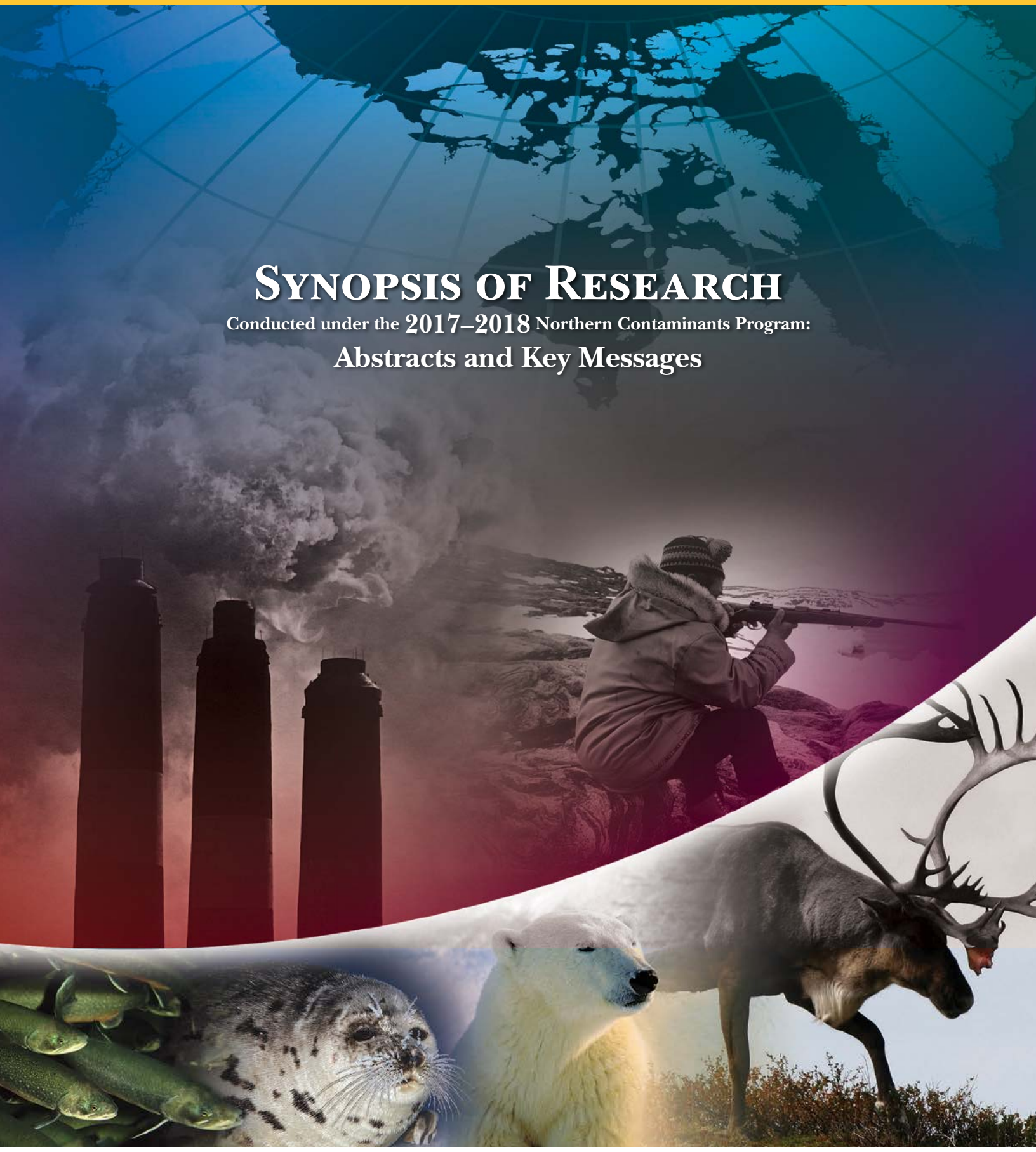
Synopsis of Research

Conducted under the 2017–2018 Northern Contaminants Program: Abstracts and Key Messages



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Synopsis of Research Conducted under the 2017-2018 Northern Contaminants Program: Abstracts and Key Messages

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This publication is also available in French under the title: Résumé de la recherche effectuée en 2017-2018 dans le cadre du Programme de lutte contre les contaminants dans le Nord : résumés et messages clés.

The full version of the *Synopsis of research* is available upon request from the NCP Secretariat (aadnc.plcn-ncp.aandc@canada.ca)

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Foreword

The Northern Contaminants Program (NCP) works to reduce and, wherever possible, eliminate contaminants in traditionally harvested foods, while providing information that assists informed decision making by individuals and communities in their food use. The *Synopsis of Research Conducted under the 2017-2018 Northern Contaminants Program: Abstracts and Key Messages* provides a detailed report of the activities and preliminary results of each project funded under the NCP between April 1, 2017 and March 31, 2018.

The projects described in this report cover the broad range of topics that contribute to understanding and addressing northern contaminants issues. They are arranged according to the five NCP subprograms: Human Health; Environmental Monitoring and Research; Communications, Capacity and Outreach; Community Based Monitoring and Research; and Program Coordination and Indigenous Partnerships. Specific research priorities, as outlined in the program's strategic documents (i.e. the NCP Blueprints and NCP Call for Proposals 2017-2018), included dietary contaminant exposure, food choice, and risk perception; effects of contaminants on the health of people and ecosystems; contaminant levels and trends in the Arctic environment/wildlife and the influence of climate change; the benefits/risk evaluation of country food consumption; and environmental microplastics monitoring. Projects were carried out using a variety of methodologies including fieldwork, laboratory analysis, community based monitoring, and workshops.

All projects supported by the NCP are subject to a comprehensive technical, peer and northern social/cultural review process, involving external peer reviewers, technical review teams, regional contaminants committees and the NCP Management Committee. This review process ensures that each project supports the priorities and objectives of the NCP and its partners. Engagement and partnership with Indigenous organizations, northern territorial and/or community authorities is required for all projects involving activities within northern communities, fieldwork in the North and/or analyses of samples, as a condition of approval for funding.

This report contributes to ensuring the transparency of the NCP and the timely sharing of results. More detailed project reports, describing project objectives, activities, results, and conclusions are compiled in the *Synopsis of Research Conducted under the 2017-2018 Northern Contaminants Program: Full Report*, which is available through the NCP Publications Database at www.aina.ucalgary.ca/ncp. All individual project reports have been lightly edited for clarity and consistency.

In addition to the *Synopsis of Research* publications, publications related to NCP funded projects (including peer reviewed journal articles) can be searched and accessed through the NCP Publications Database at www.aina.ucalgary.ca/ncp. Also, data and metadata associated with individual projects can be found on the Polar Data Catalogue website at www.polardata.ca.

Further information about the Northern Contaminants Program is available on the NCP website at www.science.gc.ca/ncp.

Introduction

The Northern Contaminants Program (NCP) engages Northerners and scientists in researching and monitoring of long-range contaminants that are transported to the Canadian Arctic through atmospheric and oceanic processes from other parts of the world and which remain in the Arctic environment and build up in the food chain. The data generated by the NCP is used to assess ecosystem and human health, and the findings of these assessments are used to address the safety and security of traditional country foods that are important to the health and traditional lifestyles of Northerners and northern communities. The findings also inform policy, resulting in action to eliminate contaminants from long-range sources. The NCP contributes scientific data and expertise to contaminants-related international initiatives such as the Arctic Council's Arctic Monitoring and Assessment Programme (AMAP), and to international agreements such as the United Nations Environment Programme's Minamata Convention on Mercury and Stockholm Convention on Persistent Organic Pollutants, that work on a global scale to improve the health of Arctic people and wildlife over the long term.

The NCP is directed by a management committee that is chaired by Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC), and consists of representatives from five federal departments (Environment and Climate Change Canada, Fisheries and Oceans, Health Canada, Polar Knowledge Canada and CIRNAC), five territorial, provincial and regional governments (Yukon, Northwest Territories, Nunavut, Nunavik and Nunatsiavut), four northern Indigenous organizations (Council of Yukon First Nations, Dene Nation, Inuit Tapiriit Kanatami and Inuit Circumpolar Council Canada), five regional contaminants committees, and Canada's Arctic-focused Network of Centres of Excellence, ArcticNet. The NCP Management Committee is responsible for establishing NCP policy and science priorities and for making final decisions on the allocation of funds. The Regional Contaminants Committees in Yukon, Northwest Territories, Nunavut, Nunavik and Nunatsiavut support this national committee with region-specific expertise and advice. Funding for the NCP's $4.1 million annual budget comes from CIRNAC and Health Canada. Details about the management structures and review processes used to effectively implement the NCP, and the protocol used to publicly disseminate health and harvest information generated by the NCP can be found in the NCP Operational Management Guide (available upon request from the NCP Secretariat).

Background

The NCP was established in 1991 in response to concerns about human exposure to elevated levels of contaminants in fish and wildlife species that are important to the traditional diets of northern Indigenous peoples. Early studies indicated that there was a wide spectrum of substances - persistent organic pollutants, heavy metals, and radionuclides - many of which had no Arctic or Canadian sources, but which were, nevertheless, reaching unexpectedly high levels in the Arctic ecosystem.

The Program's key objective is to reduce and, where possible, eliminate contaminants in northern traditional/country foods while providing information that assists informed decision making by individuals and communities in their food use.

Under the first phase of the NCP, research was focused on gathering the data required to determine the levels, geographic extent, and source of contaminants in the northern atmosphere, environment and its people, and the probable duration of the problem. The data enabled us to understand the

spatial patterns and temporal trends of contaminants in the North, and confirmed our suspicions that the major sources of contaminants were other countries. The data, which included information on the benefits from continued consumption of traditional/ country foods, was also used to carry out assessments of human health risks resulting from contaminants in those foods. Results were synthesized in the first Canadian Arctic Contaminants Assessment Report (1997).

Extensive consultations were conducted in 1997-1998 to find the common elements between the concerns and priorities of northern communities and the scientific needs identified as critical for addressing the issue of contamination in Canada's North. As a result, research priorities were developed based on an understanding of the species that are most relevant for human exposure to contaminants in the North, and geographic locations and populations that are most at risk.

In 1998, initiatives got under way to redesign the NCP, and implement new program features which continue to this day: 1) the NCP blueprints that represent the long-term vision and strategic direction for the NCP; and 2) an open and transparent proposal review process. These features ensure that the NCP remains scientifically defensible and socio-culturally aware, while at the same time, achieving real progress in terms of the Program's broad policy objectives.

In 1998-1999, the NCP began its second phase, which continued until 2002-2003. Results of this phase were synthesized in the 5-part (1, 2, 3, 4, 5) Canadian Arctic Contaminants Assessment Report II (CACAR II 2003). During that time, the NCP supported research designed to answer questions about the impacts and risks to human health that may result from current levels of contamination in key Arctic food species. To ensure a balanced assessment of the risks of consuming traditional food, an emphasis was placed on characterizing and quantifying the benefits associated with traditional diets. Communications activities were also emphasized and supported. Under the leadership of the northern Indigenous organizations, the dialogue between Northerners and the scientific community, which had been initiated during the early days of the NCP, continued to build awareness and an understanding of contaminants issues, and helped to support communities in dealing with specific contaminant issues at the local level.

Since 2003, the NCP has continued to lead and contribute to assessments that synthesize data funded through the NCP program. In 2009, the NCP released the Canadian Arctic Contaminants and Health Report. This report compiled research funded under the Human Health subprogram since the CACAR II release in 2003. It covered topics including health status of the Canadian Arctic population, human exposure to contaminants, toxicology, epidemiology, and risk-benefit evaluation.

Efforts on a third series of Canadian Arctic Contaminants Assessment Reports got under way in 2010, leading to the release of the CACAR III: Mercury in Canada's North, in December 2012; the CACAR III: Persistent Organic Pollutants in Canada's North, in December 2013; and the CACAR III Contaminants In Canada's North: Summary for Policy Makers, in April 2015.

The *CACAR III: Mercury in Canada's North* publication reported on the scientific progress made under the projects supported by ArcticNet, NCP and International Polar Year. The report also evaluated the current understanding of the environmental fate of mercury in the Canadian Arctic. Its key scientific recommendations were: 1) Continue research and monitoring of atmospheric mercury, with an enhanced focus on deposition measurements to facilitate quantification of atmospheric contributions of mercury to Arctic ecosystems. 2) Continue temporal trend monitoring of mercury in Arctic biota, and identify the processes that are changing mercury concentrations in some species. 3) Further characterize the key processes acting on mercury after atmospheric deposition and their effects on the fate of mercury in the Arctic environment. 4) Better characterize the processes that link climate

change with mercury transport, cycling and bioaccumulation. 5) Increase efforts to determine the biological effects of methylmercury exposure on Arctic fish and wildlife.

The *CACAR III: Persistent Organic Pollutants in Canada's North* publication reported research on POPs in the Canadian Arctic over the period of 2003 to 2011. It drew on results from the NCP (2003-2011) as well as on any other published or unpublished studies up to early 2013. This reporting period saw much new knowledge developed on temporal trends of POPs in air and biota, new POPs in many environmental compartments, and on ocean transport to the Arctic. The possible influence of climate warming on trends of POPs has was also investigated. The report made recommendations in relation to the transition from science to policy action, how the expansion of information on the chemical of interest impacts future research directions, how the improved knowledge of time trends of POPs impacts future research directions, the importance of local sources of new POPs, knowledge of factors influencing levels and trends or POPs, and the on-going challenge of assessing the biological effect of POPs.

The *CACAR III Contaminants In Canada's North: Summary for Policy Makers* publication gives an overview of where contaminants originate, how they are transported, and how they interact with the Arctic and Northern environment and ecosystems. The report explores NCP's current knowledge to action initiatives, including a look at the key scientific studies taking place across the Arctic. Finally, the report details the 10 key findings of NCP research to date (Box 1) and the future directions of research in the Arctic (Box 2).

The most recent reports in the CACAR series, Contaminants in Canada's North: State of Knowledge and Regional Highlights, and Human Health 2017 were released in 2018.

As part of the 25th anniversary of NCP, the report on *Contaminants in Canada's North: State of Knowledge and Regional Highlights* synthesizes the detailed scientific results presented in a series of technical reports produced from 2011 to 2017 by the Northern Contaminants Program on the issue of long-range contaminants in the Canadian Arctic. This report elaborates further on the 10 key findings reported in the *CACAR III Contaminants In Canada's North: Summary for Policy Makers* publication, and provides details of NCP's activities and a summary of contaminants related issues in the 5 regions of its geographic scope.

In Nunatsiavut, the Nunatsiavut Government Research Advisory Committee (NGRAC) and the Nain Research Centre coordinate the implementation of NCP activities and are the main points of contact for information about long-range contaminants in Nunatsiavut. In Nunavik, NCP activities are coordinated through the Nunavik Nutrition and Health Committee (NNHC). In Nunavut, NCP activities are coordinated by the Nunavut Environmental Contaminants Committee (NECC). In the Northwest Territories (NWT), the NWT Regional Contaminants Committee (NWTRCC) coordinates NCP-related activities. In Yukon, the Yukon Contaminant Committee (YCC) coordinates all NCP-related activities in the territory. Each regional highlight describes information on country foods, health and contaminants; mercury and country food; and POPs and food. The regional highlights also include information on relevant health advisories and scientific studies in the respective regions.

The *CACAR IV: Human Health Assessment 2017* is a Canadian-specific summary of an Arctic Council report from the Arctic Monitoring and Assessment Programme (AMAP) on human health in the Arctic published in 2015. The NCP undertook this assessment to address concerns about potential human health risks associated with exposure to environmental contaminants from a diet that includes traditionally prepared and harvested foods from local northern ecosystems. Traditional food, also known as country food, is central to the social, cultural, economic, and spiritual well-being of Inuit, Dene, and Métis in the North and, for many, is essential for their overall food security. The

key finding of the report were that: levels of many contaminants have decreased over time, however, there is still a strong need for additional data to ascertain contaminants trends among pregnant women and women of childbearing age in many regions of the Canadian Arctic; contaminants such as PBDEs and PFAS are also found in people and wildlife and further data is needed to understand human exposure to these contaminants and potential health outcomes; dietary advice should be regionally specific; there is a strong need for co-location of biomonitoring and wildlife monitoring studies, along with dietary assessment work to create stronger data linkage between exposure sources and contaminant levels measured in humans.

International Impact

The NCP effort to achieve international controls of contaminants has remained strong throughout the program's history. The NCP continues to generate data that allows Canada to play a leading role, particularly through cooperative actions under the Arctic Council's Arctic Monitoring and Assessment Programme (AMAP), in the following initiatives:

1. The legally binding POPs protocol, under the United Nations Economic Commission for Europe (UN ECE) Convention on Long-range Transboundary Air Pollution, was successfully negotiated and signed by 34 countries (including Canada) at the UN ECE Ministerial conference in Arhus, Denmark in June 1998. Canada ratified this agreement in December 1998.

2. A legally binding global instrument on POPs under the United Nations Environment Programme (UNEP) was completed with the signing of the POPs Convention in Stockholm, Sweden, May 23, 2001; the UNEP Stockholm Convention on POPs entered into force in May 2004. As of June 2017, in addition to the original 12 POPs included in the convention, there were 16 new POPs. As part of the continued international efforts to address new and emerging POPs, the POP review committee (POPRC) continues to meet regularly to review POPs of emerging concern. The POPRC had its 13th such meeting, in October 2017, since the treaty entered into force. As of April 30th 2018, there are 152 signatories and 182 parties to the treaty.

3. The Minamata Convention on Mercury, a legally-binding agreement to cut emissions and releases of mercury to the environment, entered into force on August 16, 2017. The convention was signed by Canada in October 2013, and on April 7, 2017 Canada became the 41st country to ratify the treaty. The NCP made important contributions to this historic signing and ratification, through use of its data, information and expertise, and will continue to play a role in monitoring the effectiveness of the Convention. The first meeting of the Conference of the Parties to the Minamata Convention on Mercury (COP1) from September 24 to 29, 2017, discussed procedures and directions for the implementation of the Convention. NCP was represented at the COP1 by an Inuit Circumpolar Council (ICC) member who participated in a panel discussion about how Inuit are affected by mercury, and about mercury monitoring in the Arctic.

Box 1.

10 key findings of the Northern Contaminants Program

1. Concentrations of 'legacy POPs' are generally going down across the Arctic.
2. As 'new POPs' come under regulation, their levels in the Arctic decline.
3. Mercury levels in the Arctic are stabilizing but are still several times higher than during pre-industrial times.
4. Climate change can affect how POPs and mercury cycle in the Arctic environment and accumulate in wildlife.
5. The complex movement of contaminants in the Arctic environment and wildlife is now better understood.
6. Current levels of POPs and mercury may be a risk for the health of some Arctic wildlife species.
7. While exposure to most POPs and mercury is generally decreasing among Northerners, mercury remains a concern in some regions.
8. Traditional/country foods continue to be important for maintaining a healthy diet for Northerners.
9. Environmental exposure to contaminants in the Arctic has been linked to health effects in people.
10. Continued international action is vital to reducing contaminant levels in the Arctic.

Box 2.

Current direction of the Northern Contaminants Program

(adapted from Contaminants in Canada's North: Summary for Policy Makers, 2015)

In terms of *Environmental Monitoring and Research,* the NCP is

- continuing to play a critical role in the detection of new chemical contaminants of concern to the Arctic and will continuously review and refine its list of contaminants of concern;
- enhancing the measurement of long-term trends of mercury and POPs by filling gaps in geographic coverage;
- carrying out more research to understand the effects of climate change and predict their impacts on contaminant dynamics and ecosystem and human health risks; and,
- supporting the expansion of community-based monitoring projects that build scientific capacity in the North and optimize the use of Indigenous knowledge.

In terms of *Human Health Research, Monitoring and Risk Assessment*, the NCP is:

- ad\dressing ongoing public health concerns related to contaminants and food safety, in partnership with territorial/regional health authorities by:
  - weighing the risks associated with exposure to POPs and mercury against the wide ranging benefits of consuming traditional/country foods; and
  - expanding monitoring of contaminant exposure among human populations across the North, and research on potential health effects in collaboration with Northern communities, to provide current information to public health officials.

In terms of *Communications and Outreach*, the NCP is:

- communicating research results and information about contaminants and risk to Northerners in the context of broader environmental (e.g. climate change) and health messages. Timely and culturally sensitive messages are being developed and communicated in association with regional health authorities and other appropriate spokespeople; these communication initiatives will be evaluated for their effectiveness; and,
- ensuring that NCP data and information is effectively communicated to key international networks, such as AMAP, and the Global Monitoring Plans under the Stockholm and Minamata Conventions for the purpose of evaluating the effectiveness of global regulations.

Human Health

Yukon contaminant biomonitoring seed funding: Investigating the links between contaminant exposure, nutritional status and country food use

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- **Project Location**
  Old Crow, YT

Abstract

Wild food is an important part of the diet for many Yukon residents, particularly First Nations, who traditionally harvest caribou, moose, fish, waterfowl, small game and many plants. Although there has been extensive research on contaminants in wild foods and some dietary surveys, there have been no human biomonitoring studies conducted in the territory. The Vuntut Gwitchin First Nation has initiated a human biomonitoring study for their citizens as a pilot project for the Yukon. To explore the possibility of developing broader Yukon Human Biomonitoring Study partnerships among Yukon First Nations, Yukon Government, Health Canada, and research scientists have been initiated. Focus groups in the community fine-tuned Food Frequency Questionnaires and Health Messages Surveys for Old Crow residents. These surveys were subsequently administered to 65 Old Crow residents. With 100% of participants reporting that they eat traditional foods, the results demonstrated the importance of such foods in Old Crow. Results showed caribou and salmon to be among the most frequently consumed traditional foods in Old Crow. Most participants had heard about the healthfulness of traditional foods and the potential risks from mercury in some fish, while relatively few participants had heard messages about the levels of cadmium in caribou. This project will continue with biomonitoring in Old Crow in the fall of 2018 and the results of Food Frequency Questionnaires and Health Messages Surveys will be used to help interpret the results.

Key Messages

- Consultations with community leaders and territorial representatives led to the creation of a community-research agreement for baseline data collection in Old Crow, YT.
- Dietary and risk perception questionnaires were refined with feedback from focus groups held in October 2017.
- 65 participants took part in baseline data collection in February-March 2017.
- Results showed caribou and salmon to be among the most frequently eaten traditional foods in Old Crow, YT.
- 100% of participants reported eating traditional foods and 98% preferred their diet to include traditional foods.
- Most participants had heard about the healthfulness of traditional foods and the potential risks from mercury in some fish.
- Relatively few participants reported receiving messages about the levels of cadmium in caribou.

Exposure to food chain contaminants in Nunavik: biomonitoring in adult and youth cohorts of the Qanuilirpitaa survey (Year 1 of 3)

Project Leader

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Project Location

Nunavik, QC

Abstract

Inuit are exposed to a wide range of environmental contaminants through their traditional diet, which includes significant amounts of fish and sea mammals. During the past 25 years, our team has monitored the exposure of Nunavimmiut to persistent organic pollutants (POPs) and metals, starting with the Santé Québec Inuit Health Survey in 1992, which was followed by the *Qanuippitaa* 2004 Health Survey. From 1992 to 2004, for most legacy POPs, a significant decreasing trend was confirmed in environmental components, and wildlife and circumpolar Inuit exposure data. Despite a decreasing trend, mostly due to reduced consumption of country foods, mercury and lead exposures remain topical issues, particularly among childbearing and pregnant women in Nunavik. In addition, each year, new chemicals are introduced in the market. These "New POPs and Contaminants of Emerging Concern" now reach the Arctic food chain and very little is known about their concentrations and temporal and regional trends in Inuit Nunangat. In the first year of this project, we aim to provide current data on exposure to toxic metals in a representative sample of the Inuit population of Nunavik, within the framework of the *Qanuilirpitaa?* Nunavik Inuit Health Survey which took place from August 19th to October 5th, 2017, in the 14 communities of Nunavik. In addition, we assembled 30 pooled plasma samples that were analysed using various targeted and

untargeted methods, in order to determine which POPs should be selected for analysis in individual samples during the subsequent years of this project. Our results will allow updating long-range environmental contaminants exposure among Nunavimmiut and contribute to better understanding the risks and benefits of country foods consumption in this population.

Key Messages

- A total of 1326 Nunavimmiut aged 16 and over participated to the *Qanuilirpitaa?* Nunavik Inuit Health Survey in 2017.
- Concentrations of cadmium, lead, mercury and selenium were determined in whole blood samples of participants.
- Pooled plasma samples (N = 30) were analysed for polychlorinated biphenyls and organochlorine pesticides, per - and polyfluoroalkyl substances and polychlorinated dibenzo-*p*-dioxins and dibenzofurans.
- Pooled plasma extracts are being analysed for the presence of unsuspected contaminants (non-targeted screening).

Exposure to food chain contaminants in Nunavik: Evaluating spatial and time trends among pregnant women & implementing effective health communication for healthy pregnancies and children (Year 2 of 3)

Project Leader

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Project Location

- All 14 communities of Nunavik
- Quebec City, Quebec
- Peterborough, ON

Abstract

Inuit are exposed to a wide range of environmental contaminants through their country food diet. During the past 20 years, our team has monitored the exposure of Nunavik's Inuit population to persistent organic pollutants (POPs) and metals. In this same period, a decreasing trend was confirmed in environmental concentrations and circumpolar Inuit exposure levels for most legacy POPs. Despite a decreasing trend due to reduced country food consumption, mercury (Hg) exposure remains a critical issue, particularly among pregnant women in Nunavik. As well, new chemicals are

introduced on the market each year. These "New POPs and Contaminants of Emerging Concern (CECs)" reach the Arctic food chain and very little is known about their concentrations, temporal and regional trends, and Inuit exposure to them.

Since 2011, we have worked on multiple related projects to assess local country food sources of Hg and nutrients in Nunavik, and to understand the effects of Hg exposure, dietary nutrients, and food security during pregnancy on child development. Together with the Nunavik Regional Board of Health and Social Services (NRBHSS), and based on data provided by the Nunavik Research Center (NRC), we developed dietary recommendations aimed at mitigating Hg exposure while enhancing nutritional and food security status for women of childbearing-age. Recent data from medical follow-up of pregnant women continue to show high Hg concentrations and reveal that health and dietary recommendations that were provided to assist healthcare providers were not very efficient in reducing Hg exposure in these women.

This three-year project aims to contribute to on-going international biomonitoring efforts on long-range environmental contaminant exposure among pregnant women in Nunavik, and evaluate the comprehension and effectiveness of health and dietary recommendations/advice given to pregnant women, other women of childbearing age, caregivers, and members of the general population.

During Year 1, a total of 97 pregnant women from 13 communities in Nunavik were recruited for biomonitoring activities. Results of Year 2 show that blood Hg and lead (Pb) levels in 2016-2017 have decreased by 16-18% since the last time they were measured in 2013. Exposure levels of Legacy and New POPs included in the Stockholm Convention have decreased markedly since they were first measured in 1992 or 2004, and continued to decrease in the recent years. However, more recent perfluorinated compounds (PFNA, PFDA and PFuDA) that were used in replacement of the older ones are now increasing since they were first measured in 2012, and PFNA exposure levels are more than three times higher than those reported for women of the same age in southern Canadian cities. Based on food questionnaire data and methylmercury (MeHg) intake estimations, beluga meat and nikku was the main source of MeHg exposure for pregnant women across seasons in 2016-2017, but primarily in the summer when most beluga products are available. All study results will be available and progressively presented to Nunavimmiut and health professionals over the next year.

Key Messages

- In 2016-2017, blood Hg and Pb levels have decreased by 16-18% since the last time they were measured in 2013.
- Exposure levels of Legacy and New POPs included in the Stockholm Convention continued to decrease since they were first measured in 1992 or 2004.
- More recent perfluorinated compounds (PFNA, PFDA and PFuDA) exposure levels are increasing since they were first measured in 2012.
- PFNA exposure levels are more than three times higher than those reported for women of the same age in southern Canadian cities.
- Beluga meat and nikku are the main source of MeHg exposure for pregnant women across seasons but primarily in the summer, when most beluga products are available.

Quantifying the effect of transient and permanent dietary transitions in the North on human exposure to persistent organic pollutants and mercury

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- **Project Location**
  - Toronto, Ontario
  - Yellowknife, Northwest Territories

Abstract

Our main activity for the 2017-2018 project year was to raise awareness and highlight the potential uses of the dietary mercury (MeHg) exposure assessment tool (MEAT v2.0) we developed with support of the Northern Contaminants Program (NCP). The tool can be used to predict the concentrations of mercury in blood and hair in humans based on the estimated dietary exposure of the individual. The MEAT v2.0 model can also estimate nutrient intakes (e.g., fatty acids, vitamins, minerals) if that information is available.

To raise awareness and highlight the potential uses of the tool, we attended the NCP Results Workshop in Yellowknife, NWT (Sept 26-28, 2017). The tool was presented as part of the NCP Researcher EXPO and during a special meeting held with researchers and representatives of the Regional Contaminants Committees and Northern Health Authorities.

Key Messages

- Biomonitoring data required for assessing human exposure to organic chemicals such as methylmercury are not always available.
- Exposure models are necessary and useful; they can help answer the fundamental question, “Do I need to be worried about mercury in the food I am eating?”
- The MEAT v2.0 model is freely available to NCP officials, the NCP Regional Committees and representatives of Northern Health Authorities.

Contaminant biomonitoring in the Northwest Territories: Investigating the links between contaminant exposure, nutritional status, and country food use

Project Leader

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Project Location

Year 1/1re année

- Jean Marie River First Nation, NT

Year 2/2e année

- Kakisa (Ka'a'gee Tu), NT
- Fort Providence (Deh Gah Gotie), NT
- West Point First Nation, NT
- Hay River Reserve (K'atl'odeeche), NT
- Deline, NT

Year 3/3e année

- Trout Lake (Samba K'e), NT
- Fort Good Hope (K'asho Got'ine), NT
- Tulita (Tulít'a), NT

Abstract

This study aims to evaluate people's exposure to a variety of contaminants, including metals and persistent organic pollutants, in Dene/Métis communities of the Dehcho and Sahtú regions of the Northwest Territories. In the third sampling year of the project, we collected samples and data in three participating communities and returned results from prior sampling years in six additional communities. Our research team traveled to Jean Marie River First Nation, Fort Providence (Deh Gah Gotie), West Point First Nation, Hay River Reserve (K'atl'odeeche), Deline and Kakisa (Ka'a'gee Tu), NT to discuss results with local leadership as well as return results to participants through public

meetings and one-to-one sessions. Building upon prior consultations in 2015-2017, our research team traveled to Tulita (Tulít'a), Trout Lake (Samba K'e) and Fort Good Hope (K'asho Got'ine), NT for data and sample collection. With the assistance of local research coordinators and nurses, we collected blood, urine, and/or hair samples from 202 individuals across the three participating communities (Tulit'a, Samba K'e, and K'asho Got'ine) in 2017-2018. Over the three-year project, 537 participants (between ages of 6 and >80 years) from nine Dehcho and Sahtú communities took part in this research. Participants also completed a health messages survey and two dietary surveys (24-hr Recall, Food Frequency Questionnaire). Data analysis of the Year 3 results (metals in blood/urine; POPs in blood; mercury in hair; dietary surveys) is currently underway. In collaboration with regional, territorial, and federal partners, results will be returned to Year 3 participating communities in Fall 2018.

Key Messages

- Year 2 results were returned to participating individuals and communities in between November 2017 and February 2018.
- For the vast majority of participants (Year 1-2), metal exposures for mercury, cadmium and lead fell below available health-based guidance values.
- Additional consultation with leaders and community members were held in Tulít'a, and K'asho Got'ine to discuss their participation in the biomonitoring project.
- Between November 2017 and March 2018, 202 participants from three NWT communities (i.e., Samba K'e, Tulít'a, and K'asho Got'ine) provided hair, blood, and/or urine samples for biomarker analyses.
- Year 3 samples are currently being analyzed for mercury (hair), metals and metalloids (blood, urine), and POPs (blood).
- Year 3 results will be returned to participating individuals and communities in fall 2018.

Community Based Monitoring and Research

Variable fish mercury concentrations in the Dehcho: Effects of catchment control and invertebrate community composition

Project Leader

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Project Location

- Ekali Lake, NT
- Big Island Lake, NT
- Sanugez Lake, NT
- Willow Lake, NT

Abstract

This project began in 2016, and aims to determine why mercury levels in fish vary between lakes and species in the Dehcho region, NT. In August 2017, fish, benthic invertebrate, zooplankton, sediment, and water samples were collected from Ekali Lake and Big Island Lake. The lakes were chosen to represent two different regions – the Horn Plateau (Willow, Big Island) and the Mackenzie Lowlands (Ekali, Sanguez). Laboratory analyses are ongoing. Results reveal that size-standardized mercury levels in northern pike and lake whitefish are higher in the two Mackenzie Lowland lakes than in the Horn Plateau lakes. Methylmercury (MeHg) in invertebrates varied among taxa, and was higher in the Mackenzie Lowlands lakes than in the Horn Plateau lakes. Levels of total and MeHg in water, and total mercury in sediment are also higher in the Mackenzie Lowlands lakes than in the Horn Plateau lakes, although MeHg in sediments did not follow this pattern. Characteristics of the land that surrounds the lakes differ substantially between the two geographic regions. Higher percent MeHg in water than sediment in the Mackenzie Lowlands lakes suggests a strong catchment source of MeHg, whereas only slightly higher %MeHg in water than sediments in the Horn Plateau lakes suggests importance of both in-lake and catchment supply of MeHg. Current and future results in this combined catchment and food web study will be used to better understand spatial differences in fish mercury concentrations in the region, and to generate better predictions of fish mercury concentrations to anthropogenic stressors, such as climate change and resource development.

Key Messages

- In lake sediments, the Horn Plateau lakes (Willow and Big Island) has lower total mercury, but higher MeHg than the Lowland lakes (Ekali and Sanguez).
- Mercury concentrations in water are lower in the Horn Plateau lakes (Big Island and Willow) than the two lowland lakes (Sanguez and Ekali), both for total mercury and MeHg (dissolved and unfiltered).
- Northern pike and lake whitefish have significantly higher size-standardized concentrations of total mercury in the Mackenzie Lowlands lakes (Ekali, Sanguez) than in the Horn Plateau lakes (Big Island, Willow).
- MeHg concentrations in invertebrates are higher in the Mackenzie Lowlands lakes (Ekali, Sanguez) than in the Horn Plateau lakes (Big Island, Willow).
- Catchment characteristics differ between the Mackenzie lowlands lakes (Sanguez and Ekali) and the Horne Plateau lakes (Big Island and Willow).

Community-based monitoring of Arctic char in Nunatsiavut: Increasing capacity, building knowledge

Project Leader

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Project Location

- Nain, Nunatsiavut
- Saglek Fjord, Nunatsiavut

Abstract

Ringed seals and sea-run arctic char continue to make up a large portion of the diet of Labrador Inuit due to the drastic reduction of the George River Caribou herd and subsequent ban on hunting of the herd imposed by the Newfoundland and Labrador Government in 2013. Given the importance of arctic char to both the diet of ringed seals and Labrador Inuit, monitoring of these fish in Nunatsiavut is essential. This community-based monitoring project continues to expand on previous NCP work on contaminant trends in sea-run char conducted by Environment and Climate Change Canada, including a capacity building component and an additional sampling location that has now been sampled for two years. Twenty fish were captured at two locations, Nain and Saglek Fjord, just before they returned inland from feeding in the ocean. The char were caught and processed by local community members, with support from staff at the Nain Research Centre, Parks Canada and Nunatsiavut Conservation Officers. The data from this project is being used for a variety of purposes, including providing needed information for dietary advice, understanding contaminant loads and how they are changing as a result of regional changes being experienced due to climate change and increased industrial development.

Key Messages

- This project is a regionally led community-based monitoring program, sampling arctic char, while building capacity and addressing contaminant concerns of Labrador Inuit, and providing valuable data to the NCP.
- This project is a result of collaboration of harvesters, community members, youth, Conservation Officers, Parks Canada, Environment Canada and staff of the Nain Research Centre.
- Continued progress towards addressing the recommendations of the ArcticNet IRIS report that community-based monitoring of arctic char should exist to ensure the population is monitored and healthy for consumption.

Tłı̨chǫ Aquatic Ecosystem Monitoring Program (TAEMP)

Project Leader

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Project Location

- Gamètì (Rae Lakes), NT
- 64.1122° N, 117.3540° W

Abstract

The Tłı̨chǫ Aquatic Ecosystem Monitoring Program (TAEMP) continues to provide a means of addressing community concerns related to changes in aquatic environments and builds on work carried out since 2010. As a successful community-driven program, it meaningfully involves community members in conducting contaminants-related research, including the science-based collection of samples, and observations using both Tłı̨chǫ and scientific knowledge to address the question: "Are the fish safe to eat and the water safe to drink?"

In September 2017, a 5-day on-the-land monitoring camp returned to Rae Lakes, near the community of Gamètì, with the camp situated at the same site as the 2013 TAEMP camp was located. The 2017 participants returned to locations on Rae Lakes where sediment and water sampling occurred in 2013 to allow for comparative sampling, with the removal of one location and the addition of two new locations as requested by community members. Elders and community members spoke about fish and aquatic ecosystem health, passed on their knowledge to participants, and ensured safe camp operations and transport to and from sampling locations. Science-based methods for processing fish and collecting water and sediment samples for lab analyses were demonstrated on shore, and field sampling provided youth with hands-on experience in scientific sampling methods. As well, youth participated in cultural activities, including making dry fish and dry meat, which were demonstrated by Gamètì elders. A results meeting was scheduled in Gamètì for June 2018; unfortunately, many participants were unexpectedly out of town and, therefore, no one attended.

Fish tissue analysis indicated mercury levels were low in Łıh (lake whitefish); while in Łıwezǫ̀ǫ̀ (lake trout), the mercury levels were close to or slightly exceeded Canadian Food Inspection Agency guidelines. Both łıh and łıwezǫ̀ǫ̀ did not show levels of mercury that were considered abnormal for northern lakes. Comparison of 2017 results to 2013 results showed no appreciable change in mercury concentration for łıh and fewer łıwezǫ̀ǫ̀ exceeding the guidelines. Water and sediment results supported the expectation that water and sediment quality is "good" (i.e. not abnormal) in Rae Lakes.

Key Messages

- The fish tissue analyses of fish species typically consumed by residents of Gamètì showed that mercury levels were low in łıh while łıwezǫ̀ǫ̀ were close to or slightly exceeded the guidelines. No contaminant levels measured in any of the species' fish tissue samples were considered to be abnormal;
- Water and sediment quality results support the expectation that water quality and sediment quality are good in Rae Lakes. No water or sediment contaminant levels were considered to be abnormal;
- Gamètì community members were pleased with the implementation of the program, citing the importance of continued monitoring near their community; and,
- Non-statistical comparison of the 2017 to 2013 results suggests that there are no major changes in the quality of fish, water or sediment; a return to Gamètì in 2021 will allow for further tracking of potential changes.

Imalirijiit: Environmental community-based monitoring of the George River Watershed, Nunavik

Project Leader

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Project Location

Kangiqsualujjuaq, QC

Abstract

In Canada's North, there is a growing interest in community-based environmental monitoring (CBEM), as resource exploitation and climate change increasingly impacts Indigenous territories. This one-year study followed up on a successful pilot Science Land Camp, involving youth conducted in 2016 in Kangiqsualujjuaq, that was co-initiated by Elders, local experts and researchers from Université du Québec à Trois-Rivières. This community-based program aims to establish baseline environmental conditions and country food quality before the start of a rare earth elements (REEs) mining project in the George River upper watershed. Youth training workshops were successfully organized, as well as sampling at ten stations along the river involving in situ measurements, collection of water samples for laboratory analyses (35 metals including REEs, nutrients, chlorophyll-a) as well as macroinvertebrates and vertebrates (fish, seal) sampling. Lichens from nearby terrestrial sites were also collected, as potential bioindicators of atmospheric deposition of REEs.

Community engagement in sample collection for the CBEM project was very strong and led to high quality results, as shown by reliable data on REEs and other metals (including mercury, Hg) in water, lichens, invertebrates, fish and seal livers and muscles. The results obtained were very consistent with a recently published article on REEs from another site in Nunavik. Levels of REEs in fish and seal muscles were very low, whereas those in aquatic invertebrates were 1000 times higher. REE levels in lichens were about half those in invertebrates. With respect to mercury (Hg), levels in edible vertebrate tissues were below the Canadian consumption guideline of 0.5 ppm, except for some

muscle tissues samples from sculpin. Land-based activities, hands-on workshops, real data collection and sharing between different generations and cultures through the Imalirijiit project, has helped make science practical and meaningful for local Inuit youth and other participants in the science camp. This project has also fostered local capacity in environmental monitoring in the community.

Key Messages

- A community-based environmental monitoring (CBEM) program was successfully implemented near the proposed site of a rare earth mining project.
- An environmental science land camp on issues relevant to youth was successfully held.
- Background pre-mining levels of rare earth elements (REEs) in water, aquatic invertebrates, fish, lichens and seal were obtained.
- REE levels were higher in organisms at the base of the food web than in fish and seal.
- REE levels were higher in fish and seal livers than in muscles.
- Levels of mercury in wildlife were generally lower than consumption guidelines.

Contaminants concentrations in traditional country food from the Eclipse Sound and dietary exposure in Pond Inlet, Nunavut: Science and local knowledge assessing a local baseline of the risks to human health

Project Leader

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Project Team

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Project Location

- Pond Inlet, NU
- Emerson Island, NU
- Bylot Island, NU

Abstract

Traditional country food is vital to Inuit culture, as it has provided high-quality resources for millennia. With industrial development, natural contaminant concentrations (*e.g.* mercury) have, at times, increased in the atmosphere and oceans, accumulating in ecosystems and living organisms in the most remote Arctic regions with many adverse effects being identified on animal and human health. Balancing the benefits that country food represents to Arctic residents (body health, mental health, and culture) with the risks associated with the utilization of country food that contains contaminants is not an easy task.

In this Northern Contaminants Program (NCP) project, we monitored contaminants; mercury, trace metals and Persistent Organic Pollutants in different tissues of ringed seal, and documented local observations and knowledge in order to better understand this species as well as the community's exposure to contaminants. One of the most unique aspects of this project was that it was community-based under the lead of a local researcher and hunter, James Simonee, who received guidance from researchers from multiple university and research centres for training and guidance.

We (James Simonee, assistant, and research mentor Vincent L'Hérault) harvested and sampled 30 ringed seal from 3 different areas in the spring and fall of 2017. Contaminants and stable isotopes results are not yet available as they are still pending. We interviewed a total of 9 local participants; active hunters, elders and women on ringed seal about traditional uses, biology and ecology,

population trends, and environmental changes. Interview results indicate a global decline in the ringed seal population of the Eclipse Sound region along with some observations of changes in blubber and pelt quality. Several causes to a declining seal population were discussed and included the rise of predators, shipping disturbance and contaminants. Based on the success of this baseline study and local capacity developed, we intend to pursue the expansion this project to other marine wildlife in the years to come.

Key Messages

- This community-based project was led by a local researcher, with support from NCP researchers.
- This project harvested and sampled various tissues of 30 ringed seal for mercury, trace metals and Persistent Organic Pollutants. This allowed for among season comparison of contaminants in seal populations (lab results pending).
- Interview results suggest declining ringed-seal numbers in various traditional hunting areas.
- Interview results suggest potential linkages between declining seal and the rise of predators, shipping activity, and contaminants in the environment.

Mobilizing Inuit Knowledge and land use observations to assess ecosystem trends and processes affecting contaminants

Project Leader

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Project Location

Sanikiluaq, NU

Abstract

The community of Sanikiluaq has been working to develop novel ways to systematically document Inuit knowledge and observations of ecosystem trends and processes. This project formed a key proof-of-concept for using the new SIKU.org platform and mobile app to document Inuit hunting stories of seals and polar bears. In doing so, this app and platform will provide context on animal ecology, diet, body condition and associated environmental conditions that could benefit contaminants research. In addition to ongoing consultation and co-development with Inuit, a workshop was held in Sanikiluaq in fall 2017 to guide development of the mobile app and platform in the context of documenting seal and polar bear diets and body condition for Northern Contaminants Program (NCP) research. The community was highly supportive and workshop outcomes guided development of features, approaches to intellectual property and other details of the platform, mobile app and overall project.

Following development of the mobile app through fall 2017, field testing to document seal and polar bear diet and body condition began in winter 2018. Preliminary testing in January helped guide improvements and proof-of-concept for a fully functional mobile app and online platform was achieved in early March by Inuit hunters. The mobile app is now consistently allowing over a dozen hunters to document diet, body condition, associated sea ice and other conditions around seal and polar bear harvesting, as well as for other species, sea ice habitat features. The app works offline using a built in GPS and camera, and syncs up data and media to the online platform on return to wifi range.

With proof-of-concept for mobilizing raw data behind Inuit harvesting activities achieved, the next phase of the project is to deliver a 3 year pilot study that will a) provide an adequate database of Inuit observations for preliminary analysis, b) provide real-time trends and summaries of wildlife diet/ condition for hunters and communities using SIKU, c) develop the back end for bulk transferring raw data (e.g. diet, body condition, etc.) to contaminants researchers in a framework that respects the intellectual property rights decisions of Inuit SIKU users d) directly incorporate these results into contaminants research and e) provide a full evaluation of the three year pilot program, including the ability to scale the tools developed for this project to more generally incorporating Inuit harvesting observations into contaminants research programs across the Arctic.

Key Messages

- The community consultation and planning workshop in Sanikiluaq indicated strong support for the project and provided guidance on approach to developing the mobile and online tools to document wildlife diet, body condition, and environmental conditions as a part of harvesting activities, towards use of Inuit observations in contaminants research.
- Online platform (Figure 1) and mobile app (Figure 2) and features were developed in SIKU to support local hunters documenting, sharing and archiving observations from harvesting activities in support of contaminants research.
- A Proof-of-concept was achieved for the project by Inuit hunters in Winter 2018 with observations from hunters now showing on the SIKU.org platform
- The next phase of the project involves a three-year pilot program to continue to collect Inuit harvesting observations for seals and polar bears, develop real-time analysis and data synthesis tools in SIKU, use these data in research on contaminants pathways for seals and polar bears, and provide a full evaluation on the success of this approach towards meaningfully incorporating Inuit observations into contaminants science.

An East Hudson Bay Network research initiative on regional metal accumulation in the marine food web

Project Leader

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Project Location

- Sanikiluaq, NU
- Inukjuak, QC
- Umiujaq, QC
- Kuujjuaraapik, QC
- Chisasibi, QC

Abstract

Communities in East Hudson Bay are concerned about ecosystem changes observed in recent decades, particularly related to sea ice and oceanographic conditions, and also about potential impacts of contaminants from long-range atmospheric transport and regional human activities. The Arctic Eider Society's Community-Driven Research Network (CDRN) has been established to measure and better understand large scale cumulative environmental impacts in East Hudson Bay and James Bay. Building on CDRN collaborations and activities in five communities (Sanikiluaq, Kuujjuaraapik, Inukjuak, Umiujaq, Chisasibi), this NCP project is generating new information on contaminants (specifically metals) that provide a regionally integrated perspective on metal exposure in the East Hudson Bay and James Bay marine environment. The five communities sampled coastal bioindicator species (blue mussel, common eider, sea urchins) between 2015 and 2017. Offshore bioindicators (ringed seal, herring gull, plankton, marine sculpin, arctic cod) were additionally collected from Kuujjuaraapik, Inukjuak and/or Sanikiluaq. These locally-important bioindicators of metal accumulation will be used to characterize geographic and habitat-specific variation (coastal and offshore zones) in the marine environment. Community-driven execution of biological collections as well as parallel ecosystem measurements on sea ice and water will allow for more integrated research in the context of environmental change.

Key Messages

- Blue mussels, sea urchin, common eider, Arctic cod, marine sculpin, and ringed seal were collected by community team members in East Hudson Bay and James Bay.
- Tissues were analyzed for levels of mercury and other metals (such as lead and cadmium).
- Information on the project and animal collections has been posted on a web-based platform called SIKU (https://www.beta.siku.org (note the website is now live at www.siku.org) - previously called Interactive Knowledge Mapping Platform; IK-MAP).

Mercury in seaweed, lichens and mushrooms from the home range of the Qamanirjuaq caribou

Project Leader

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Project Team

Lars Qaqqaq, Baker Lake, NU; Emma Kreuger and Keenan Lindell, Arviat NU

Project Location

- Baker Lake, NU
- Arviat, NU
- Chesterfield Inlet, NU
- Rankin Inlet, NU
- Whale Cove, NU

Abstract

Qamanirjuaq caribou have higher mercury concentrations than many other Arctic caribou herds. Usually, caribou get most of their mercury from lichens, but local elders described the Qamanirjuaq caribou eating seaweed from the seashore. Since seaweed is known to accumulate some metals, it was hypothesized that the caribou may be getting additional mercury from this source. Interviews with elders and hunters in four Kivalliq communities indicated that Qamanirjuaq caribou forage for lichens on the tundra and hilltops in the winter and for lichens and other vegetation (including seaweed) on lakes, rivers and the seashore in the summer. Mercury concentrations were significantly and consistently lower in seaweed than in mushrooms and lichens in four Kivalliq communities, suggesting that seaweed is not a major source of mercury for the Qamanirjuaq caribou. Results of this project were presented to five Kivalliq communities in the fall of 2017.

Key Messages

- Qamanirjuaq caribou forage for lichens on the tundra and hilltops in the winter and for lichens and other vegetation (including seaweed) on lakes, rivers and the seashore in the summer.
- Seaweed in the Kivalliq region is very low in mercury.
- Seaweed is not a major source of mercury to the Qamanirjuaq caribou.

Environmental Monitoring and Research

Northern contaminants air monitoring: Organic pollutant measurements

Project Leader

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Project Location

- Alert, NU (82°30′ N, 62°20′ W)
- Little Fox Lake, YK (61°21′ N, 135°38′ W)

Abstract

The atmosphere is the most rapid pathway for organic pollutants to reach the remote Arctic. Since 1992, this continuous monitoring program has measured how much organic pollutants are present in Arctic air. Knowing how levels of organic pollutants change over time helps researchers identify if air concentrations are decreasing, increasing or not changing over time; where these chemicals have come from; how much from which region and what climate conditions influence their movement to the Arctic. Results from this project are used to negotiate and evaluate international control agreements on organic pollutants and to test atmospheric models that explain how contaminants move from sources in the South to the Arctic.

Starting in 2006, we extended the program to screen for emerging chemicals, such as current-use pesticides (CUPs), flame retardants and stain-repellent-related per and polyfluoroalkyl substances (PFASs), in Arctic air at Alert. Flame retardants (FRs) and polybrominated diphenyl ethers (PBDEs) started to show declining trends in air after 2012 and non-BDE FRs are frequently detectable in air at Alert but concentrations are very low. We updated the time trends for PFASs in which the data now covers 2006 to 2017. 8:2 fluorotelomer alcohol (FTOH), 10:2 FTOH, and perfluorooctanesulfonic acid (PFOS) showed declining trends since 2012-2013. New emerging PFASs were screened in air samples collected from October 2015 to March 2017. Trace level of perfluorobutane sulfonamide (FBSA) was found but polyfluoroalkyl phosphate diesters (diPAPs) were below method detection limit. A passive flowthrough sampler (FTS) specifically designed for use in cold environments has been deployed at Little Fox Lake, Yukon, since August 2011. Sampling at this site is continuous and ongoing.

Key Messages

- Air monitoring for organic pollutants at Alert, Nunavut, and Little Fox Lake, Yukon, and measurements are ongoing.
- Air concentrations of flame retardants (FRs) polybrominated diphenyl ethers (PBDEs) started to decline at Alert after 2012.
- Non-BDE FRs are frequently detectable in air at Alert but concentrations are very low and background contamination of air samples in some years prevented the determination of time trends.
- Source region analysis suggested that perfluorooctanesulfonic acid (PFOS) levels at Alert were influenced by air masses transported from land while perfluorooctanoic acid (PFOA) levels were influenced by oceanic air masses.

Mercury measurements at Alert and Little Fox Lake

Project Leader

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Project Location

- Little Fox Lake, YK
- Alert, NU

Abstract

Mercury (Hg) is a priority pollutant of concern in Canada, especially Arctic regions. The Arctic primarily receives Hg via long range transport from regions that are mainly from outside of Canada. Our results from atmospheric Hg concentration measurements at Alert, Nunavut show a median decreasing trend of -0.9 ± 0.3 % per year for the past 23 years from 1995-2017. In contrast, Hg concentrations at Little Fox Lake, Yukon show an increasing median trend (+1.3% ± 1.2% per year for 10 years from 2007-2016). At Alert, Hg continues to show a distinct seasonal decrease in gaseous elemental Hg (GEM) in the spring. Concurrently, there are also seasonal patterns in shorter-lived Hg species including reactive gaseous mercury (RGM), and particle-bound mercury (PHg). There is a peak in PHg during early spring and a peak in RGM in late spring; both show enhanced deposition of mercury to the snow at the same time. Recent trend analysis shows that trends in the springtime concentration levels of PHg and RGM are changing at Alert. The project team worked with the Regional Contaminants Committees in both Nunavut and the Yukon to discuss project plans and ideas for this work.

Key Messages

- Atmospheric mercury concentration measurements have been collected at Alert, Nunavut since 1995 and at Little Fox Lake, Yukon since 2007.
- Gaseous elemental mercury levels at Alert have decreased annually since 1995 to present and at Little Fox Lake have increased annually from 2007 to present.
- The timing, magnitude and composition of speciated mercury observations during springtime atmospheric mercury depletion events (AMDE) at Alert are changing. Speciated mercury

describes the various types of mercury found in the air that have a shorter lifetime than GEM and include reactive gas phase mercury and mercury on particles.

- The data collected as part of this program will be used as scientific contribution to national policies and strategies. As well, it will be used in the assessment of effectiveness of national and international emission reduction strategies.

Passive air sampling network for organic pollutants and mercury

Project Leader

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Project Location

- Inuvik/Mackenzie Delta, NT
- Fort Resolution, NT
- Cambridge Bay, NU
- Kuujjuaq, QC
- Iqaluit, NU
- Nain, NL
- Northwest River, NL

Abstract

This project measures contaminants, namely persistent organic pollutants (POPs) and mercury, in the air at seven locations across Canada's North. Before the start of the project in 2014, these contaminants in the air in Canada were only measured at Alert and Little Fox Lake under the Northern Contaminants Program (NCP); and Alert, Little Fox Lake and Coral Harbour as part of the Global Atmospheric Sampling (GAPS) Network. The current project adds seven sites, including Inuvik/Mackenzie Delta, Fort Resolution, Cambridge Bay, Kuujjuaq, Iqaluit, Nain, and Northwest River. These additional sampling locations provide data to create a more comprehensive picture of the levels of contaminants over various environments, how they are carried through the air from more southerly regions and arrive in the Arctic and how contaminant levels are changing over time.

Under this project, POPs measurements continued at seven passive air sampling stations across the Arctic from April 2017 to March 2018. While passive sampling takes much longer than traditional sampling methods, the passive samplers are a low-cost, low-maintenance way to monitor contaminants in air because they do not require power for pumps or housing for the instruments that are usually used for contaminant sampling. Passive sampling is straightforward and can easily involve students or other interested persons in the sample collection. This can enhance communication between the project team and local communities as well as creates training opportunities for Northern students. This year, field tests for developing a passive mercury air sampler have been completed and the mercury passive samplers at the Arctic stations will soon be used at the 7 passive sampling sites and at Alert and Little Fox Lake. A northern student, Jamie Thomas, was engaged to research on Indigenous Knowledge (IK) in the Yukon region which may be used in the air monitoring projects for POPs and mercury. Jamie has interviewed four elders and has drafted a report which we are currently reviewing to better understand the IK information.

Key Messages

- Passive air sampling equipment for POPs has been sent to seven arctic sites and most stations were in operation since October 2014.
- Project leaders visited Iqaluit (Nunavut), Whitehorse (Yukon) and Inuvik (NWT) to discuss with the respective Regional Contaminants Committees and community leaders about the science activities and communication/outreach plans under this project. Project leaders also engaged communities through a variety of communication/capacity building activities, including giving lectures at the Nunavut Arctic College, Yukon College, the Aurora College and East Three Secondary School.
- Polychlorinated biphenyls (PCBs) were found in air samples collected at five arctic sites at concentrations similar to other Arctic locations. The highest concentrations were found in Nain, Nunatsiavut with levels close to those found at an urban site in Toronto. These high concentrations at Nain suggest potential local sources of PCBs in Nain.

Temporal trends of persistent organic pollutants and metals in ringed seals from the Canadian Arctic

Project Leader

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Project Location

- Sachs Harbour, NT
- Resolute Bay, NU
- Arviat, NU
- Nain, NL

Abstract

The major questions that this project is addressing are: (i) how are concentrations of legacy contaminants and other persistent organic pollutants (POPs) as well as mercury changing over time in ringed seals? and (ii) are trends similar across the Inuit Nunangat? The presence and trends of new and emerging contaminants are also investigated. This project involves annual sampling completed by local harvesters and coordinated by Hunters and Trappers Associations/Committees in Sachs Harbour, Resolute Bay, Arviat, and Nain. The annual measurements of contaminants in Arctic ringed seals have demonstrated that seals are very good indicators of changing uses and production of chemicals widely incorporated in consumer and industrial products.

Since 2016, outreach activities to the communities and integration of Inuit knowledge have been added to this long-term monitoring project. This year, a one-day educational workshop on ringed seal health was successfully organized at the Inualthuya school in Sachs Harbour, NWT. This complementary project "*Learning about ringed seal health from contaminants science and Inuit knowledge: an educational workshop in Sachs Harbour, Northwest Territories*" funded as part of the Northern Contaminants Program's (NCP) Communications, Capacity Building, and Outreach subprogram, allowed NCP research scientists working on contaminants in ringed seals to share information about

their work and provided opportunities for Inuvialuit elders to share their knowledge with students and researchers in seal ecology and traditional methods of captures and skinning.

Key Messages

- Legacy compounds such as PCBs, DDT, Chlordane, and HCH continue to decline in blubber of ringed seals.
- Mercury concentrations in liver and muscle vary from year to year but overall are not increasing in ringed seals.
- Trends were updated up to 2016 for flame retardants and results indicated very slow decrease of PBDEs and HBCD in blubber of seals for Sachs Harbour, Arviat, and Resolute.
- In recent years, increases of perfluoroalkyl substances have been observed in liver of seals at some locations.
- The annual measurements of contaminants in Arctic ringed seals have indicated that seals are very good indicators of changing uses and production of chemicals widely incorporated in consumer and industrial products.
- Collaborations between this Environmental Monitoring and Research project and the Communications, Capacity Building and Outreach project "*Learning about ringed seal health from contaminants science and Inuit knowledge: an educational workshop in Sachs Harbour, Northwest Territories*" provide opportunities to enhance local capacity building, communications and the use of traditional ecological knowledge in contaminants research on ringed seals.

Temporal and spatial trends of legacy and emerging organic and metal/elemental contaminants in Canadian polar bears

Project Leader

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Project Location

- Western Hudson Bay (Keewatin Region): Arviat, Rankin Inlet and Whale Cove
- Southern Hudson Bay (Qikiqtaaluk Region): Sanikiluaq
- Baffin Bay (Qikiqtaaluk Region): Clyde River and Pond Inlet

Abstract

The polar bear (*Ursus maritimus*) is the top predator of the Arctic marine ecosystem and food web. Starting in 2007 and ongoing through the 2017-2018 fiscal year, on a biennial or annual basis, this project assesses long-term time trends and changes in Northern Contaminants Program (NCP) priority persistent organic pollutants (POPs), both legacy and new, in polar bears. This project also measures elemental pollutants in polar bears in similar fashion. The focus of this project is on western and southern polar bear subpopulations in the climate change impacted Hudson Bay (Nunavut) region. Some newer POPs are currently banned or regulated (e.g. under the treaty of the Stockholm Convention on POPs). For example, tetra- to octa-brominated diphenyl ether (PBDE) flame retardant contaminants, in fat samples from bears from both subpopulations, continue to show gradual decreases since 2009. An even newer flame retardant, hexabromocyclododecane was put on the Stockholm Convention list in 2013, and has not been detectable in Hudson Bay bear fat samples since that same year. Since 2007 and every year until 2017, and despite increasing regulation, Arctic contaminants known as PFOS (perfluorooctane sulfonate) and the sum of perfluorinated carboxylic acids (∑PFCA) have remained consistently at high concentrations in bear liver samples over this 10 year period (and higher in the livers of southern Hudson Bay bears). Other new contaminants like polychlorinated naphthalenes (PCNs) had ∑PCN concentrations in 2017-collected bears fat are comparable to legacy POPs such as the pesticide Mirex and ∑PBDEs. Total mercury levels in 2017-collected bear liver samples generally remained in the same range as historical levels going back to 2007. POP and mercury data in samples from bears from these subpopulations are used locally, regionally, nationally, and internationally to assess changes over time of POP and metal exposure

to the bears and thus a sentinel of contamination of the Arctic marine ecosystem and the possible health impacts. To understand contaminant changes over time, important factors such as age, sex, body condition, time of collection, lipid content, and diet and food web structure are also being determined, as well as important observational information from Indigenous knowledge holders in the participating communities.

Key Messages

- For 2013-2014 collected tissue samples from southern and western Hudson Bay, chemical screening was recently completed for a large and complex suite of 295 legacy and new halogenated POPs. A total of 210 POPs were detected and/or quantifiable with some frequency in all fat or liver samples, and thus illustrating the increasingly "complex cocktail" of contaminants the bears are exposed to.

- Time trends for the sum (S) of PBDE concentrations (in fat) showed an increase from 1991 to 2010 and reaching about 80 ng/g (lipid weight) for western Hudson Bay bears, but have since decreased gradually; the most recently levels are in the 50 ng/g (lipid weight (lw)) range. The time trend assessment for southern Hudson Bay bears has been over a shorter period (starting in 2007-2008), where in 2010 the ∑PBDE concentrations were in the 120 ng/g lw range, but most recently concentrations are around 50 ng/g lw.

- HBCDD was consistently at very low levels, and close to the detection level for this contaminant, in bear fat over the years 2001 to 2013, but was not detected in 2014, 2015 or 2016 samples for all bears. BB-153 concentrations were quite high in comparison to $\sum_4$PBDE concentrations in most years including in the most recent samples.

- During 2007-2018, for Hudson Bay bears, among the 22 per/poly-fluoroalkyl substances (PFASs) analyzed (in liver) the concentrations were consistently greater for PFOS and ∑PFCAs (low levels of PFOA but mostly C_9, C_{10} and C_{11} PFCAs).

- In liver samples from 2010 and up to 2017, PFOS concentrations were in the >1000 ng/g (wet weight (ww)) range for southern Hudson Bay bears, and western bears were in the <1000 ng/g ww range. ∑PFCA concentrations were also higher in the southern bears and generally between 500 to 1000 ng/g ww for all bears. There continues to be no obvious increasing or decreasing trends for ∑PFCAs and PFOS for both subpopulations of bears during 2007-2017.

- From 2002 to 2017, total mercury (THg) concentrations in liver samples continued to range from 5 to 25 mg/g ww. Concentrations were slightly greater in bears from western Hudson Bay versus southern Hudson Bay, but remain generally unchanged for that period for both bear populations.

Temporal trends of mercury and halogenated organic compounds in Hendrickson Island, Sanikiluaq and Pangnirtung beluga

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Project Location

- Hendrickson Island, NT
- Sanikiluaq, NU
- Pangnirtung, NU

Abstract

The overarching objectives of this project are to monitor contaminant levels in three beluga populations to assess spatial and temporal trends in mercury, organic halogenated compounds (including legacy and new compounds) along with supporting biological and dietary metrics (e.g. stable isotopes, size, age). Samples of liver, muscle and muktuk of beluga whales collected in 2017 were analyzed for total mercury. Levels of mercury remained similar to ranges found in previous years. Of the organs analyzed in this study, liver typically had the highest concentrations of mercury, followed by muscle and muktuk. Data from these samples were added to the growing database on concentrations of these elements in organs of Arctic marine mammals. The database now contains information on over 500 Hendrickson Island beluga from 22 collections, taken every year since 1993, with the exception of a gap between 1996 and 2001.

Mercury content varies among individual animals, and among organs defined by different processes associated with different mercury species. This variation makes rigorous detection of differences among animals, places, and times statistically difficult with low sample sizes. Knowing the age of the individuals is required for interpretation of liver concentrations and the beluga size and diet preferences is required for interpretation of muscle and muktuk mercury concentrations. Age data

for this year is lacking due to the disruption of analytical instruments (LC/MS used to measure aspartic acid in eye lenses for age determination). The additional samples obtained each year improve the statistical analysis and ability to account for the confounding factors of size, age and gender and reduce the chances of reporting apparent differences if they are not real.

Key Messages

- The mean level of mercury in 2017 liver samples from the Hendrickson Island beluga was 16.54 ± 12.54 µg/g. Mercury in muscle was lower than that in liver with a mean concentration of 0.96 ± 0.59 µg/g.
- In spite of the lower mercury values in muscles tissues from Hendrickson Island beluga, all but one specimen still exceeded 0.5 µg/g, the concentration used to regulate the consumption of commercial fish in Canada.
- Of the three organs analyzed in the Hendrickson Island animals, muktuk contained the lowest levels of total mercury with a mean 0.42 ± 0.18 µg/g. Thirty percent of the samples (9 of 30) exceeded 0.5 µg/g.
- Unlike liver, total mercury in muscle and muktuk is equivalent to methylmercury (MeHg) (i.e. THg = MeHg). MeHg is the form of mercury that bioaccumulates and is toxic.

Temporal trends of contaminants in arctic seabird eggs

Project Leader

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Project Location

- Prince Leopold Island, NU
- Coats Island, NU

Abstract

This project monitors contaminants in Arctic seabird eggs as an index of contamination of Arctic marine ecosystems. Eggs of thick-billed murres and northern fulmars have been collected from Prince Leopold Island in the Canadian high Arctic since 1975. Concentrations of total mercury (Hg) continue to increase in fulmar eggs but at a much slower rate, whereas Hg concentrations in murre eggs have plateaued and may only be starting to decrease recently. Concentrations of PCBs and DDT continue to plateau after dramatic declines in the 1970s and 1980s, whereas polychlorinated naphthalenes continue to decline. Climate change is affecting concentrations of organochlorines and total mercury in seabird eggs from Prince Leopold Island.

Key Messages

- Concentrations of total Hg continue to increase in fulmar eggs from Prince Leopold Island but at a much slower rate, whereas Hg concentrations in the murre eggs have plateaued and may be starting to decrease.
- Concentrations of PCBs and DDT declined dramatically in the 1970s and 1980s and are now plateauing in eggs of thick-billed murres and northern fulmars from Prince Leopold Island.
- Concentrations of polychlorinated naphthalenes continue to decline in eggs of thick-billed murres from Prince Leopold Island.
- Increased concentrations of total mercury as well as some organochlorines in seabird eggs from Prince Leopold Island are correlated with increasingly positive North Atlantic Oscillation conditions and increasing rainfall/precipitation in this region.

Temporal trends and spatial variations of mercury in sea-run Arctic char from Cambridge Bay, Nunavut

Project Leader

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Project Location

Ekaluktutiak (Cambridge Bay), NU

Abstract

This core biomonitoring study investigates trends in mercury concentrations in sea-run (anadromous) Arctic char from the domestic fishery at Ekaluktutiak (Cambridge Bay). Of particular scientific interest is investigating whether year-to year changes in mercury concentrations are similar to year-to-year changes in climate and mercury releases to the air from urban and industrial areas. Local fishermen harvested the Arctic char from the sea that was used for our mercury analyses. As part of other collaborative studies, fishermen working with the Hunters and Trappers Organization (HTO) and university researchers working with the HTO harvested lake trout, lake whitefish, least cisco, and char from Grenier Lake where the sea-run char return after feeding in the sea. A community fisherman also provided char from Keyhole Lake, a landlocked lake. Mercury concentrations were very low in the char that fed in the sea (sea-run char) and in char that were from Grenier Lake. Mercury concentrations were higher in landlocked char from Keyhole Lake. Posters were developed that more easily show our study findings with respect to mercury in fish.

Key Messages

- Mercury concentrations remain very low in sea-run char from the Cambridge Bay domestic fishery.
- While air temperatures are warming in the Cambridge Bay area, mercury concentrations do not appear to be increasing in sea-run char.

- Thinner sea-run char tend to have slightly higher mercury concentrations than heavier sea-run char.
- Mercury concentrations are slightly higher in char living in Grenier Lake than char feeding in the sea.
- Mercury concentrations are higher in lake trout from Grenier Lake, possibly because they are older on average and have different feeding habits compared to fish in other lakes.

Temporal trends of persistent organic pollutants and mercury in landlocked char in High Arctic lakes

Project Leader

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Project Location

- Resolute, NU
- Quttinirpaaq National Park, NU

Abstract

This long term study examines trends over time of mercury and other trace elements, as well as legacy and new persistent organic pollutants (POPs) in landlocked Arctic char. In 2017, we completed our annual sampling and collected char from lakes near the community of Resolute Bay on Cornwallis Island (Amituk, Char, North, Resolute, and Small) and in Lake Hazen in Quttinirpaaq National Park on Ellesmere Island. Overall, results show that over the period of 2005-2017 concentrations of mercury in char declined in Hazen and Char Lakes but concentrations have levelled off or increased slightly in Resolute, North and Small lakes. Concentrations of POPs have generally declined since the early 2000s but the trends vary among lakes and specific chemicals. In Resolute Lake, toxaphene and PCBs have increased slightly since 2010 which may be due to old sources of contaminants being reintroduced into the lake with climate change.

Key Messages

- While concentrations of mercury in landlocked Arctic char still show overall declining trends since 2005, levels have recently levelled off or increased slightly.
- Concentrations of POPs have generally declined since 2000 but the trends vary among lakes and specific chemicals.
- The year to year variation in concentrations of both mercury and legacy POPs in Arctic char may be influenced by climatic factors.

Spatial and long-term trends in persistent organic contaminants and metals in lake trout and burbot from the Northwest Territories

Project Leader

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Project Location

- Lutsel K'e, NT
- Hay River, NT
- Fort Resolution, NT

Abstract

Our study measures trends in mercury, other metals, and persistent organic pollutants (POPs) in lake trout and burbot from three locations in two regions of Great Slave Lake. Lake trout were obtained from the domestic fishery at Lutsel K'e (East Arm) and the commercial fishery operating out of Hay River (West Basin). Burbot were obtained from the domestic fishery at Fort Resolution (West Basin). In addition, under our other studies, we continue to investigate mercury concentrations in burbot at Lutsel K'e and northern pike at Fort Resolution. Mercury concentrations remain relatively low in these fish but with trends of continuing mercury increase in lake trout and burbot. We worked on a series of posters to present our mercury findings in a clear and understandable way; as part of this we met with several community organizations in March 2018 to discuss our study results and refine poster design. POPs concentrations are declining, particularly ΣDDT and ΣHCH. We continue to work with Fort Resolution (water intake study) and Lutsel K'e (Stark Lake concerns), and contribute to related studies being conducted by other researchers, including mercury trends in fish in Dehcho lakes (Buffalo Lake) and Great Bear Lake.

Key Messages

- Mercury concentrations remain relatively low (average <0.5 µg/g) in lake trout, burbot, and northern pike from Great Slave Lake.
- Mercury continues to show a trend of increase in lake trout and burbot but not northern pike.
- Persistent organic pollutant concentrations are declining, particularly in West Basin fish.

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

Project Leader

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Project Location

Fort Good Hope, NT

Abstract

Partnering with the Fort Good Hope Renewable Resources Council, we collected 40 burbot from the Mackenzie River (Rampart Rapids) in early 2018. Our goals for 2017-2018 were to analyze the concentrations of mercury and other contaminants (e.g. persistent organic pollutants), from this country food, analyze the data with historical time-series concentrations (spanning 32 years in total) and other attributes of the fish, and report information to relevant end users in the Sahtú region and the Northwest Territories. Knowledge on contaminants in burbot from this project is shared to key stakeholders (regional health authorities, the Fort Good Hope Renewable Resources Council, and the Sahtú Renewable Resources Board) to promote safe consumption guidelines and sustainable renewable resource management regimes by relevant administrations. Preliminary results indicate that average mercury concentrations in these fish (both liver and muscle tissue) remain below the recommended guideline for consumption. Length and age do not appear to influence mercury concentrations, although in some years females had higher concentrations in liver. Burbot with dark livers had higher concentrations of mercury in both liver and muscle compared to those with white livers. Dark livers are a sign of starvation (low lipid stores) and thus mercury is likely more concentrated in these dark livers. This seems to support local Indigenous Knowledge that dark livers are “unhealthy”. Average annual mercury concentrations have increased over the last three decades, and thus there is a definite need to continue this environmental monitoring.

Key Messages

- Mean concentrations in muscle and liver over the entire data sets were 0.361 ± 0.144 (n = 742) and 0.100 ± 0.087 (n = 737) mg/g wet weight, respectively.
- Burbot with dark livers had statistically higher total mercury concentrations in liver ($t=3.819$, $p<0.001$) and muscle ($t=2.596$, $p=0.013$) compared to burbot with white livers. Dark livers are a sign of starvation and contaminants are likely bio-concentrating in these tissues.
- Length and age did not influence mercury concentrations. In some years, females contained higher concentrations of mercury in liver tissue compared to males.
- Average annual mercury concentrations have increased over the last three decades, and thus there is a definite need to continue this environmental monitoring.

Temporal trends of contaminants in Yukon lake trout

Project Leader

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Project Team

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Project Location

- Lake Laberge, YT
- Kusawa Lake, YT

Abstract

This project has been monitoring contaminants in lake trout from Lake Laberge and Kusawa Lake, in the Yukon, since 1993, and annually since 2001. In the fall of 2017 and early winter of 2018, seven lake trout were collected from Kusawa Lake and 12 from Lake Laberge. Otoliths were aged and liver and muscle samples from these fish are currently being analyzed. Previous data from this project are being gathered and curated prior to being analyzed and reported. Plain language summaries have been created for each lake and distributed widely. An outreach program (lecture and lab) was conducted with the Yukon Fisheries Field Assistant Program at Yukon College in May 2017 in Whitehorse, YT. Ta'an Kwach'an Council and Champagne and Aishihik First Nations are integrally involved in fish collections for this project and in the ongoing refinement of the communication of results. We have been developing our communication capacity, and are including Yukon Contaminants Committee, Yukon Environment (Fisheries) and Kwanlin Dun First Nation in discussions. As we move forward with this collaborative approach we anticipate many new opportunities for value-added consultation and communication activities.

Key Messages

- Lake trout samples were collected from Lake Laberge and Kusawa Lake in collaboration with Ta'an Kwach'an Council (TKC) and the Champagne and Aishihik First Nations (CAFN) and are currently being analyzed.
- Data from previous years from this project are currently being gathered and curated.
- Plain language summaries discussing lake trout from Lake Laberge and Kusawa Lake, were distributed widely and revised for inclusion in newsletters and websites.

Arctic caribou contaminant monitoring program

Project Leader

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Project Location

- North Yukon (Porcupine herd)
- Western Yukon (Forty-Mile herd)
- Kivalliq region, Nunavut (Qamanirjuaq herd)

Abstract

This project studies contaminant levels in caribou in the Canadian Arctic to determine if these populations remain healthy (in terms of contaminant loads); whether these important resources remain safe and healthy food choices for Northerners; and if contaminant levels are changing over time. In 2017-2018 samples were collected from nine Porcupine, 17 Qamanirjuaq and 13 Forty-Mile caribou. Sample analyses for these collections had not been completed at the time this report was prepared. Porcupine, Qamanirjuaq, Bluenose West, and Ahiak samples collected in the 2016-2017 year were analyzed, and results are presented in this report.

Renal lead declined over time in the Porcupine and Qamanirjuaq caribou and mercury appears to be stable over the long term in the Porcupine and Qamanirjuaq herds. Toxic elements tended to be higher in cows than bulls, likely due to the relatively higher volume of food intake (and hence toxic element intake) by cows due to their smaller size and the higher energy needs for reproduction and nursing. Short-chain per- and polyfluoroalkyl substances (PFASs) are man-made chemicals that are used in things like Teflon and fire-fighting foams. Some types of PFASs are increasing over time in the Porcupine and Qamanirjuaq caribou (largely due to increases in pentafluorobenzoic acid (PFBA), a degradation product of a chemical used in automobile air conditioners). The longer-chain PFASs are, for the most part, no longer being manufactured for widespread use and are declining over time. Perfluoroalkyl sulfonic acids (PFSAs) are another group of man-made chemicals created for various industrial uses. They are also declining over time in caribou, largely due to the ban on use of perfluorooctanesulfonic acid (PFOS) which was used as a fabric protector. Polybrominated diphenyl ethers (PBDEs) were commonly used as flame retardants and are also found in caribou, although, like PFASs, concentrations were very low.

Levels of most contaminants measured in caribou kidneys were not of concern toxicologically, although renal mercury and cadmium concentrations may cause some concern for human health

depending on the quantity of organs consumed. Yukon Health has advised restricting intake of kidney and liver from Yukon caribou, the recommended maximum varying depending on herd (e.g. a maximum of 25 Porcupine caribou kidneys/year). The health advisory confirms that heavy metals are very low in the meat (muscle) from caribou and this remains a healthy food choice. There have been no health advisories issued for caribou in NWT or Nunavut.

Key Messages

- Levels of most contaminants measured in caribou tissues are not of concern, although kidney mercury and cadmium concentrations may cause some concern for human health depending on the quantity of organs consumed. Caribou meat (muscle) does not accumulate high levels of contaminants and is a healthy food choice.
- Mercury concentrations in the Porcupine and Qamanirjuaq caribou are stable over the long term, although there is variation from year to year.
- Short-chain PFASs are increasing in the Porcupine and Qamanirjuaq caribou; this is likely coming from PFBA, a degradation product of a chemical used in automobile air conditioners.
- This program will continue to monitor the Porcupine and Qamanirjuaq caribou herds annually to maintain confidence in this traditional food and to better understand the dynamics of contaminants within this ecosystem (particularly mercury).

Community based seawater monitoring for organic contaminants and mercury in the Canadian Arctic

Project Leader

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Project Location

- Barrow Strait near Resolute Bay, NU (74.612, -95.026)
- Wellington Bay near Cambridge Bay, NU (69.2363, -106.4448)
- Beaufort Sea near Sachs Harbour, NT (71.9327, -125.3251)
- Anaktalak Fiord near Nain, NL (56.4481, -62.0045)

Abstract

This project examines levels and time trends of contaminants in Canadian Arctic marine waters. The project started in May 2014 and built on previous work in Barrow Strait near Resolute in 2011 and 2012. Seawater samples for a full suite of contaminants were successfully collected from Barrow Strait under ice covered conditions (May-June 2017) and from open water (August-September 2017) using (i) passive samplers (thin plastic films) deployed for four to six weeks (ii) large volume water samplers (200 L), and (iii) Niskin samplers to obtain 1 L samples at various depths. A full suite of collections was also carried out in Anaktalak Fiord near Nain using passive and Niskin samplers in the open water season in July. Passive samplers were successfully deployed in Wellington Bay near Cambridge Bay and in the Beaufort Sea near Sachs Harbour in open water in August 2017. Analyses of 2016 samples are complete and major findings to date are that while levels of numerous industrial surfactant compounds, used as stain repellants and firefighting foams (perfluoroalkyl substances, PFASs), have not changed over the sampling time, perfluorooctane sulfonate (PFOS) has declined

to non-quantifiable levels since the mid-2000s in Barrow Strait. Since 2015, this project has also investigated the presence of organophosphate ester (OPE) flame retardants and plasticizers in seawater using active and passive sampling methods. Analysis indicated much higher levels of OPEs in water compared to historically used brominated flame retardants. Mercury concentrations in Barrow Strait (2014-2016) remain unchanged compared to 10 years earlier (2004-05). This project is continuing in 2018-2019 so that a long term temporal data set can be developed that can be used to predict and better understand the impacts of changing ice, permafrost, and snow on contaminant levels in seawater.

Key Messages

- Concentrations of numerous legacy and new/emerging persistent organic pollutants and mercury were measured in seawater samples from Barrow Strait near Resolute Bay, Nunavut and other Arctic locations.
- In Resolute Bay higher concentrations of 16 organophosphate ester flame retardants and plasticizers were found compared to brominated flame retardants.
- Levels of most of the perfluorinated alkyl substances (PFASs) analyzed show no temporal trend between 2005 and 2017; however, PFOS, which was used in aqueous film forming foams needed for firefighting, has decreased over this period possibly due to international restrictions on production and usage.
- Early May snow melt is a source of long chain PFASs such as PFOS and PFOA while June to August sea ice melt is a source of short chain PFASs such as PFBA based on timing of peak surface water PFAS concentrations compared to the rest of the water column.
- Mercury/methylmercury concentrations at Barrow Strait (2014-2016) remain unchanged compared to 10 years earlier (2004-05).
- Mercury/methylmercury concentrations in Clyde River and Anaktalak Bay were much lower than in Barrow Strait.
- Methylmercury concentrations in seawater build up during the ice-covered period but decrease during the ice-free conditions, likely due to photodemethylation.

Investigation of the toxic effects of mercury in landlocked Arctic char

Project Leader

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Project Location

- Cornwallis Island, NU
- Small, North, Amituk lakes, Cornwallis Island, NU
- East and West lakes, Melville Island, NU

Abstract

In the Canadian Arctic, mercury (Hg) concentrations in the tissues of lake-dwelling Arctic char may exceed levels known to be toxic for fish. Starting in 2011, we began collecting tissues from landlocked Arctic char from Small, 9-mile, North, and Amituk lakes on Cornwallis Island in cooperation with the "core" monitoring project to determine whether wild Arctic char populations are experiencing Hg toxicity. To build upon our previous work, in 2017 we sampled Arctic char from three lakes representing a mercury contamination gradient on Cornwallis Island (Small, North, and Amituk), and Arctic char from twin lakes on Melville Island (East and West) that are undergoing climate-driven changes at different rates. Mercury, and other metals, are pro-oxidants, which can interfere with the anti-oxidant defense systems of fish leading to a state of oxidative stress. We have measured biomarkers of oxidative stress in the tissues of Arctic char to better understand the potential impacts of Hg contamination and climate change on fish health. In Arctic char collected in 2017, we noted inconsistent responses in antioxidant enzyme activities; glutathione peroxidase (GSH-Px) activity increased with total Hg in the livers of Arctic char, while catalase (CAT) activity decreased with increasing total Hg. TBARS, a measure of lipid damage, decreased significantly with liver total Hg across the study lakes. For East and West lakes, none of the oxidative stress biomarkers measured in livers differed significantly between the two populations. Conversely, GSH-Px activity was significantly higher in gills collected from West Lake Arctic char than those collected from East Lake. TBARS levels were higher in the gills of Arctic char collected from East Lake, though CAT activities were

similar between the two populations. The results of our five-year study indicate that Arctic char do not effectively detoxify methylmercury in their tissues, which is correlated with changes in liver histology and the antioxidant defense system.

Key Messages

- Total Hg in Arctic char muscle varied among the five study populations.
- Oxidative stress biomarkers in livers varied among Arctic char populations.
- Oxidative stress biomarkers in liver varied with total Hg in liver.
- West Lake char had significantly higher total Hg concentrations in muscle, liver, brain, and gill tissues than Arctic char from nearby East Lake.

Impact of climate change on the mobilization and bioaccumulation of persistent organic pollutants in arctic freshwater systems

Project Leader

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Project Location

Cape Bounty, Melville Island, NU

Abstract

This long term study (2008-2016) examines trends over time in levels of legacy persistent organic pollutants (POPs) in landlocked Arctic char from West and East lakes in the Cape Bounty Arctic Watershed Observatory (CBAWO), on southern Melville Island. This study also helps assess the main terrestrial repositories of legacy POPs such as lake sediments, soils and vegetation. CBAWO is considered a remote and uninhabited location, 400 km from the nearest community of Resolute, Nunavut and represents an environment largely unimpacted by direct human activity. Due to its remoteness and absence of human activities, all organic pollutants found in freshwater and terrestrial compartments have been introduced through long range atmospheric transport. We've found that legacy POPs and OCPs in char declined in East Lake over the period 2008 to 2016 but have significantly increased (especially more hydrophobic chemicals such as polychlorinated biphenyls (PCBs) and DDTs) in West Lake. PCBs levels also showed an increasing trend in samples from the stomach content of the char (2008-2016) from West Lake. In West Lake higher levels of elevated particulate organic carbon (POC) and dissolve organic carbon (DOC) are probably associated with continued permafrost disturbances and subaqueous slumps in the West Lake and watershed. Increased levels of PCBs in char from West lake, together with increases in sedimentation rates, high turbidity, elevated POC and DOC, observed in West Lake, are altering the temporal trends of legacy POPs in Arctic char from West Lake.

Key Messages

- Legacy POPs such as PCBs and OCPs were measured for the first time in Arctic char, fish stomach content, lake sediments and vegetation samples collected in two lakes on Melville Island.

- Lipid content was observed to be a key factor controlling concentrations of PCBs and OCPs in Arctic terrestrial vegetation as well as the char.
- ΣPCBs, ΣHCH and ΣDDT levels in Arctic char from East Lake, which are not greatly impacted by permafrost disturbances, have declined significantly in the past 8 years.
- ΣPCBs and ΣDDTs in Arctic char from West Lake have significantly increased due to permafrost degradation which are greatly affecting this lake.
- Using data from sediment cores taken from each lake we found that fluxes of PCBs have leveled off in sediments from East Lake while significantly larger sedimentation rates and therefore of PCBs fluxes were observed in West Lake, especially after 2010.

Climate change, contaminants, ecotoxicology: interactions in Arctic seabirds at their southern range limits

Project Leader

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Project Team

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Project Location

Coats Island, Hudson Bay

Abstract

Pagophilic (ice-associated) Arctic species are facing multiple stressors from climate change and toxic contamination. We investigated whether contaminants magnified the impact of climate change on wildlife by limiting their ability to respond to changes in ice availability. In 2017-2018, 67 thick-billed murres were tracked via GPS-accelerometers, and concentrations of hormones, mercury and per-/polyfluoroalkyl substances (PFAS) were measured in the blood plasma of 47 of the 67 birds. We investigated concentrations of these contaminants in relation to circulating hormone levels to determine whether contaminants disrupted foraging activities. Levels of PFASs were low, and unrelated to hormones or behaviour. However, mercury levels were associated with pre-trip levels of circulating triiodothyronine (T3) hormones. In contrast to a medium-ice year (2016), in a low-ice year (2017), the relationship between T3 and Hg was negative. The pre-trip levels of T3 were associated with foraging behaviour; in contrast to 2016, higher levels of T3 were associated with lower diving rates. We found no associations with corticosterone. GPS tracks demonstrated that birds foraged to the north of the colony during incubation (when ice was present) and moved to forage to the northwest as chick-rearing progressed (when ice was no longer present). Birds from each subcolony partitioned the space available. Thus, mercury was negatively associated with T3, which may relate to decreased diving rates away from ice concentrations. Based on our collective 2016-18 data, we tentatively conclude that mercury may be influencing the ability of thick-billed murres to adjust to variation in ice cover, and we will further examine that hypothesis in 2018 with a larger sample size and different environmental conditions.

Key Messages

Reduced ice cover associated with climate change is altering how ice-obligate animals forage, sometimes leading to reduced reproductive success and survival. Contaminants may add additional stress to already-stressed populations. Levels of BFRs and PFAS were quite low. However, mercury may influence the ability of murres to adjust to variation in ice cover via associations with hormones. The underlying mechanism appears to vary among years of varying ice concentrations.

Plastics as a vector of contaminants to Arctic seabird tissues and eggs

Project Leader

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Project Location

Prince Leopold Island, NU

Abstract

Plastic debris is commonly ingested by seabirds, even in high Arctic waters, but only recently has attention turned to what the impacts may be of this ingested pollution. Importantly, there is increasing evidence that once marine plastic pollution is in the gut of seabirds, contaminants adsorbed to plastics are released, which may have negative effects on exposed wildlife. We examine how chemical contaminants known to be associated with ingested plastics, may be transferred to two Arctic marine bird species (northern fulmars; *Fulmarus glacialis*) and black-legged kittiwakes (*Rissa tridactyla*). This project completes analyses of plastic debris and contaminants on bird samples that were already collected as part of an ongoing NCP monitoring project on seabirds from Prince Leopold Island. We assessed both adult liver tissue and eggs for phthalates, trace elements, organochlorines, PCBs and other contaminants. Patterns in contaminant concentrations will be examined between species with varying plastic ingestion levels, between the sexes within each species, and in the eggs. Results of these analyses are expected in late 2018 and early 2019. This work builds on past work in the region, and will further identify the potential risks marine plastics may pose to marine birds, and evaluate if eggs contain contaminants shown to be plastic-associated, such as phthalates.

Key Messages

- Plastic ingestion varies with species and season in the seabirds that have been examined in the Canadian Arctic.
- Both environmental contaminants that are absorbed by plastics and plastic-associated contaminants should be investigated in species that ingest plastic debris.
- The potential for some species to metabolise certain plastics should be considered when examining the relationship between plastic ingestion and plastic-associated contaminants in wildlife.

Assessing persistent organic pollutants (POPs) and microplastics (MPs) in Canadian Arctic air and water as an entry point into the Arctic food chain

Project Leader

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Project Location

- Central archipelago, Canada
- Eastern archipelago, Canada
- Beaufort Sea, Canada

Abstract

In collaboration with ArcticNet, we collected air, water and sediment samples to determine levels of persistent organic contaminants in the Canadian Archipelago in the summer of 2017 from on board the CCSG Amundsen and Sir Wilfrid Laurier. The contaminants we are focusing on are pesticides, flame retardants, fluorine containing compounds and fossil fuel related compounds. The major concern with persistent organic pollutants (POPs) is that they are taken up by arctic biota including fish, seals and whales so when traditional foods are eaten, Northerners are exposed.

Our group has been conducting research on pesticides in the Arctic since the early 1990s. Over the years, the types of compounds investigated has evolved as the lists of compounds of concern have expanded. This work is complemented by air sampling at Alert and an Arctic cod project targeting the same list of compounds. Recently we identified a new class of flame retardants and plasticizers (isopropylated diphenyl phosphates) in arctic snow and melt pond water, these compounds are classified as high priority compounds by the Canadian Chemicals Management Plan.

We have developed pesticide trends in air and water over time at different locations in the Canadian Archipelago, and the data collected in the summer of 2017 will add to these temporal and spatial trends. Generally, the trends show that chemicals that have been banned by national and international regulators such as the Stockholm Convention of Persistent Organic Pollutant, are declining in air and water where chemicals that are still being used are remaining constant or increasing. We were also able to provide training and capacity building to a Karen Nungaq, student

attending Nunavut Arctic College from from Pond Inlet. She participated in the schools on board program where she learned about and participated in the multiple scientific programs while on board the Amundsen.

Key Messages

- All proposed samples were collected in the summer of 2017.
- A northern student from Nunavut Arctic College in Iqaluit participated in the field study on board the Amundsen.
- Passive water samplers from the Global passive water sampling network (AQUA-GAPS) were deployed in three regions of the Canadian Archipelago.
- A Canadian Chemical Management Plan high priority compound of concern, (isopropylated triphenyl phosphates) was identified in arctic snow, melt pond water and sediment.

Microplastics in the Beaufort Sea beluga food web

Project Leader

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Project Team

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Project Location

- Tuktoyaktuk, NT
- Beaufort Sea, Canada

Abstract

Microplastics (particles < 5 mm) are increasingly seen as a threat to ocean life. They have been detected in industrialized coastal environments, as well as remote parts of the world. Our team previously reported on widespread distribution of microplastics in the NE Pacific Ocean, as well as ingestion by two keystone zooplankton species. This raises concerns about potential effects on biota. We proposed to carry out a focused study of microplastics in the Beaufort Sea beluga whale (*Delphinapterus leucas*) food web in collaboration with Fisheries, Oceans & the Canadian Coast Guard Canada (DFO) and the community of Tuktoyaktuk. Samples of water and sediment were collected with Inuvialuit youth citizen scientists. Several species of fish (Arctic Cisco (*Coregonus autumnalis*), Arctic Flounder (*Liopsetta glacialis*), Arctic Cod (*Boreogadus saida*), Saffron Cod (*Eleginus gracilis*) and Fourhorn Skulpin (*Myoxocephalus scorpioides*)) and beluga digestive tracts were collected between July and September, 2017. In the lab, we invested considerable time and effort in the development of high quality protocols for extraction and analysis of microplastics, so as to maximize the reliability and reproducibility of results in the emerging microplastics research field. After completion of the trials, 15 fish samples were dissected, digested and vacuum filtered. In addition, a specialized "wet lab" was retrofitted to accommodate the handling and extraction process for the larger beluga samples. Sample processing will continue in the summer and fall of 2018 with the final step consisting of Fourier Transform InfraRed spectrometry (FT-IR) analyses to determine individual microplastic particle polymer identity. These results will provide an assessment of microplastic abundance and type in the southern Beaufort Sea beluga food web, and evaluate the potential for transfer of microplastics from fish to beluga whale within a food web.

Key Messages

- Extensive sampling was conducted in 2017: Arctic Cisco, Arctic Flounder, Fourhorn Skulpin, Saffron Cod, Arctic Cod and Beluga stomachs were collected through partnerships with Fisheries, Oceans & the Canadian Coast Guard Canada (DFO) and the community of Tuktoyaktuk.
- A specialized 'wet lab' has been retrofitted at the Ocean Wise laboratory to accommodate the handling and extraction process of beluga stomachs.
- Refined methods to extract microplastics from the digestive tracts of Beluga whales and each fish species have been developed.

Interacting effects of contaminants and climate change on the health of western Arctic beluga whales: applying an expanded gene expression toolbox to a time series

Project Leader

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Project Team

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Project Location

Beaufort Sea, Canada

Abstract

Beluga whales (*Delphinapteurus leucas*) in the Arctic may be vulnerable to the combined effects of contaminants and a changing climate. NCP supported our previous work on Hendrickson Island (2008-2010) that demonstrated the effect of PCBs on the health of Beaufort Sea beluga using a new genomics toolbox (17 genes). Our previous study suggested that genes involved in metabolism and condition were altered by inter-annual changes in feeding ecology by beluga[1], but a longer time series is needed to document the effects of climate change on their health. The goal of the work for the 2017-2018 funds was to expand the genomics toolbox from 17 to 27 genes. Our rigorous quality assurance work demonstrated that out of the 10 candidate genes selected, six primer pairs passed and will provide us additional information on the nutritional status of the whales. In addition, we submitted 2017 samples for metabolomics analyses. The analyses of such molecules, together with gene expression information, will provide valuable information for an in-depth health assessment. As of April 2018, laboratory work is being finalized.

1 NOËL, M., L. L. Loseto, C. C. Helbing, N. Veldhoen, N. J. Dangerfield et P. S. Ross. « PCBs are associated with altered gene transcript profiles in Arctic beluga whales (Delphinapterus leucas) ». Environmental Science and Technology 48, 2014, p. 2942 à 2951.

Key Messages

- Additional samples were collected in the summer of 2017 and the remainder of the year was spent processing samples for genomics analyses.
- We conducted extensive quality assurance/quality control on 10 new genes that can provide information on nutritional stress (for a total of 27 genes).
- We extracted RNA, made complementary DNA (cDNA) from up to 15 individuals from each of the following sampling years: 2012, 2013, 2014, 2015, 2016 and 2017.
- We are currently finishing the PCR runs for the 23 genes that pass quality assurance and quality control (QA/QC).
- 2017 blood samples for metabolomics analyses have been submitted.

Snowpack mercury mass balance over the spring melt period, Iqaluit, NU

Project Leader

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Project Team

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Project Location

Iqaluit, NU

Abstract

The purpose of this this two-year project is to improve understanding and predictive modelling of the fate of mercury in end-of-winter Arctic snowpack. This requires intensive monitoring of the surface to air exchanges of mercury prior to and throughout the spring melt period. The study is being conducted near the community of Iqaluit, NU, South Baffin Island. In Arctic coastal regions such as this, mercury cycling is strongly influenced by marine aerosols and the enhanced atmospheric deposition rates associated with springtime atmospheric mercury depletion events, which have yet to be reported on for Baffin Island. Field activities in 2017 began in mid-June after the onset of spring melt. Despite the late start to the field season, we collected a 25-day time series of snow-air and soil-air mercury fluxes. Fluxes from snow were initially high at the onset of the monitoring period because of a fresh snowfall, but subsequent fluxes from snow and soil surfaces were low for the duration of the field season. A second field-season will be conducted in the spring of 2018, with the goal of an earlier start to capture the pre-melt surface-air exchanges of mercury and the potential contribution of atmospheric mercury depletion events to the net contribution of snowpack mercury to surface waters during the spring melt period.

Key Messages

- Snowpack-air fluxes of gaseous elemental mercury were low during the late season melt period.
- A short-lived, high gaseous elemental mercury emission event occurred immediately following a fresh snowfall event. This event was followed by a return to lower flux rates within two days.
- Soil-air gaseous elemental mercury (GEM) fluxes were lower than snowpack-air GEM fluxes, for the period immediately following snowpack disappearance.
- In year two of this study, field activities will start in early spring to capture data over the pre-melt period and to monitor for the occurrence of atmospheric mercury depletion events which play an important role in mercury cycling in Arctic coastal regions.

Sources of methylmercury, perfluoroalkyl substances, and polychlorinated biphenyls to ringed seal food webs of Lake Melville, Northern Labrador

Project Leader

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Project Team

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Project Location

- Lake Melville, NL
- Rigolet, NL
- Northwest River, NL

Abstract

People living on Lake Melville are concerned about contaminant levels in country foods they harvest, especially methylmercury (MeHg; the toxic form of mercury that biomagnifies through food webs), and projected increases in methylmercury resulting from hydroelectric power development on the Churchill River. Lake Melville is also a unique Arctic site to study because it is affected by both river and ocean water and it has a history of polychlorinated biphenyl (PCB) contamination from local sources, such as the Goose Bay air base. We are utilizing combined analyses of mercury, methylmercury, carbon and nitrogen stable isotopes with perfluorinated alkyl substance (PFAS) and PCB congener analyses, to identify the relative importance of local versus regional, and terrestrial versus marine, contaminant sources to Lake Melville ringed seal food webs prior to hydroelectric development and further climate-induced alterations. This research is a community-based monitoring project, working with collaborators from the Nunatsiavut Government and community members from North West River and Rigolet, to investigate contaminant levels in Lake Melville's food web and to provide a benchmark for future studies by providing a baseline dataset.

81 seal samples were collected during harvests by local hunters between 2013-2017 and are being analyzed for mercury and methylmercury. A subset of these samples are being analyzed for mercury stable isotopes, PFASs and PCBs. Average methylmercury concentrations in the liver and muscle of Lake Melville seals collected between 2013-2017 were 202 ± 226 and 133 ± 129 ng/g wet weight (ww), respectively, with 24 of 81 liver samples and 19 of 81 muscle samples surpassing the Canadian frequent consumer guideline of 200 ng/g ww. Average mercury concentrations in Lake Melville ringed seals are on the lower end of those recently reported for 14 communities across the Canadian high and sub-Arctic (average muscle mercury concentrations between 2007-2011 were 107-1070 ng/g) (Brown et al. 2016), likely because many of the seals sampled between 2013-2016 were pups. Results from mercury stable isotope analyses demonstrate that Lake Melville seals obtain food from both inland and marine sources. Analyses of seals collected in 2017 for PFASs show that adult ringed seals in Lake Melville have 67 ± 12 ng/g ww total PFAS, which is comparable to ringed seals in other areas in Labrador, Hudson Bay and the Beaufort Sea but generally higher than ringed seals from the more northern areas, such as Resolute, Sachs Harbour and Pangnirtung. Higher PFAS were observed in pups compared to adults and were associated with higher trophic level and terrestrial feeding. We are continuing this project in 2018-2019 so that adult seals can be analyzed for the full suite of contaminants, as well as seal health markers, which will strengthen the baseline dataset. Results will be used to assess the impacts of the hydroelectric power developments on wildlife used for food by people of the region and for predicting the impacts of the 22 hydro-electric power developments planned across Canada.

Key Messages

- People living on Lake Melville are concerned about contaminant levels in country foods such as ringed seals, that they harvest, especially methylmercury (MeHg) and predicted increases in MeHg resulting from hydroelectric power development on the Churchill River.
- This project is analyzing Hg, MeHg, carbon and nitrogen stable isotopes, perfluorinated alkyl substances (PFASs), and polychlorinated biphenyls (PCBs) in the Lake Melville food web, including ringed seals.
- Information from the project is allowing the relative importance of local versus regional and terrestrial versus marine contaminant sources to Lake Melville ringed seal food webs prior to hydroelectric development and further climate-induced alterations to be determined.
- Average MeHg concentrations in the liver and muscle of Lake Melville seals collected between 2013-2017 were 202 ± 226 and 133 ± 129 ng/g wet weight and are comparable to those recently reported at other Labrador locations.
- 2017 data show that adult ringed seals in Lake Melville have 67 ± 12 ng/g wet weight total PFAS, which is comparable to ringed seals in other areas in Labrador, Hudson Bay and the Beaufort Sea: Nain: 45±6 ng/g, Arviat: 71±8 ng/g, Ulukhaktok 51 ±6 ng/g, but generally higher than ringed seals from the more northern areas such as Resolute, Sachs Harbour and Pangnirtung.
- Some types of PFASs, PFOS and long chain perfluorocarboxylates, were higher in Lake Melville ringed seals than other locations but correlation analysis suggests this is driven by the juvenile status of the seals.
- Higher PFAS were associated with higher trophic level and terrestrial feeding.
- Results from this project will be used to assess the impacts of the hydroelectric power developments on wildlife used for food by people of the region.

Investigating the abundance, types and potential sources of microplastics in the Arctic

Project Leader

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Project Team

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Project Location

- Eastern Canadian Archipelago
- Central Canadian Archipelago
- Alert, NU

Abstract

Microplastics pollution is found across the globe, but with limited information from Polar Regions. Although there is evidence of microplastics in the Arctic and Antarctic, little is understood about the sources, fate and extent of contamination. This project was funded to collect samples of water, sediment, and zooplankton in collaboration with ArcticNet from on board the CCGS Amundsen in central and eastern Canadian Archipelago. Additional snow samples were collected at Alert, NU. Samples have been archived or have been distributed to collaborators that are willing to provide analysis of these samples at no cost. Thus far, we are able to conclude that the Arctic is contaminated with anthropogenic particles, and that the vast majority of the type of particle found in zooplankton, surface water, and snow samples is microfibres.

Key Messages

- Samples were collected for microplastics in the Canadian Archipelago in the summer of 2017.
- Sample types included: surface water, surface sediment, zooplankton from vertical tows and snow from Alert.
- Samples have been archived or distributed to collaborators that are willing to do the analysis at no cost to NCP.

Fine-scale temporal changes in mercury accumulation in Labrador ringed seals (*Pusa hispida*) using laser ablation technology on whiskers and claws: influence of a changing ice regime

Project Leader

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Project Location

- Nachvak Fjord, Labrador
- Saglek Fjord, Labrador
- Okak Bay, Labrador
- Anaktalak Bay, Labrador

Abstract

The Labrador coast is experiencing changing sea ice conditions, with 2010 having a below normal extent of ice coverage and earlier spring breakup. Recent studies have reported a shift in ringed seal (*Pusa hispida*) foraging and/or feeding ecology in response to unfavourable ice conditions. The change in foraging and feeding habits, in turn, might change the amount of mercury seals are exposed to in their diet as well as their environment. This may, in turn, impact mercury (Hg) accumulation in seals. The present study measures Hg concentrations and stable isotopes along both ringed seal whiskers (n=20) and claws (n=20) and provides a history of diet and Hg exposure over varying climate conditions. This data will contribute meaningful information with respect to marine mammal toxicology which could be harnessed in wildlife management practices that employ non-lethal sampling methods.

Key Messages

- Hg concentrations and stable N and C isotope ratios along ringed seal whiskers (n=20) and claws (n=20) were measured using laser ablation inductively-coupled plasma mass spectrometry (LA-ICP-MS) and continuous flow ion ratio mass spectrometry (CFIR-MS), respectively.

- Hg was measured in ringed seal muscle (n=20) using a Direct Mercury Analyzer.
- Intra- and inter- annual variation in Hg levels and biological, ecological, and physical factors are being evaluated using whisker and fur samples from seals aged 3-21 years. These samples were collected from the northern Labrador coast between 2008 and 2011.

Temporal trends of emerging pollutant and mercury deposition through ice and sediment core sampling

Project Leader

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Project Team

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Project Location

- Mount Oxford plateau, NU
- Lake Hazen, NU

Abstract

Contaminants produced and emitted in low-latitude regions can travel through the atmosphere and be deposited in high-latitude regions, such as the Arctic. Remote Arctic ice caps preserve and record concentrations of these chemicals and allow us to understand trends in atmospheric transport and deposition of contaminants. This project collects ice cores from the summit of a remote ice cap on Ellesmere Island in the Canadian High Arctic, as well as sediment cores from Lake Hazen located downstream of the ice cap. Ice and sediment cores are analyzed for priority contaminants, including mercury and emerging pollutants. By examining ice cores, we are able to determine how these chemicals are transported to the High Arctic and identify any changes in deposition over time. Data from sediment cores are used to understand how these contaminants make their way into downstream water bodies where they may bioaccumulate in aquatic organisms, such as Arctic char. Understanding the sources and pathways that lead to Arctic pollution, and how pollutant accumulation in the Arctic responds to changes in production and emission of these contaminants, will aid in our understanding and management of contaminant exposure for people and wildlife in the North. In this study, we collect samples with the ultimate goal of examining a suite of emerging pollutants including mercury from ice cores, allowing us to better understand spatial trends and sources of long-range transport to the Arctic. This information complements current air sampling programs in the Arctic.

Key Messages

- Ice cores were collected from the Mount Oxford plateau in May 2017.
- Sediment cores were collected from Lake Hazen in May 2017.
- Age-depth relationships will be determined for ice and sediment cores.

Investigation into relatively high walleye mercury concentrations in Tathlina Lake

Project Leader

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Project Team

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Project Location

Kakisa Lake, NT
Tathlina Lake, NT

Abstract

The objective of this project is to understand why mercury levels in walleye from Kakisa Lake are lower than in Tathlina Lake. This is in spite of the fact that these lakes are connected, have similar fish communities, and are both shallow, warm, and productive. In 2017, fish, water, bugs, and sediment were collected from Kakisa Lake. Tathlina Lake will be sampled in 2018. Once the second year of sampling is complete, fish ecology, benthic invertebrate communities, and levels of mercury in benthic invertebrates, water, sediment, and fish will be compared between the two lakes. This data will help elucidate the drivers of the differences in fish mercury contamination between the two fish populations. Data generated in 2017 indicate that fish in Kakisa Lake generally have mercury levels that are below Health Canada's commercial sale guideline, which is important because Kakisa Lake supports an important commercial fishery. Future results will aid in understanding why walleye from Tathlina Lake are more likely to exceed this guideline, and how catchments, food web structure, and benthic invertebrate communities ultimately affect mercury levels in fish.

Key Messages

- No walleye from Kakisa Lake had mercury levels that exceeded the commercial sale guideline.
- Three northern pike from Kakisa Lake exceeded the commercial sale guideline; northern pike were more likely to exceed this guideline at sizes greater than 550 mm.
- Results from ultra-trace analyses of mercury in water indicate that most of the mercury entering the lake from Kakisa River is in the particulate form. Methyl mercury concentrations in water

were 10 times higher in a small tributary than in either the Kakisa River or in the main basin of the lake; substantial methylation may thus be occurring either in the catchment or in small, shallow streams. Further research is necessary to determine the primary sites of mercury methylation in this lake system.

Communications, Capacity and Outreach

Yukon Contaminants Committee (YCC)

Project Leader

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Project Team

Yukon Contaminants Committee (YCC) including: James MacDonald, Council of Yukon First Nations (Co-Chair YCC), Dr. Mary Vanderkop, Dr. Aynslie Ogden, Dr. Brendan Hanley, Yukon Government; Mary Gamberg, independent consultant and researcher; Derek Cooke, Ta'an Kwäch'än Council

Project Location

Yukon, Canada

Abstract

The YCC has operated since 1991 and continues to keep residents of the Yukon informed of the Northern Contaminants Program's initiatives. In 2017-2018 the YCC continued to work with Yukon Health authorities on contaminants in traditional food sources. At various workshops throughout the Yukon and the Results Workshop in Yellowknife this past fiscal year, YCC members discussed NCP initiatives with participants, and described the application process for NCP funding. The YCC was successful at recruiting three Yukon communities (White River First Nation, the First Nation of Nacho Nyäk Dun and Taku River Tlingit First Nation) to submit proposals researching long-range contaminants in wildlife in their Traditional Territories These projects were approved for funding as part of the NCP's Community-based Monitoring Program in 2018-2019, and will span over a two-year period. The YCC was also successful in securing funding for the Yukon College to purchase a direct mercury analyzer.

Key Messages

- Our Traditional Country Foods are safe to eat.
- Levels of contaminants are generally low in the Yukon Territory.
- New contaminants are emerging globally due to climate change and monitoring and we must continue to ensure traditional food are safe to eat.
- The work of the NCP continues to be relevant at the local, regional, national, and international level.
- Yukon First Nations have a role to play in contaminant research through leading or partnering and contributing to this research.

Northwest Territories Regional Contaminants Committee (2017-2018)

Project Leader

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Project Location

Northwest Territories, Canada

Abstract

In the 2017-2018 year, the Northwest Territories Regional Contaminants Committee (NWTRCC) continued to fulfill its mandate of communicating results of research to Northwest Territories (NWT) residents and providing input on proposed research projects from a social/cultural lens. The 2017 Northern Contaminant Program (NCP) Results Workshop was held in Yellowknife, and the Regional Contaminants Committee (RCC) Secretariat and Committee members played an important role in planning this meeting. In addition to this, the NWTRCC held a number of in person and teleconference meetings to meet its objectives. Members also worked independently, in the communities they represent, to share research and where possible identify community research priorities in regards to long-range contaminants.

Key Messages

- Through its social-cultural review of all NT-based NCP proposals, the NWTRCC ensures Northern and Indigenous interests are being served by scientific research conducted in the Northwest Territories, and results of these studies are shared with communities.
- The NWTRCC continues to highlight the need to integrate Indigenous Knowledge in all stages of research projects, and to ensure research helps to address community concerns about whether the water is safe to drink and country foods are safe to eat.

Nunavut Environmental Contaminants Committee (NECC)

Project Leader

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Project Team

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Project Location

Nunavut, Canada

Abstract

The NECC represents the Northern Contaminants Program (NCP) in Nunavut to ensure that northern and Inuit interests are being served by scientific research conducted in Nunavut, and to serve as a resource to Nunavummiut for long-range contaminants information in Nunavut. The NECC attended the NCP Management Committee (NCPMC) meetings in Ottawa, ON in April and October 2017; hosted a productive social-culture review of NCP proposals in Iqaluit, NU in February 2017; and hosted 2 other face-to-face meetings in Iqaluit in September and October 2017. The NECC participated in the NCP Results Workshop in Yellowknife, NT (September 2017); Wildlife Contaminants Workshop in Iqaluit, NU (November 2017); the Royal Tour in Iqaluit, NU (June 2017) and the Sentinel North International Field School in Iqaluit, NU (March 2018). The NECC provided feedback to NCP researchers on communications, met face-to-face with NCP-funded researchers to discuss their respective proposals/projects, and attended seminars/workshop held by NCP researchers.

Key Messages

- The NECC has spent the past 19 years communicating results of the NCP to Nunavummiut and contributed to national/international publications.
- Through its social-cultural review of all Nunavut-based NCP proposals, the NECC ensures northern and Inuit interests are being served by scientific research conducted in Nunavut.
- The NECC aims to serve as a resource to Nunavummiut for long-range contaminants information in Nunavut.
- This year the NECC attended several internal and external meetings, participated in five capacity-building activities funded by NCP, and met or corresponded with numerous NCP-funded researchers to provide feedback on projects and communication materials.

Nunavik Nutrition and Health Committee: Coordinating and learning from contaminants research in Nunavik

Project Leader

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Project Team

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Project Location

Nunavik, QC

Abstract

The Nunavik Nutrition and Health Committee (NNHC), originally named the PCB Resource Committee, was established in 1989 to deal with issues related to food, contaminants, the environment and health in Nunavik. Since its inception, the committee has broadened its perspective to take a more holistic approach to environment and health issues, inclusive of both benefits and risks. Today, the committee acts as the review and advisory body for health and nutrition issues in the region and includes representation from many of the organizations and agencies concerned with these issues, as well as those conducting research on them. The NNHC provides guidance and acts as a liaison for researchers and agencies, from both inside and outside the region; directs work on priority issues; communicates with, and educates the public on, health and environment topics and research projects; and represents Nunavik interests at the national and international levels. All activities are conducted with the goal of protecting and promoting public health in Nunavik.

In 2017-2018, the committee has held three in-person meetings and had regular email exchanges in order to fulfill its mandate. The NNHC has worked on a number of topics related to contaminants, nutrition and environmental health, with an important focus on the *Qanuilirpitaa*? 2017 Health Survey. Regional efforts toward the reduction of lead and mercury exposures were also among main priorities for 2017-2018.

Key Messages

- The Nunavik Nutrition and Health Committee is the key regional committee for health and environment issues in Nunavik.
- The committee advises the Nunavik Public Health Director about educating the public on food and health issues, including benefits and risks associated with contaminants and country foods.
- The committee continues to be active within the NCP, reviewing and supporting research in the region, ensuring liaison with researchers and helping in the communication of research results in a way that is appropriate and meaningful to *Nunavimmiut*.

Northern Contaminants Researcher

Project Leader

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Project Team

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Project Location

Nain, NL

Abstract

The Northern Contaminants Researcher (NCR) is a core component of the Nunatsiavut Government. Based at the Nain Research Centre, within the Environment Division of the Department of Lands and Natural Resources, the NCR works inter-departmentally and across communities, in part through the Nunatsiavut Government Research Advisory Committee (NGRAC) to help Inuit of Nunatsiavut better understand contaminants within the region. This includes some Northern Contaminants Program (NCP) funded projects and how these projects relate to Inuit health and wellbeing. In partnership with the Nunatsiavut Government Research Advisory Committee, the NCR disseminates essential information on contaminants and research projects throughout the region and is the first point of contact for contaminants related information. This project is a prescribed priority activity within the NCP and builds on the capacity that has been developed in the region to facilitate an even greater level of management and ownership of research in Nunatsiavut. This position ensures the continuation of the NGRAC, as well it complements other NCP research programs ongoing or previously implemented in the region, including water, air, ringed seal and arctic char monitoring. All our monitoring programs include an Indigenous Knowledge component, as this knowledge is essential to properly understanding trends and issues, and is the best record of historical information throughout our region.

All our NCP research programs are coordinated through the NCR at the Nain Research Centre on an annual basis. This ensures there is a trusted, consistent point of contact who will actively engage Nunatsiavimmiut while disseminating contaminants related information within the context of the many other related issues and initiatives in the region.

Key Messages

- The NCR continues to be the main contact for any concerns relating to contaminants, health and environmental issues. Any individual expressing interest in contaminants, which is becoming more common, will have the opportunity to be trained in the field and research opportunities will be provided to them.
- The NCR continues to build capacity through the community freezer and the Going Off, Growing Strong program (Aullak Sangilivalliannatuk), traditional hunting and through collaboration with educators in the communities.
- The NCR employs focused health messaging, based on the results of the Inuit Health Survey and Integrated Regional Impact Studies (IRIS) 4 report.
- The NCR continues to work effectively with coworkers including the Inuit research Advisor (IRA), Research Manager and Community Outreach Manager to achieve NCP objectives.

Coordination, participation and communication: evolving Inuit Research Advisor responsibilities in Nunatsiavut for the benefit of Inuit and their communities

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- **Project Location**
  Nunatsiavut, Canada

Abstract

The Inuit Research Advisor for Nunatsiavut continues to serve as the 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. The Nunatsiavut Government (NG) encourages researchers to consult with Inuit Community Governments in the five Nunatsiavut communities, Rigolet, Makkovik, Postville, Hopedale and Nain, as well as NG departments in developing more community based research proposals. Comprehensive reviews of proposals are initiated involving appropriate NG departments, Inuit Community Government(s)/Corporation(s).

Together with IRAs in the other Inuit regions of Canada, the Nunatsiavut IRA works towards achieving a new way of knowledge sharing and engagement of Inuit in Arctic science in the region. In addition to NCP support, the program is co-funded by ArcticNet and the Nunatsiavut Government.

Key Messages

- The IRA co-coordinates the Nunatsiavut Government Research Office, serving as the first point of contact for all researchers conducting work in Nunatsiavut and requiring contact with or assistance from the Nunatsiavut Government.
- The IRA is the Chair and administrator of the Nunatsiavut Government Research Advisory Committee (NGRAC). The IRA has communicated with over 54 researchers from 1st April 2017 to 31st March 2018. This year the IRA has chaired 12 NGRAC meetings one of which was a face-to-face meeting in Nain.

- The IRA served as a liaison, contact and assistant to research projects taking place in Nunatsiavut. This assistance ranged from linking the researchers with appropriate individuals and/or organizations, such as NG departments and Inuit Community Governments in Nunatsiavut; to assisting researchers in the field obtaining samples; to providing input on research proposals and plans.
- The IRA has also served as liaison for partners such as Inuit Tapiriit Kanatami (ITK), Inuit Circumpolar Council (ICC) Canada, Nunatsiavut Inuit Community Governments/ Corporations, researchers, students, and other organizations.

Inuit Research Advisor for the Inuvialuit Settlement Region: Duties and NCP support for 2017-2018

- **Project Leader**
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- **Project Location**
  Inuivialuit, NT

Abstract

The main purpose of this project is to support the Inuit Research Advisor (IRA) position in the Inuvialuit Settlement Region (ISR) including travel to participate in NCP related meetings, such as the biennial Results Workshop and Social and Cultural review. Planned and unplanned activities were conducted in Inuvik, Yellowknife and Ottawa. This position also ensures that there are appropriate consultation practices in the region, as the IRA advises NCP researchers and project leaders with improving their social, cultural and economic aspects of their work in Inuvialuit communities.

Activities that were completed by the IRA include, organizing and presenting at the NCP biennial Results Workshop (RW) in Yellowknife from September 26-28 (as a separate contribution agreement), hosting two NCP Cultural events during the RW on September 26-27 (in lieu of Dene Nation), attending the Fall Management Committee meeting in Ottawa on behalf of the Chair of the NWT Regional Contaminants Committee (NWT RCC) from October 17-19, and attending the NWT RCC Social and Cultural Review in Yellowknife from February 6-8, 2018.

Key Messages

- The IRA continues to participate and serve as a representative of the IRC in key NCP activities. (e.g. NWT Regional Contaminants Committee teleconferences and in person meetings, mid-year reviews, and other events such as this year's risk management workshop).
- The IRA served as liaison, contact, and assistant to research projects taking place in Inuvialuit Settlement Region.
- There is a need to change the governance structure within the NCP to be more equitable to all regions engaged in NCP research. Inuvialuit is the only Inuit region without a guaranteed seat on the Management Committee, partially due to ISR not having its own RCC, and partially due to the current terms of reference and governance processes regarding how the Chair and Co-chair are selected annually. The IRA will work with the Northern Contaminants Program to ensure that these issues are communicated and addressed.

Nunavik Inuit Research Advisor: Building health and environment research capacity in the Nunavik region

Project Leader

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Project Team

Nunavik Nutrition and Health Committee (NNHC); Makivik Corporation; Inuit Tapiriit Kanatami (ITK); ArcticNet

Project Location

Nunavik, QC

Abstract

The Nunavik Inuit Research Advisor (IRA) continues to serve as the first step in a coordinated approach to facilitate community involvement and coordination of Arctic science in Nunavik. The IRA position is housed within the Renewable Resources, Environment, Lands and Parks Department of the Kativik Regional Government (KRG) and works closely with the Nunavik Nutrition and Health Committee (NNHC), the Nunavik Board of Health and Social Services (NRBHSS), the Kativik School Board (KSB), and the Makivik Research Center. The objective of the IRA position is to help facilitate research, at the program level, by assisting researchers from the Northern Contaminants Program (NCP) and ArcticNet, and by updating communities in advance of research. Together, with IRAs in the other Inuit regions of Canada, the Nunavik IRA works towards achieving a new way of knowledge sharing, and engagement of Inuit in Arctic science and research. In addition to NCP support, the Nunavik IRA position is co-funded by ArcticNet.

Key Messages

- The Nunavik Inuit Research Advisor (IRA) is a continued essential link between the Nunavik residents and the scientific research community.
- This coordinated collaboration enhances and benefits both parties by ensuring the perspectives and needs of Nunavimmiut are met and its needs and interests represented.

Wildlife Contaminants Workshop – building contaminants research capacity in Nunavut

Project Leader

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Project Team

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Project Location

Iqaluit, NU

Abstract

In November 2017, the project team successfully delivered the 11th annual Wildlife Contaminants Workshop (WCW) to students of Nunavut Arctic College's Environmental Technology Program (ETP) in Iqaluit, Nunavut. The WCW employs an experiential training approach tailored for the learning needs, preferences, and strengths of ETP students, and is structured to enhance students' knowledge of environmental contaminants research, communication, and assessment within broader contexts of ecosystem, public and wildlife health. In 2017, the WCW combined lectures, interactive lab activities, and group discussions around wildlife contaminants monitoring, risk communication, and the links between wildlife and human health. Students learned how contaminant trend monitoring programs are designed and carried out, and they learned survey techniques to document Inuit knowledge and observations about wildlife health. Students were also trained in methods for tissue sampling of ringed seal and Arctic char and learned traditional Inuit techniques for ringed seal butchering and necropsy. Students utilized the Nunavut Research Institute's (NRI) new Direct Mercury Analyzer to measure total mercury concentrations in seal and char tissue samples collected

during the workshop. The workshop also included interactive learning modules on health risk communication in Nunavut, with special emphasis on ensuring country food safety in the context of addressing Nunavut's food security challenges.

Key Messages

- The Wildlife Contaminants Workshop was held in Iqaluit in November 2017.
- The workshop focused on Arctic char and ringed seals in 2017.
- Several activities were improved upon in 2017 based on past workshop evaluations.
- Emphasis was put on having students learn skills to sample and test tissues for mercury using a direct mercury analyser that is situated in Iqaluit.

Learning about ringed seal health from contaminants science and Inuit knowledge: an educational workshop in Sachs Harbour, Northwest Territories

Project Leader

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Project Team

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Project Location

Sachs Harbour, NT

Abstract

This project addresses a shared interest among Nunavummiut and scientific researchers in enhancing communications and community capacity building related to contaminants research on ringed seals. On January 31st, 2018, we delivered an educational workshop on ringed seals in Sachs Harbour, Northwest Territories, where annual core monitoring of ringed seals takes place under the Northern Contaminants Program (NCP). This workshop was held at the Inualthuyak School with the objective of engaging students, elders, scientific researchers, school personnel and the local Hunters and Trappers Committee in learning about ringed seals from both Inuit knowledge and scientific perspectives. The workshop allowed NCP research scientists working on contaminants in ringed seals to share information about their work with students from the Inualthuyak School, and Sachs Harbour community members. It also provided an opportunity for Inuvialuit elders to share their knowledge with students and researchers in seal ecology and traditional methods for butchering seals, preparing seal skin and identifying abnormalities in harvested game. This one-day event employed a combination of short interactive presentations, laboratory activities, group discussions, storytelling,

games, and art activities to teach participants core concepts, issues and methodology related to the study and understanding of ringed seal health from both scientific and Inuit perspectives. One student from the Arctic College Environmental Technology Program (ETP) in Iqaluit, and one graduate student from the University of Manitoba, co-led the Sachs Harbour workshop as a way to increase the capacity of northern students and early career scientific researchers to meaningfully engage with community members in contaminants research. During the workshop, the ETP student was responsible for implementing a student-developed hunter survey created during the 2017 NCP Wildlife Contaminants Workshop held at the Nunavut Arctic College in Iqaluit. This survey was developed to collect Inuit knowledge that may be associated with contaminants in ringed seals, and can be administered by local students to help increase their involvement in local research. Lastly, through a series of discussions and a written survey, the project aimed to identify best communication practices for contaminants research and inform the development of innovative methods of community engagement around contaminants monitoring in wildlife. This project will contribute to expanding collaboration and communication between northern residents and researchers working on contaminants in Sachs Harbour and Inuit Nunangat.

Key Messages

- An educational workshop on ringed seals involving students, elders, scientific researchers, school personnel, and the local Hunters and Trappers Committee was held at the Inualthuyak School, Sachs Harbour, NWT, in January 2018.
- Students, elders, school personnel, and community members worked together with scientific researchers to increase understanding of contaminants in ringed seals and learn from Inuvialuit knowledge about seal ecology and traditional methods for butchering seals, preparing seal skin and identifying abnormalities in harvested game.
- Local students actively engaged with several types of interactive classroom activities (presentations, laboratory activities, group discussions, storytelling, games, and art activities), and school personnel welcomed researcher engagement in the classroom.
- Best practices for sharing information about contaminants research with northern schools through workshops include: having a flexible approach to workshop programming, developing teaching tools that can be easily adapted to various age groups, preparing educational material that can be left with teachers once the workshop is over, taking the time to introduce concepts that are new to students (e.g., contaminants, bioaccumulation, biomagnification), and implementing a mix of hands-on activities and short presentations.
- Participation of one student from the Arctic College Environmental Technology Program in Iqaluit and one graduate student from the University of Manitoba contributed to increasing the capacity of northern students and early career scientific researchers to meaningfully engage with community members in contaminants research in Inuit Nunangat.
- We implemented a student-developed hunter survey for collecting local/ Indigenous knowledge that may be associated with contaminants in ringed seals. This survey can be administered by local students to help increase their involvement in contaminants research.

Program Coordination and Indigenous Partnerships

Council of Yukon First Nations Participation in the Northern Contaminants Program

Project Leader

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Project Team

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Project Location

Whitehorse, YK

Abstract

As with the previous year, the Council of Yukon First Nations (CYFN) has continued to be an active member of the Northern Contaminants Program (NCP) Management Committee through responding to requests for information, participating in Yukon Contaminants Committee meetings and activities, informing Yukon First Nations and Renewable Resources Councils about the annual call for proposals, maintaining the Yukon NCP website, and working with NCP researchers currently active in the Yukon Territory.

Key Messages

- Our traditional country foods are safe to eat.
- Levels of contaminants are generally low in the Yukon Territory.
- We need to continue monitoring as new contaminants are being released into the atmosphere and water which may cause challenges in the future.
- The effects of climate change on contaminant mobility and loading needs to be tracked.
- The work of the NCP continues to be relevant at the local, regional, national, and international level.
- Yukon First Nations have a role to play in contaminant research through leading or partnering in such research and contributing Indigenous knowledge.

Dene Nation participation in the national NCP Management Committee (NCPMC) and Northwest Territories Regional Contaminants Committee (NWTRCC)

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- **Project Location**
  Dene National Office, Yellowknife, NT

Abstract

Dene Nation received funding from the Northern Contaminants Program (NCP) through the Program Coordination and Indigenous Partnerships envelope for the fiscal year 2017-2018. The funds supported its participation in the NCP Management Committee and the NWT Regional Contaminants Committee (NWTRCC). Additional funds were provided for the Dene Nation Land and Environment Committee to attend the NCP Results Workshop at Yellowknife during September, 2017. Unfortunately, the entire committee could not attend.

The Dene Nation participated in two NCP Management Committee meetings at Ottawa, ON, attended NWTRCC meetings and participated in teleconferences. In addition, the Dene Nation reported to the Dene Leadership meetings and to the Dene National Assembly. Information sharing enhanced communication between the Dene National office and its communities. Communications with the NWTRCC was maintained.

Dene Nation is also engaged with revamping its website (denenation.com) to allow easier access for its membership to information on contaminants. The revamped site is expected to be complete by the end of May 2018.

Key Messages

- The Dene Nation participated on NCP Management Committee.
- The Dene Nation participated on the NWTRCC.
- The Dene Nation provided advice to NCP on contaminant issues in the communities.
- The Dene Nation liaised on NCP activities within the Dene Nation membership.

Inuit Tapiriit Kanatami National Coordination

Project Leader

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Project Team

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Project Location

- Ottawa, ON
- Inuit Nunangat, Canada

Abstract

Since the beginning of the Northern Contaminants Program (NCP) in 1991, Inuit Tapiriit of Kanatami (ITK) has participated in the program as managing partners. This partnership continues to be fruitful and effective both for Canadian Inuit and to the Northern Contaminants Program.

As the national political voice of Canadian Inuit, ITK continues to play multiple roles within the NCP. ITK provides guidance and direction to Crown-Indigenous and Northern Affairs (CIRNAC) and the other NCP partner's (Health Canada (HC), Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC), etc.), bringing Inuit interests to NCP management and liaison committees, of which, we are active members. As a result, the NCP can better respond to the needs and concerns of Inuit. Also, ITK is dedicated to facilitating appropriate, timely communications regarding contaminants in the North. Working with their Inuit partners at the Inuit Circumpolar Council (ICC)-Canada, ITK also works on the international stage to persuade nations to reduce the generation and use of persistent organic pollutants (POPs) and heavy metals (mercury) that end-up in the Inuit diet. Lastly, ITK works with other research programs to ensure that research on contaminants is conducted in a coordinated approach.

Keys Messages

- The ITK national coordinator continues to provide a voice for Inuit Nunangat during NCP discussions;
- The ITK national coordinator continues to be an active and constructive member of the NCP Management Structure, ensuring that the contaminants issue and NCP research and results are communicated to Inuit and that Inuit are represented at key regional, circumpolar and international meetings and initiatives;
- The ITK national coordinator continues to contextualize contaminant information in a broader communication process using the Inuit Knowledge Centre and other ITK structures (i.e. National Inuit Committee on Health (NICoH));
- The ITK national coordinator continues to develop the confidence of Inuit in making informed decisions about country food use; and
- The ITK national coordinator continues to coordinate contaminants activities with other research programs.

Inuit Circumpolar Council – Canada Activities in Support of Circumpolar and Global Contaminant Instruments and Activities 2017- 2018

Project Leader

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Project Team

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Project Location

Ottawa, ON

1 Tom Sheldon is no longer with ICC Canada. The project leader is now Eva Kruemmel, ScienTissiME/ICC Canada, email: ekruemmel@scientissime.com

Abstract

This report outlines ICC Canada's activities funded by the Northern Contaminants Program (NCP) in the fiscal year 2017-2018. ICC Canada is working nationally and internationally to address the issue of contaminants in the Arctic. National activities include support to the NCP on the Management Committee, blueprint and proposal reviews, and input into the Canadian Arctic Contaminants Assessment IV (Human Health) report. Internationally, ICC Canada continued its activities related to the United Nations Environment Programme (UNEP). Work on the Stockholm Convention on Persistent Organic Pollutants (POPs) is ongoing, with ICC Canada attending the 13th POP Review Committee (POPRC) in October 2017, and participating in a panel discussion during the first Conference of the Parties of the Minamata Convention on Mercury. ICC Canada continued to support Arctic Council activities and attended several meetings of the Arctic Monitoring and Assessment Programme (AMAP). ICC Canada was very active on the Sustaining the Arctic Observing Networks (SAON) Board, the SAON Executive Committee, and continued working on the organizing committee of the Arctic Observing Summit (AOS).

Key Messages

- ICC Canada actively supported NCP by working on the Management Committee, Environmental Monitoring, Human Health and CBM technical review committees.
- ICC Canada attended the 13th POP Review Committee (POPRC) meeting, provided input in POPRC working group documents, and informed the NCP and AMAP about POPRC work.
- ICC Canada attended a panel discussion during the first Conference of the Parties (COP-1) of the Minamata Convention and provided information on how Inuit are impacted by mercury in the Arctic, as well as outlined monitoring activities in the Arctic under NCP and AMAP.
- ICC Canada actively contributed to the Arctic Council related work, attended the Arctic Monitoring and Assessment Programme (AMAP) Working Group and Heads of Delegation meetings, SAON meetings, teleconferences of the SAON Executive Committee and teleconferences of the Arctic Observing Organizing (AOS) Committee.
- ICC Canada was very active in the AMAP Human Health Assessment Group (HHAG) and co-led Chapter 6 on Risk Communication for the AMAP Assessment 2015: Human Health in the Arctic. A special issue was published from this assessment in the International Journal of Circumpolar Health, including a paper on risk communication (led by ICC Canada). Follow-up work is planned for the fiscal year of 2018-2019.

Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)