Classement CCEK

Titre Contaminants/ Polluants: Nunavik

Type Dossiers Environementaux

Date D'ouverture 1997

Notes

21 Avril 1997: Memo de Inuit Tapirisat of Canada; Funding for Contaminants Communication in Nunavik

Document: Répertoire des inventaires portant sur les sites contaminés et les contaminants locaux dans le Nord du Québec; Septembre 2004

7 Octobre 2004: Lettre de NTK; Monitoring of polluant and Contaminant Levels and Effects in Hudson Bay

25 Février 2005: Lettre d'Environnement Canada; Initiative des écosystèmes nordiques (IEN) ; Répertoire des inventaires portant sur les ites contaminés et les contaminants locaux dans le Nord du Québec

Environment Canada   Environnement Canada

Division des évaluations environnementales
et des affaires autochtones
1141, route de l'Église, C.P. 10 100
Sainte-Foy (Québec) G1V 4H5
Tél. : (418) 648-5675

Comité consultatif
de l'environnement Kativik
reçu le
08 Mars 2005 NG.

Québec, le 25 février 2005

Madame Nathalie Girard
Comité consultatif de l'environnement Kativik
Case postale 930
Kuujjuaq (Québec) J0M 1C0

Objet : Initiative des écosystèmes nordiques (IEN) : Répertoire des inventaires portant sur les sites contaminés et les contaminants locaux dans le Nord du Québec

Madame,

Il me fait plaisir de vous faire parvenir une copie CD-ROM du *Répertoire des inventaires portant sur les sites contaminés et les contaminants locaux dans le Nord du Québec*, réalisé dans le cadre l'*Initiative des écosystèmes nordiques* (IEN). L'IEN est un programme d'Environnement Canada (EC) basé sur le partenariat et axé sur les priorités du gouvernement du Canada en matière d'environnement, qui intègre un ensemble de préoccupations environnementales, sociales et économiques.

En 2003, dans le cadre du volet sur les contaminants de l'IEN, nous avons mandaté le consortium formé par les firmes Dessau-Soprin inc. et ÉEM inc. (DS-EEM) pour produire un répertoire compilant des inventaires des sites contaminés et des contaminants locaux préoccupants (CLP) dans le Nord du Québec. Votre organisation avait été contactée par le consortium de consultants.

Je profite de l'occasion pour vous remercier de votre collaboration lors de la collecte d'information. Votre apport, petit ou grand, a été essentiel pour l'élaboration du répertoire. Nous souhaitons qu'il vous soit utile dans vos travaux.

Veuillez agréer l'expression de mes sentiments les meilleurs.

Claude Saint-Charles
Gestionnaire, Division des évaluations environnementales
et des affaires autochtones

JP/mg

p.j. Copie CD-ROM du répertoire

Canada

Environment Canada Environnement Canada

Environmental Assessment and
Aboriginal Affairs Division
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Tél. : (418) 648-5675

Comité consultatif
de l'environnement Kativik
reçu le
08 Mars 2005 . 9/16.

Quebec, February 25, 2005

Mrs Nathalie Girard
Comité consultatif de l'environnement Kativik
Case postale 930
Kuujjuaq (Québec) J0M 1C0

Subject : Northern Ecosystem Initiative (NEI): Registry of inventories of contaminated sites and local contaminants in Northern Quebec

Dear Mrs Girard,

I am pleased to submit to you CD-ROM copy of the *Registry of inventories of contaminated sites and local contaminants in Northern Quebec*, carried out in the Northern Ecosystem Initiative (NEI). NEI is an Environment Canada (EC) partnership based program focussed on the priorities of the Government of Canada as regards environment, which integrates a whole of environmental, social and economic concerns.

In 2003, under contaminants component of the NEI, we mandated the consortium formed by the firms Dessau-Soprin inc. and DS-EEM (ÉEM inc.) to compile and produce a registry of all the inventories of contaminated sites and local contaminants of concern (LCC) in Northern Quebec. Your organization has been contacted by the consultants' consortium.

I take advantage of this letter to thank you for your collaboration during the data collection. Your contribution, small or important, was essential for the development of the registry. We wish that this registry will be useful for your work.

Sincerely yours,

Claude Saint-Charles
Chief, Environmental Assessment and
Aboriginal Affairs Division

JP/mg

p.j.: CD-ROM copy of the Registry

Canada

Nunavut Hudson Bay Inter-Agency Working Group

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NTK

Nunavuummi
Tasiujarjuamiuguqatigiit
Katutjiqatigiingit

"People of the Bay Working Together"

RECEIVED
OCT 15 2004

Mr. Johnny N. Adams
Chairperson
Kativak Regional Government
P.O. Box 9
Kuujjuaq, Quebec
J0M 1C0

cc: M. Barrett
J.F. Arteau
L. Mercier

October 7, 2004

Dear Mr. Adams:

Monitoring of Pollutant and Contaminant Levels and Effects in Hudson Bay

The Nunavut Hudson Bay Inter-Agency Working Group (NTK) involves representatives from the Municipality of Sanikiluaq, Qikiqtani Inuit Association, Nunavut Tunngavik Incorporated and Government of Nunavut. Its purpose is to study and report on issues and implications of development on Hudson Bay and James Bay in a coordinated, efficient and focused manner.

As an advisory group NTK is dedicated to protecting the natural environment of the Hudson Bay bioregion, particularly with respect to the way environmental impacts affect Inuit of the Belcher Islands. The importance of traditional ecological knowledge is emphasized in NTK's approach to all environmental issues.

NTK is alarmed by the apparent lack of monitoring of pollutant and contaminant levels and effects in Hudson Bay and James Bay. Both bays act as a "sink," the final resting place for many pollutants and contaminants used in industry and agriculture thousands of kilometres away. These contaminants are persistent, entering the food chain and bioaccumulating in each level. Inuit are exposed to health risks as they ingest such contaminants when eating traditional food.

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Sanikiluaq Environment Committee
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Nunavut Tunngavik Incorporated

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Qikiqtani Inuit Association
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Government of Nunavut

P.O. Box 174
Sanikiluaq, Nunavut X0A 0W0
Tel: (867) 266-8929
Fax: (867) 266-8837
Email: ntkwg@polarland.com

We have three questions that your organization may be able to assist in answering:

1. Within your jurisdiction, is there monitoring for pollutants and contaminant levels and effects:
   a. In the waters and biota of Hudson and James Bays?
   b. Along the shorelines of Hudson and James Bays?
   c. Along and at the mouths of fresh water rivers flowing into Hudson or James Bay?

2. If there is such monitoring, can you provide particulars (e.g., type of monitoring program, monitoring requirements, sample locations, sampling frequency, etc.)?

3. If there's no monitoring, why not (e.g. lack of resources, low priority, etc.)?

Since we are in the process of developing a community-based monitoring program, the information we are seeking is of particular, and timely, interest. If you have any knowledge on the information collected from any ongoing or past monitoring of Hudson and James Bay and their surrounding watersheds, we would appreciate hearing about it.

In conclusion, NTK looks forward to your reply. If you require further background information concerning the basis of our inquiry, please do not hesitate to contact myself or our Secretariat, Miriam Fleming.

Yours sincerely,

Lucassie Arragutainaq
Co-Chair

MEMO

INUIT TAPIRIIKSAT KANATAMI
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INUIT TAPIRISAT OF CANADA

To: Minnie Grey, Stas Olpinski, Michael Barrett
From: Craig Boljkovac, ITC
Re: **Funding for Contaminants Communication in Nunavik**
Date: 21 April/97

Greetings. As you know, the Northern Contaminants Program portion of DIAND's Arctic Environmental Strategy has been renewed for at least this fiscal year. ITC submitted a communications proposal designed to give all six regions some sore capacity to deal with contaminants issues. It was approved at a greatly reduced level, and with an added wrinkle.

The wrinkle was that since Minnie's proposal for a contaminants coordinator had been approved by the NCP's Technical Committee, DIAND felt that an allocation to Nunavik under our communications proposal would be duplicative.

I think, however, that we have a solution for this. ITC's core funding from the program, despite having been cut, has an expanded mandate aimed at assisting the regions as fully as possible with regard to contaminants issues. A small portion (10-15K or so) of our core funding could be allocated, through a sub-contract, to help fund a contaminants coordinator in Nunavik - be it an addition to the present coordinator's responsibilities or for a new, part-time coordinator - whatever you all decide.

The overall goal of the contaminants communication proposal is to ensure that there is at least a minimal core capacity in the regions to deal with the contaminants issue - which is something that you already have in Nunavik. What we would like to see in addition to that (in the form of some modest deliverables in the sub-contract) would be access to your coordinator to get input on NCP activities, participation in an (informal at this point) national Inuit contaminants steering group, a workplan on contaminants for your region outlining priorities in your region, and participation in an annual national contaminants workshop.

Please let me know if you are OK with this proposal. If you have any questions please call me - I should be in the office for the next week or so.

Thanks,
Craig

RECEIVED
April 21, 97

Suite 510, 170 Laurier Ave. W., Ottawa, Ontario K1P 5V5 Ph: (613) 238-8181 Fax: (613) 234-1991

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INUIT TAPIRIIKSAT KANATAMI
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INUIT TAPIRISAT OF CANADA

– Memorandum –

To ITC Regional Contacts for Environment:
Norm Snow/Bruce Hanbidge, Joint Secretariat
David Igutsaq/Jim Cunningham, Kitikmeot I.A.
Hugh Nateela, Kivalliq I.A.
Terry Audla/Paul Crowley, Q.I.A.
Stas Olpinski, Makivik Corporation
Michael Barrett, Kativik Regional Government
Judy Rowell/Frank Andersen/Katie Harris, L.I.A./Eco-Research
Helen Klengenberg/Bruce Gillies, N.T.I.
Roda Grey, Pauktuutit
Terry Fenge/Violet Ford, ICC

From: Craig Boljkovac, ITC
Date: March 20, 1997
Re: **MEMO for April 3 conference call re:** DIAND Northern Contaminants Program Funding for 97-98

As many of you know, DIAND has committed renewing of the Arctic Environmental Strategy's Northern Contaminants Program for at least the fiscal year 1997-98, though there is an excellent chance that the program is being renewed for a full five-year period.

1. ITC/ICC core funding

The core funding for ITC and ICC to continue their work as aboriginal partners to the Program has been cut substantially, **from $150K per organization to a total of $243K for both organisations**. Nevertheless, ITC made a commitment to the Program to facilitate the expansion of regional participation, as per what was laid out in the draft proposal we submitted to DIAND in January (which was circulated to you for comment).

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The draft proposal put forward the idea of further developing the regions' capacity to deal with contaminants issues through more direct involvement in the Northern Contaminants Program. This (we hoped in the proposal) would be achieved by, for example:

1) greater participation of the regions in AES meetings, committees and subcommittees (giving Inuit a stronger role in decision-making concerning the Program);

2) funding for a person to work on contaminants issues in each region;

3) resources to assist in the set-up of contaminants committees in each region; or where they already exist (such as in Nunavik and Labrador), to enable them to become more involved in the NCP.

ITC would act as the main secretariat for this work, taking direction from the regional committees,

- participating in the Science Managers and Technical Committees of the NCP,
- organizing the annual environment workshop,
- providing technical advice,
- providing training when needed;
- tracking federal initiatives (such as CEPA or the proposed Endangered Species Act);
- coordinating national-level communication (such as regular contaminants contacts conference calls) and strategies

ICC will also act as a secretariat for international contaminants work, seeking advice. providing technical advice and expertise on continuing basis.

2. Regional funding and proposed structure

The original plan for getting a regional structure into place involved ITC assisting the regions in securing funding for the next (September/97) NCP deadline. At the February meeting of the NCP Technical Committee, DIAND officials approached ITC to ensure that some funds were set aside for the regions.

$150,000 was then allocated under the Education and Communications funding category as seed money to put into place:

1) a part-time contaminants coordinator in each region;
2) modest resources for communications and support for regional contaminants committees;
3) seed money for the ITC Environment workshop (15K).

For each of the six regions, the amount allocated comes out to $22,500 each for this year.

The contract for regional funding will go through ITC. We will then subcontract each region for equal amounts. Deliverables and a budget will be included in each contract. The ones we have thought of so far **(please feel free to add/delete)** are:

1. bimonthly written activities summaries for each regional contact;
2. draft regional communications plans;
3. mid-year report
4. end-of -year financial and narrative summary.

I would suggest that a bare-bones budget for the 22.5K include:

- coordinator's part time salary;
- communications (phone, fax, conference calls)
- travel (e.g. to NCP meetings)

For regions which already have committees, these resources could be used differently. Some core functions concerning the NCP would have to be fulfilled, however. Some limited travel and communications funds can come out of ITC's core allocation. The main aim here, however, is to get someone into place in each region who will have the skills and capacity to coordinate what that region wants to do with regard to contaminants, and who will have a basic familiarity with what is going on at the national level. Part of that capacity would be, with ITC/ICC's assistance, to access additional project-related funds from the NCP and other sources. The next project funding deadline for the program is September/97.

For this 150K pot of funding, we have to get a finalised budget and workplan into Science Managers for its final approval at the April 9-10 meeting in Ottawa. The budget and workplan for the core ITC/ICC allocation will have to be submitted to DIAND by April 15th. **We would therefore like you comments/input individually as soon as possible, and collectively on the April 3rd conference call.**

Thanks

Craig

305 5

Government of Canada / Gouvernement du Canada
Environment Canada / Environnement Canada

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867 Lakeshore Road
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Sophie Robillard, U de M	514-773-8521
Jennifer Rogers/Ken Reimer, RMC	613-541-6596
Becky Sjare, DFO Nfld	709-772-3207

From: Derek Muir

May 22, 1997

Page 1 of 14

Phone: 204-983-5168/ or 905-319-6921
E-mail: Derek_Muir@FWI.DFO.CA
Fax No: (204) 984-2403

Re: Background information for the Nunavik/Northern Labrador Contaminants meeting - May 27-29th Kuujjuaq

Attached is a review that I produced last January prior to initial discussions about the need for a workshop on contaminants in Nunavik and N. Labrador. This version is slightly revised following comments from individuals knowledgeable about contaminants work in Nunavik. It intended only to give all attendees the same background information. Those of you on the above list may not have seen the earlier version. Copies will be available at the meeting.

See you there!

Derek Muir

Persistent Organochlorines and Meavy Metals in Nunavik and Northern Labrador: A review of existing data

Derek Muir
Freshwater Institute
Winnipeg MB

Information on levels of persistent organochlorine (OCs) contaminants and metals in the physical and biological environment of northern Québec and northern Labrador has been compiled and assessed in two chapters of the recent Assessment report of the Northern Contaminants Program (NCP) (Muir et al, 1996; Barrie et al, 1996). These reviews identified knowledge gaps in information on contaminants in Nunavik and Labrador in comparison to NWT and Yukon. The "ideas" workshop of NCP, held in Yellowknife Nov 25-28, reiterated the need for further studies in northern Québec and Labrador.

The purpose of this discussion paper is to briefly review the information available on contaminants in northern Québec and Labrador, with special emphasis on the Inuit communities in the northern parts of the region, and to propose additional work to address knowledge gaps. The first two drafts of the paper were circulated to individuals familiar with contaminant measurements in northern Québec and to representatives of First Nations groups in January 1997. This third draft is slightly revised as a result of the comments and additional data received.

A substantial dataset does exist for contaminants in biota for northern Québec including the Nottaway-Broadback-Rupert and Grand Baleine river basins as a result of environmental impact studies for future hydro-electric development conducted by HydroQuebec in the late 1980's and early 1990s (HydroQuebec 1993; Langlois and Langis 1995). Levels of contaminants in aquatic (marine and freshwater) and terrestrial food chains of northern Québec have been reviewed and compiled by Dewailly et al. (1990) and Careau et al. (1992). A computer database developed by Careau et al. (1992) includes results from the Hydro Québec surveys of metals (especially mercury) and persistent OCs in biota of the Grand Baleine region well as other data from studies funded by Dept of Indian and Northern Affairs (DIAND) on contaminants marine mammals and fishes from arctic Québec. Lockhart et al. (1992) reviewed results for OC and metal contaminants in fishes and surface waters in northern Québec and Labrador. Some of this information is reviewed in more detail below but several majors gaps in the information are apparent:

(1) there is considerable information on levels of OCs and heavy metals in marine mammal tissues from coastal communities such as Inukjuak and Salluit there is very little data on contaminants in tissues of alternative foods such as freshwater and anadromous fishes and terrestrial mammals.
(2) No contaminant studies have been carried in northern Labrador
(3) No recent data were found on levels of OCs or heavy metals in lake or marine sediments, surface waters, snow or air in the Nunavik region or in northern Labrador.
(4) There is no information on temporal trends on contaminants in freshwater and terrestrial biota.

Why conduct further contaminant measurements in northern Québec and Labrador? The main reason for additional work is to provide information to communities about contaminants in the food chain so that residents of this region have a similar level of information to those in the Yukon and NWT. This addresses the major objective of NCP which is to "provide information that assists informed decision-making by individuals and communities ..."(Whitby 1996).

Review of Existing Data

1. Contaminants in biota

The contaminant data from northern Québec are available primarily from the large study by Hydro-Québec (1993) conducted between 1989 and 1991 in the Great Whale and Rupert Nottaway basin study areas (summarized by Langlois and Langis 1995) and from work funded by DIAND (Braune 1992; 1993; Muir and Rosenberg 1990; Olpinsky 1990). Recent DIAND funded studies by Kingsley (1994;1996) have added to information on metals in biota from the east Hudson Bay area. Levels of contaminants in aquatic (marine and freshwater) food chains of northern Québec have been reviewed by Dewailly et al. (1990). The database developed by Careau et al. (1992) includes a substantial northern Québec component mainly from the Hydro Québec surveys of metals (especially mercury) and persistent OCs in biota of the Grand Baleine region.

1.1 Freshwater and anadromous fish: A large number of fish from Northern Québec have been analysed for mercury and other metals as part of environmental studies for the Grand Baleine project (Hydro-Québec 1993, Langlois and Langis 1995). Large numbers (total of ~1400 samples) of lake whitefish, lake trout, longnose sucker, northern pike and walleye from the Grand Baleine region were analysed for mercury (Langlois and Langis 1995)(Table 1). Other metals, Arsenic, copper, nickel, cadmium, lead and selenium) were analysed in smaller numbers of fishes. Highest concentrations of mercury were found in lake trout and northern pike flesh and lowest in lake whitefish. Mercury levels were determined in brook trout, salmon, lake trout, lake whitefish and other fishes from the Koksoak River fishery in 1989, 1991 and 1993 (Boivin and Gordon 1991; Doidge et al. 1993; Kaminsiki and Gordon 1994). Mercury in Koksoak River salmon and brook trout was generally low i.e. about 0.1 ug/g ww. Higher levels were found in lake trout and whitefish. Mercury and selenium were also determined in brook trout, lake trout. salmon, whitesuckers and lake whitefish from the Kuujjuaraapik/Umiujaq area of eastern Hudson Bay (lakes not specified)(Kingsley 1994;;Muir and Lockhart 1996). Lake trout and lake whitefish in the Grand Baleine region had similar concentrations of mercury and other metals as trout and whitefish from large NWT lakes (Belot, Peter, Colville) (Muir et al. 1996). Mercury concencentrations in northern Pike muscle from the Grand Baleine region were higher than observed in pike from most NWT or Yukon locations. Selenium was present at similar concentrations to mercury in lake trout and pike while selenium/mercury ratios were >1 in whitefish and brook trout.

Lake trout, lake whitefish and northern pike from the Grand Baleine and Nottaway-Broadback-Rupert regions were also analysed for OCs (Langlois and Langis 1995; Hydro Quebec 1993). Whitefish low levels of total PCBs (ΣPCBs) in flesh (skinless fillets), similar to those in NWT (e.g. Great Slave Lake) when compared on a lipid basis (Muir et al. 1996). Lake trout had the highest concentrations of PCBs and other OCs of all fish sampled in the Grand Baleine basin (Table 2). Mean concentrations in lake trout flesh from Lac Bienville of 47 ng/g wt weight (or 3300 ng/g lipid wt) were similar to those in Great Slave lake trout and higher than those found in lake trout from small western NWT and Yukon lakes (Muir et al. 1996).

Information on concentrations of OCs and metals in fishes from lakes near coastal communities in Arctic Québec is limited. Small numbers of arctic char and lake trout were analysed as part of a study of OC contaminants in coastal communities (Muir and Rosenberg 1990; Olpinsky 1990) (Table 2). Toxaphene was the major OC contaminant in all fish analysed. There are only limited results from N. Québec for toxaphene because it was not determined in the Hydro-Québec study.

Doidge et al. (1993) measured heavy metals, PCBs and OC pesticides in blue mussels (*Mytilus edulis*) from six communities in Nunavik. Mean concentrations of most heavy metals were relatively low (Table 1) (e.g. mercury = 0.03±0.01 ug/g ww). Exceptions were arsenic (1.49 ug/g) and zinc (12.8 ug/g). Organochlorine compounds were present at low ng/g levels similar to concentrations in Arctic char (e.g. PCBs as Aroclor 1254 = 42 ng/g ww).

OCs and metals were measured in fish from southern Labrador lakes including the Smallwood Reservoir in the 1970's and early 1980's (Musial et al. 1979; Lockerbie and Clair 1988; Lockerbie 1987). There appear to be no data from northern Labrador.

1.2. Terrestrial mammals and plants: Levels of heavy metals and radionuclides in northern Québec caribou herds were studied in the mid-1980's (Crête *et al.* 1989; Marshall and Tracey 1989). Concentrations of cadmium in liver and kidney averaged 2.3 and 27.5 ug/g (dry wt), respectively (Crête et al. 1989). Much lower levels were found in muscle (0.002 ug/g). Cadmium levels in N. Québec herds were similar to levels in NWT herds (Muir et al. 1996). No data is available on persistent OCs in northern Québec/Labrador caribou. Low levels of persistent OCs were found in NWT caribou (generally ΣPCBs were < 20 ng/g in fat). However, a significant west to east increase in ΣPCBs, HCB and ΣHCH was found in caribou from NWT with highest mean levels in Cape Dorset and Lake Harbour herds and lowest in the Inuvik herd. This trend was also observed for chlorinated dioxins and furans (PCDD/Fs) in caribou. Higher levels of these OCs in the east are probably also the result of the predominate west to east/northeast atmospheric circulation pattern, which delivers these contaminants from industrialized regions of central and eastern North America to the Arctic via long-range atmospheric transport. Whether the levels of OCs in northern Québec herds are similar to those in Baffin region is unknown.

The main source of contaminants for caribou are plants which they forage upon such as lichen. Crete et al. (1989) found cadmium levels in lichen from N. Québec averged 0.17 ug/g (dry wt). This was about 4-times higher found in lichen from the Yukon (Muir et al. 1996). There are no measurements of persistent OCs in lichen from N. Québec. Measurements of OCs in NWT lichen showed low ng/g levels (generally < 1 ng/g) of PCBs, total chlordane-related compounds (ΣCHL) ΣHCH and HCB. The more persistent compounds, ΣCHL and PCBs, biomagnified up to about 100x in the lichen to caribou to wolf food chain.

Langlois and Langis (1995) and Hydro-Québec (1993) reported levels of OCs and metals in muscle and liver of small numbers of terrestrial animals (hare, mink, marten, fox) from the Grand Baliene region. Highest levels of mercury in muscle were found in mink (2.4 ug/g wet wt) and lowest in hare. ΣPCB and ΣDDT concentrations in mink liver averaged 351 and 43 ng/g (wet wt) respectively. These levels were about 14-times higher than in mink liver from southern NWT locations (Muir et al. 1996). Marten liver from Grand Baliene also had higher concentrations of

PCBs than the same species from Ft. Good Hope (NWT).

1.3. Game birds and waterfowl: Organochlorine and metal contaminants in muscle and eggs of game birds and waterfowl from N. and northern Labrador were determined by Braune (1992; 1993). Species sampled included glaucous gull, herring gull, black guillemot, Canada goose, common loon, oldssquaw, ptarmigan, merganser, and common eider. Major sampling sites were Inukjuaq, Kangiqsualuujjuaq, Salluit, and Kuujjuarapik in N. Québec, and near Rigolet and Nain in Labrador. Concentrations in breast muscle of all birds ranged widely depending upon the diet of each species. Highest levels of PCBs (0.020-17 ug/g wet wt) were found in fish eaters such as glaucous gulls, merganser, common loon and herring gulls. Lowest levels of PCBs (<0.001-0.225 ug/g wet wt) and other persistent OCs were found in Canada goose, common eider, king eider, snow goose, ptarmigan and oldsquaw.

Mergansers, thick-billed murre and loons also had relatively high mercury in breast muscle)(0.29-1.23 ug/g wet wt) while ptarmigan and oldsquaw had lower levels (<0.08-0.24 ug/g). Higher PCBs and other organochlorines, particularly mirex, were found in waterfowl, especially in molluscivores and piscivores, in eastern (mainly coastal N. Québec locations) compared with the western Arctic. In the case of birds, however, most overwinter in temperate latitudes and the east-west trends in organochlorines may therefore reflect migratory patterns and winter feeding locations rather than regional contamination differences.

1.4 Marine mammals, fishes and invertebrates: A relatively large amount of data is available on persistent OCs and metals in marine mammals from N. Québec. Results for OCs are summarized in Table 3. In general, highest concentrations of OCs are found in beluga blubber and lowest in bearded seal blubber. There are few major geographical differences in levels of most persistent OCs (e.g. ΣDDT and ΣPCBs) in blubber of beluga or ringed seals between the eastern Canadian arctic (including east Hudson Bay/ Hudson Strait) and the western Arctic. Higher concentrations of OCs are found in ringed seals from eastern Greenland, Svalbard and northern Russia while lower levels are found in ringed seals from the East Bering and Chukchi seas (DeMarch et al. 1996 in prep). Walrus from Inukjuak were found to have relatively high concentrations of persistent OCs in blubber when compared to walrus from Alaska (Bering Sea) and Foxe Basin, or to most samples from Akulivik (Muir et al. 1995). This may be due to a high proportion of seal eating walrus at Inukjuak. The same walrus had relatively low levels of mercury and other heavy metals (Wagemann and Stewart 1994).

Recent work, summarized in Wagemann *et al.* 1996, and in Muir et al. 1996, has resulted in a large metals data base for ringed seals and beluga from the Canadian Arctic, including northern Québec. Kingsley (1994;1996) analysed additional ringed seal, beluga and walrus tissues from the the Kuujjuaraapik/Umiujaq area of eastern Hudson Bay for cadmium, mercury and selenium. In general, levels of mercury and cadmium in Canadian arctic marine mammals show distinct differences between the eastern Arctic/N. Québec and the western Arctic which are probably related to differences in geology and mineralogy (Canadian shield in the east; sedimentary geology in the west). For example, average mercury levels in ringed seal liver from three N. Québec communities (Inukjuak, Kangiqsujuaq and Kangiqsualujjuaq) ranged from 4.1-11.0 ug/g (wet wt) compared to 4.5-59 ug/g in the western Arctic (Sachs Harbor, Holman and Shingle Pt). Cadmium shows the opposite trend; about 2-fold higher concentrations in seals from N. Québec.

There are relatively few measurements of persistent OCs in tissues other than blubber for marine mammals in N.Québec. Langlois and Langis (1995) reported low levels of ΣPCBs (13 ng/g wet wt) in beluga muscle collected near Grand Baleine. Levels of PCBs in beluga muktuk from the Sanikuluaq area (E. Hudson Bay stock) indicate levels about 1/10 of those in blubber of the same animals and proportional to fat content of the sample. Metals have generally been determined in liver, muscle and kidney but there are only limited data for skin (muktuk). There is also a lack of information about speciation of metals, particularly the proportion of toxic methyl-Hg, in tissues of marine mammals from N. Québec. In general, concentrations of mercury in muktuk and other ringed seal and beluga tissues exceed Health Canada guidelines for fish muscle of 0.5 ug/g wet wt, especially in older animals.

Little information is available on contaminants in marine fishes from N. Québec (Hudson Bay or Hudson Strait coasts). Muir and Lockhart (1996) reported low levels of mercury (0.137 ug/g) in sculpin from the Kuujjuaraapik/Umiujaq area of eastern Hudson Bay. Kingsley (1994) found low levels of mercury in mussels (0.02 ug/g) from the same area. Langlois and Langis (1995) found low ug/g (dry wt) concentrations of heavy metals arsenic, cadmium, lead and selenium in blue mussels from the Grand Baleine are of Hudson Bay. Muir et al. (1995a) found low ng/g concentrations of ΣPCBs (2.5 ng/g wet wt)in clams (*Septentrion* sp.) from Manitounik Sound. Studies of contaminants in commercial deep sea fishes from the southern Labrador/north Newfoundland coast (Hellou et al. 1993; 1995) show relatively low levels of ΣPCBs in liver of yellow tail flounder (4.8 ng/g wet wt) and higher levels in atlantic cod, greenland halibut, and American plaice (16-154 ng/g wet wt).

2. Contaminants in the physical environment

2.1 Air and precipitation: Measurements of OCs and metals in the physical environment are needed to provide information about sources of the contaminants. Studies of spatial trends of organic contaminants in caribou, waterfowl and marine mammals suggest that levels are higher in the eastern Arctic and northern Québec because of the predominate west to east/northeast atmospheric circulation pattern, which delivers these contaminants from industrialized regions of central and eastern North America to the Arctic via long-range atmospheric transport. This hypothesis has never been thoroughly investigated. No studies have been done on concentrations of persistent organics or heavy metals in air, snow or wetfall entering N. Québec ecosystems. By contrast there is now a substantial body of information on atmospheric inputs for the Yukon and NWT (Barrie et al. 1996 in prep). The closest air sampling station in the NCP program was at Cape Dorset (Baffin Is.).

2.2. Surface waters. No recent measurements have been made of persistent OCs in surface waters of N. Québec. However, a detailed study by Langlois (1987) between 1983 and 1987 demonstrated the presence of HCH isomers in rivers flowing into Hudson Bay and Ungava Bay.ΣPCB, ΣDDT and dieldrin were below rather high detection limits (4-9 ng/L) in most samples. Higher concentrations of HCH were seen in waters flowing into Hudson Bay compared to Ungava Bay. ΣHCH levels were comparable or higher than concentrations in southern Canadian locations such as the St. Lawrence river indicating the widespread distribution of HCH as a result of atmospheric transport and deposition. Langlois (1987) also quantified the heavy metals arsenic, cadmium and lead in N. Québec river water.

2.3 Sediments: Dated sediment cores have been used to infer net atmospheric inputs of persistent organics and heavy metals to lakes in Yukon and NWT (Lockhart 1994; Muir et al. 1995b; 1996). Mercury and lead deposition in sediment has been studied in northern Québec lakes (Lucotte et al. 1995) but there has been no work on persistent organochlorines or PAHs.

Lucotte et al. (1995) found no spatial trends in mercury deposition along a north-south transect (45-55°N) from southern Québec to the Grand Baleine watershed. However, lead deposition declined over the same transect reflecting major sources in industrialized areas of southern Canada and northeast US. Lucotte et al. (1995) also concluded that both lead and mercury levels in N. Québec lake sediments had increased this century due to anthropogenic sources such as coal burning (in the case of mercury) in the industrialized areas of North America.

3. Conclusions and knowledge gaps

Freshwater fishes: Contaminant analysis of freshwater fishes in the Nunavik area of northern Québec is limited mainly to small numbers of arctic char and lake trout from Inukjuaq, Salluit, Kangiqsujuaq and Kangiqsualujjuaq. These samples were collected near these communities in 1989-90 (Olpinsky 1990). There is therefore an opportunity over the next few years to examine temporal trends over a 9-10 year period. The data gaps are lack of information on other species that serve as important food sources in each community (e.g. lake whitefish), lack of any information on OC or metals in any species of fish from northern Labrador, lack of information on contaminants in organisms in the food chain of N. Québec lakes.
Terrestrial mammals and birds: The work of Crête et al. (1989) on cadmium in caribou serves as a good baseline. Information is lacking for levels of other heavy metals particularly mercury as well as PCBs and other persistent OCs in the same herds. Although studies by Langlois and Langis (1995) determined metals and OCs in small mammals in the Grand Baliene region there are no results for communities further north or in N. Labrador. Although sample numbers were limited the results suggest significantly higher levels of PCBs in small carnivorous mammals in N. Québec compared with NWT. Similar trends are evident when comparing OC levels in waterfowl and game birds from N. Québec with NWT and Yukon. The contaminants data available for birds is quite comprehensive. Samples collections were made in N. Labrador as well as near three N. Québec communities. Because these collections were made in 1991-92 a followup study to examine temporal trends might be useful, especially for fish-eating birds which had relatively high OC levels and mercury in muscle compared to muscle of almost all other animals sampled in the region.
Marine mammals and fishes: Contaminants data for marine mammals from N. Québec is quite comprehensive in terms of species and sample numbers, especially for the E. Hudson Bay and Hudson Strait communities. No samples of marine mammals have been analysed from Ungava Bay or N. Labrador communities. As noted for birds, there is an opportunity to examine temporal trends over a 9-10 year period, for OCs and mercury, at one or two locations (particularly at Inukjuak) because samples were first collected in 1989-90. There may be a need for additional information on OCs in marine mammal tissues other than blubber. In the case of mercury, there is much less data

on methyl mercury in marine mammal tissues, than on total mercury. There is only very limited information on contaminants in marine fish and shellfish from the region (only from E. Hudson Bay). Additional work should be contemplated if these fisheries are considered important food sources by local people.

Surface waters, air and precipitation: The work on persistent OCs in surface waters of N. Québec in the mid-1980's provides a baseline from which to examine temporal trends over a 10-15 year period. This would be the only opportunity to examine temporal trends of persistent OCs in surface waters in the Canadian arctic over such a long time period; measurements in NWT are restricted to samples collected in the 1990's. No data on persistent contaminants in air or precipitation are available for N. Québec. Any future monitoring of surface waters should be combined with atmospheric measurements so that sources (including back trajectories) of the contaminants can be identified.

Sediments: The work of Lucotte et al. (1995) on mercury and lead in sediments went only to the Grand Balicne reservoirs but serves as a good baseline for additional studies which could continue the transect north into Arctic Québec. Analysis of dated sediment cores from the region would give information on current sources as well as historical trends in contaminant loadings.

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Proposed N. Québec and N. Labrador contaminants study

This brief review of contaminants data for N. Québec and N. Labrador demonstrates that the region has been underserved by the 1991-97 NCP, especially in the case of freshwater and terrestrial biota. The N. Québec/ Labrador contaminants study, conducted under the next phase of the NCP, would seek to address these data gaps. The purpose would be to provide information to communities about contaminants in the food chain so that residents of this region have a similar level of information to those in the Yukon and NWT. An integrated study is proposed which would involve measurements of contaminants in both the biological and physical environment. It would require the collaboration of aboriginal/community groups (ITC, LIA, Nunavik Regional Board of Health), groups active in samples collection and contaminants work in the region (e.g. Kuujjuak Res. Centre, Centre Hospitalier Université Laval), and government departments with appropriate contaminants expertise (NWRI, DFO, CWS, Environ. Canada-Québec, Ministère de Loisir, Chasse et Pêche de Québec). A five year study is envisioned with year 1 involving mainly community consultation. Given the limited resources probably available for contaminant measurements from the NCP funding in the range of $50-100K annually would be the maximum that could be requested and this would be split among multiple participants as needed.

Please send comments on this review and proposal to Derek Muir (e-mail: Derek_Muir@fwi.dfo.ca; Fax-204-984-2403; Phone - 204-983-5168) **prior to** the NCP meeting of Jan 21-23 in Sidney BC.

At the Sidney meeting I have booked an "open space" session for Wednesday afternoon to discuss the proposed project in more detail so that a proposal can be submitted to DIAND by Feb 7th. We may also want to meet at the Empress Hotel or at IOS on Tuesday or Wednesday following the DIAND meeting.

It would be helpful for discussion at Sidney to know your view on whether such a study is necessary, what the major focus should be, who should do it, and how much funding will be required etc.

Derek Muir
January 13, 1997

Table 1. Mean concentrations of metals in muscle of freshwater and anadromous fish (µg/g wet weight) in Northern Québec waters analysed during the period 1989 to 1995.

Species	Location	Year	N	Cd $\mu g\ g^{-1}$	Cu $\mu g\ g^{-1}$	Zn $\mu g\ g^{-1}$	Hg $\mu g\ g^{-1}$	Se $\mu g\ g^{-1}$	Ref[1]
Arctic char	Eastern Hudson Bay	1994	9	0.003			0.057	0.48	1
Mussels	Eastern Hudson Bay	1993	39	<0.005			0.02-0.04	0.45-1.07	2
Mussels	Hudson Bay, Hudson Strait and Ungava Bay communities	1993	18	0.50±0.27	0.74±0.16	12.8±3.42	0.03±0.01	nd	3
Brook trout	Koksoak River	1989	138				0.09±0.01		4
Brook trout	Koksoak River	1991	17				0.20±0.3		5
Brook trout	Koksoak River	1993	22				0.11±0.05		6
Brook trout	Koksoak & Little Whale River ?	1994	22				0.106	0.33	7
Lake trout	Koksoak River	1991	16				0.80±0.4		5
Lake trout	Koksoak & Little Whale River ?	1994	8				0.368	0.36	7
Salmon	Koksoak River	1989	14				0.04±0.01		4
Salmon	Koksoak River	1993	25				0.05±0.03		6
Salmon	Koksoak River	1991	40				0.10±0.01		5
Salmon	Koksoak & Little Whale River ?	1994	25				0.049	0.28	7
Sculpin	Koksoak River	1989	22				0.18±0.01		4
Sculpin	Koksoak & Little Whale River ?	1994	25				0.137	0.34	7
Sucker	Koksoak & Little Whale River ?	1994	15				0.231	0.20	7
Lake whitefish	Koksoak River	1989	27				0.14±0.01		4
Whitefish	Koksoak River	1991	56				0.20±0.1		5
Whitefish	Koksoak River	1993	31				0.16±0.10		6
Whitefish	Koksoak & Little Whale River ?	1994	31				0.164	0.27	5
Longnose sucker	Grand Baleine	1989-90	341				0.16±0.11		8
Brook trout	Grand Baleine	1989-90	19	0.01	0.31	6.25	0.16	0.63	9
Lake trout	Grand Baleine	1989-90	504				0.77±0.66		8
Lake trout[2]	Grand Baleine	1989-90	106	0.01	0.35	3.28	0.71	0.79	9
Lake whitefish	Grand Baleine	1989-90	400				0.16±0.09		8
Lake whitefish	Grand Baleine	1989-90	41	<0.02	0.38	4.00	0.14	0.66	9
Northern pike	Grand Baleine	1989-90	75				0.63±0.46		8
Northern pike	Grand Baleine	1989-90	6	<0.05	0.27	3.80	0.63	0.58	9

[1] 1 = Lockhart, unpublished data 1995; 2 - Kingsley 1994; 3 - Doidge et al. 1993; 4 = Boivin and Gordon 1991;
5 = Doidge et al. 1993; 6 - Kaminsky and Gordon 1994; 7 - Muir and Lockhart 1996;
'8 - Langlois and Langis 1995; 9 - Hydro-Quebec 1993

[2] Samples analysed for Cd, Cu, Zn and Se as well as Hg. Samples analysed for Hg only are shown separately.

Table 2. Mean concentrations (ng/g ±SD wet wt) of major organochlorines in freshwater and anadromous fishes from northern Québec (1989-95)

Species	Lake/River	Region		Tissue[1]	N	% lipid	ΣHCH	ΣCHLOR	ΣDDT	ΣPCB	Toxaphene	Ref[2]
char	Kangiqsualujjuaq	Ungava Bay	1990	M	4	10.2 ± 6.1	6.1 ± 5.3	22.7 ± 6.8	11.8 ± 4.0	53.8 ± 31.6	155 ± 59.1	1
	Kangiqsujuaq	Hudson Strait	1990	M	9	8.6 ± 2.0	2.0 ± 0.95	9.8 ± 4.9	5.0 ± 3.0	24.0 ± 9.63	76.5 ± 34.6	1
lake trout	Inukjuak	Hudson Bay	1989	W	5	3.6 ± 1.9	3.1 ± 1.8	11.1 ± 12.2	11.8 ± 14.4	56.6 ± 21.7	34.1 ± 31.1	2
	Salluit	Hudson Strait	1989	W	5	5.1 ± 0.3	1.9 ± 0.5	16.8 ± 5.3	15.2 ± 6.5	44.7 ± 17.5	38.5 ± 10.2	2
	Kangiqsujuaq	Ungava Bay	1989	W	5	4.0 ± 0.9	2.7 ± 1.5	14.1 ± 6.5	23.7 ± 15.4	39.1 ± 17.1	34.7 ± 25.3	2
	Lac Bienville	Grande-Baliene	1989	M	6	1.5	<5.0	<5.0	6.68	47.1	nd	3
	Lac Bienville	Grande-Baliene	1989	L	2	6.0	4.0	<5.0	174	898	nd	3
	Lac Raraire	Grande-Baliene	1989	M	2	0.7	<5.0	<5.0	<5.0	<15.0	nd	3
	Lac Morpain	Grande-Baliene	1989	M	2	2.0	<5.0	<5.0	6.69	34.7	nd	3
	Lac des Loups Marins	Grande-Baliene	1989	M	3	1.0	<5.0	<5.0	5.60	28.9	nd	3
	Lac Amichinatwayach	Grande-Baliene	1989	M	2	1.1	<5.0	<5.0	<5.0	<15.0	nd	3
	Grande-Baliene lakes[3]	Grande-Baliene	1989	M	3	1.0	<5.0	<5.0	<5.0	<15.0	nd	3
Northern pike	Lac Bienville	Grande-Baliene	1989	M	1	0.5	<5.0	<5.0	<5.0	<15.0	nd	3
	Lac Morpain	Grande-Baliene	1989	M	1	0.7	<5.0	<5.0	<5.0	<15.0	nd	3

[1] M=muscle, W=whole fish, L = liver

[2] References: 1 - Muir and Lockhart 1993; 2 - Muir and Rosenberg 1990; 3 - Hydro-Quebec 1993.

[3] Mean concentrations for single samples from Lac Bienville, Lac des Loups Marins and Lac Wapask

Table 3. Organochlorines in marine mammal tissues from Northern Quebec waters (ng/g wet wt)

Region	Location	species	Tissue[1]	sex		N	Lipid	ΣCBz	ΣHCH	ΣCHL	ΣDDT	ΣPCB	Toxaphene	Ref[2]
Hudson Strait	Salluit	harp seal	B	F	1990	8	nd[2]	nd	nd	nd	486 ± 289	897 ± 295	nd	1
E. Hudson Bay	Inukjuaq	ringed seal	B	F	1989-92	7	92.9 ± 5.3	55 ± 53	276 ± 231	1008 ± 1338	1006 ± 1164	1301 ± 1560	307 ± 327	2
				M		4	94.7 ± 2.0	62 ± 17	275 ± 123	708 ± 453	1143 ± 681	1234 ± 636	221 ± 112	
Hudson Strait	Kangiqsujuaq	ringed seal	B	M	1989	16	86.3 ± 7.9	51 ± 29	225 ± 113	801 ± 1076	839 ± 1543	854 ± 1245	353 ± 500	3
				F		8	87.2 ± 9.6	66 ± 38	319 ± 152	721 ± 651	691 ± 763	588 ± 607	294 ± 304	
Hudson Strait	Salluit	ringed seal	B	F	1989	2	94.3	54	138	502	616	535	169	3
Ungava Bay	Kangiqsualujjuaq	ringed seal	B	F	1989	3	80.6 ± 12.8	48 ± 7.3	136 ± 15	194 ± 98	179 ± 112	432 ± 277	136 ± 82	3
				M		2	83.4	39	102	254	419	360	86	
E. Hudson Bay	Grande-Baliene	freshwater seal	M	?	1989-90	4					8.2[3]	225		4
E. Hudson Bay	Inukjuaq	bearded seal	B	M	1989	3	68.8 ± 12.1	24 ± 3.1	75.1 ± 11	514 ± 198	501 ± 239	387 ± 153	505 ± 153	3
				F		2	74.1	17	57.3	383	345	367	414	
Hudson Strait	Kangiqsujuaq	bearded seal	B	M	1989	2	80.6	13	69.5	415	267	415	424	3
E. Hudson Bay	Inukjuak	walrus	B	M	1989-92	4	84.5 ± 4.7	67 ± 33	267 ± 149	6293 ± 4236	4609 ± 3165	11512 ± 8465	3493 ± 2443	2
				F		9	82.4 ± 4.2	62 ± 48	214 ± 114	2753 ± 1784	2164 ± 924	4790 ± 2376	1451 ± 954	
E. Hudson Bay	Akulivik	walrus	B	M	1991	8	83.2 ± 5.5	23 ± 13	116 ± 77	1169 ± 2105	561 ± 1087	1201 ± 2056	420 ± 286	2
E. Hudson Bay	Grande-Baliene	beluga	M	?	1989-90	5					40.6	13.1		4
			B		1989-90	2			130 - 250	2880 - 3609	7360 - 17330	3370 - 3810		4
E. Hudson Bay	Sanikiluaq	beluga	B	F	1994	10	93.4 ± 2.2	254 ± 122	335 ± 87	1450 ± 943	1697 ± 1391	2185 ± 1559	7185 ± 3614	5
				M		7	94.6 ± 0.8	460 ± 255	442 ± 133	4167 ± 1585	#### ± 8231	6768 ± 2346	14150 ± 7041	
E. Hudson Bay	Naskapoca R.	beluga	B	M	1984/85	8	86.5 ± 2.2	320 ± 200	210 ± 60	1860 ± 350	2270 ± 680	2770 ± 510	4130 ± 820	6
				F		8	86.4 ± 3	160 ± 130	150 ± 40	870 ± 580	980 ± 730	1230 ± 840	1990 ± 1100	
E. Hudson Bay	Naskapoca R.	beluga	B	M	1987	6	85.8 ± 5.9				5530 ± 670	7990 ± 1990		6
				F		6	88.7 ± 2.9				1960 ± 2050	2530 ± 2950		
			M	M	1987	6	1.3 ± 0.7				27.6 ± 12.6	67.2 ± 22.3		5
				F		6	1.2 ± 0.2				9.9 ± 8.9	26.2 ± 26.0		

[1] B= blubber; M = muscle

[2]References: 1. Beck *et al.* 1994, 2 - Muir et al. 1995, 3 - Muir and Rosenberg 1991; 4 Langlois and Langis 1995, 5 - Muir et al. 1990; 6 - Muir 1996

[3] - DDE only