



Plasma concentrations of persistent organic pollutants in the Cree of northern Quebec, Canada: Results from the multi-community environment-and-health study



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HIGHLIGHTS

- Plasma concentrations of 17 POPs for 9 Canadian Cree First Nations (n = 1776)
- POPs concentrations generally increased with age except for PBDEs.
- Sex differences were limited to specific contaminants (e.g., PBDEs and DDT).
- Geographic variation in POPs (order of magnitude difference)

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ABSTRACT

Historically, resource development has had negative impacts on the traditional lifestyle of First Nation Cree Communities in the Province of Quebec, Canada. In response to the perceived need for fisheries restoration and for managing health concerns associated with environmental pollutants, the Mercury Program in the James Bay Region of Quebec was reconstituted in 2001 and broadened to include a wider range of chemicals of concern. Based on comprehensive surveys of the nine Cree Territory (*Eeyou Istchee*) communities in this region during the period 2002–2009, blood plasma concentrations are presented of Aroclor 1260, PCB congeners 28, 52, 99, 101, 105, 118, 128, 138, 153, 156, 163, 170, 180, 183, and 187, Aldrin, β -HCH, α -Chlordane, γ -Chlordane, oxy-Chlordane, trans-Nonachlor, cis-Nonachlor, *p,p'*-DDT, *p,p'*-DDE, Hexachloro benzene (HCB), Mirex, PBB 153, PBDE 47, PBDE 99, PBDE 100, PBDE 153, Toxaphene 26, and Toxaphene 50. The organohalogenated compounds were extracted using solid-phase extraction and cleaned on florisol columns before high resolution HRGC–MS analysis. Principal component analysis (PCA) was used to reduce the large number of contaminant variables into a smaller number of uncorrelated variables. ANOVA identified significant differences between age groups, with the older participants having higher body burdens of legacy lipophilic contaminants, but not for the PBDEs. In certain female age groups, plasma concentrations of PBDEs were observed to be lower than for males; conversely, DDT was higher. Among communities, concentrations were different ($p < 0.001$) for all contaminants. This work provides a baseline for the James Bay *Eeyou Istchee* communities who, to varying degrees, rely on food and other resources from the land and therefore are at higher risk of increased body burdens of legacy persistent organic pollutants (POPs).

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1. Introduction

POPs such as polychlorinated biphenyls (PCBs) and dichlorodiphenyltrichloroethane (DDT) are ubiquitous, semi-volatile, and

lipophilic. Many arctic and subarctic communities are especially impacted by environmental contaminants (AMAP, 2012). This suite of environmental contaminants is referred to as the legacy POPs, which are relatively resistant to photochemical, biological, and chemical degradation; thus they persist in the environment, and bioaccumulate and biomagnify in food chains (AMAP, 2012; Donaldson et al., 2010; Letcher et al., 2010). Typically, exposure to most legacy POPs in First Nation communities in Canada and similar native communities elsewhere

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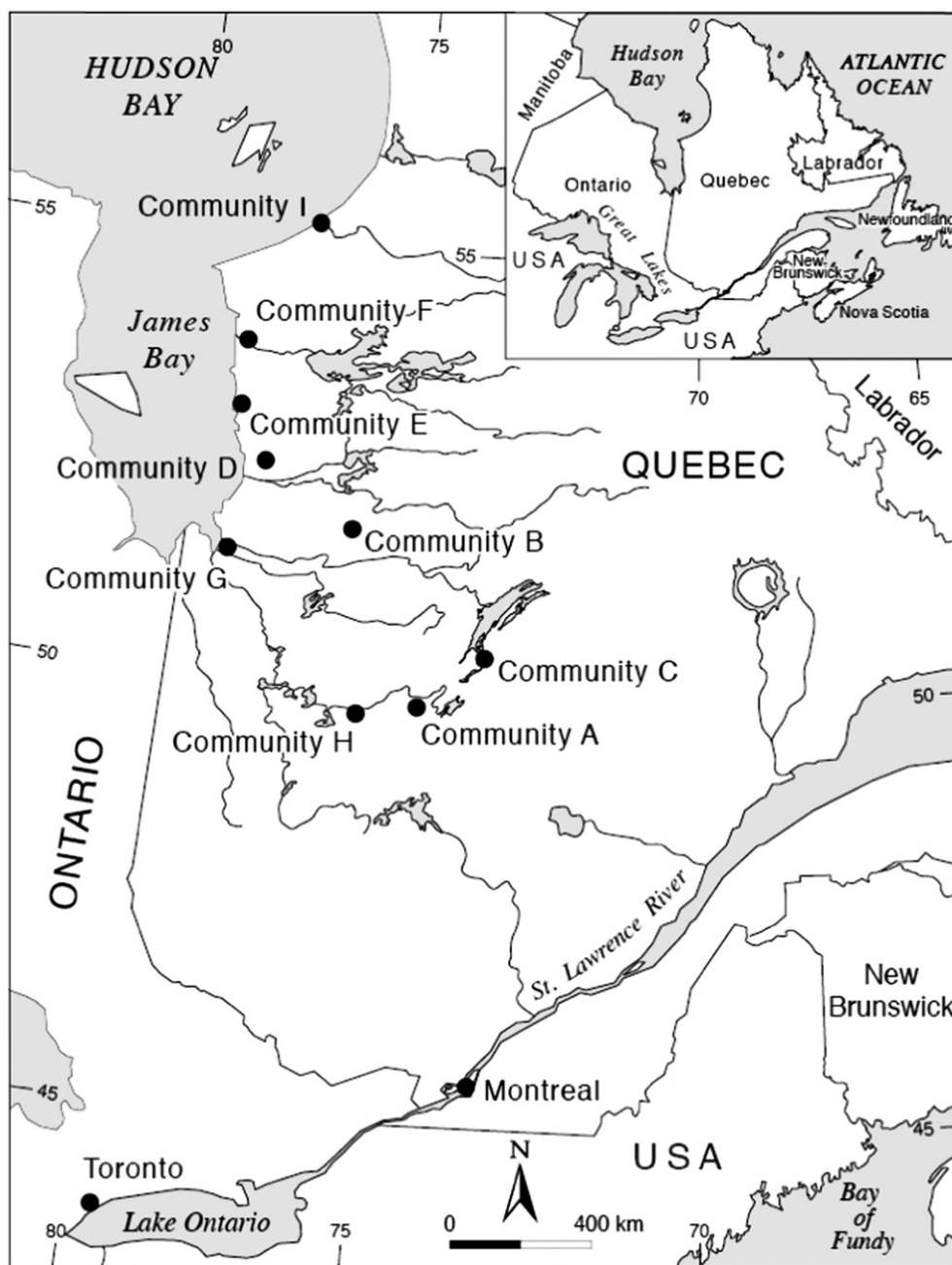


Fig. 1. The nine Eeyou Istchee communities of James Bay, Quebec (coded A to H) in relation to major population centers in Canada.

has been ascribed to dietary intake of traditional foods (Butler Walker et al., 2003; Sandanger et al., 2009; Tsuji et al., 2007a, 2007b, 2008; Van Oostdam et al., 1999, 2005) although in some cases such as the polybrominated diphenyl ethers (PBDEs) fire retardants, leaching from commercial and household goods appear to contribute to the human body burden (Frederiksen et al., 2010; Liberda et al., 2011). Known adverse effects of exposure to some of these contaminants in humans and animals include endocrine and metabolic disruption, immunotoxicity, neurotoxicity, and perhaps carcinogenicity (Gascon et al., 2013; Gill et al., 2013; Segner et al., 2011; Wong et al., 2012; Wu et al., 2013).

Concerns with the human health impacts of exposures to POPs in northern communities stem primarily from aboriginal peoples' greater dependency on a subsistence diet of traditional foods, when compared to more urban communities (Dewailly et al., 1989). Additionally, resource development (e.g., hydroelectric power generation, forestry and mining) in or near many Cree First Nation communities of the James and Hudson

Bay regions of northern Quebec, Canada, may act as point sources of contaminants. Thus, increased levels of POPs and metals may be present in the environment, in addition to those accruing from long range transport.

Table 1

Community data (The Grand Council of the Crees, 2013; Statistics Canada, 2010).

Community	Population	Year sampled
Community A	622	2002
Community B	616	2002
Community C	2679	2005
Community D	561	2007
Community E	1178	2007
Community F	3820	2008
Community G	1967	2008
Community H	1473	2009
Community I	798	2009

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