Spatial and temporal trends of flame retardants in ringed seals (Phoca hispida) from the Canadian Arctic

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ABSTRACT

Concentrations of polychlorinated dibenzo-p-dioxins (PCDDs) and alternative flame retardants were analyzed in ringed seal (Phoca hispida) harvested during aboriginal hunts between 1998 and 2012. Results indicated that the highest PCDD concentrations (sum of 13 congeners) were found in seals in Nain (Labrador) as well as in Iqaluit and Arviat (Pond Inlet Bay). The lowest mean concentrations were found in seals from Lancaster Sound, Resolute Bay (2004) and 2009 were the predominant congeners quantified. The most frequently detected non-PCDD flame retardants were 1,2,3,4,5,6,7,8-octachlorodibenzo-p-dioxin (TEP) and 1,2,3,4,6,7,8,9-octachlorodibenzofuran (HCB). These results are consistent with previous studies in the region and did not change during the past decade The increase of flame retardants in ringed seal’s skin suggest increased contaminant in the Canadian Arctic environment.

INTRODUCTION

The ringed seal (Phoca hispida) is:
• the most abundant Arctic pinniped with a large geographic distribution
• a relatively sedentary seal species of a great cultural, economic, and nutritional importance to native communities
• a key biomonitor organism for the evaluation of spatial and temporal trends of persistent environmental pollutants in the Arctic
• a high trophic level marine mammal inhabiting northern industrialized regions as well as remote locations such as the Canadian Arctic archipelago, Alaska north slope, Greenland and Scotland.

A large suite of organic contaminants, including flame retardants, have been reported in their tissues

OBJECTIVES

• Evaluate the spatial distribution of PCDDs as well as a suite of alternative flame retardants in blubber of ringed seals harvested during subsistence hunting across the Canadian Arctic
• Determine the temporal trends of these chemicals
• This information will help understand the long-range transport of flame retardants to higher latitudes as well as evaluate repercussions of the PCDD regulations on Canadian Arctic wildlife.

RESULTS

Results indicate:
• The highest HCB concentrations were found in Nain in 2002 and 2007 (29.8 ng/g lw.) and 19.8 ng/g lw.) respectively. Arviat in 2006 (20 ng/g lw) and Nain in 2005 (28.8 ng/g lw.) were the three southernmost sites of this study.
• The lowest mean concentrations were found in seals from Resolute Bay, Grise Fiord and Arctic Bay (≤ 4 ng/g lw).
• PCDD concentrations did not change over time in seal blubber from Sachs Harbour (p=0.06, 12% year) and East Baffin (p=0.001, 12% year).
• PBDE concentrations between the two Hudson Bay sites were significantly different for both years of simultaneous sampling (2002 and 2007) with highest levels found in female and juvenile male ringed seals collected in Resolute Bay (2002: 29.6±3.2 ng/g lw; 2007: 19.6±5.7 ng/g lw.) compared to the western site (11.2±2.1 ng/g lw, 8.3±3.6 ng/g lw.)
• The most frequently detected non-PCDD flame retardants in Canadian ringed seals were TBPED and HCB.
• Rapid HCB concentration increased in seals from Beaufort Sea (p=0.003, 113% increase), of Nain (p=0.001, 10% increase), and East Baffin (p=0.001, 167%).
• Results of this long-term study indicate the on-going bioaccumulation of regulated PCDDs and alternative flame retardants in pliopods throughout the Canadian Arctic suggesting the continuous input of these chemicals in the Arctic environment.

REFERENCES


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