Organohalogen Compounds, Volume 61, Pages 321-324 (2003)

PCDD/Fs IN ARCTIC MARINE AND FRESHWATER BIOTIC MEDIA

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Introduction

Study of the environmental and biosphere pollution of arctic areas has been carried out by northern countries for a long time but there is only a limited volume of data related to arctic regions of Russia[1]. Since the previous AMAP assessment data on some wild animals have become available[2]. The aim of this research was determination of PCDD/Fs concentration in fish and sea animals, estimation of the arctic biota background pollution as the first stage of studying biomagnification in food chains of the Russian Arctic and assessment of PCDD/Fs impact on the indigenous population.

Materials and Methods

Pool samples of muscles and fat of different types of fish served as an object of research (chum salmon, omul, broad whitefish, ide, arctic charr, inconnu, pike, whitefish), some species of seal (ringed seal, bearbed seal**)** and an individual sample of a three years old specimen of gray whale. The area of sampling presented the main semi-polar regions of Russia: Kola Peninsula (settlement Lovozero), downstream water of the Pechora river (settlement Oksino), Taimir Peninsula (settlements of Dudinka and Khatanga) and Chukotka Peninsula (settlements of Lavrenty and Kanchalan).

The samples were thawed and skinned. The muscle and fat were homogenized, subdivided into smaller replicate portions (100 g) and stored at –20° C prior to analysis. Extraction was carried out with methylene chloride-hexane-ethyl acetate and enrichment by defatting followed by separation on SiO_2-Al_2O_3-Carbopac C/Celite columns. Measurement was made by GC/HRMS in the EI mode. Quantification was performed by the isotope dilution internal standard method using carbon-13 congeners (CIL). Analysis of blank samples and reference material (cod liver) was made. Recoveries of internal standards added prior to injection ranged between 63-81%. Detection limits of for PÑDD/Fs ranged between 0.1-0.5 pg/g lipid.

Results and Discussion

PCDD/Fs were detected in all fish samples (figure 1). The TEQ-WHO (fish) PÑDD/Fs ranged from 0.02 to 0.9 pg/g w.w. (1.31-14.0 pg/g lipids). The found values actually correspond to the levels in fish from other arctic countries. Thus, PCDD/Fs were found in pike and in whitefish (0.05-0.08 pg/g w.w.) from lakes in Sweden, in lakes of Norway values up to 8.29 pg/g w.w. were found[2]. In the samples of atlantic salmon from the Varzuga river on Kola Peninsula, Russia increased PCDFs and especially PCBs content was found in comparison with samples from rivers of Norway, though there were no essential differences in TEQ PCDD/Fs of samples that was changing within the range of 29.2-34.6 pg/g lipids or 0.7-1.0 pg/g w.w.[3]. The new found levels are somewhat lower but both fish samples from Kola Peninsula also contain increased PCDD and particularly PCDFs levels unlike the samples from other regions of Russia. But in the sample of chum salmon from Chukotka TEQ PCDFs almost by 2 times exceeded of TEQ PCDDs also.

Table 1. **Pool samples of fish muscles, Russian Arctic**

Region of sampling	Species of fish		N	% lipids
Kola Peninsula (settlement Lovozero)	Whitefish	*Coregonus lavaretus*	10	0.9
	Pike	*Esox lucius*	12	0.6
Lower Pechora (settlement Oksino)	whitefish	*Coregonus lavaretus*	12	4
	Ide	*Leuciscus idus*	12	3.3
Taimir Peninsula (settlement Dudinka)	whitefish	*Coregonus lavaretus*	10	1.7
	omul	*Coregonus autumnalis*	10	2.9
Taimir Peninsula (settlement Khatanga)	whitefish	*Coregonus lavaretus*	10	2
	broad whitefish	*Cerogonus nasus*	10	1.6
Chukotka (settlement Kanchalan)	Inconnu	*Stenodus nelma*	10	0.8
	Broad whitefish	*Cerogonus nasus*	10	1.1
Chukotka (settlement Lavrentiya)	chum salmon	*Oncorhynchus keta*	10	0.5
	Arctic charr	*Salvelinus alpinus*	10	3.1

TEQ for fat of seal and whale from Chukotka makes 1-1.76 pg/g lipids, i.e. corresponds to the low limit of values found for ringed, harp and fur seal blubber from Arctic and Antarctic (1.4-29 pg/g fat TEQ), but corresponds to the values found in permanent fatty soil from Chukotka polluted with fat of sea animals – 0.73 pg/g fat [4]. PCDD/Fs content in muscles is increased by 2-4 times for different species converted to lipids (figure 2). PCDDs are prevailing over PCDFs (figure 3).

Table 2 Pool samples of sea animals, Chukotka Peninsula, the settlement of Lavrenty

Region of sampling	Species of of animals		N	% lipids
Ringed seal	*Phoca hispida*	Muscles	8	5.4
Ringed seal	*Phoca hispida*	adipose tissue	8	98.8
Bearbed seal	*Erignatus barbatus*	Muscles	2	2.3
Bearbed seal	*Erignatus barbatus*	adipose tissue	2	86.2
Seal	*Phoca largha*	Muscles	10	4.5
Seal	*Phoca largha*	adipose tissue	10	83
Grey whale	*Eschichtius gibbosus*	Muscles	1	0.7
Grey whale	*Eschichtius gibbosus*	adipose tissue	1	42.5

Acknowledgment

This research has been carried out as a component part of the project of RAIPON/AMAP/GEF "Persistent Toxic Substances (PTS), Food Security and Indigenous Peoples of the Russian North". The authors express their gratitude to the Secretariat of AMAP for organization of this research in Russia, and to the staff of the Centre for Monitoring in Arctic and RAIPON for organization of sampling in difficult conditions of Russian Semi-Polar regions. This abstract is published upon the permission of AMAP Secretariat.

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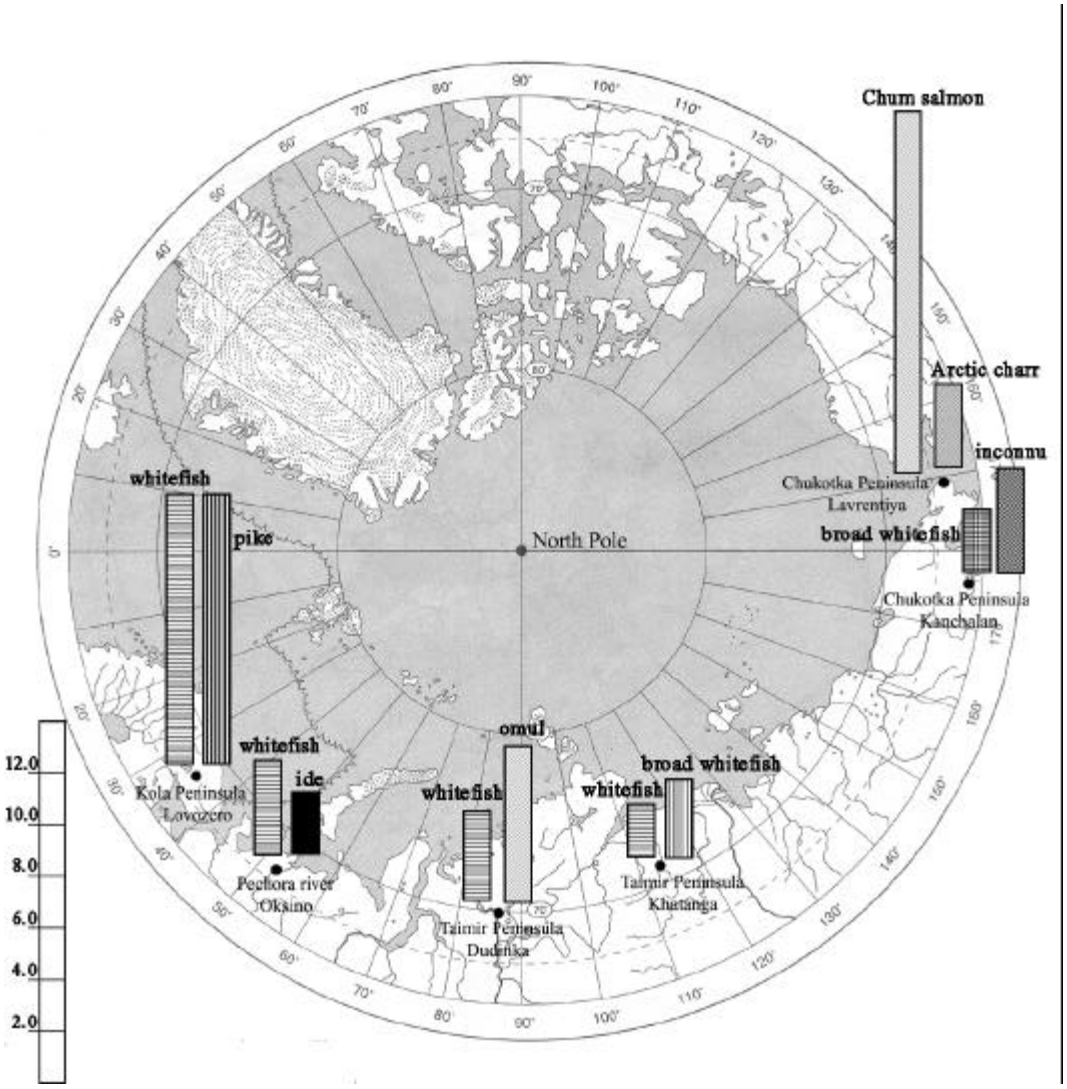

Figure 1. PCDD/Fs in different species of fish, TEQ-WHO, pg/g l.w.

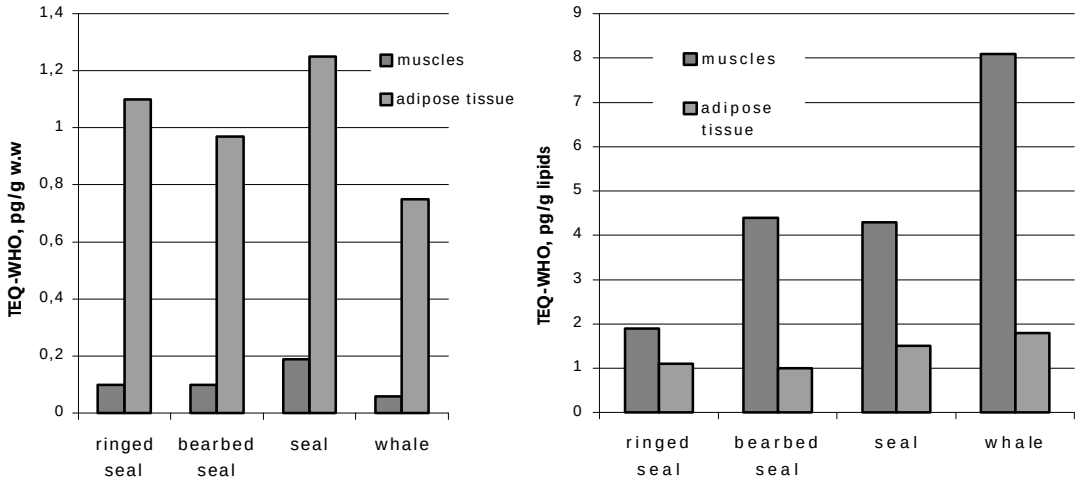

Figure 2 TEQ-WHO PCDD/Fs in muscles and adipose tissue of marine animals

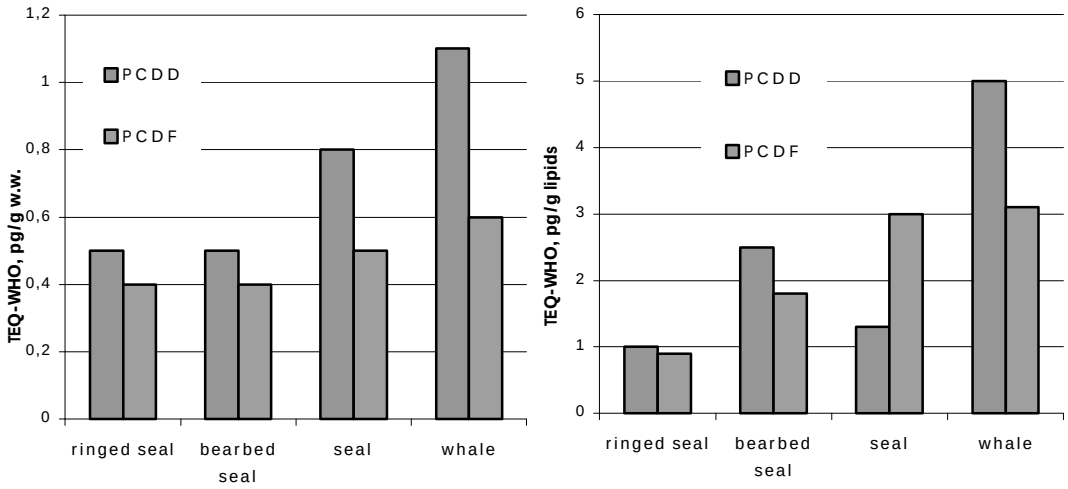

Figure 3. PCDDs and PCDFs in the samples of adipose tissues of marine animals