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Chemistry and Ecology

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713455114>

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Online publication date: 14 September 2010

To cite this Article Roots, Ott(2003) 'Halogenated contaminants in female perch from the Matsalu Bay (Baltic Sea)', *Chemistry and Ecology*, 19: 1, 1 – 3

To link to this Article: DOI: 10.1080/0275754031000108162

URL: <http://dx.doi.org/10.1080/0275754031000108162>

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HALOGENATED CONTAMINANTS IN FEMALE PERCH FROM THE MATSALU BAY (BALTIC SEA)

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(In final form 14 June 2002)

Polychlorinated biphenyls (PCBs), DDT-related substances, hexachlorocyclohexane (HCH) and hexachlorobenzene (HCB) were analysed in female perch (*Perca fluviatilis*) collected in August and September 1999 in Matsalu Bay (Baltic Sea). Concentrations of all halogenated compounds were very low and notably lower than threshold values reported by FAO/WHO guidelines.

Keywords: Baltic Sea; Estonia; PCB; DDT; HCH; HCB; Perch

Halogenated organic contaminants released into marine ecosystems are of great concern for their toxicity, persistence, bioaccumulation through the food chain, and the public health aspects, such as consumption of fish. The Baltic Sea is an important sink of these substances, but their concentrations as well as the potential detrimental effects on living biota are still rather limited (Blomkvist *et al.*, 1993; Roots, 1995; Olsson *et al.*, 1999; Agrell *et al.*, 2001). In this perspective, perch (*Perca fluviatilis*) collected in coastal waters of the Estonian Republic has been utilised as a model for assessing the potential health risk induced by the presence of organochlorine compounds. Seventeen female perch were collected between August and September 1999 in Matsalu Bay. Matsalu Bay is located in the eastern part of the Väinameri Region (western coast of the Estonian Republic) and is one important area for perch fishing (average fishing productivity of 2.5 kg/ha; Järv, 2000). This area belonging to the West-Estonian Archipelago Biosphere Reserve (WEABR) is characterised by salinity values ranging from 5.0 to 6.5 in the western part and <1.0 in the eastern sector.

Before chemical analyses, length, weight, sex and maturity stage of all animals were determined (Tab. I). ca.10 g of fish muscle was utilised for chemical analyses. Reagents utilised for chemical determinations were of analytical grade. *n*-hexane, acetone and diethyl ether were obtained from Riedel-de Haen AG (Seelze, Germany) and Fisons Discol Solvent (UK), whereas methyl-tert-butyl ether (MTBE) were obtained from Rathburn Chemical (Walkerburn, Scotland). 2,3,4,5,3',4',5'-heptachlorobiphenyl (IUPAC No 189, Ballschmitter *et al.*, 1993), were synthesised at the Department of Environmental Chemistry. Clophen A-50 from Bayer AG (Germany) was utilised for the quantification of the total PCB.

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TABLE I Biological Parameters of Female Perch Collected in Matsalu Bay (Number 1–6, Samples Collected in August 1999; Number 7–17, Samples Collected in September 1999).

<i>Number</i>	<i>Length (mm)</i>	<i>Weight (g)</i>	<i>Maturity</i>	<i>Age (years)</i>	<i>Lipid (%)</i>
1	362	621	VI–II	10	0.43
2	332	591	VI–II	10	0.41
3	310	414	VI–II	7	0.51
4	258	247	VI–II	6	0.69
5	256	238	II	6	0.64
6	280	291	II	6	0.56
7	285	290	III	6	0.21
8	245	199	III	5	0.22
9	260	241	III	5	0.47
10	295	388	III	6	0.23
11	245	219	III	6	0.33
12	305	387	III	7	0.12
13	390	825	III	11	0.21
14	375	629	III	9	0.34
15	310	377	III	7	0.36
16	365	593	III	8	0.27
17	300	400	III	7	0.37

Halogenated contaminants in fish muscle were extracted according to Jensen *et al.* (1983) and Roots (1995) and analysed by capillary gas-chromatography (Varian 3400/3300) equipped with a electron capture detector (ECD).

Polychlorinated biphenyl (PCB), DDT-related substance, hexachlorocyclohexane (HCH) and hexachlorobenzene (HCB) concentrations in perch collected in Matsalu Bay are shown in Table II. These values are very low and up to ten times lower than those reported

TABLE II Mean and Median Values (mg/kg lipids) and Coefficient of Variation of Biological and Chemical Variables in Female Perch Collected in Matsalu Bay.

	<i>Mean</i>		<i>Median</i>		<i>Coefficient of variation</i>	
	<i>August</i>	<i>September</i>	<i>August</i>	<i>September</i>	<i>August</i>	<i>September</i>
Age (years)	7.5	7.0	6.5	7.0	26	26
Length (mm)	300	307	295	300	14	16
Weight (g)	400	414	352	387	43	47
Lipid (%)	0.54	0.28	0.54	0.27	21	35
α -HCH	2.9	2.8	2.6	2.0	46	99
γ -HCH	135.5	31.8	41.0	28.5	133	63
HCB	14.2	13.3	13.2	9.5	70	82
p,p'-DDE	175.3	574.3	183.9	544.7	33	74
p,p'-DDD	90.0	306.4	73.9	247.6	52	56
p,p'-DDT	188.3	248.2	162.6	255.3	42	51
sum DDT	453.5	1128.8	389.6	1017.6	38	58
IUPAC PCB:						
28 + 31	75.8	53.0	39.9	7.5	115	255
52	68.2	39.1	52.7	19.9	72	156
101	77.7	56.4	84.1	30.8	35	118
118	94.8	67.0	96.0	52.6	48	131
153	119.8	100.1	126.1	81.0	30	62
105	57.0	45.5	61.2	26.3	33	118
138 + 158 + 163	120.3	116.5	116.9	85.3	40	71
180	22.1	41.8	20.3	42.0	27	41
sum PCB	635.7	519.4	658.5	355.3	36	99

TABLE III Safe Concentrations of Halogenated Contaminants in Perch Collected in Matsalu Bay.

Perch ($n = 7$)	sum DDT* = 0.07×10^{-3}	Part of ADI
	sum DDT* = 0.007×10^{-3}	Part of NOEL
Length (24.5–39.0 cm)	sum HCH** = 0.09×10^{-3}	Part of ADI
	sum PCB*** = 0.03×10^{-3}	Part of NOEL

*sum DDT = p,p'DDE + p,p'DDD + p,p'DDT;

**sum HCH = α -HCH + γ -HCH;

***sum PCB = IUPAC No. 28, 31, 52, 101, 118, 153, 105, 138, 158, 163 and 180.

in perch collected in the Baltic Sea between late 1960s and early 1970s (Roots, 1995). Similar concentrations were found in perch collected in a relative pristine area of the Swedish coast (Haraguchi *et al.*, 1992; Valters 2001), suggesting that also Väinameri Region was relatively unpolluted by halogenated organic compounds. On the basis of halogenated contaminant concentrations found in this study, we try to evaluate the potential risks for human health by means of ADI (acceptable daily intake) and NOEL (no observed effect level) values previously reported (Reports and Studies, 1991). Safe concentrations were obtained by using 150 g of eaten fish per day, instead of 60 g per day of European countries. These calculations demonstrate that, even if the highest organochlorine concentrations are considered, the consumption of perch from Väinameri Region do not represent any human health risk (Tab. III).

Acknowledgements

This research was financially supported by the Ministry of the Environment and by the Research and Writing Initiative of the Program on Global Security and Sustainability of the John D. and Catharine T. MacArthur Foundation Grant (No. 01-68124-00). Author thanks V. Zitko for help in statistical analyses and L. Järv for biological determinations on perch samples.

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