

DIOXINS IN THE BALTIC HERRING AND SPRAT IN ESTONIAN COASTAL WATERS

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Introduction

Polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF) are a group of toxic and persistent chemicals whose effect on human health and on the environment include dermal toxicity, immunotoxicity, reproductive effects and teratogenicity, endocrine disrupting effects and carcinogenicity. Toxic properties of dioxins well known at present however, among 75 PCDD only 7 isomers are toxic and among 135 PCDF – 10.

EU Council Regulation 2375/2001 put the threshold limit value of dioxins in fish - 4 pgTEQ/g wet weight. The Baltic Sea fish have been separately brought out because in them the dioxins content presumably exceed the threshold. There are large regional differences in the observed levels [1-3].

The aim of these investigations was to pinpoint the regions with higher toxicant concentrations, so that we could focus on the examination of these above-mentioned areas.

Methods and Materials

In the 2002 dioxin concentrations in the Baltic Sea fish from four areas of the Estonian coastal waters were determined.

We selected baltic herring (*Clupea harengus*) and sprat (*Sprattus sprattus*) [4], because:

- they can be caught in all parts of the Baltics (this is important for comparison);
- they are important commercial species;
- their biology is fairly well known;
- they are of suitable size for preanalytical sample treatment;
- they are easy to collect;

Fish were caught from the eastern and central parts of the Gulf of Finland, Gulf of Riga and Open Baltic Sea (Central Baltic). Collection data, length, weight, age of fish analysed are shown in Table 1.

Because there are no facilities for analysing dioxins and furans in Estonia the analysis of the Baltic herring and sprat samples was done at the Institute of Ecological Chemistry of the National Research Centre for Environment and Health in Neuherberg (Germany). The laboratory has been accredited in Germany for determination of dioxins and polychlorinated biphenyls (accreditation licence No. DAC-P-0141-01-00 valid through 21.11.2006). In brief the fish were freeze dried, homogenized before being extracted by employing accelerated solvent extraction. Cleanup encompassed a silica column coated with layers of H₂SO₄ and NaOH followed by column chromatography on a column filled with aluminiumoxide and florisil each. Identification and quantification was achieved by ¹³C-labelled standards and HRGC-HRMS measurements.

Results and Discussion

Of the eight Baltic sprat samples taken from four regions of Estonian coastal waters during the autumn 2002 the dioxin content of them all was below the internationally permitted threshold (Table 1). Therefore, according to the international normatives this Baltic sprat caught from the areas of Estonian coastal waters was qualified for eating.

Table 1. Concentration of dioxins (pgTEQ/g wet weight) in the Baltic herring and sprat from Estonian coastal waters in 2002.

Fish/Area	Length (cm)	Weight (g)	Age (year)	Lipid content (%)	pgTEQ/g wet weight
Sprat					
Open Baltic Sea	12,0	11,2	2,5	15,1	2,4
	12,0	10,9	2,7	14,6	2,6
Gulf of Finland western part	12,6	12,8	3,8	11,5	2,1
	12,0	11,7	2,9	12,7	2,1
	12,1	11,8	3,0	12,3	2,0
	11,8	11,2	2,5	13,3	1,7
Gulf of Finland central part	11,8	11,0	2,6	15,5	1,6
	11,6	10,3	1,9	15,7	2,5
Herring					
Open Baltic Sea	17,6	37,4	6,1	12,2	4,5
	16,1	29,3	4,5	12,2	3,4
	15,5	27,4	3,8	12,1	2,8
Gulf of Finland western part	15,1	23,3	3,3	7,6	2,0
	14,0	18,2	2,5	7,1	1,0
	13,6	17,3	1,8	8,1	0,8
Gulf of Finland central part	15,4	23,6	4,5	6,7	2,0
	14,4	20,1	3,4	8,6	1,4
	14,3	19,3	2,6	8,1	1,3
Gulf of Riga	16,2	28,9	3,8	10,4	2,4
	14,5	21,3	2,3	10,7	1,4
	14,3	20,4	2,3	10,6	1,4

A significant, statistically reliable rise of PCDD/PCDF content can also be observed with increase in age as well as length and weight of the fish in the Finnish data [5;6]. This is not a function of increased fattines of the fish.

The results do not exclude the need to monitor toxicants in fish also in the future, because the use of hazardous chemicals in the Baltic Sea region will probably continue .

Of the twelve Baltic herring samples taken from regions of Estonian coastal waters the dioxin content of them only from one (fish older 6 years old and more than 17 cm length) was above the internationally permitted threshold (Figure 1).

In the Finnish data [5;6] the concentration was highest in the inner part of the Gulf of Finland. On a wet weight basis this corresponds to 2,9 – 24 pg/g. The highest wet weight concentrations were found in fat specimens of old age from the Bothnian Sea and the Gulf of Finland. The samples consisted of pools of herring of age classes 2-18.

Swedish data on dioxin concentrations (TEQ) in individual young herring from the Bothnian Bay range from 8.5 to 57 pg/g lipid weight. In the Southern Baltic Proper the corresponding values are 1.9-56 pg/g [6].

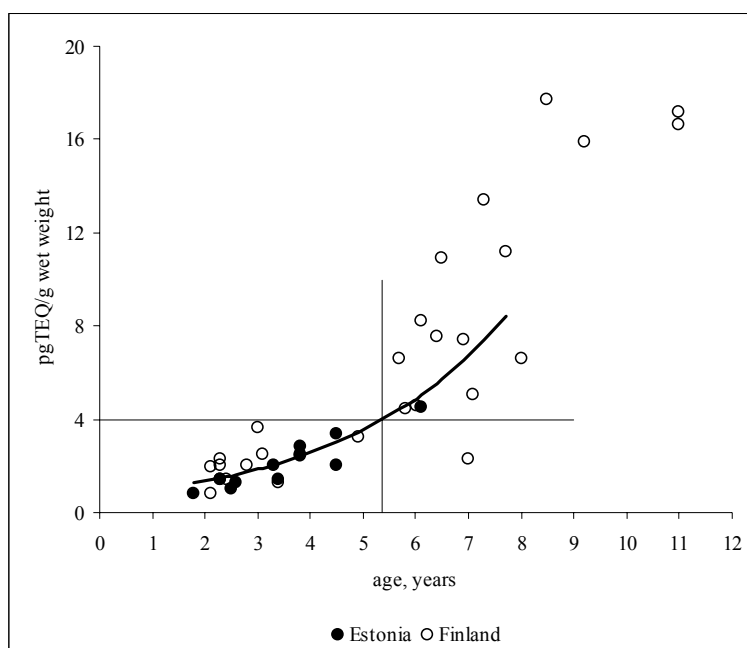


Figure 1. Dioxin concentration (pgTEQ/g wet weight) in Estonian and Finnish [3] Baltic Sea herring muscle tissue.

Acknowledgments

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