

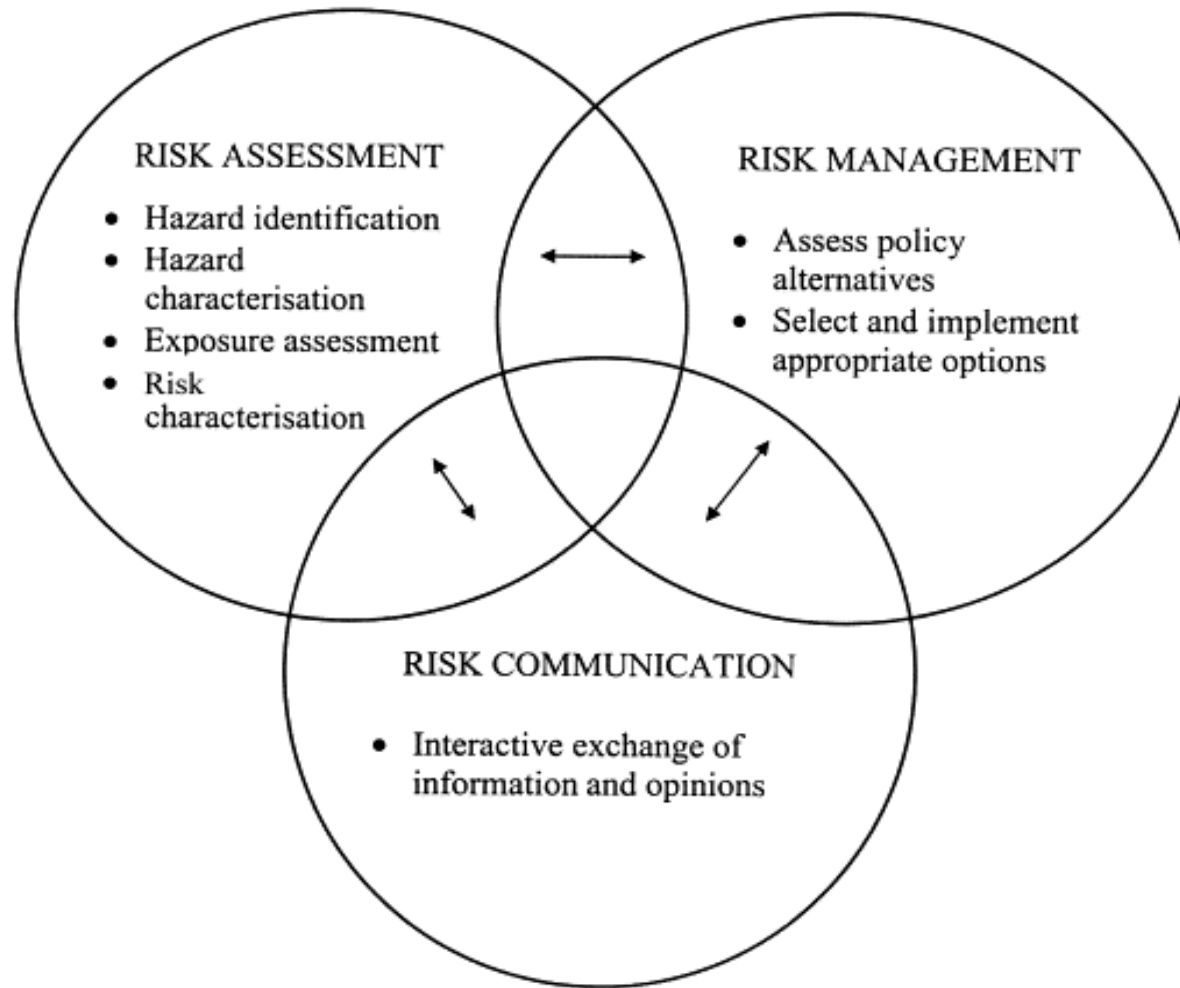
Adverse health effects of environmental pollutants: need for risk analysis

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Foodweb seminar
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Food safety approach

Food safety policy is based on the principle of risk analysis



Environmental Health Criteria 240 (2009)

- [Chapter 1: Introduction](#)
- [Chapter 2: Risk Assessment and its Role in Risk Analysis](#)
- [Chapter 3: Chemical Characterization, Analytical Methods and the Development of Specifications](#)
- [Chapter 4: Hazard Identification and Characterization: Toxicological and Human Studies](#)
- [Chapter 5: Dose-Response Assessment and Derivation of Health-Based Guidance Values](#)
- [Chapter 6: Dietary Exposure Assessment of Chemicals in Food](#)
- [Chapter 7: Risk Characterization](#)
- [Chapter 8: Maximum Residue Limits for Pesticides and Veterinary Drugs](#)
- [Chapter 9: Principles Related to Specific Groups of Substances](#)

Examples of the most important environmental pollutants

- **Dioxins and PCBs**, dioxins formed in many reactions, PCBs used in electrical equipments 1930-1980.
- **PBDEs**, polybrominated diphenylethers, used as flame retardants.
- **PFCs**, perfluorinated compounds, used in many water resistant consumer products.
- **OTCs**, organic tin compounds, used in antifouling paints.

Environmental pollutants

- may have **endocrine disruptive effects**
- suspected of causing **developmental disruption in humans**
- OTCs cause the **masculinisation** of female fish and molluscs
- influence the functioning of fat cells and possibly the tendency **to gain weight**
- PBDEs, dioxins and PFCs have an impact on reproductive health, for instance on **sperm and cryptorchidism**

Many other endocrine Disrupting Chemicals

HERBICIDES

2,4,-D
2,4,5,-T
Alachlor
Amitro
Atrazine
Linuron
Metribuzin
Nitrofen
Trifluralin

FUNGICIDES

Benomyl
Ethylene thiourea
Fenarimol
Hexachlorobenzene
Mancozeb
Maneb
Metiram - complex
Tri-butyl-tin
Vinclozolin
Zineb

INSECTICIDES

Aldicarb
beta-HCH
Carbaryl
Chlordane
Chlordecone
DBCP
Dicofol
Dieldrin
DDT and metabolites
Endosulfan
Heptachlor / H-epoxide
Lindane (gamma-HCH)
Malathion
Methomyl
Methoxychlor
Oxychlordane
Parathion
Synthetic pyrethroids
Transnonachlor
Toxaphene

INDUSTRIAL CHEMICALS

Bisphenol - A
Polycarbonates
Butylhydroxyanisole
Cadmium
Chloro- & Bromo-diphenyl
Dioxins
Furans
Lead
Manganese
Methyl mercury
Nonylphenol
Octylphenol
PBDEs
PCBs
Pentachlorophenol
Penta- to Nonylphenols
Perchlorate
PFOA
p-tert-Pentylphenol
Phthalates
Styrene

Diseases with a Known/Suspected Environmental pollutants

- Cancers
- Birth defects (**cleft palate, cardiac malformations**)
- Reproductive dysfunction (**infertility**)
- Lung dysfunction (**asthma**)
- Neurodegenerative diseases (**Parkinson's**)
- Neurodevelopmental disorders (**autism**)

Persistence of biological effects

- Health effects of exposure to endocrine disruptors can be observed *long after* the actual exposure has stopped.
- This is especially true when exposures occur during growth and development, processes that are very sensitive to endocrine regulation.
- Environment is critical factor in DNA expression; we're born with genes, but environment affects epigenetic changes.

Effects in Wildlife (Fish, Frogs, Reptiles, Birds)

Exposure to Endocrine Disruptors:

- Decreases:
 - Survival
 - Immune system - resistance to disease
- Increase:
 - Size of thyroid
 - Size of liver
 - Abnormal testes and ovaries
 - Spontaneous abortions
 - Abnormal sexual behavior
- Disruption:
 - Thyroid hormones
 - Estrogen - ovarian hormones
 - Androgen - testicular hormones

Need for national dietary advices on fish consumption

**Examples from Finland and Sweden;
both have derogation to exceed MLs of dioxins and
PCBs in specific fish species inside the countries**

Weighting **BENEFITS AND RISKS**

- The most important **benefits** of the fish are directed **to older people** with cardiac vascular diseases.
- Harmful, particularly **hormonal effects** are directed **to younger people**, pregnant women, fetuses, children and young people in fertilized ages.

Problematic Baltic herring

We know:

- Dioxin and DL PCB intake is about at the level of TDI= 2pg/kg/d in Finland.
- Most of the dioxin and PCB intake, 86%, is from fish.
- 50% of that is from Baltic herring.
- In year 2004 average consumption of Baltic herring was 1 kg/year, now it is only 400 g.
- The levels of POPs as well as new data from nutrients, D-vitamin and fatty acids are available for the new project: **risk-benefit analysis of Baltic herring.**

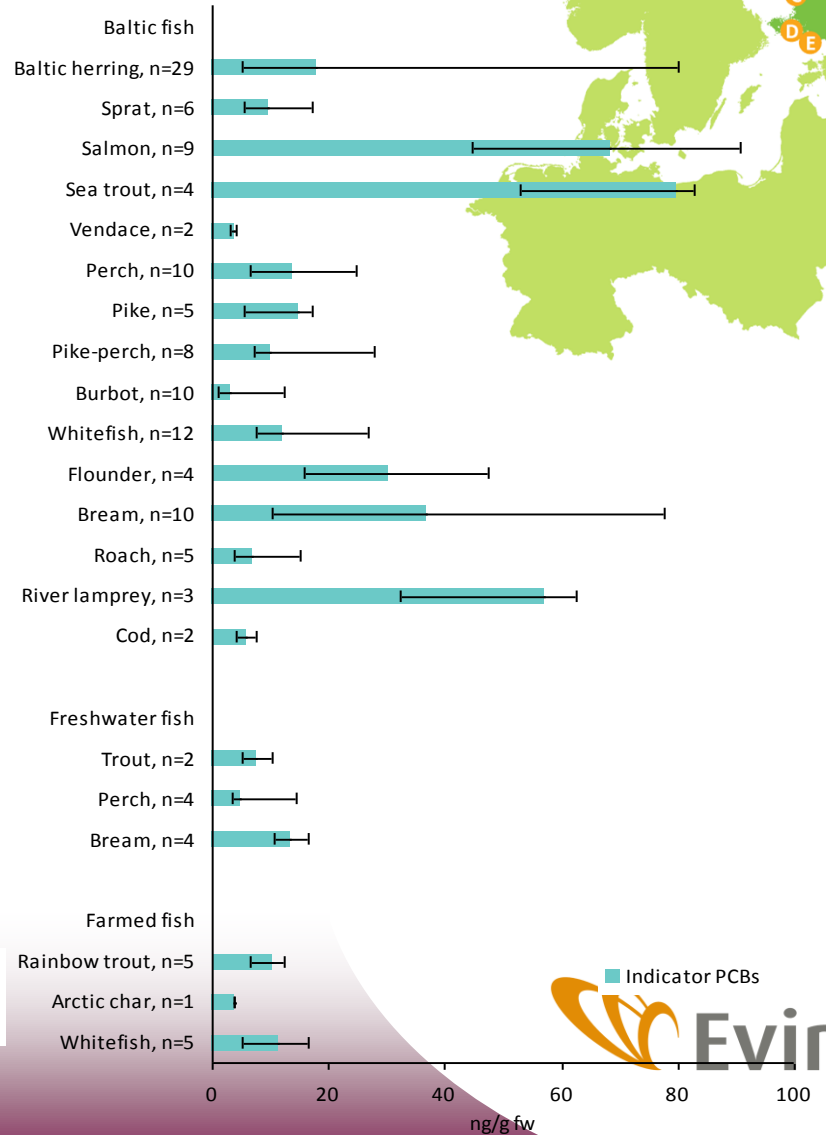
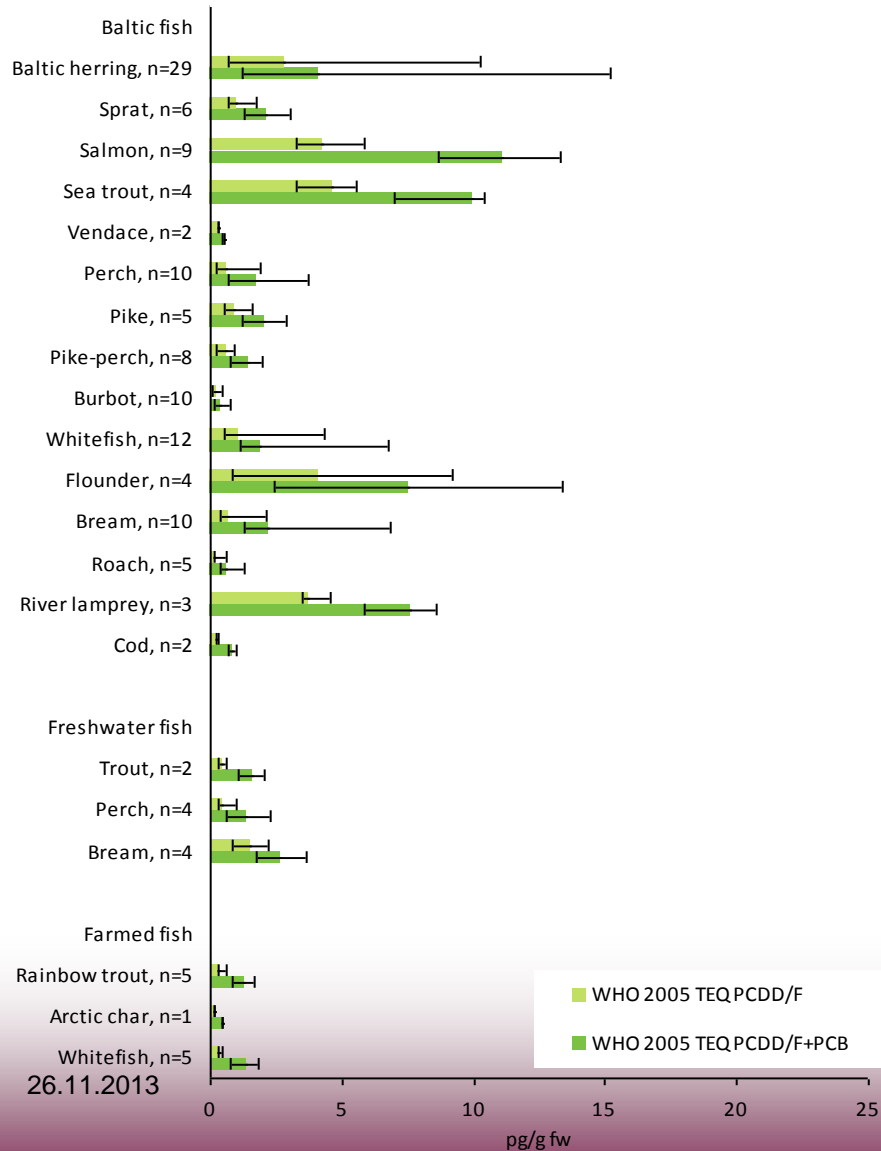
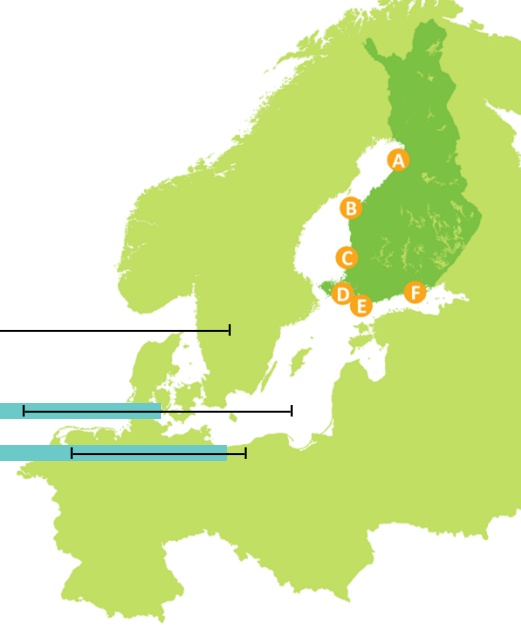
EU FISH II project in Finland

2009-2011

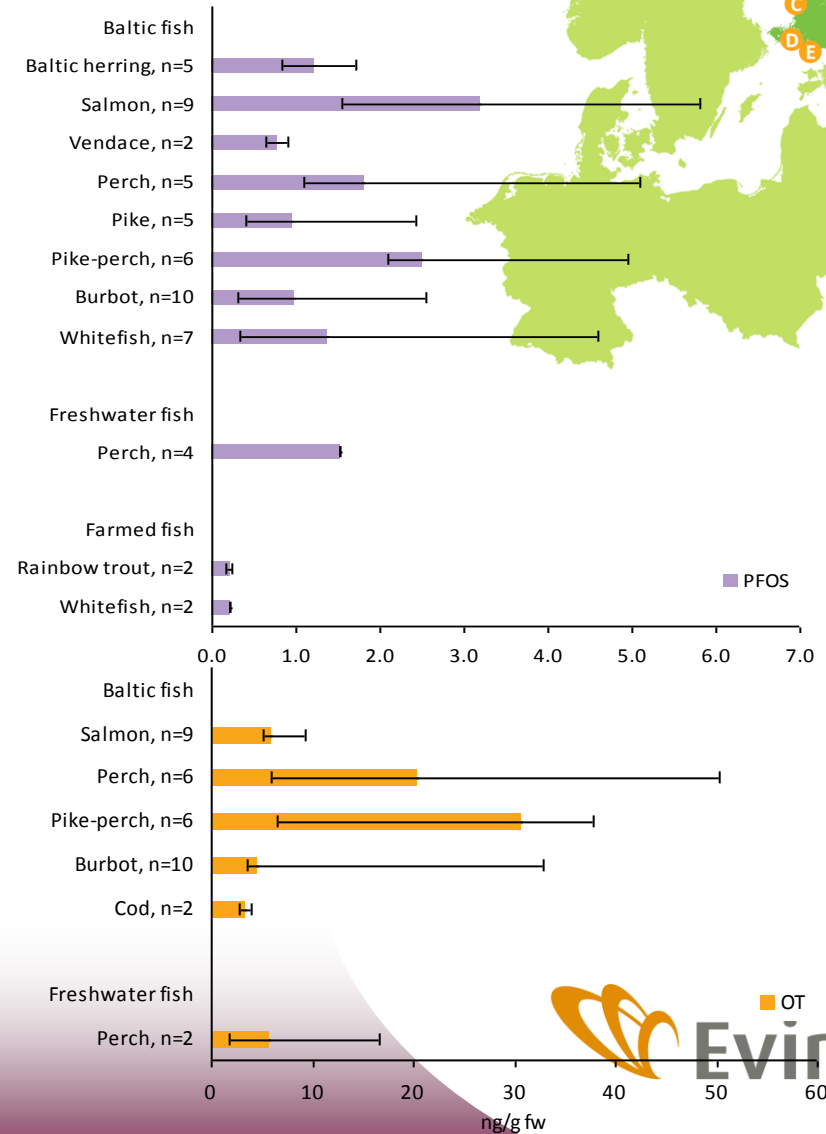
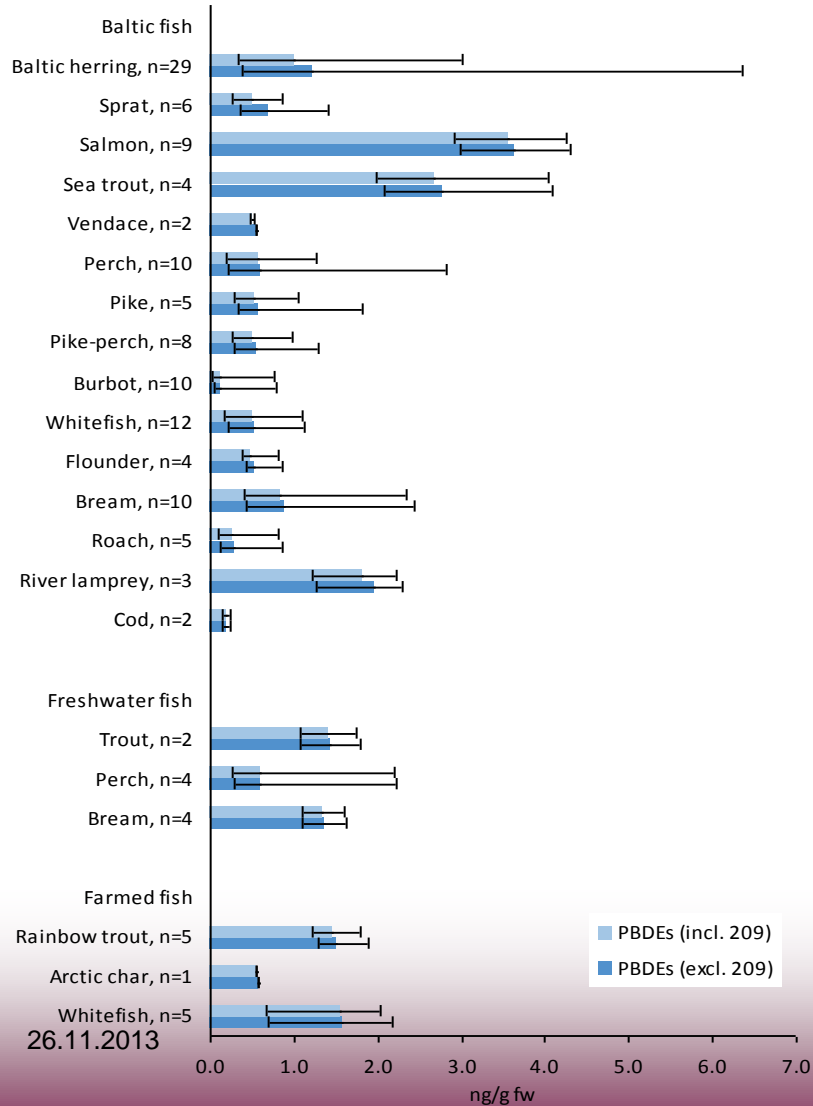
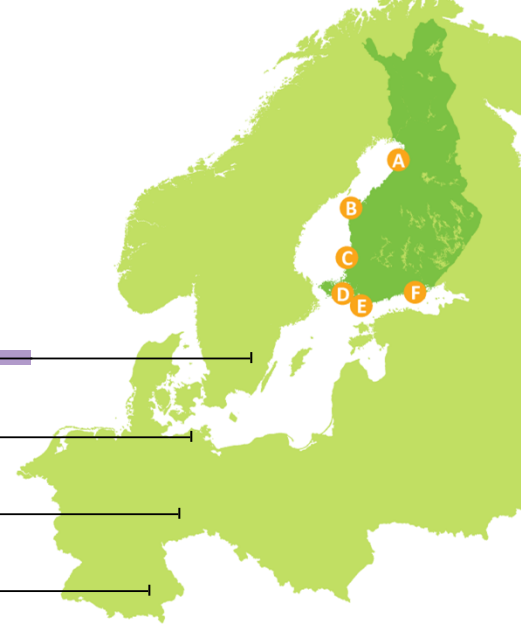
EU fish II publications

- Anja Hallikainen, Riikka Airaksinen, Panu Rantakokko, Jani Koponen, Jaakko Mannio, Pekka.J. Vuorinen, Timo Jääskeläinen and Hannu Kiviranta: Environmental pollutants in Baltic sea fish and other domestic fish: PCDD/F, PCB, PBDE. PFC and OT compounds, **Evira Research reports 2/2011, 1-101**
- Riikka Airaksinen, Panu Rantakokko, Anu W Turunen, Terttu Vartiainen, Pekka Vuorinen, Antti Lappalainen, Aune Vihervuori, Jaakko Mannio and Anja Hallikainen: Organotin intake through fish consumption in Finland, **Environmental Research (2010) 110 (6) : 544-547**
- Kiviranta H, Airaksinen R, Rantakokko P, Vuorinen PJ, Jääskeläinen T, Mannio J, Hallikainen A: PCDD/Fs and PCBs in Baltic sea herring and salmon; concentration changes between 2002-2009, **Dioxin 2011**
- Panu Rantakokko, Anja Hallikainen, Riikka Airaksinen, Pekka Vuorinen, Antti Lappalainen, Jaakko Mannio, Terttu Vartiainen: Concentrations of organotin compounds in various fish species in the Finnish inland waters and Finnish coast of the Baltic sea. **Science of the Total Environment 408 (2010) 2474–2481**
- Anna Karjalainen, Hannu Kiviranta, Tero Hirvonen, Harri Sinkko, Carina Kronberg-Kippilä, Suvi Virtanen, Anja Hallikainen, Olli Leino, Mikael Knip, Riitta Veijola, Olli Simell, Jouni Tuomisto: Long-term daily intake estimates of polychlorinated dibenzo-p-dioxins and furans, polychlorinated biphenyls and polybrominated diphenylethers from food in Finnish children: risk assessment implications. **Food Additives and Contaminants. Part A, 07/2012; 29(9): 1475-88**

The Baltic Sea Summary



The Baltic Sea Summary



Finland; DIETARY ADVICE ON FISH CONSUMPTION and EXCEPTIONS to them

Common dietary advice:

- Fish should be eaten at least twice a week.
- Different fish species should be varied in the diet.

Dietary advice continues

The exceptions to dietary advice have been issued to **children, young people and people at fertile age:**

- **Large Baltic herring**, more than 17 cm in length, can be eaten once to twice a month, (portion 100 g) and as an alternative to large herring.
- **Wild salmon or trout** caught in the Baltic sea can be eaten once to twice a month, (portion 100 g).

Example: Baltic herring 1-2 times /month; TDI will not exceed

- **TDI for dioxins and DL PCBs 2 pg TEQ/kg bw/d = 120 pg daily for 60 kg weighting adult**
- 2 g average consumption of Baltic herring x (7,2 + 3,3) pg/g fw (concentration of Baltic herring when marketing to consumers) = 21pg/**120**

And respectively

- daily 200 g (about ten Baltic herrings) will be 2100 pg/**120**
- the same amount allowed monthly 2100pg/ 30x120 =**3600**

Dietary advice in Sweden

- **Eat maximum 2-3 times a year** because of dioxins and PCBs.
- Baltic herring, fermented Baltic herring
- Salmon* and salmon trout*, wild, from the Baltic, Lake Vänern and Vättern;
- whitefish*, wild, from Lake Vänern and char*, wild, from Lake Vättern.
- **This advice applies to children up to 18 and women of childbearing age.**
- ** The advice primarily concerns women who eat fish that have been caught non-commercially, since these fish are seldom to be found in normal shops.*

Nya Åland 30.8.2013: Sverige and Finland oeniga om giftig fisk



Why there are different advices?

My answers

- In Sweden portion is bigger.
- In Gulf of Bothnia there are 3 times bigger concentrations of dioxins and PCBs than in Gulf of Finland.
- Intakes from fish are dividing in a different way in the countries.
- Our results show decrease in dioxin concentrations.
- There is risk benefit analysis done in Sweden.
- Two different cultures and policy makers.