

# Screening of consumer and industrial chemicals and pesticides as priority substances in Finnish aquatic environments

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**Jaakko Mannio, Katri Siimes, Kirsti Kalevi, Jari Nuutinen, Pirjo Sainio,  
Kirsti Erkomaa, Jari Heinonen, Jukka Mehtonen & Susan Londesborough**  
Finnish Environment Institute

**Leena Welling & Keijo Mäntykoski, Univ. of Jyväskylä, Ambiotica laboratory**  
**Panu Rantakokko, National Public Health Institute, Kuopio**  
**Anri Aallonen, Lahti Science and Business park, Research laboratory**

# Objectives of the screening

- ❑ Identify EU/WFD prioritized and nationally selected organic pollutants in aquatic environments near sources of discharge
- ❑ Provide information to source identification – but not single pollution sources (impact monitoring, compliance checking => enterprises)
- ❑ To develop best practices, analytical methods and cooperation between laboratories
- ❑ To identify WFD substances which should enter the national monitoring networks



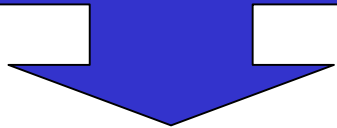
# PROPERTIES

- water solubility
- logKsed-water
- Bio Conc. Factor

# SUBSTANCES

- risk based selection
- EU PS + National

*drives selection*



# PRESSURE

- municipalities
- SME industry
- large factories
- agriculture

# MATRICES

- STP sludge
- STP effluent
- surface water
- sediment
- fish
- stream water
- sediment

# SITES

- number of samples
- pooling ?
- replicates ?
- number of sites ?



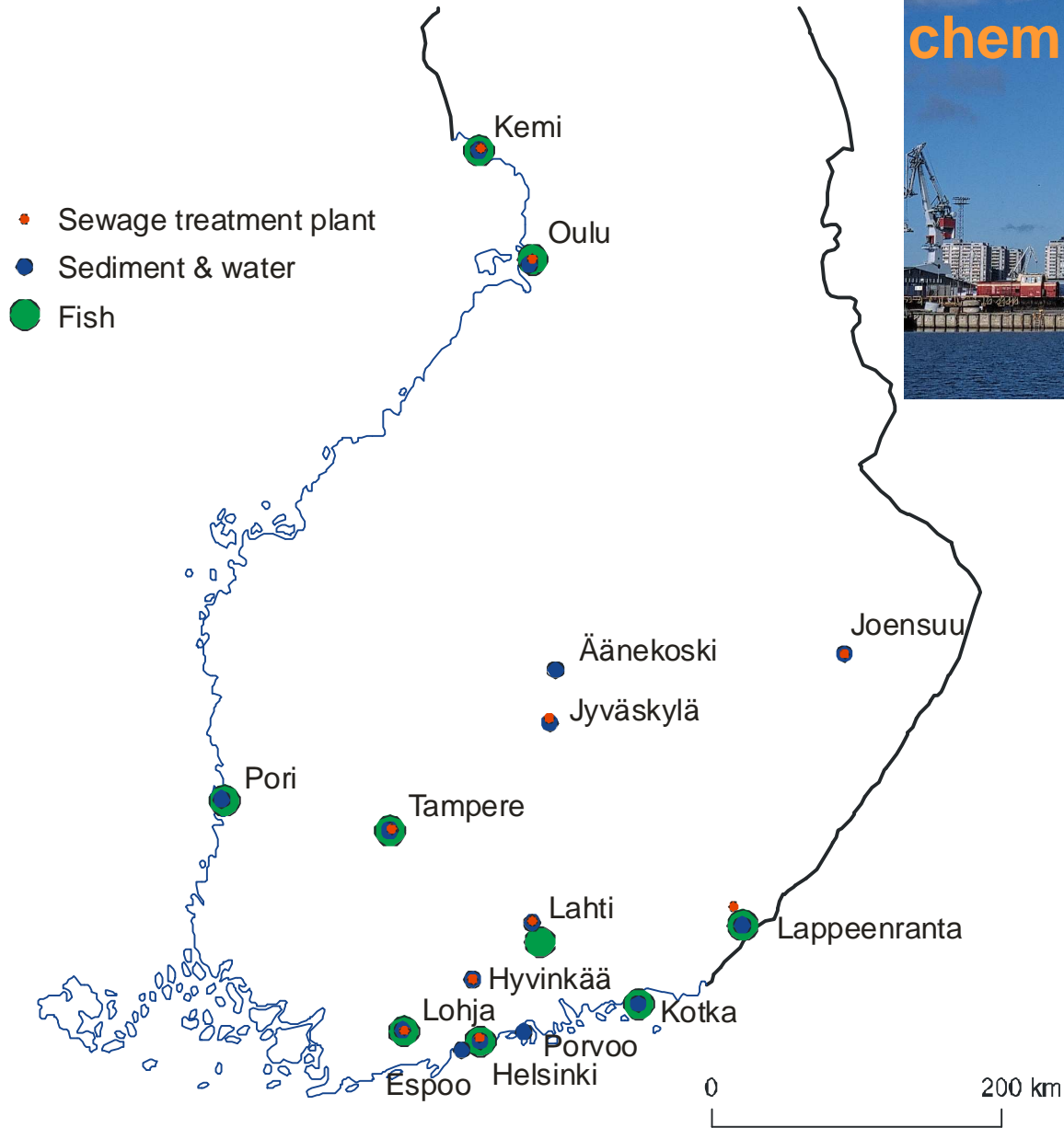
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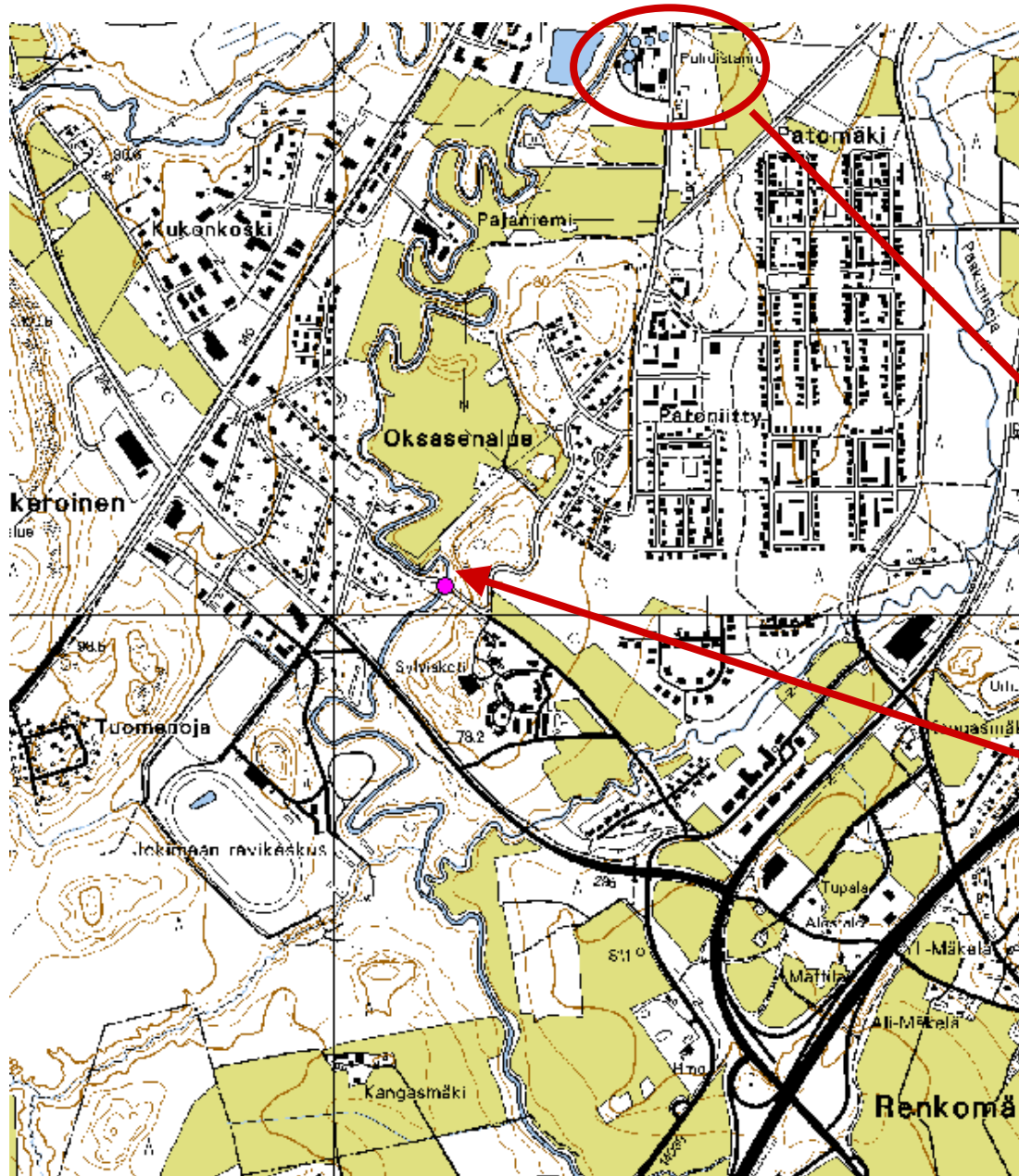
# Project: VESKA 1

## Industrial & household chemicals



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# VESKA 1

## Lahti, Porvoonjoki

Sewage treatment plant  
population > 100 000

sediment+ surface water  
3 km from discharge

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# VESKA 1

## Tampere, Viinikanlahti

Sediment + surface water  
Near effluent pipe <200 m



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Sewage treatment plant



# Treatment plant effluent indicates, what might be found in surface water

- ❑ Max observation of 12 substances not even 5 percent of the EQS<sub>water</sub> (!)

- ❑ 10 substances max 5 – 100 % of EQS<sub>water</sub>

- ❑ 6 substances max > EQS<sub>water</sub>

- ❑ MBT, DBT, DEHP, 4-tert-octylphenol, nonylphenylethoxylate, 4-n-nonylphenol

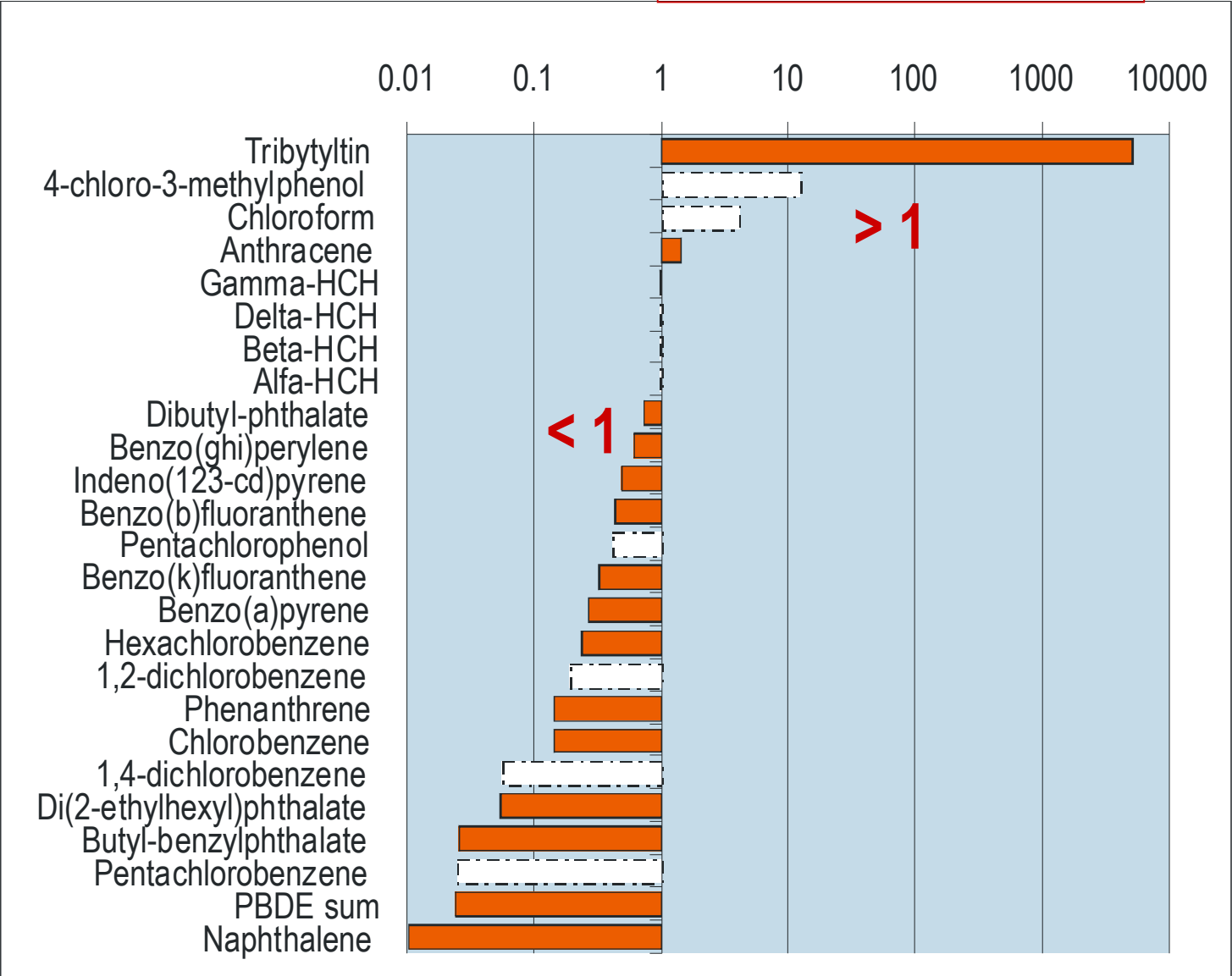
# Surface water; few detected

- ❑ Very few substances even detected: chloroform, 1,2-dichlorethane < 1 µg/l -range
- ❑ HCB, lindane & α-HCH, HCBd in < 1 ng/l range
- ❑ Nonylphenyl ethoxylates (precursor to NP) found (0.4 µg/l) in the range of EQS proposal (0.3 µg/l) for NP
- ❑ NP/OP not detected
- ❑ Phthalates and PAHs found occasionally in 2006-2007 pilot monitoring



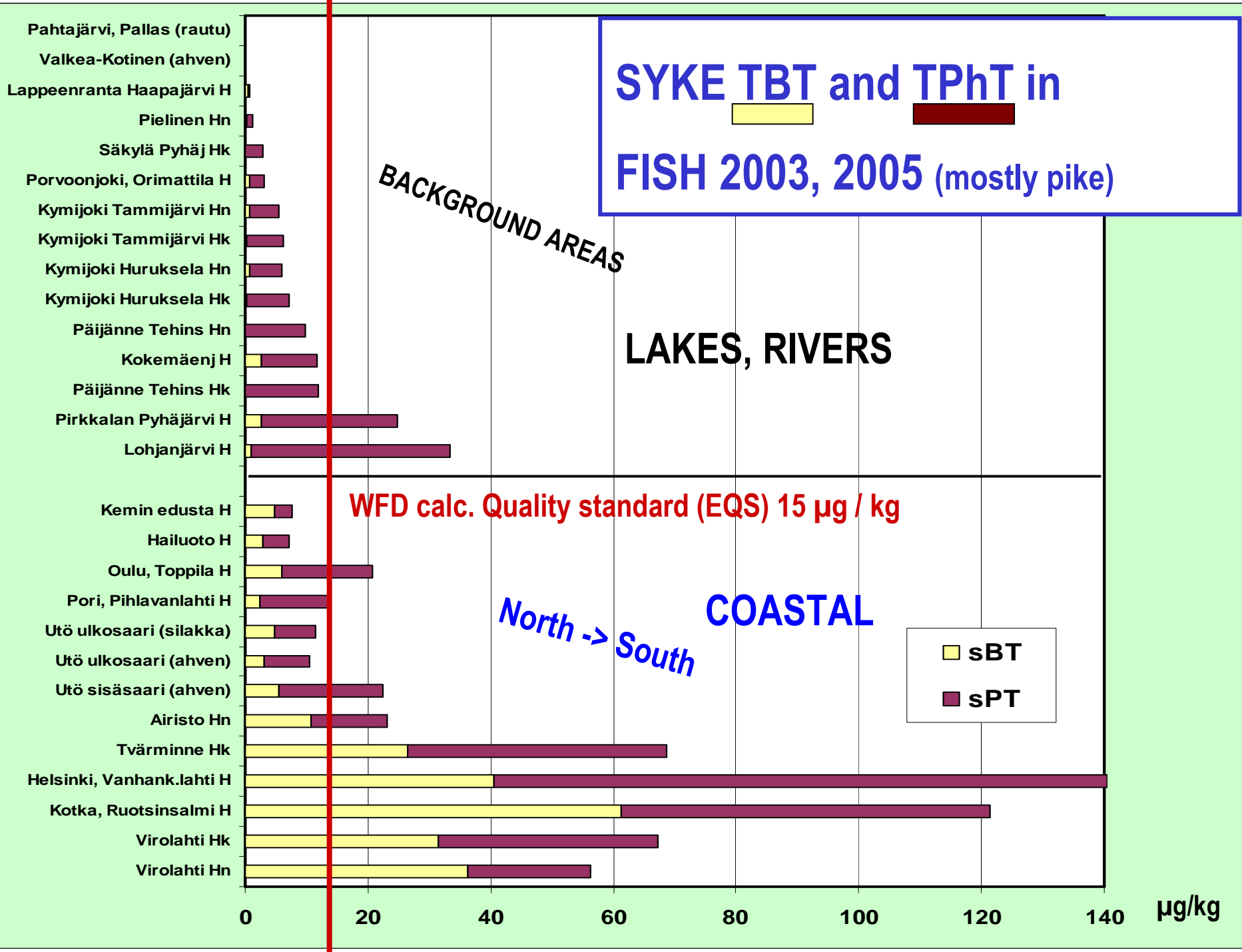
# Mainly TBT exceed the estimated EQS-values in sediment

Max observed / EQS<sub>sediment</sub>



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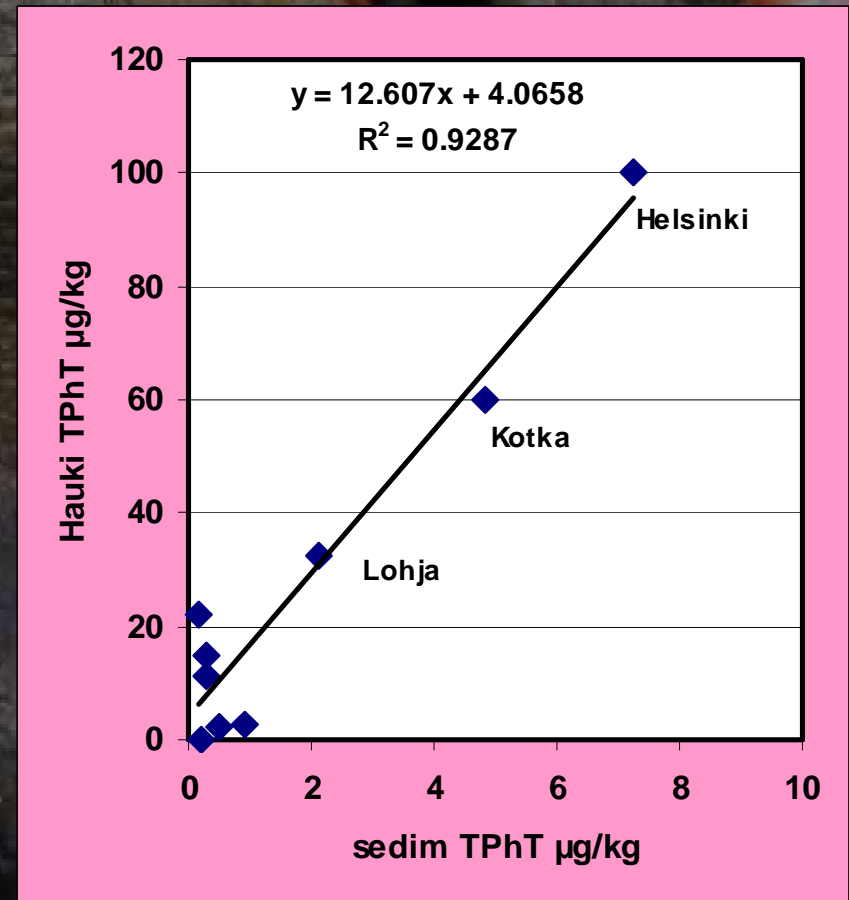
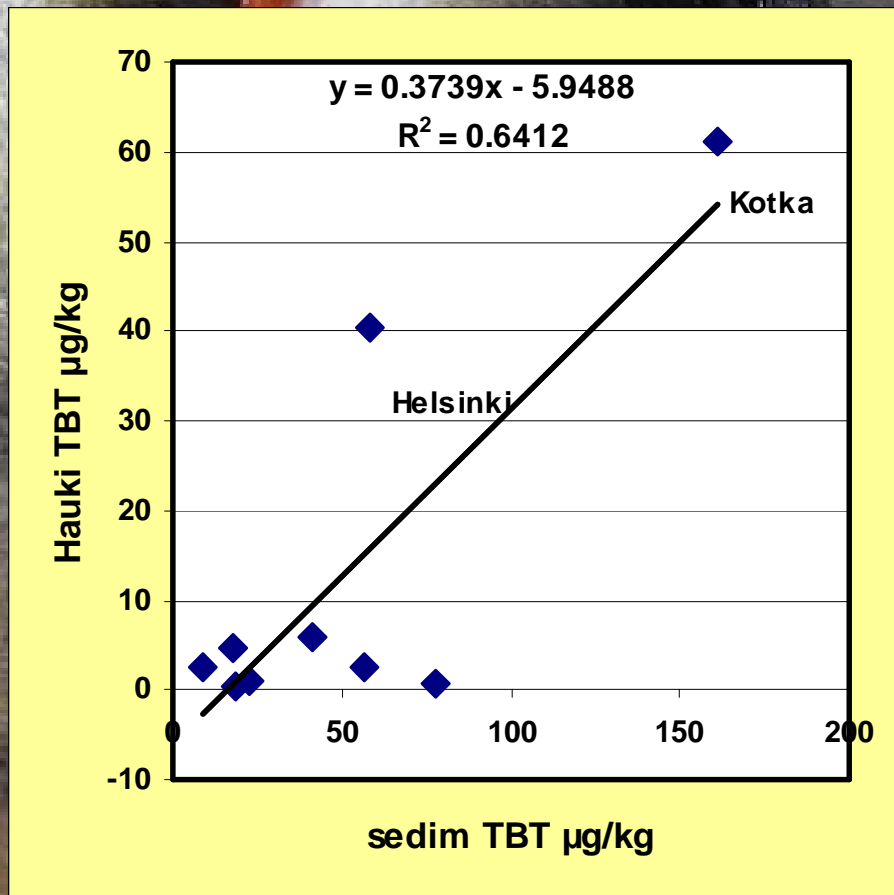
# SYKE TBT and TPhT in FISH 2003, 2005 (mostly pike)



# TBT bioaccumulates, but TPhT bioaccumulates much stronger

If sediment clearly TBT contaminated, fish *might* be contaminated

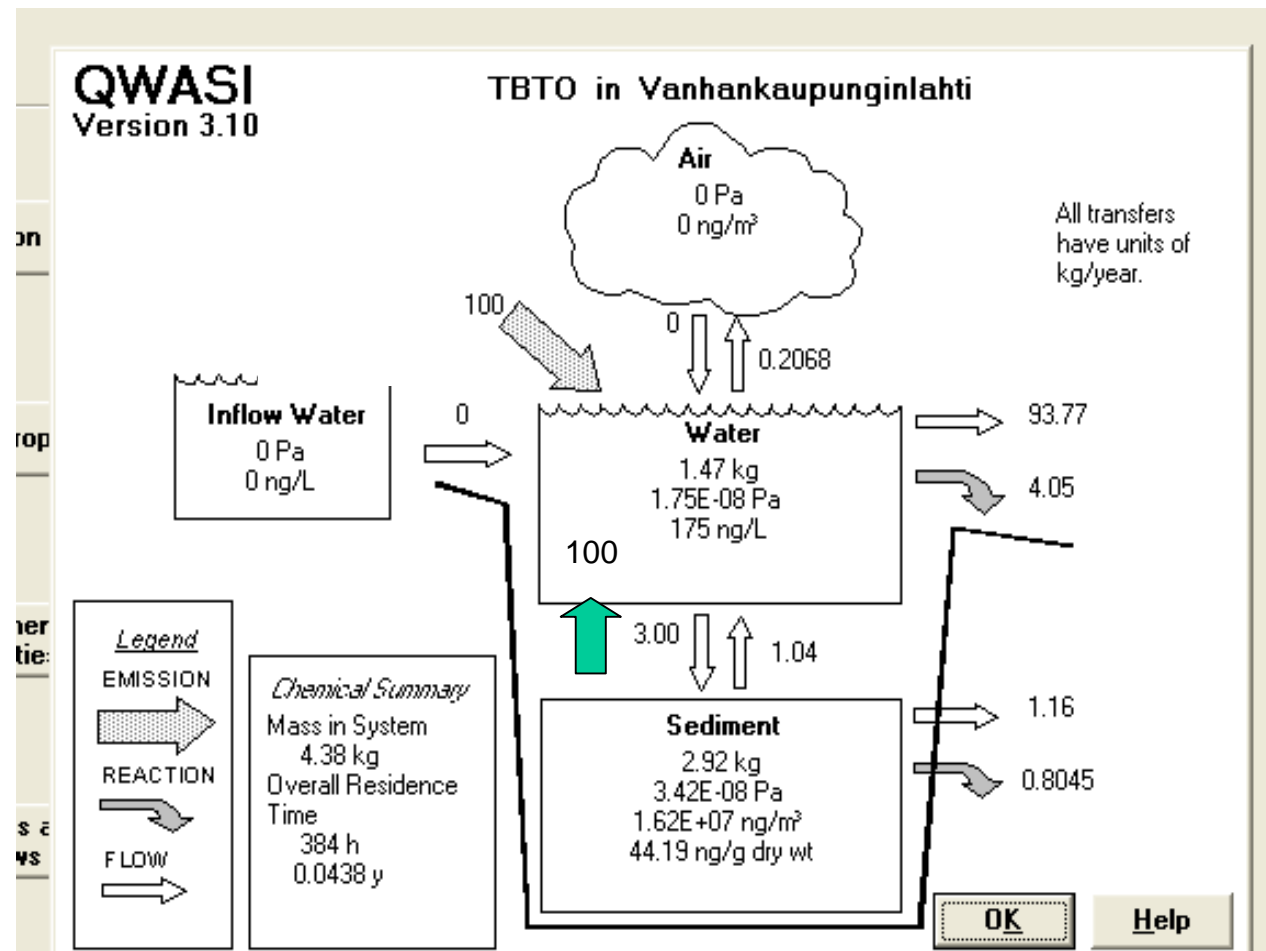
If sediment **slightly TPhT** contaminated, fish **are contaminated**



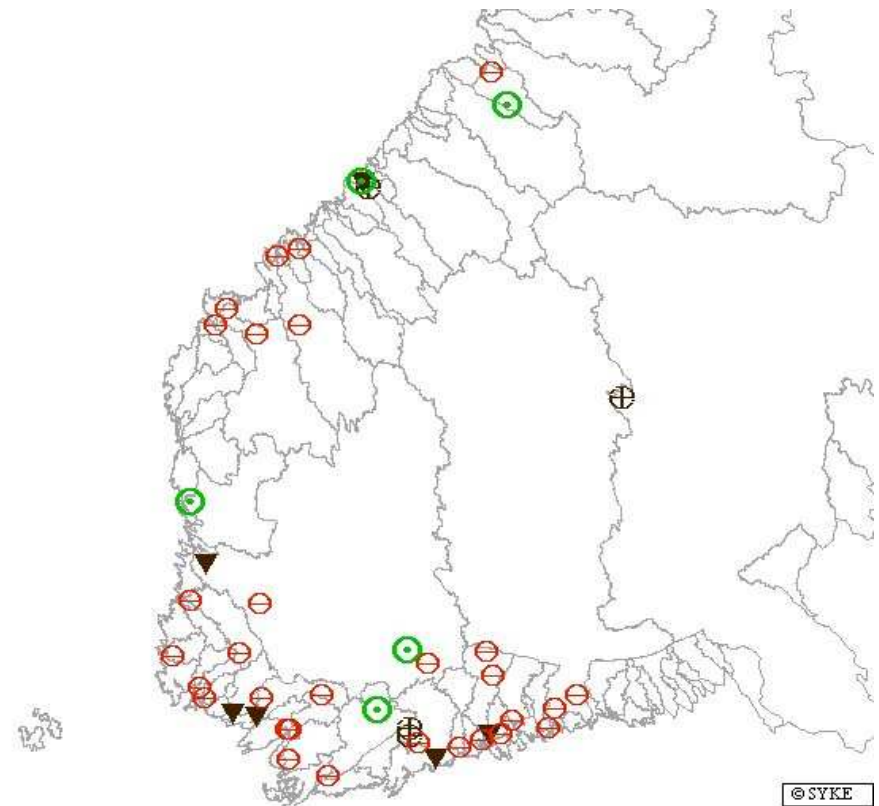


EQS = 0.2 ng/L corresponding to c.a. 0.1 kg/a emission

**TBT**  
Modeling at  
catchment/  
estuary  
scale



# VESKA 2: Pesticides Regional screening 2005



## 35 agricultural rivers

- 120 water samples;  
over 100 pesticides analysed  
– 46 found

### ○ Statistical sample, 2 sampling occasions

- selection based on watershed number
- sediment sample from most sites
- field percentage over 25

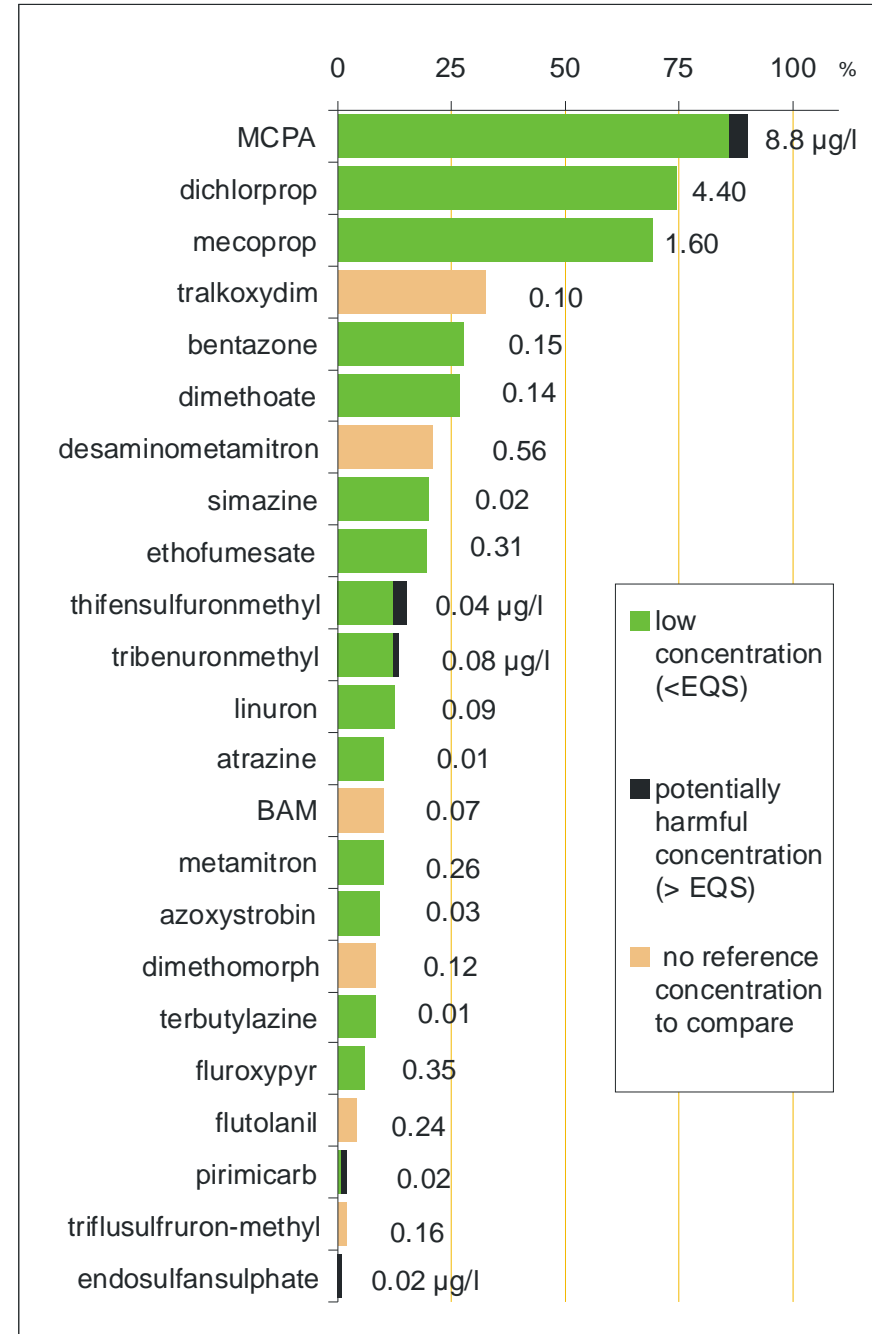
### ○ 5 reference areas, field percentage < 10

### ▼ 6 major rivers, monthly sampling

# Many substances found, but not much



Percentage of samples with detected amount



# VESKA analyses and risks

analytes	COMPOUND GROUP	STP	Surface	Sludge	Sediment	Pike	PROBLEMS
		effluent	water				
6	Organotins	15		6	14	28	found constantly, observations > EQS (solid)
120	Pesticides (mostly phenoxyherbicides)		160		35		detected in rivermouths, monitoring to be targeted
7-9	PBDE			10	5	30	water analysis difficult, diffuse sources
8-14	PAHs		40	20	14	10	water analysis difficult, diffuse sources
3	NP, NPE, OP	20	70	20			difficult to analyse, diffuse sources
3	Phthalates	10	40	6	14	10	easily contaminated, diffuse sources
n.10	VOC: chlor & aromatic	40	70		14	10	have to be analysed rapidly
7	HCB, HCHt, HCBd	40	30	20	14	monit	persistent, banned, still found
2	SCCP	10		5			difficult to quatify, few analyses
2	Chlorophenols	20	30	10	14		
1	TCMTB	13			3		
2	Bronopol &resorcinol	24	2	9	2	1	
	<b>Detected, Risk</b>		30	sample number			
	<b>Unsure</b>			not analysed			
	<b>Detected, no risk</b>			not analysed, wfd requirement, but DL > EQS			
	<b>Not detected</b>						

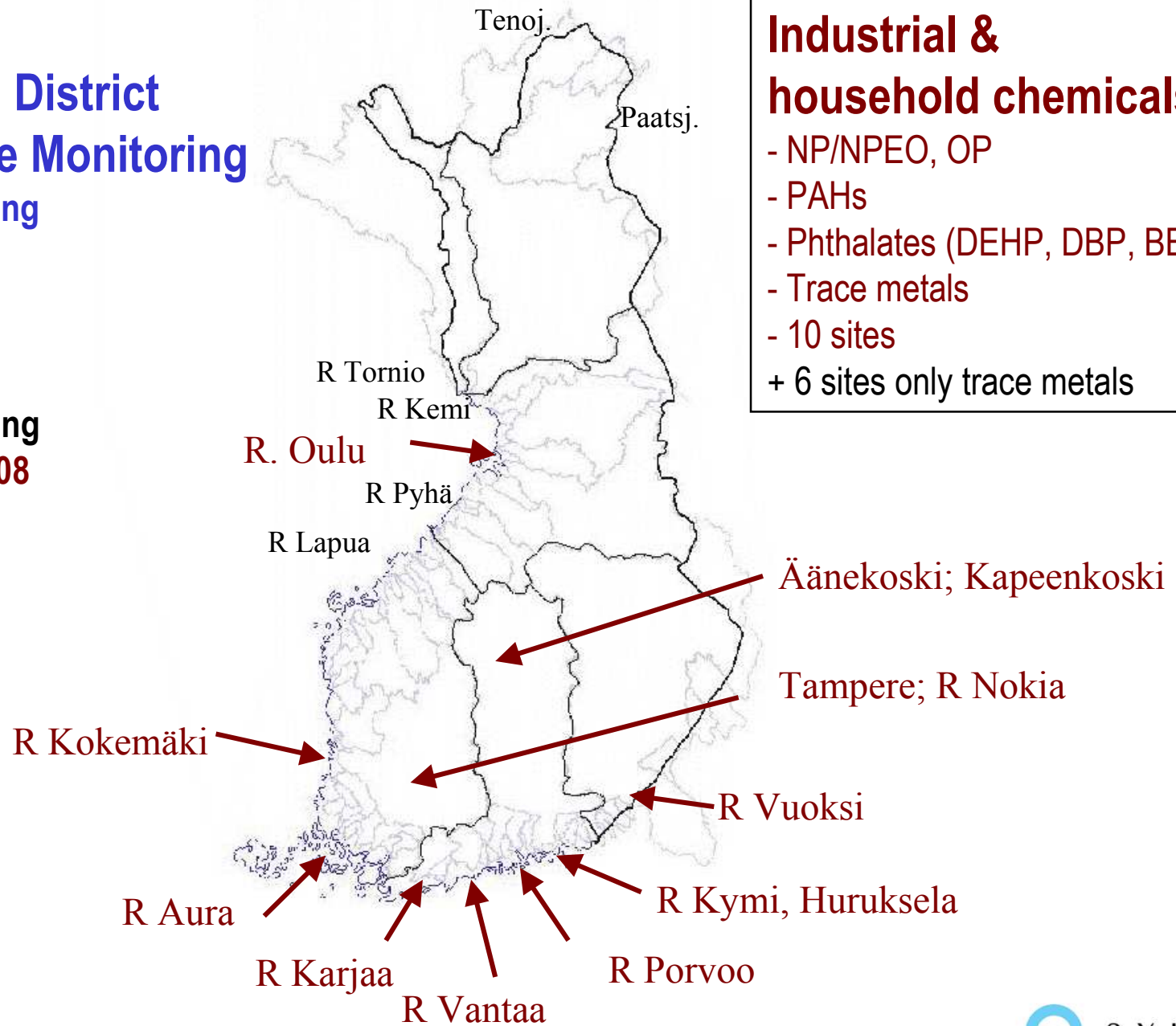
# Screening Lessons

- ❑ **Organotin** compounds found in all matrices => need for research, monitoring and management
- ❑ **Many pesticides** and few industrial chemicals (**NP/NPE**) are found in surface water => need for monitoring
- ❑ For some substances difficult to assess the need for monitoring: **PAH, PBDE, phthalates, chlorobenzenes**
- ❑ **Analytical methods** and equipment fairly well established – in theory, but practice lacking
- ❑ **Simultaneous screening** of several substance groups suitable for pesticides but not for industrial & household chemicals (several, poorly known sources)
- ❑ Natural conditions in Finland (population/water volume, lake-richness) would favour **sediment and biota over water, in monitoring industrial & household chemicals**



# River Basin District Surveillance Monitoring for WFD reporting

Water phase  
monthly sampling  
May-07 – April-08



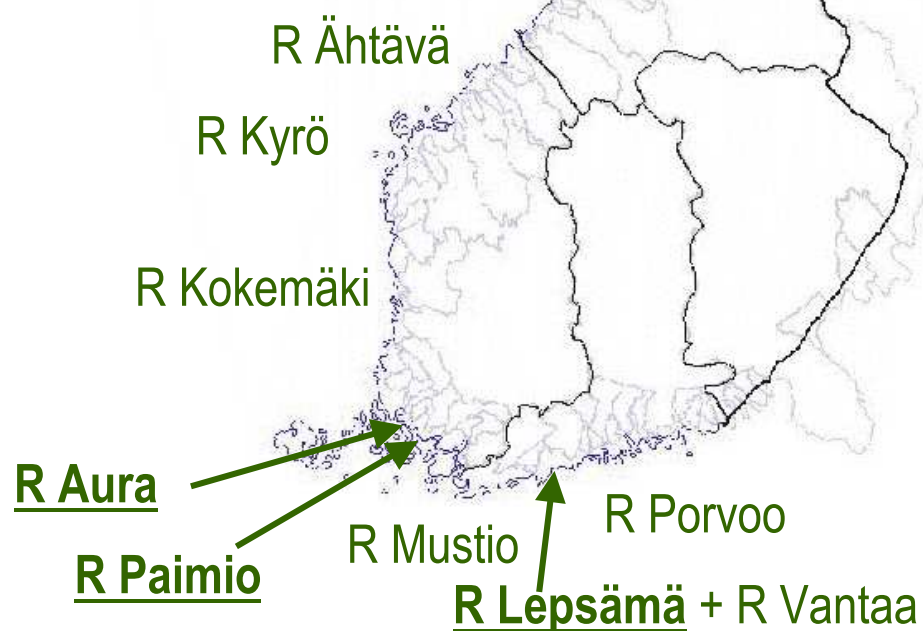
## Industrial & household chemicals:

- NP/NPEO, OP
- PAHs
- Phthalates (DEHP, DBP, BBP)
- Trace metals
- 10 sites
- + 6 sites only trace metals

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# River Basin District Surveillance Monitoring for WFD reporting

Water phase  
monthly sampling  
May-07 – April-08



**Pesticides:**  
>100 substances /  
sample  
- rivers 12 samples / yr

Sites in three year rotation  
+ 3 intensive rivers every year

**=> max 9 rivers per year**

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# Fish & sediment monitoring

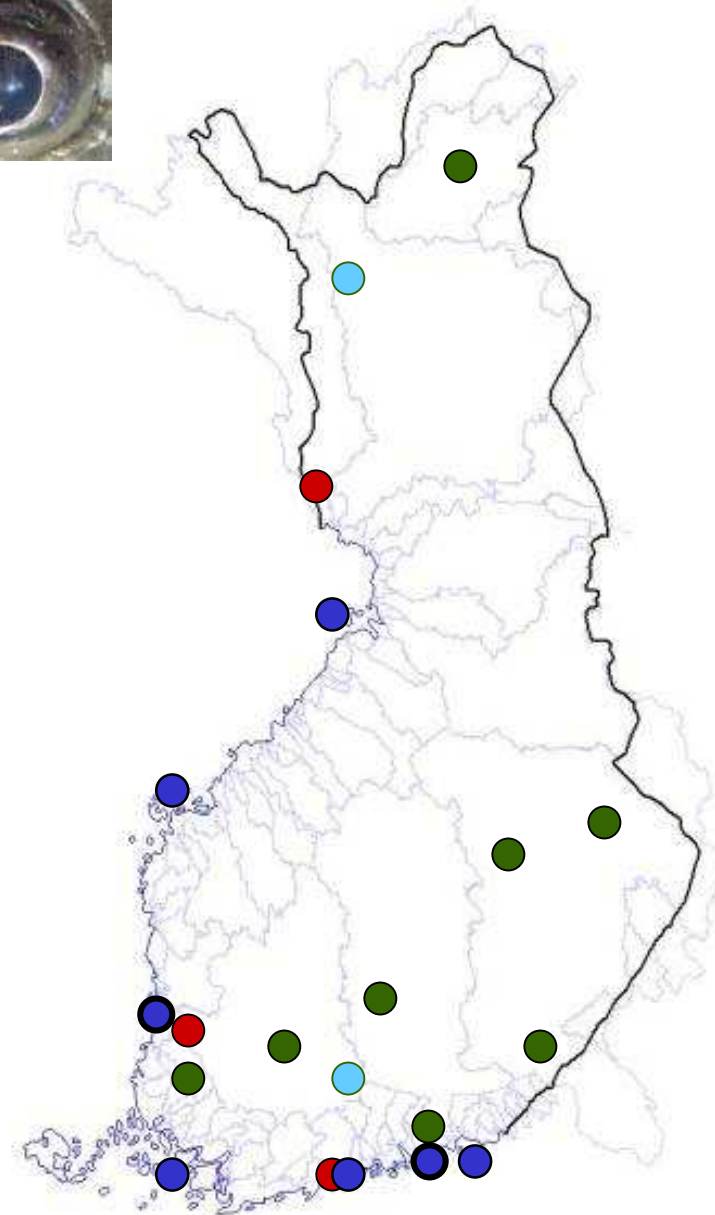


**Frequency: 2-6 yr, site specific**  
**2006: pooled herring, vendace**  
**2007: individual pikes (+pooled perch 2 lakes)**

- Hg, Cd, Pb + other trace metals
- OCPs, PCB (12+12Copl), PCDD/F (part)
- new: PBDE, organotins

- 8 large lakes
- 2 headwater lakes
- 3 major rivers
- 7 coastal areas
- 2 sedimentation traps

**Sediments: all sites, in 4-5/yr time**



# Specimen banking

Prepared, homogenized aquatic & terrestrial tissue samples stored in liquid nitrogen  $-196\text{ }^{\circ}\text{C}$



photos: Matti Verta

# Prioritisation of substances and matrices

## EU:

### • directives

- water, air, soil, sludge, IPPC
- REACH
- Env Health Strategy
- RA & RM

### International Conventions

- UNEP
- CLRTAP
- OSPAR /HELCOM
- AMAP

### Emission/ pressure Information

- Registers/  
data banks

### National Priorities

- “own substances”
- meaningful participation in EU & int. monitoring

Screening

Monitoring

Decision on Monitoring: Screening, Threshold values (EQS), trends, RA, research, modelling

# Emerging substances monitoring in future

- ❑ Better identification of sources
- ❑ Monitoring and screening activities should be internationally harmonized and optimized – cooperation!
- ❑ Importance of concentration in sediments( & soils) and biota must be understood better
  - ❑ => realistic Environmental Quality Standards
- ❑ QA/QC in the whole information chain
  - ❑ Planning, manuals, sampling, storage, pretreatment,
  - ❑ Analyses / validation, PT schemes
  - ❑ Data storage, reporting...
- ❑ Chemical monitoring combined to biological (effects) monitoring
  - ❑ Combined effects of several compounds likely
- ❑ Link to risk management and risk research
  - ❑ no “monitoring for monitoring” => think: why, what, where, how....





**Thank You !**