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WFD and biota monitoring A (German) Bavarian perspective Georgia Buchmeier Bavarian Environment Agency



My conclusions of the workshop 2013 in Brno

- Chemical load in water, sediment or a passive sampling medium gives no (direct) information about chemical load in biota (Biota incorporate pollutants from water and from food)
- Biotamonitoring is necessary to assess the risk of secondary poisoning and human fish consumption
- Biota-samples have to be standardised as good as possible in a sampling-program and should be described (age, fat, weight...) for interpretation of data (fish and mussel of different species, age and feeding behaviour accumulate differently)
- Passive sampling could be an additional tool in monitoring of waters (or trend monitoring?) and has to be standardised as good as possible, too



Germany is a Federal Republic...

- With 16 Federal States and 16 more or less different monitoring programs for
 - trend monitoring
 - compliance check
- All Federal States have agreed upon a common biotamonitoring strategy which accords with Guidance Document No. 32 on biota monitoring
- I will present:
 - 1. The German biotamonitoring strategy
 - 2. The Bavarian perspective on biotamonitoring



The German trend monitoring strategy with biota or sediment

- Ca. 100 trend monitoring sites all over Germany
- Matrix: sediment, suspended sediment, mussel soft body, fish filet (or liver)
- Federal lands choose the matrix that fits to their monitoring possibilities (e.g. in alpine rivers sediment and mussel monitoring isn't possible; long data series for suspended sediment of river Rhine...)
- Not all substances must be measured in the same matrix

Problems:

- standardization of samples has to be as good as possible (sometimes difficulties with fish samples)
- in some cases quantification limits (substances without EQS: how to define which quantification limit is necessary?)

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Example: trend monitoring with mussel (Bavarian data)

PFOS (μg/kg ww) Trend not significant Mussel soft body of *Dreissena polymorpha* River Isar, site Altheim Exposition for 6 month Samples taken in autumn Quantification limit 0,5 μg/kg

The trend was calculated with an Excel-based software tool from German UBA (LOESS trend)

PFOS-Gehalt (µg/kg) in D. polymorpha, Isar, Altheim, Herbst



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The German biotamonitoring strategy - Compliance check

Mussel - Fluoranthene and Benzo(a)pyrene

- Active or passive monitoring
- Passive monitoring: no indigenous species; instead *Corbicula sp.* or *Dreissena sp*.
- Active monitoring: if *Corbicula sp.* or *Dreissena sp.* only at sites which are invaded
- Minimum: All surveillance sites (WFD), onetime within 6 years
- Mussel number: target 10 to 100
- Age: target 3 to 5 years old
- Mussel soft body
- Pool samples allowed (similar/same age and size)
- Homogenized samples







The German biotamonitoring strategy - compliance check Fish

- Passive monitoring (fishing after mating period, sometimes) coupled with fish monitoring of WFD or/and foodstuff control)
- Minimum: All surveillance sites (WFD), once within 6 years
- Fish species: list of preferred species (different species for rivers, lakes, marine influenced waters)
- Fish number: target 10
- Age: target 2+ or 3+ years old
- Filet samples, without integument (human health; very clear exceedance or compliance of substances with "sec. poisoning EQS")
- Pool samples allowed (fish of similar/same age and size)
- Homogenised samples





Biotamonitoring strategy – compliance check (Bavarian data) – filet vs. whole fish

Substance	EQS (µg/kg)	Matrix	Ubiquitous	Protection goal	Exceeds EQS
Fluoranthene	30	mussel		human health	in 1 waterbody
Benzo(a)pyrene	5	mussel	Х	human health	in 1 waterbody
Hexachlorobenzene (HCB)	10	fish		human health	
Dioxins and dioxin-like compounds	0,0065	fish	Х	human health	
Heptachlor and heptachlor epoxide	0,0067	fish	Х	human health	in ca. 90 % of monitored waterbodies
Perfluorooctane sulfonic acid (PFOS)	9,1	fish	Х	human health	in ca. 10 % of monitored waterbodies
Brominated diphenylethers (PBDE)	0,0085	fish	Х	human health	in 100 % of monitored waterbodies
Hexachlorobutadiene (HCBD)	55	fish		sec. poisoning	
Hexabromcyclododecan (HBCDD)	167	fish	Х	sec. poisoning	
Dicofol	33	fish		sec. poisoning	
Mercury (Hg)	20	fish	Х	sec. poisoning	in 100 % of monitored waterbodies

blue: compliance; yellow: compliance in some waterbodies; red: no compliance



Fish species of German biotamonitoring

Marine influenced waters (no photos): smelt, herring, flounder Rivers: **chub**, bream, perch, roach, brown trout





Blue arrows: Main species in Bavarian monitoring program Lakes: bream, perch, roach, pike, coregonus, arctic charr









Different assessment results when using water or biota EQS (Bavarian data)

EQS Exceedance at more sites, when water EQS is used







Biotamonitoring in fish cannot be substituted easily by passive sampling, both methods are not equivalent

- fish accumulate substances via water and food
- half-life of some substances is very long in fish (e.g. Hg)



