



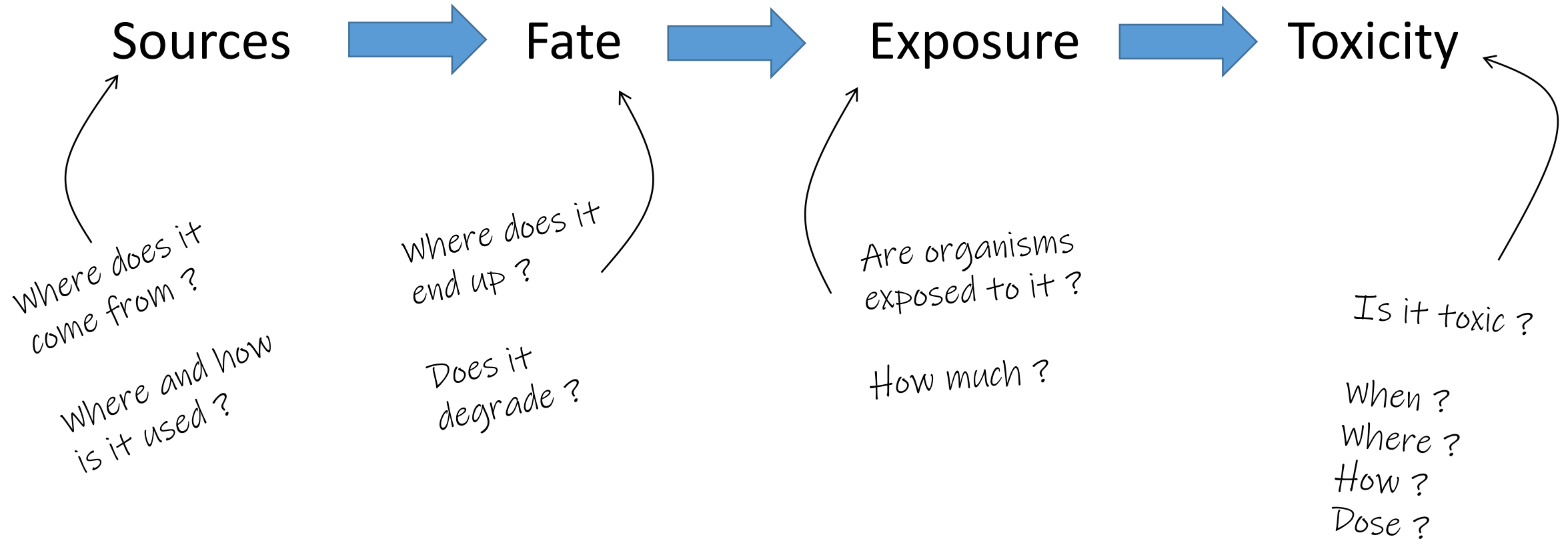
Environmental Risk Assessment of benzyl butyl phthalate (BBP)

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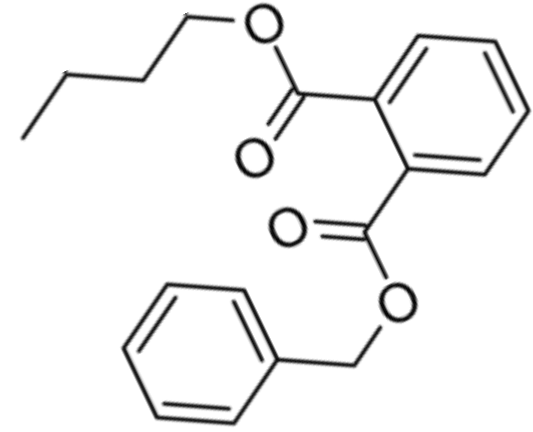


Risk assessment



BBP uses

- ☐ Plasticizer- used especially in PVC (vinyl flooring, foam, childrens toys)
- ☐ Adhesives
- ☐ Packaging materials
- ☐ Inks
- ☐ Arts and crafts products, paints
- ☐ Cosmetics (eg nail kits)
- ☐ Coatings for textiles
- ☐ Home maintenance (eg paint, waterproofing)
- ☐ Paint and coatings



Sources of phthalates to the environment

Industrial
production
and use

Leachate from building materials
and consumer goods

Leachate from
solid waste
disposal

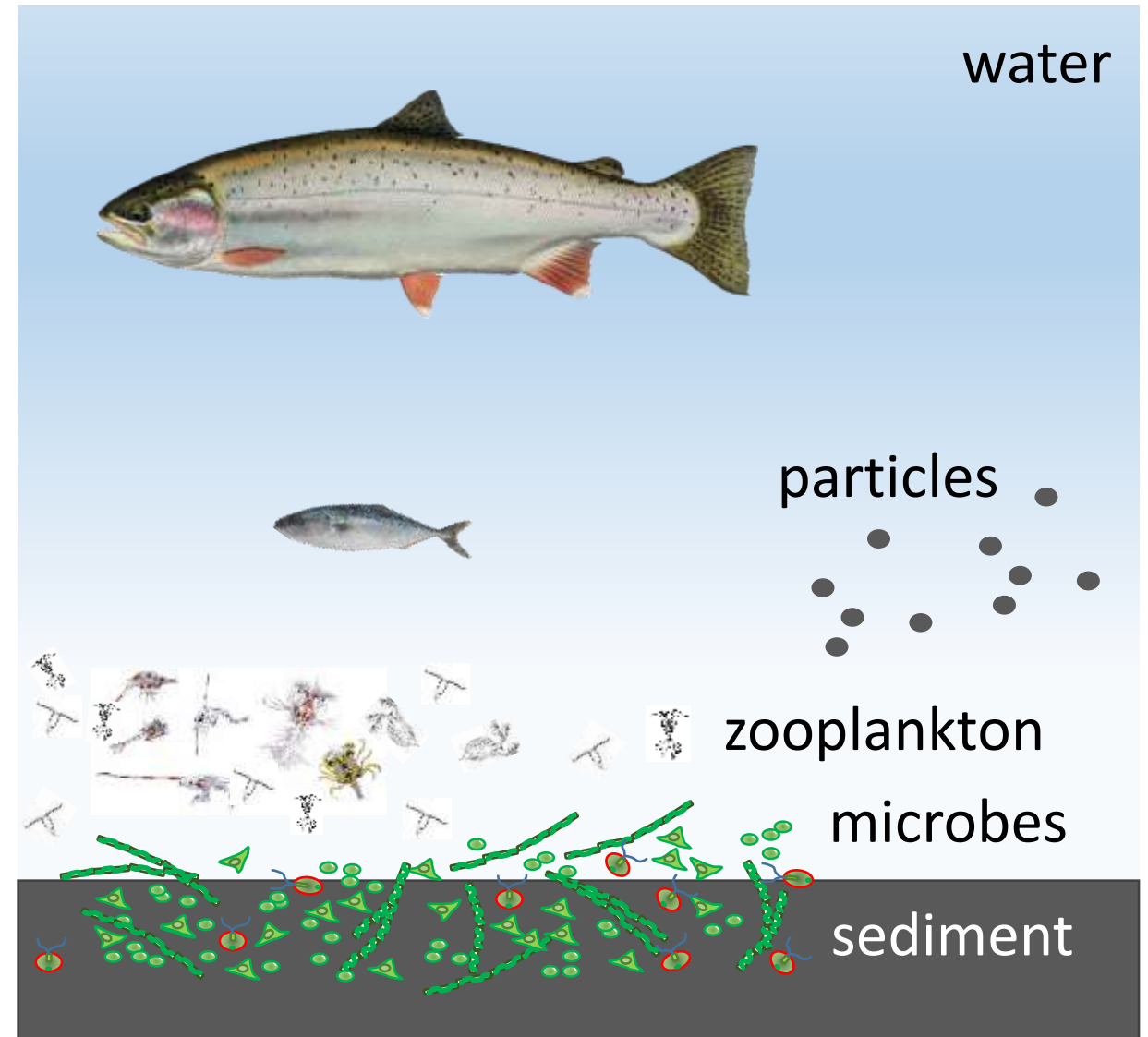
Leachate from
litter/waste in the
environment



Wastewater, run off, leachates --> freshwater and marine systems

Fate of BBP in the environment

- ☐ Water solubility 2.8 mg/L
- ☐ Log K_{ow} 3.6 - 5.8
- ☐ Microbial degradation
- ☐ Photocatalytic degradation
- ☐ Half-life 1-7 days
- ☐ Low bioaccumulation
- ☐ No discernible biomagnification



BBP Mode of Action

For the medium-chain phthalates, moderate to high toxicity has been observed in numerous studies with aquatic organisms (summarized in Environment Canada, Health Canada 2015b; ECCC 2016). Results indicate that those with side-chain backbones of six or fewer carbons—i.e., DBP, BBP, DCHP, DEHP and B79P—are highly hazardous to fish, invertebrates, and algae, where LC_{50} and effects such as behavioral abnormalities in fish, reproductive effects in daphnids, and effects on biomass in algae were observed at an exposure concentration of less than 1 mg/L. Secondary effects linked to estrogenic, thyroid-, or anti-androgenic modes of action are also relatively well documented for these substances, although inconsistent responses have been observed for alteration of VTG levels in studies with BBP and DEHP. BBP was shown to displace estradiol from the hepatic estrogen receptor, to inhibit ER binding, to either alter VTG production in rainbow trout following intra-peritoneal injection (Christiansen et al. 2000) or to have no impact on VTG levels in studies with fathead minnow (Study Submission 2014d; Harries et al. 2000), to impact gonadal histology (Study Submission

BBP Regulatory Assessment

- ❑ Substance of Very High Concern (SVHC) under REACH
- ❑ On REACH Annex XIV (authorisation list), classified as toxic for reproduction according to Art. 57c
- ❑ Sunset data: 21 February 2015
- ❑ On REACH Annex XVII (restriction list)

Hazard classification & labelling



Danger! According to the **harmonised classification and labelling** (CLP00) approved by the European Union, this substance may damage the unborn child and is suspected of damaging fertility, is very toxic to aquatic life and is very toxic to aquatic life with long lasting effects.



BBP Production and Use Volumes

- ❑ In Europe: Production and import of 0-10 tons / year according to REACH dossier (1 registrant)
- ❑ Other countries: unknown

However:

- ❑ Indirect import via articles unknown
- ❑ Huge amounts embedded in infrastructure and materials at wastesites (long-term emission sources!)

Aims and Strategy

Overarching question: do the available data indicate an environmental risk?

Strategy for ecotoxicity data retrieval:

- ☐ Data compilation for US EPA's ecotox database
- ☐ Plausibility check of the retrieved data
- ☐ Search in the primary literature
- ☐ Remove all duplicates (163 datapoints)
- ☐ Classify into „acute toxicity“ and „chronic toxicity“
- ☐ Averaging: 1 ecotoxicity estimate per species

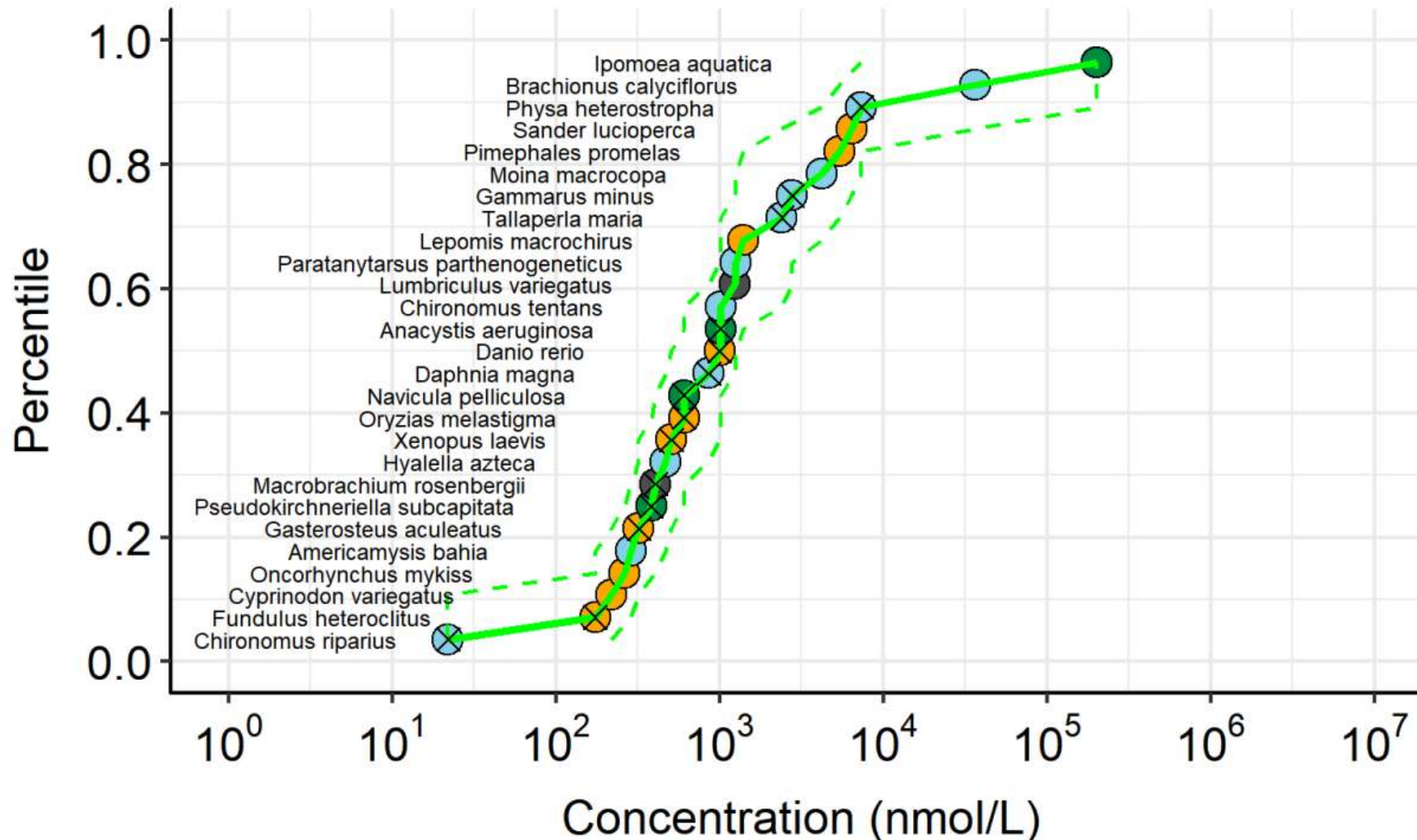
Aims and Strategy

Overarching question: do the available data indicate an environmental risk?

Strategy for exposure data retrieval:

- ☐ Collect of all publically available monitoring data
- ☐ Delete all non-detects
- ☐ Use only data for freshwater

BBP Species-sensitivity distribution



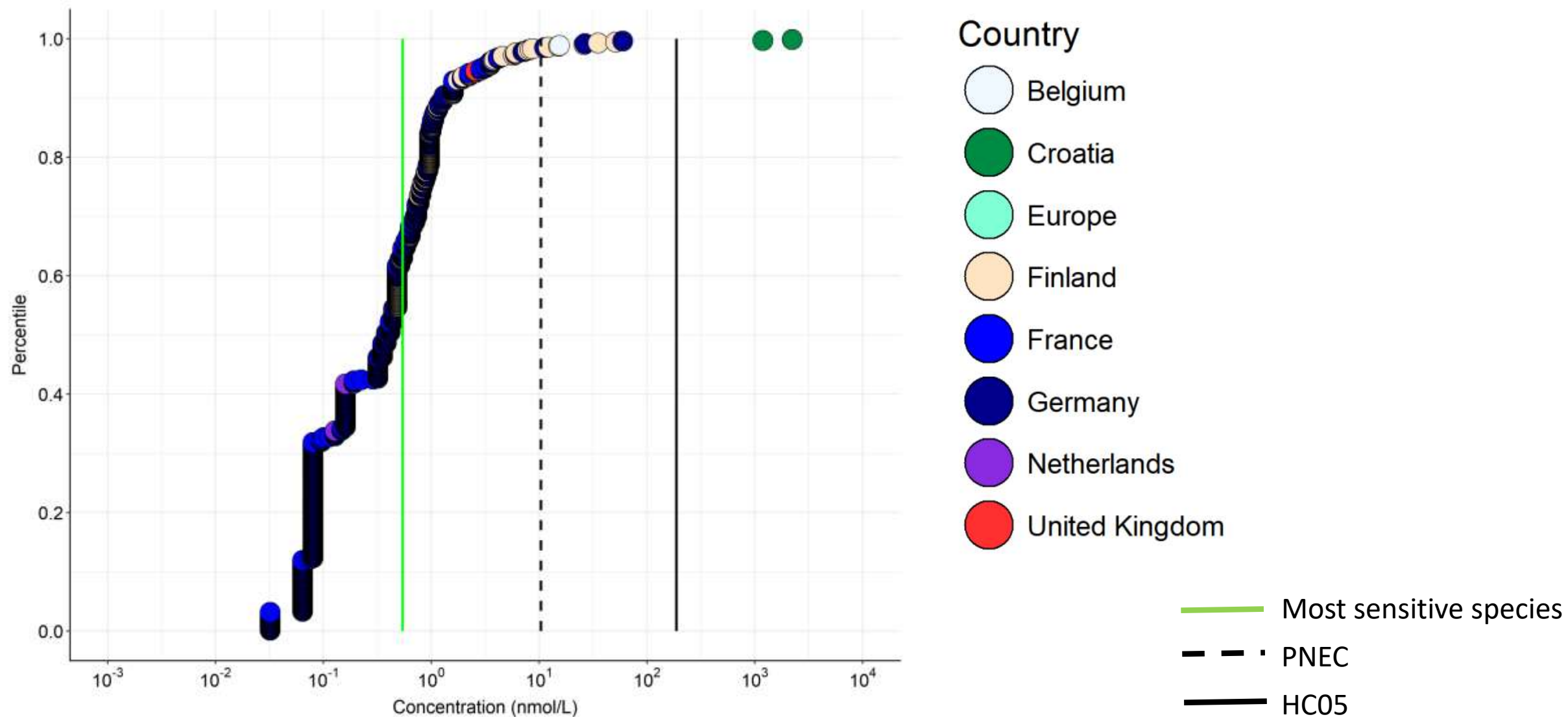
HC05: Concentration that is hazardous for 5% of the species

Does NOT include an assessment factor.

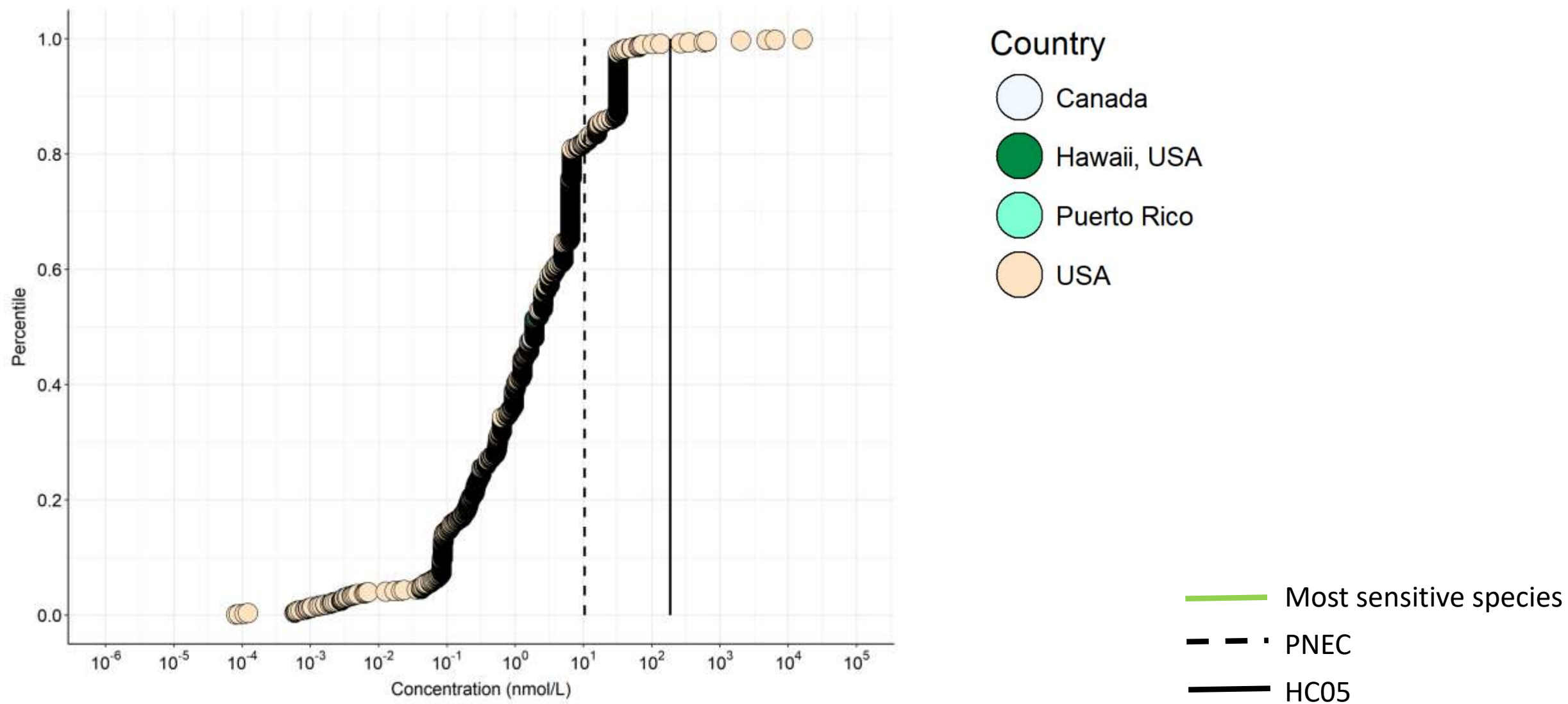
BBP toxicity to environmental organisms

HC05	187 nmol/L	Our own results
Most sensitive QSAR-estimate (chronic toxicity to fish)	300 nmol/L	In silico toxicity estimate
PNEC (aquatic, freshwater)	10.4 nmol/L	...this is the value used by ECHA
Most sensitive species: <i>Chironomus riparius</i>	Chronic NOECs for survival: 3.2 nmol/L	

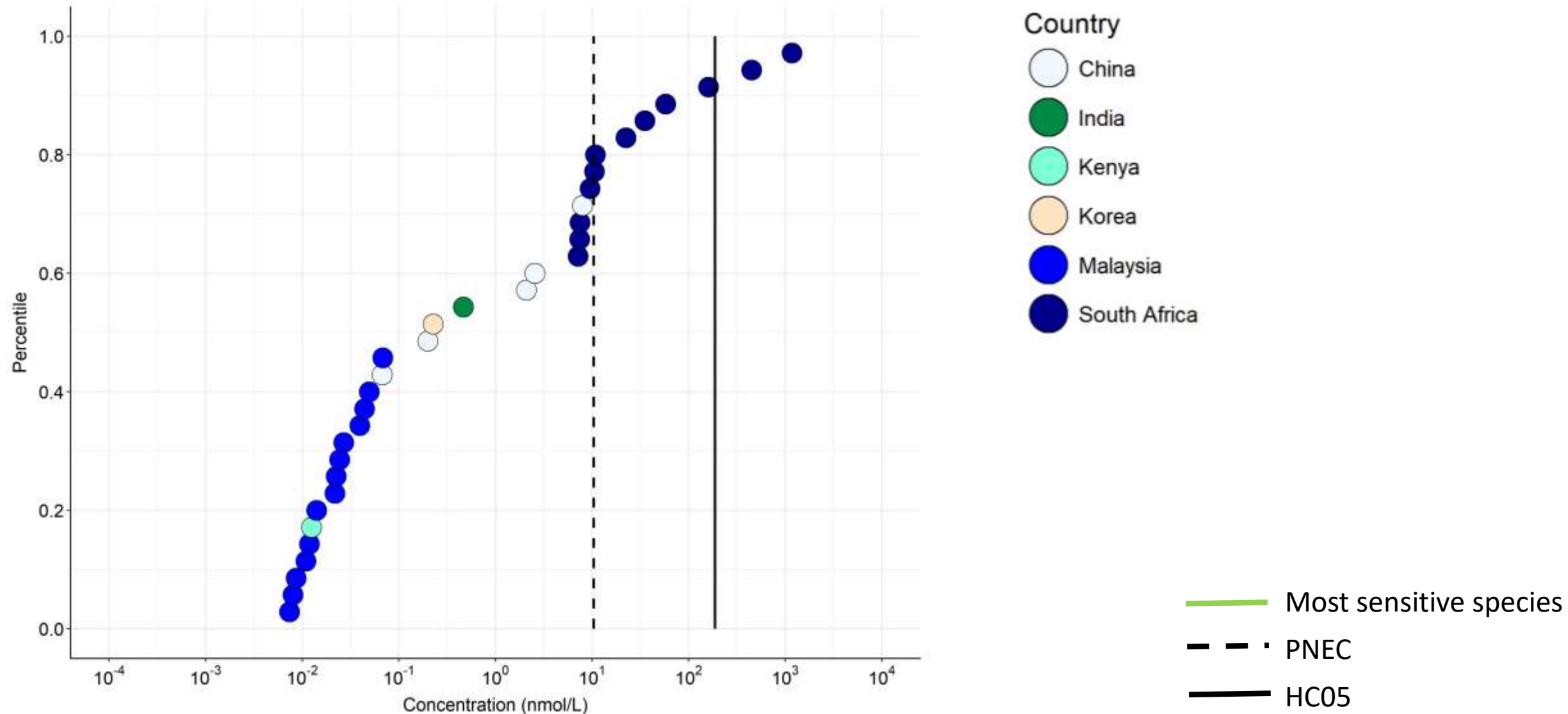
Environmental risks (Europe)



Environmental risks (North America & US)



Environmental risks (other countries)



Summary & conclusions

- ❑ BBP is found routinely in monitoring survey in the freshwater aquatic environment
- ❑ Huge differences in the amounts found
- ❑ Huge differences in the sensitivity of different organisms
- ❑ Environmental risks at highly exposed sites





BBP is just one member of a big family...

Table 1-2 Subgroup 2 – Medium Chain Phthalate Esters (carbon backbone length of 3 to 7^a)

CAS RN	Chemical Name (DSL)	Acronym	Substance Type
131-16-8	1,2-Benzenedicarboxylic acid, dipropyl ester	DPrP	Discrete
84-69-5	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	DIBP	Discrete
5334-09-8	1,2-Benzenedicarboxylic acid, cyclohexyl 2-methylpropyl ester	CHIBP	Discrete
84-64-0	1,2-Benzenedicarboxylic acid, butyl cyclohexyl ester	BCHP	Discrete
84-74-2	1,2-Benzenedicarboxylic acid, dibutyl ester	DBP	Discrete
85-68-7	1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester	BBP	Discrete
84-61-7	1,2-Benzenedicarboxylic acid, dicyclohexyl ester	DCHP	Discrete
27987-25-3	1,2-Benzenedicarboxylic acid, bis(methylcyclohexyl) ester	DMCHP	Discrete
71888-89-6	1,2-Benzenedicarboxylic acid, di-C ₆₋₈ -branched alkyl esters, C ₇ -rich	DIHepP	Isomeric Mixture ^b
27554-26-3	1,2-Benzenedicarboxylic acid, diisooctyl ester	DIOP	Isomeric Mixture
27215-22-1	1,2-Benzenedicarboxylic acid, isooctyl phenylmethyl ester	BIOP	Isomeric Mixture
117-81-7	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester	DEHP	Discrete
84-75-3	1,2-Benzenedicarboxylic acid, dihexyl ester	DnHP	Discrete
111381-89-6	1,2-Benzenedicarboxylic acid, heptyl nonyl ester, branched and linear	79P	UVCB ^c
68515-48-0; 28553-12-0	1,2-Benzenedicarboxylic acid, di-C ₈₋₁₀ -branched alkyl esters, C ₉ -rich; 1,2-Benzenedicarboxylic acid, diisononyl ester	DINP1,2 ^d	Isomeric Mixture
68515-40-2	1,2-Benzenedicarboxylic acid, benzyl C ₇₋₉ -branched and linear alkyl esters	B79P	UVCB
16883-83-3	1,2-Benzenedicarboxylic acid, 2,2-dimethyl-1-	B84P	Discrete

CAS RN	Chemical Name (DSL)	Acronym	Substance Type
	(1-methylethyl)-3-(2-methyl-1-oxopropoxy)propyl phenylmethyl ester		
523-31-9	1,2-Benzenedicarboxylic acid, bis(phenylmethyl) ester	DBzP	Discrete

PHthalates AND CUMULATIVE RISK ASSESSMENT

The Tasks Ahead

Summary & conclusions

- ❑ BBP is found routinely in monitoring survey in the freshwater aquatic environment
- ❑ Huge differences in the amounts found
- ❑ Huge differences in the sensitivity of different organisms
- ❑ Environmental risks at highly exposed sites
- ❑ ***What about combination effects?***

... work to be done (still)





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