Passive Samplers for Monitoring of Pesticides in Water

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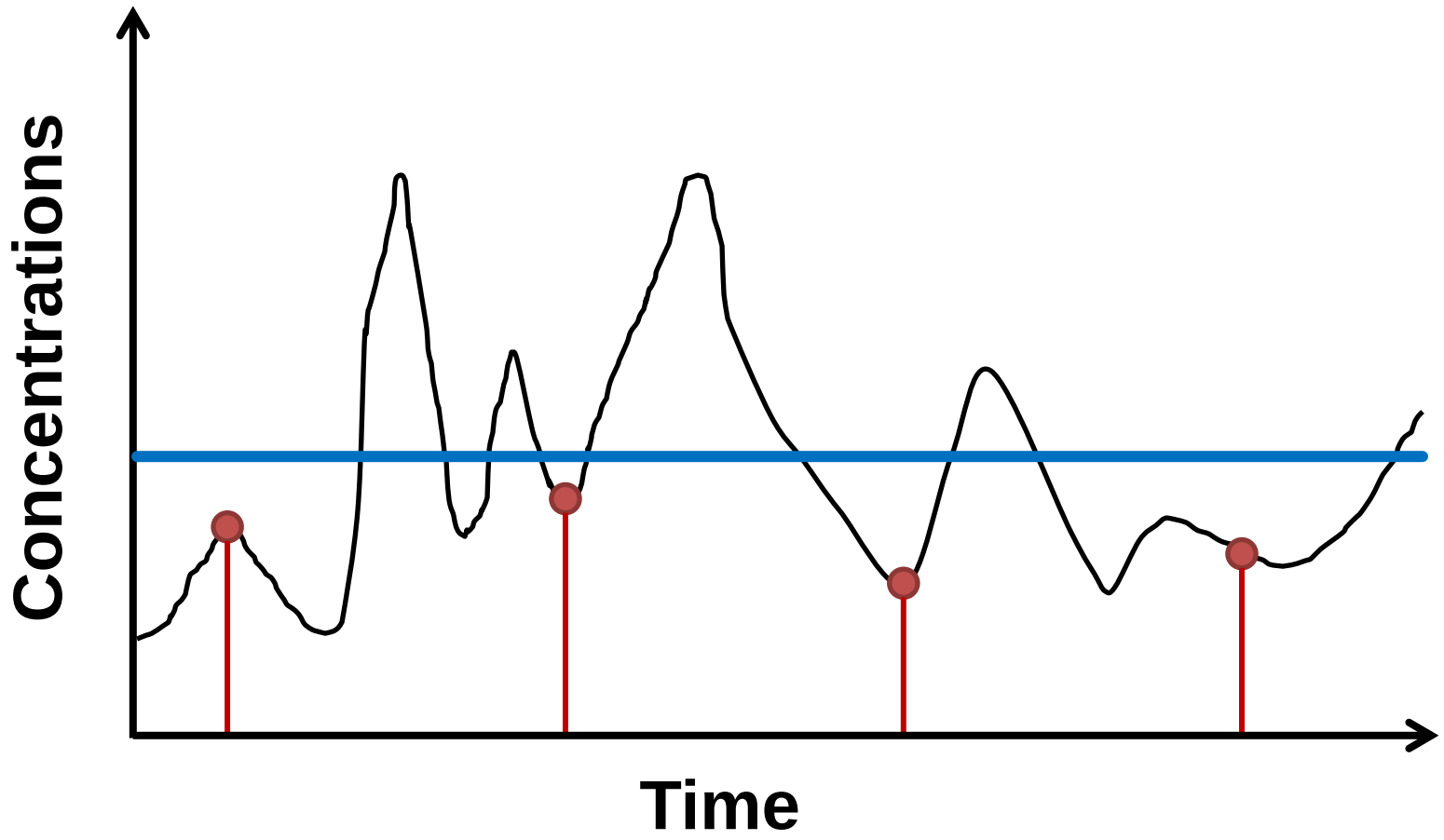
Sampling Strategies

Grab Sampling

vs

Passive Sampling

Grab Sampling vs Passive Sampling



- Grab sampling
- Passive sampling

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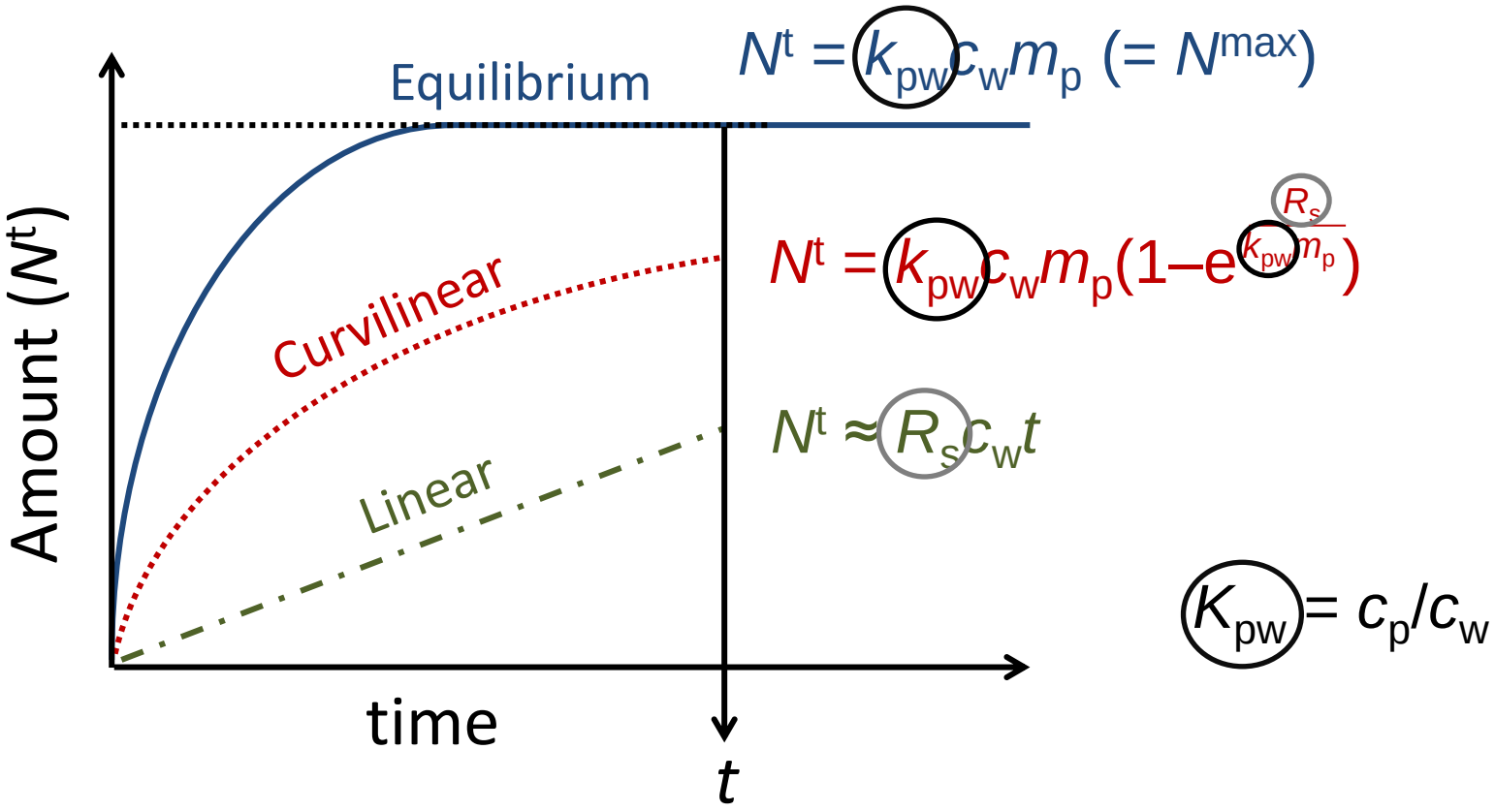
Passive Sampling

Passive sampling

Sorbents

- **Time-integrated sampling for freely dissolved chemicals in water**

Uptake Process



N^t : amount on the sampler after t days exposure
c_w: free dissolved concentration in water
m_p: sorbent mass per sampler
R_s: sampling rate
c_p: concentration in the sampler

➢ **Affected by environmental conditions (e.g. water temperature)**

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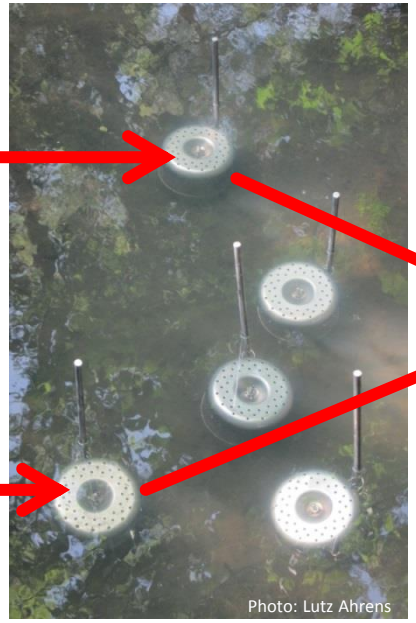
Performance Reference Compounds (PRCs)

Sorbents

Passive sampling



Sorbents

Spike of PRCs

Analysis of PRCs

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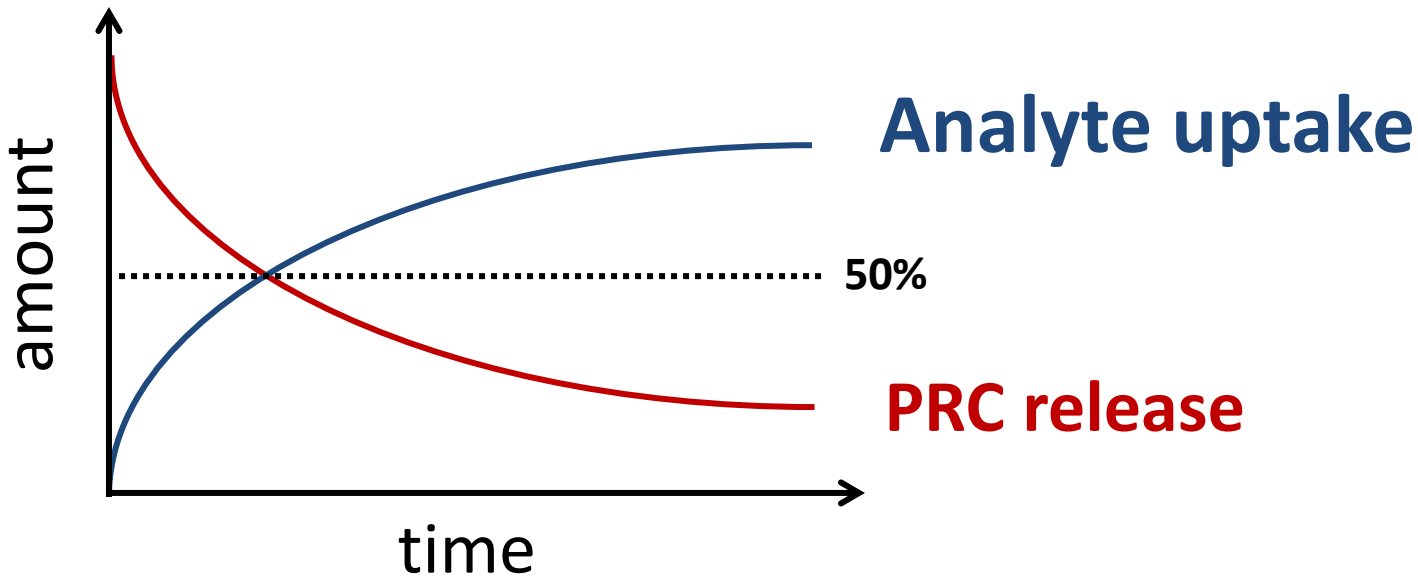
Performance Reference Compounds (PRCs)



- The rate of PRC loss during the exposure can be used to estimate *in situ* sampling rates of the analytes of interest

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Target Compounds

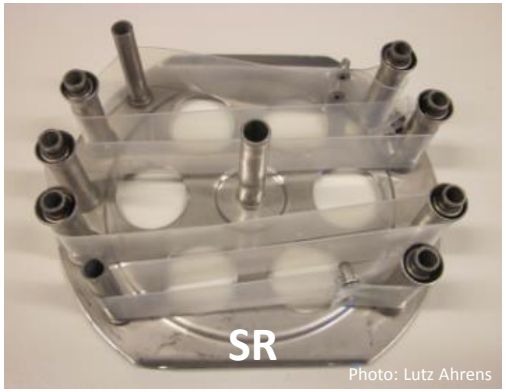
- **124 pesticides**
- Including **16 Priority Substances** of the **WFD**
- **log K_{OW} –1.9 to 7.6**
- **Analysis**
  - LC-ESI-MS/MS (–/+)
  - GC-MS (EI, CI)

EU WFD Priority Substances	AA-EQS (inland surface water) (µg/L)
aclonifen	0.12
alachlor	0.3
atrazine	0.6
bifenox	0.012
chlorfenvinphos	0.1
chlorpyrifos	0.03
cybutryne	0.025
dichlorvos	0.0006
diuron	0.2
endosulfan	0.005
hexachlorocyclo-hexane (HCH)	0.02
isoproturon	0.3
quinoxyfen	0.15
simazine	1.0
terbutryn	0.065
trifluralin	0.03

Ahrens L, Daneshvar A, Lau AE, Kreuger J., 2015. J Chromatogr A. 1405, 1-11

Passive Sampler Sorbents

Overview of passive sampling devices
Silicone rubber (SR)
POCIS A: Pharmaceutical-POCIS, polar organic chemical integrative sampler (Oasis hydrophilic–lipophilic balance (HLB) sorbent)
POCIS B: Pesticide-POCIS, Triphasic sorbent admixture (Isolute ENV+ and Ambersorb 1500) enclosed in a polyethersulphone membrane
Chemcatcher® SDB-RPS: Styrene divinyl benzene Empore™ disk
Chemcatcher® C18: Empore™ disk



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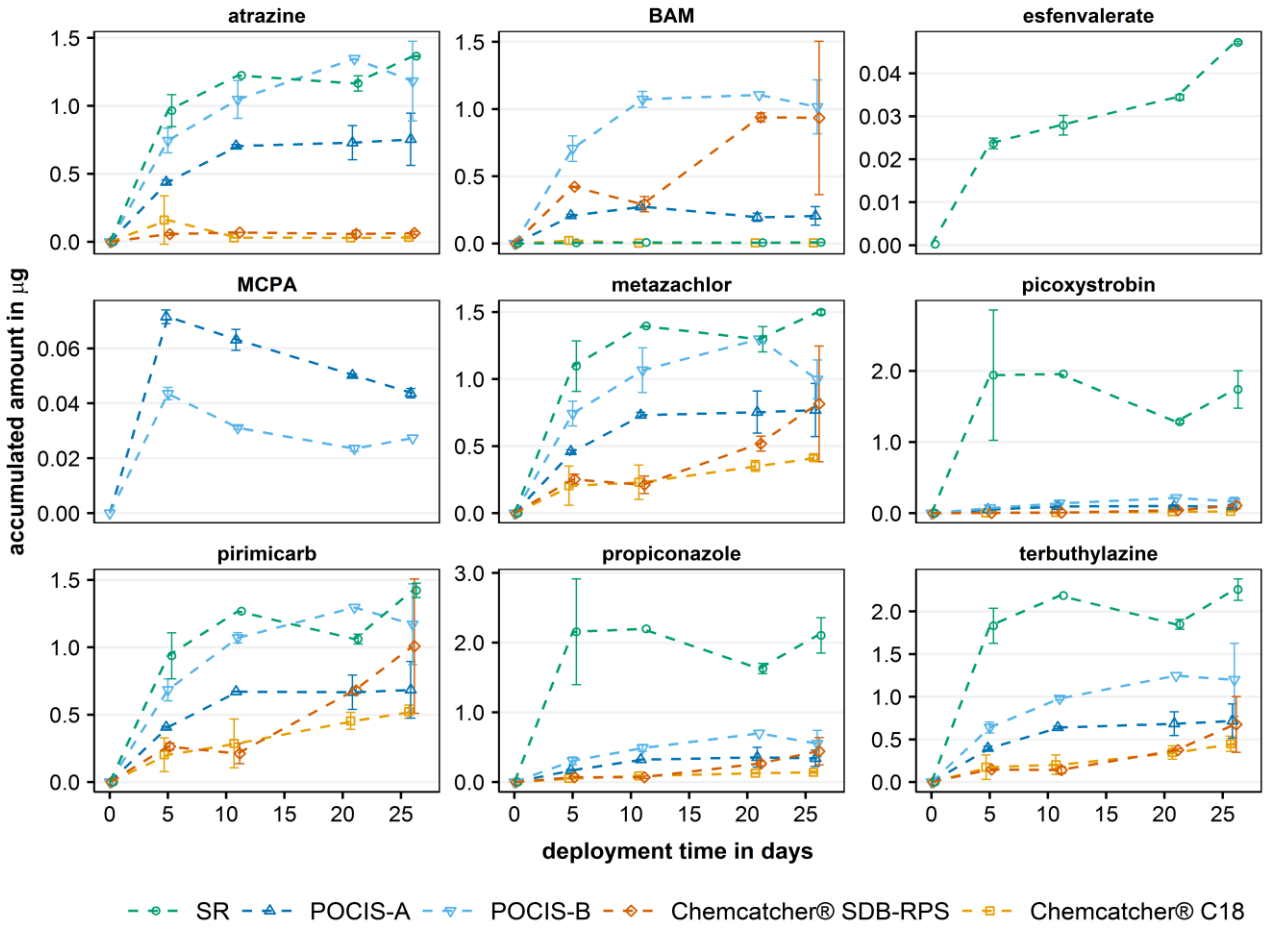
Uptake profiles of selected pesticides in water using passive samplers



- Sampling rate (R_S) and passive sampler-water partition coefficients (K_{pw}) calculated for five passive samplers

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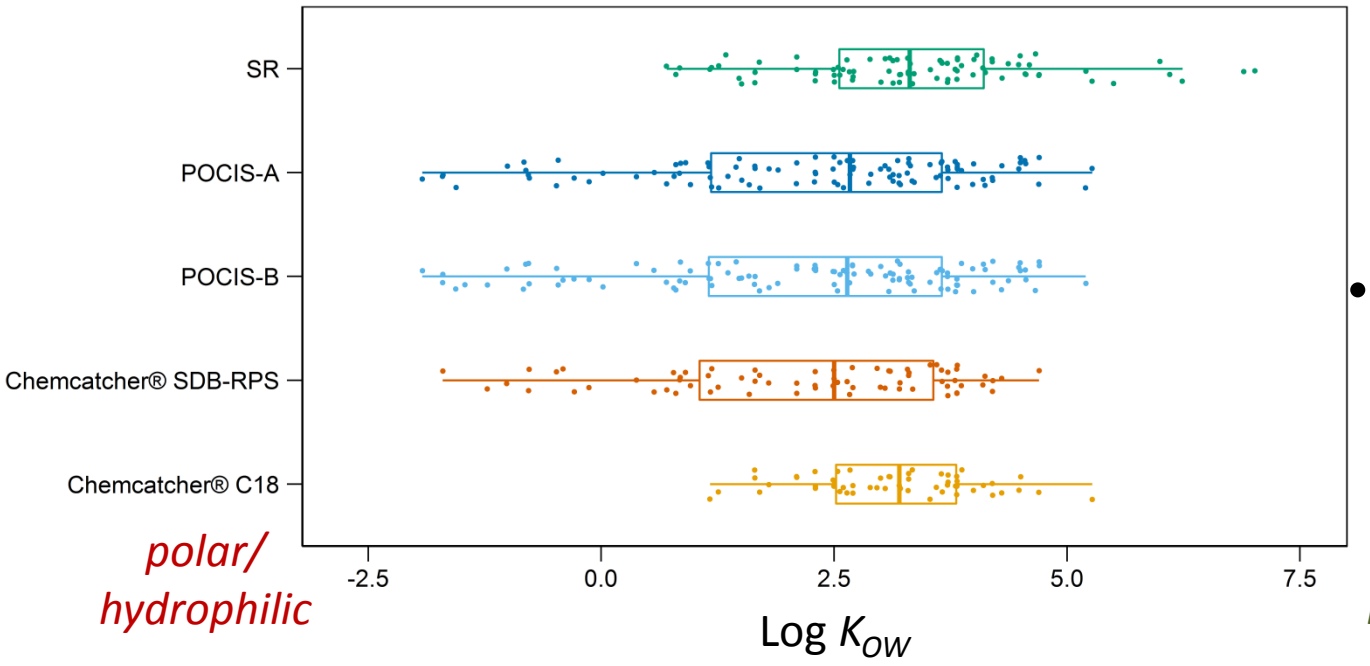
Comparison of Passive Sampler Sorbents



Tested for 124 pesticides

polar/ hydrophilic

non-polar/ hydrophobic

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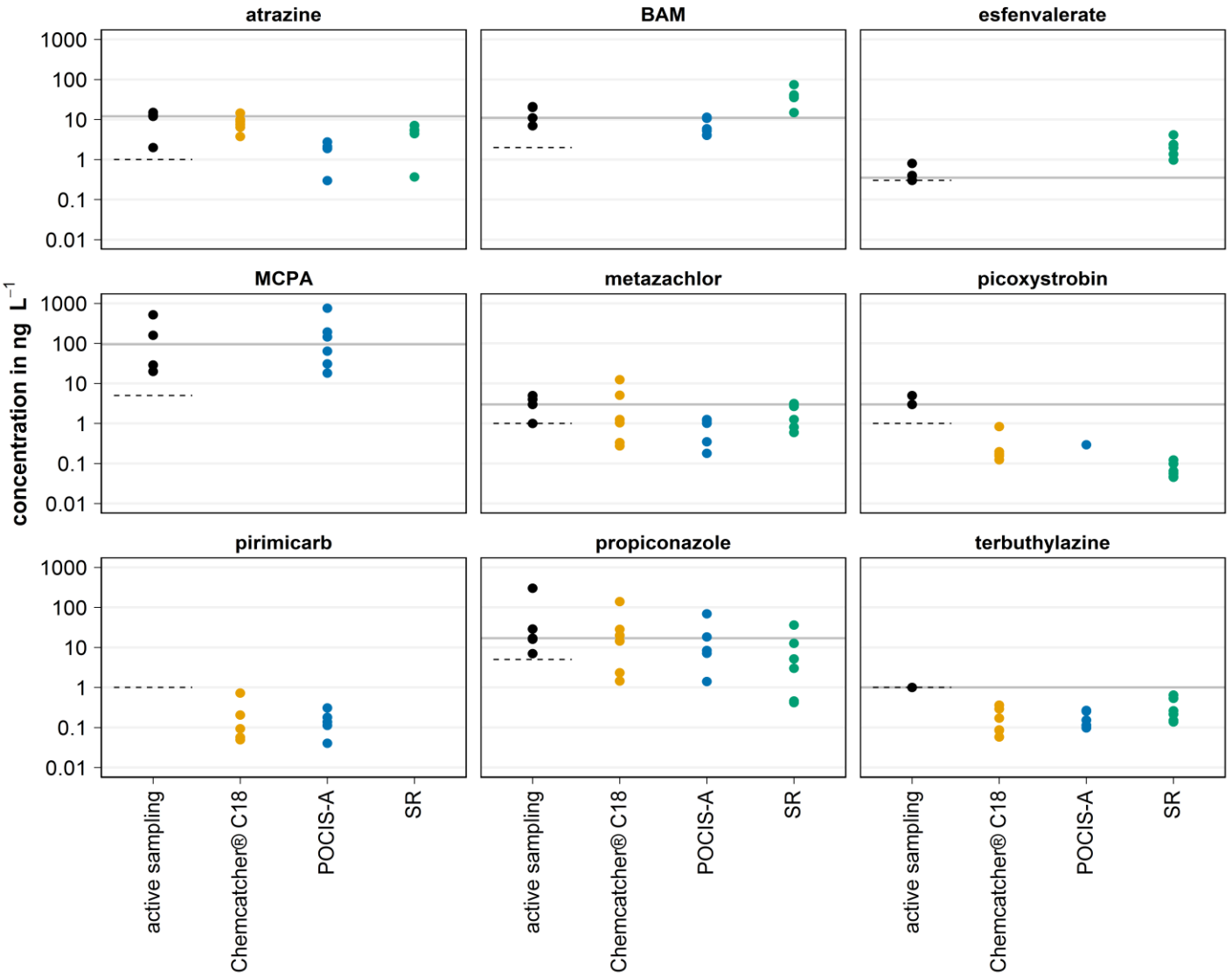
Field application

- Application of three passive sampler types: SR, POCIS-A and Chemcatcher® C_{18}
- Deployment at two active monitoring stations in Sweden for one week over a period of six weeks
- Deployment for 1, 2, 4 and 6 weeks at one site to investigate the uptake profiles

Ahrens L, Daneshvar A, Lau AE, Kreuger J. Submitted.

Comparison of selected pesticides in water using active passive sampling



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Summary

- Sampling rate (R_S) and passive sampler-water partition coefficients (K_{pw}) calculated for five passive sampler types for 124 pesticides
- Good agreement between active and passive sampling results
- 52 pesticides were detected using active sampling, while 69, 58, and 32 using SR, POCIS-A, and Chemcatcher® C_{18}
- 38 pesticides were detected by the passive samplers but not by active sampling
- Passive samplers providing time-integrated concentrations, simple application, and high sensitivity due to pre-concentration

On-going projects using passive sampling

- Suspect and non-target screening of organic micropollutants from on-site sewage facilities (RedMic)
- Toxicity bioassays using passive sampler extracts (Agneta Oskarsson)
- Identification of micropollutants by chemical and toxicological analysis of drinking water using passive samplers (SafeDrink)
- Assessment of the efficiency of water treatment processes for organic micropollutants in drinking water plants (PFAS-FREE)
- Identifying and quantifying loss pathways of pesticides to surface water (Maria Sandin)
- Comparison of grab sampling, TIMFIE and passive sampler (Ove Jonsson)
- Monitoring of pesticides in Sweden (CKB)

THANK YOU
FOR YOUR
ATTENTION!

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