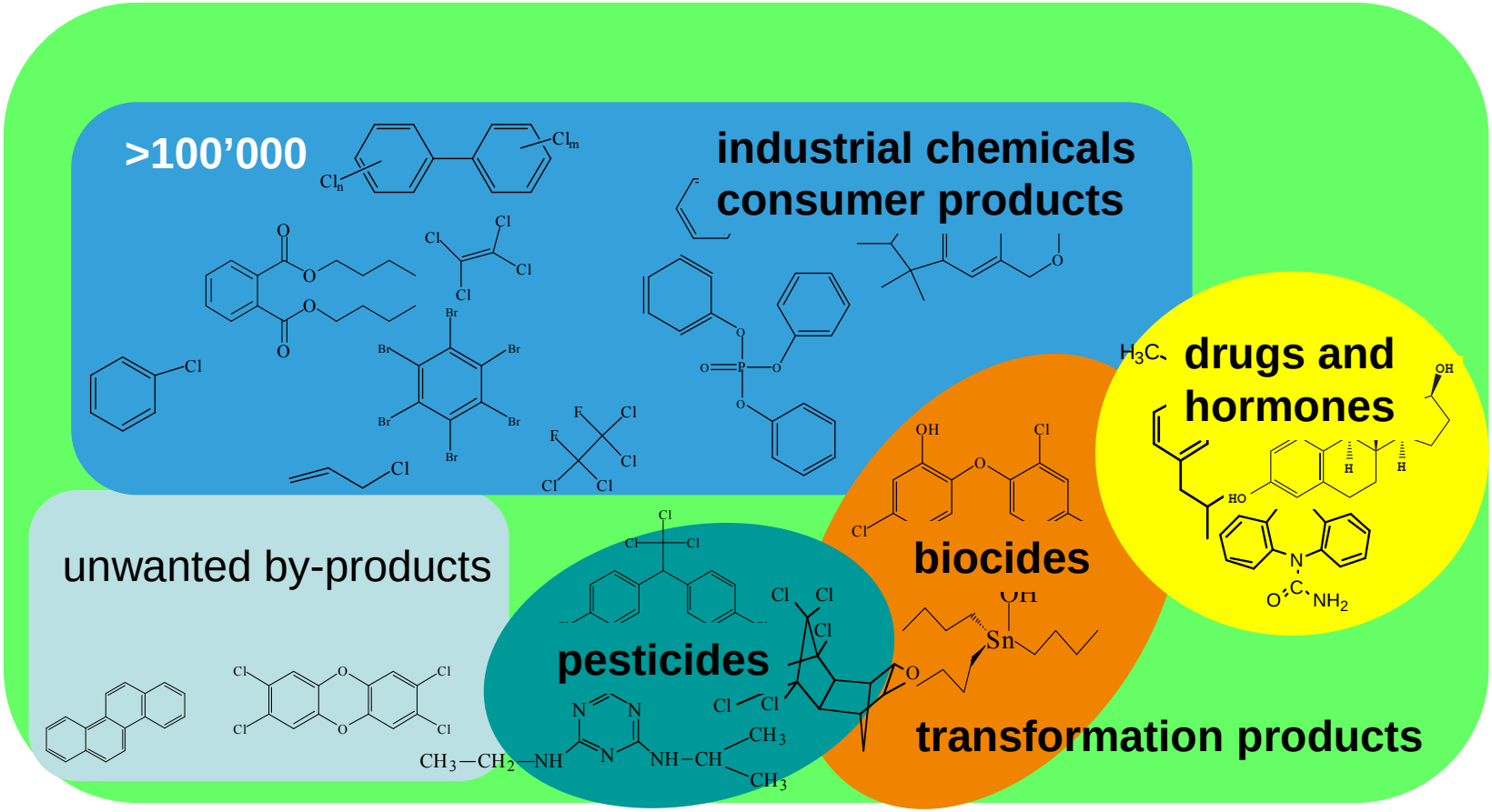
eawag
aquatic research

Passive sampling: biological and chemical analysis of estrogens and photosynthesis inhibitors

Etiënne Vermeirssen and Beate Escher

4th Norman workshop: Lyon, 17-18 March 2008

Micropollutants in the aquatic environment



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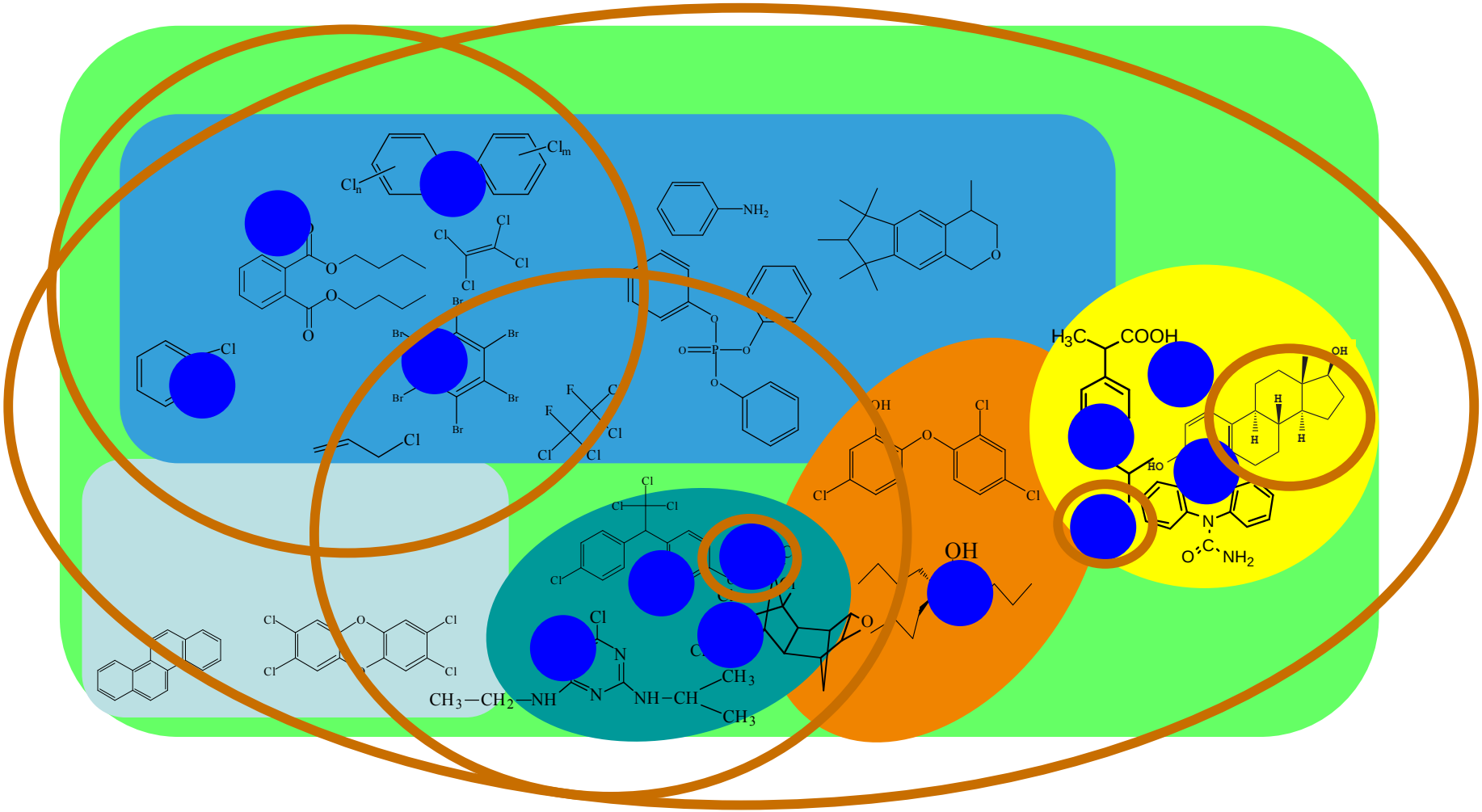
Chemical Analysis

Biological analysis



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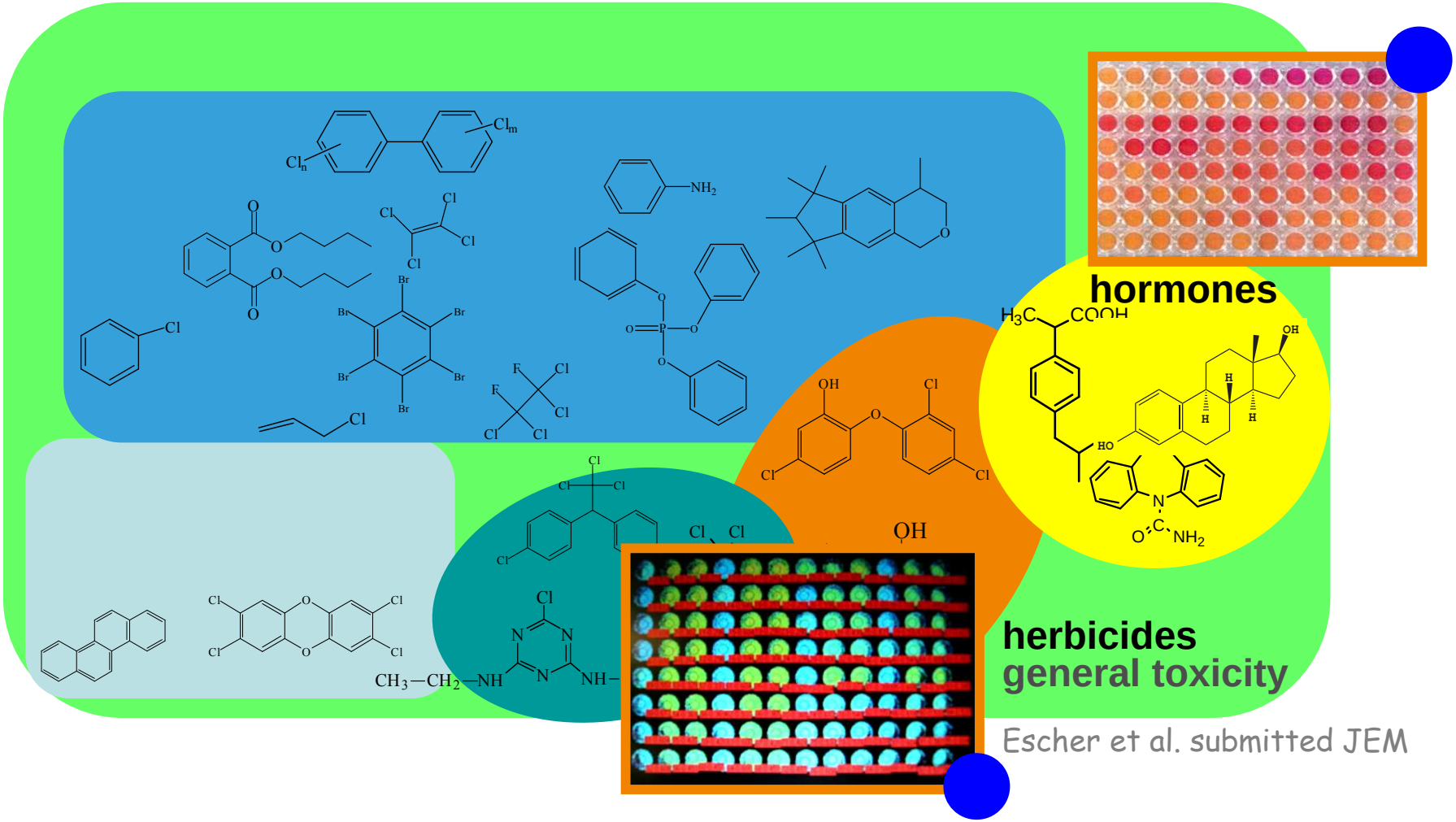
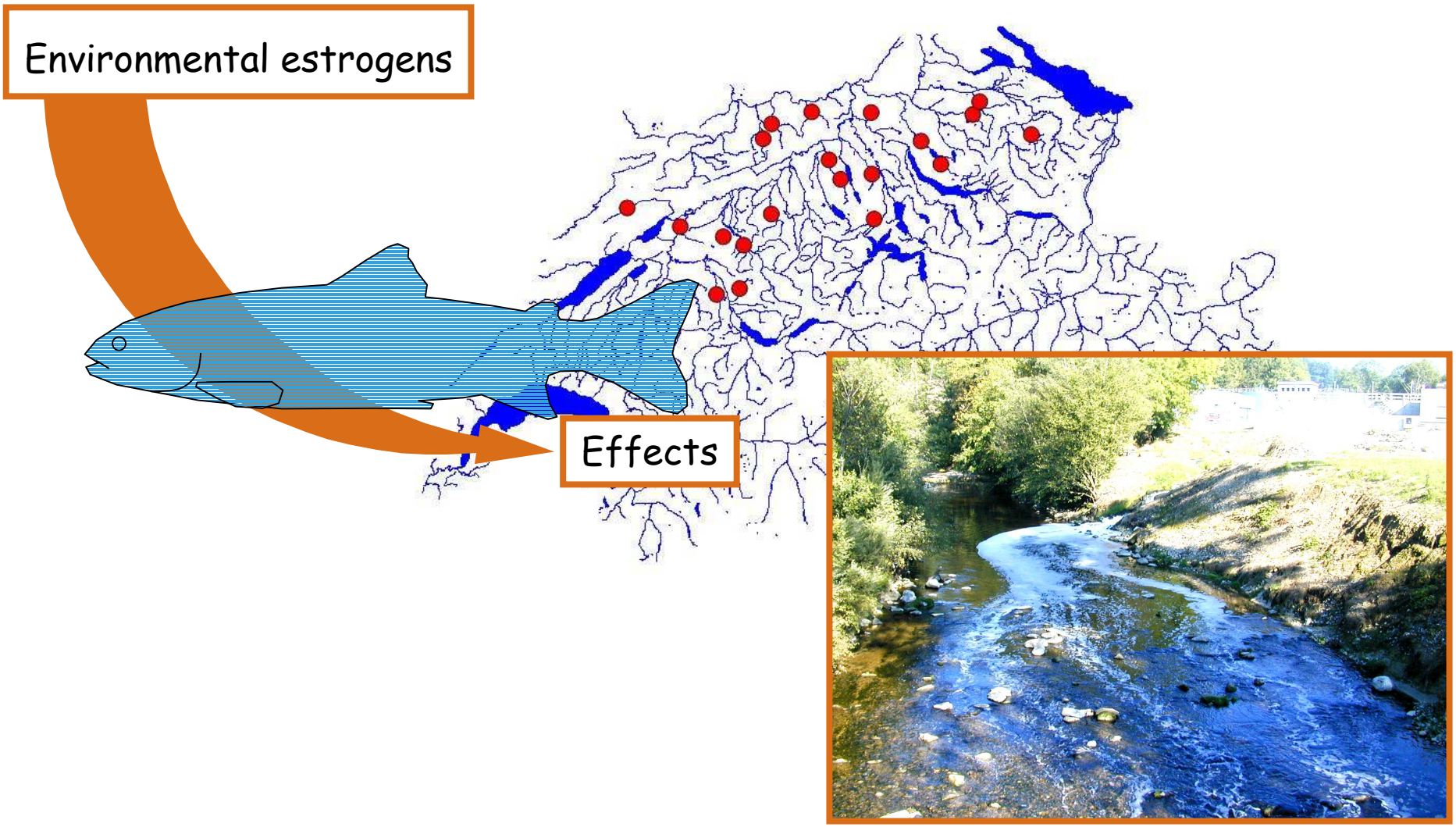
Chemical Analysis

Biological analysis



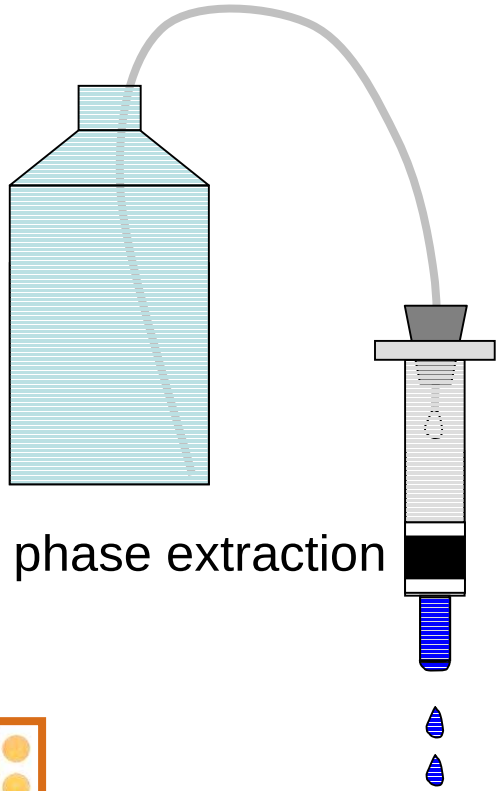
Escher et al. submitted JEM

Reproductive biology → aquatic chemistry



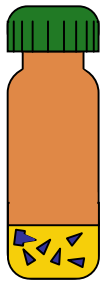
Exposure assessment with grab sampling

grab sample

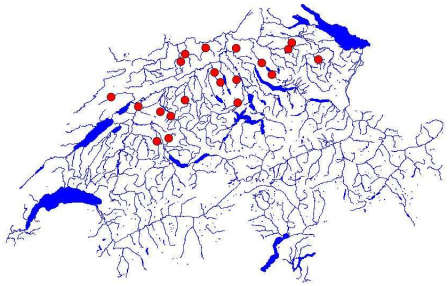


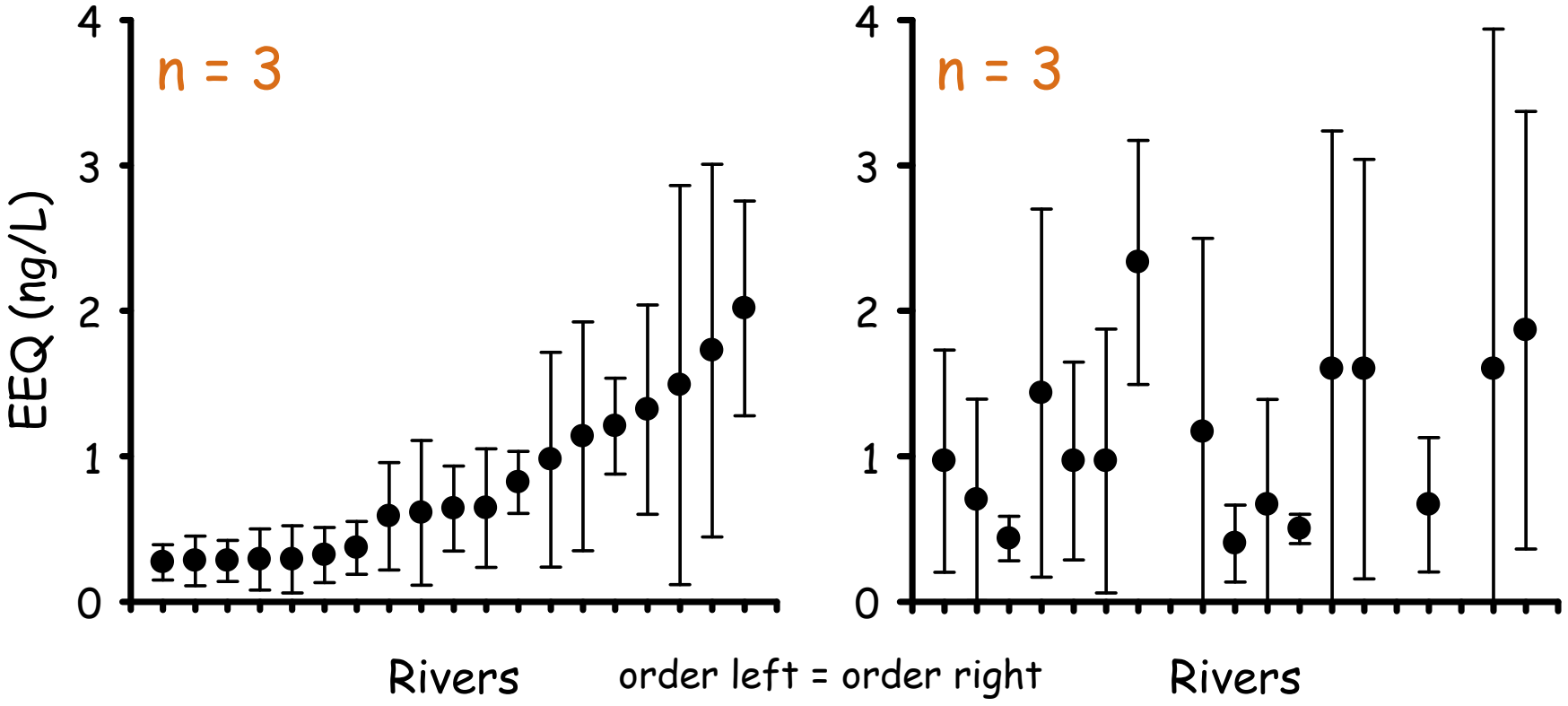
solid phase extraction

yeast estrogen screen



Grab sampling data



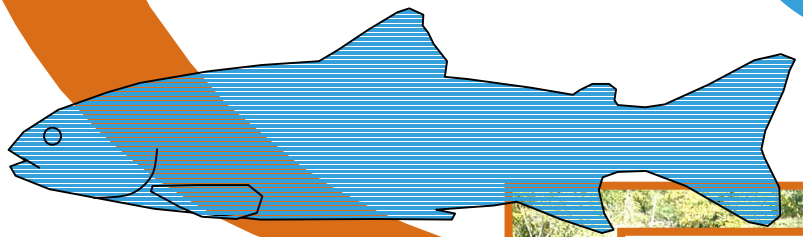


Estrogenicity is low and **very** variable

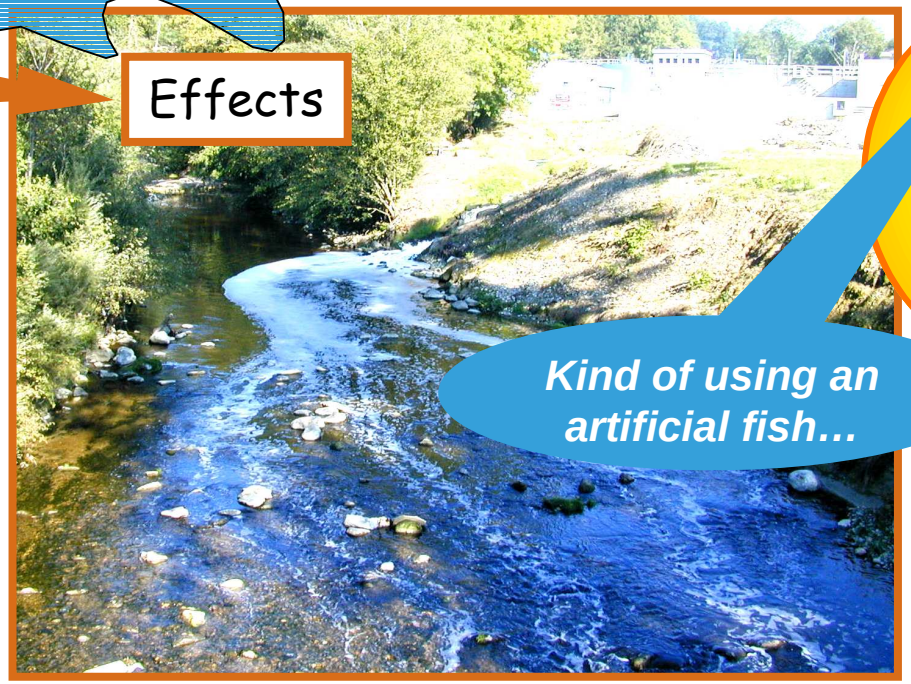
Vermeirssen et al. 2005 ETC 24

A more integrative method is needed…

Environmental estrogens



Effects

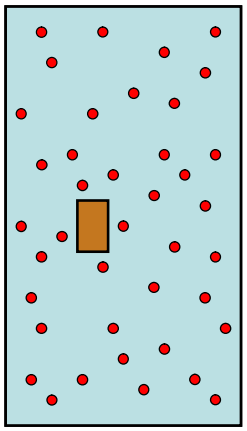


Maybe passive sampling is a solution.

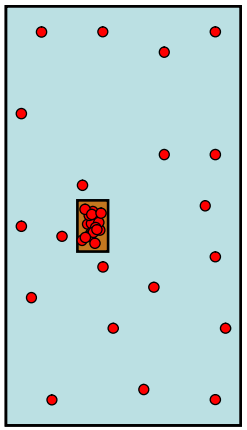
Aquatic chemist

Kind of using an artificial fish…

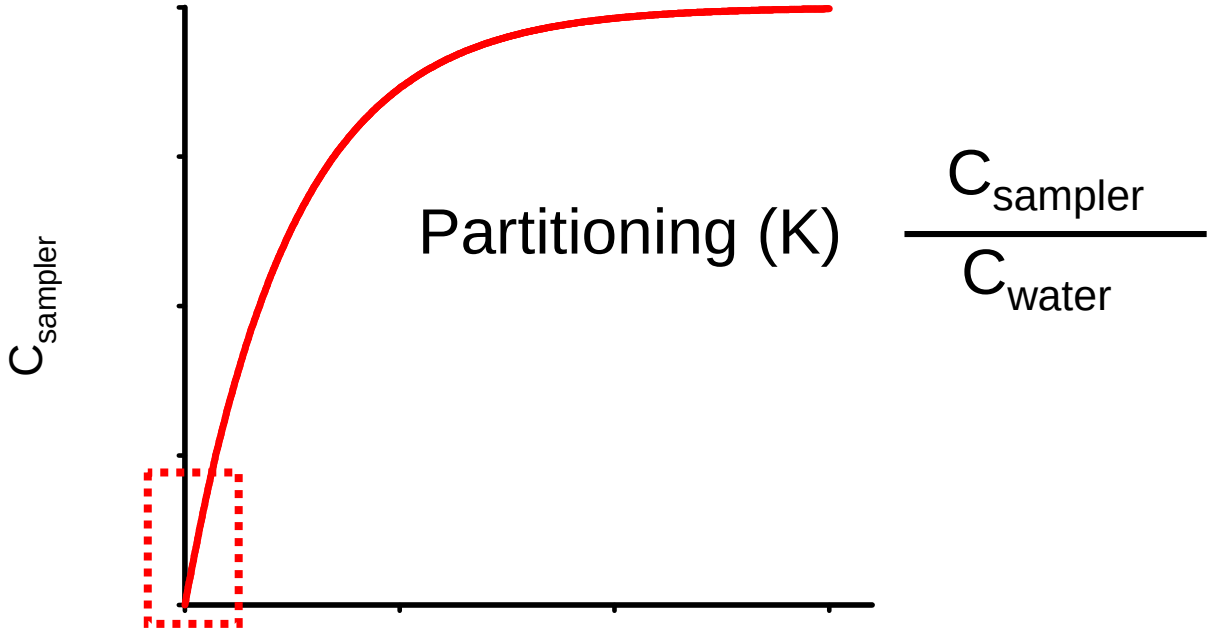
Passive sampling



t = 0

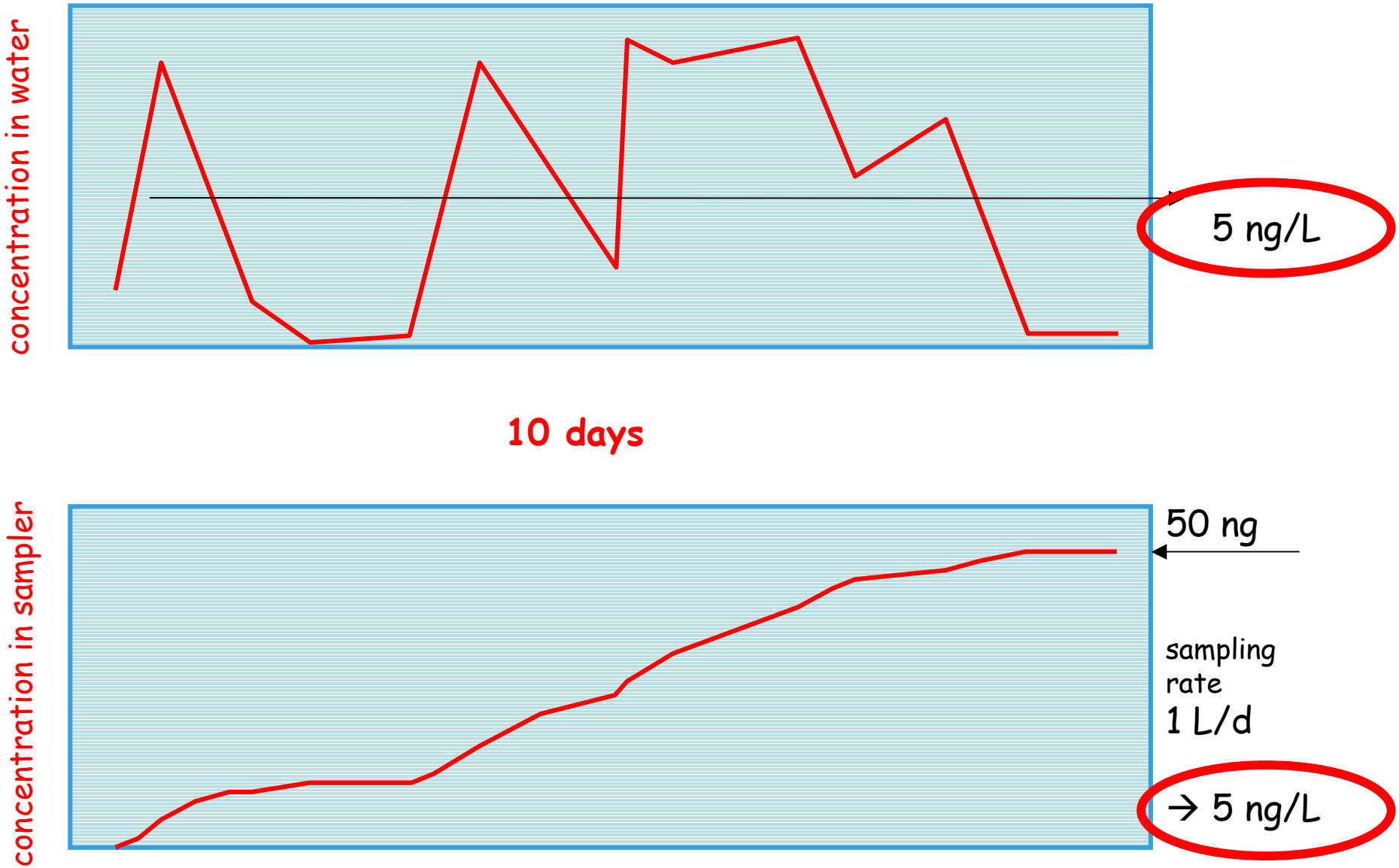


t = x days



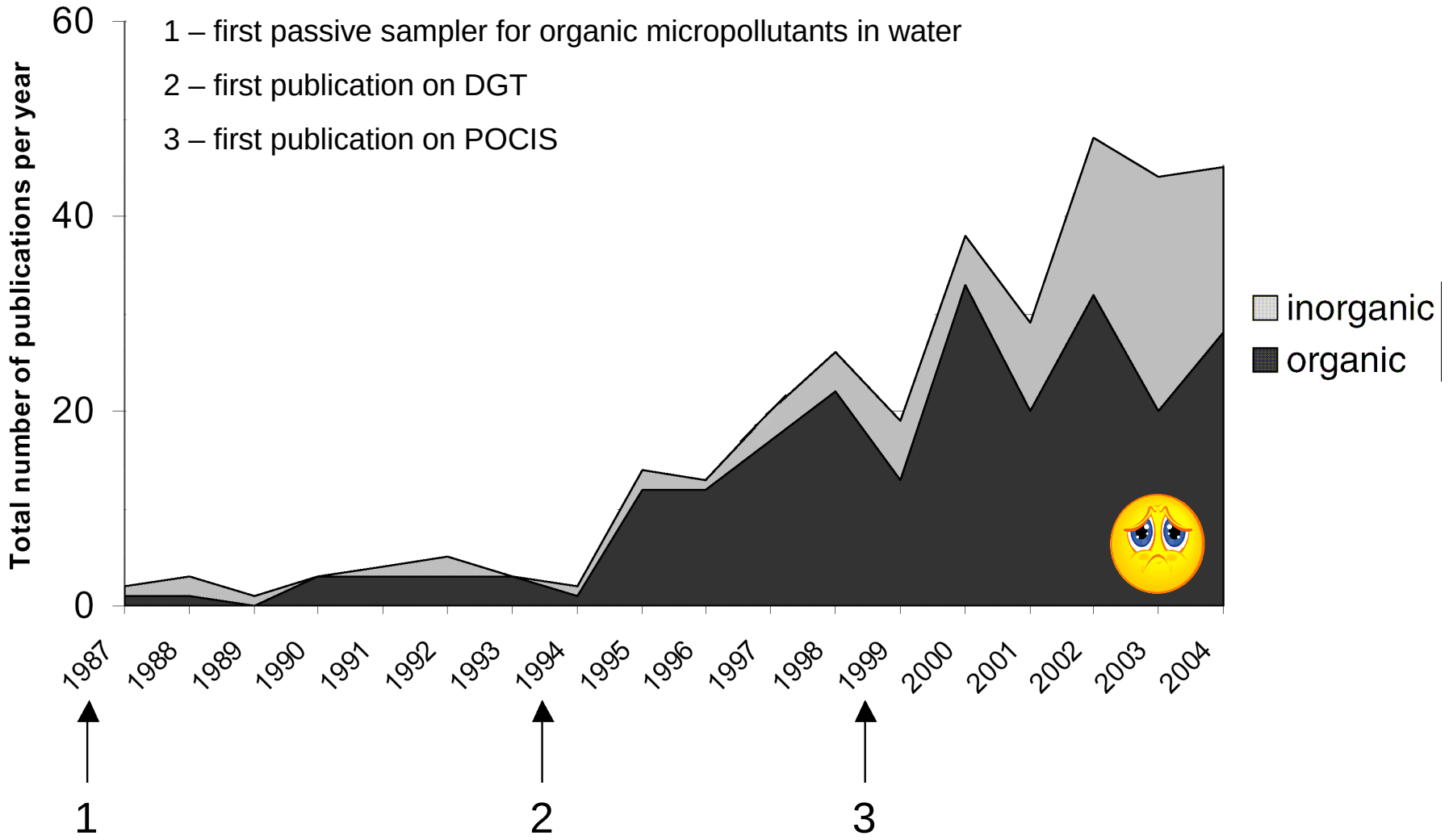
Sampling rate, R_S (L/d)

Ideal passive sampling scenario



Passive sampling – size of research field

Vrana et al. 2005 TrAC 24



Passive sampling – sampler diversity

Vrana et al. 2005 TrAC 24

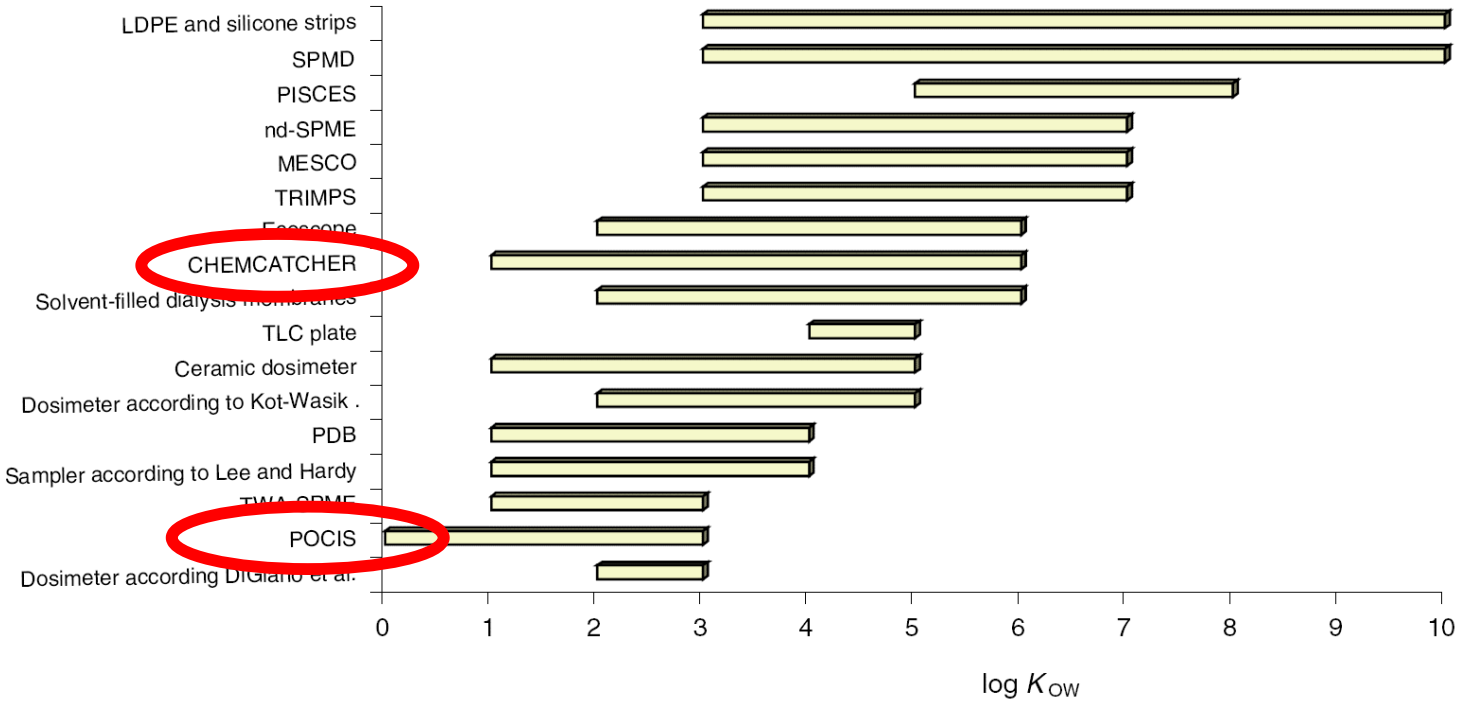
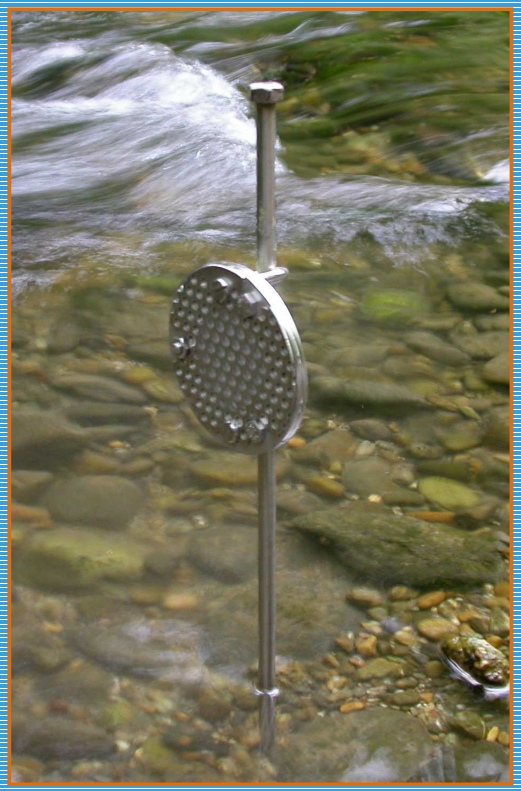
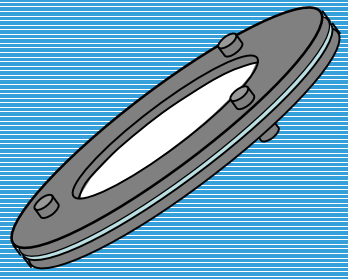


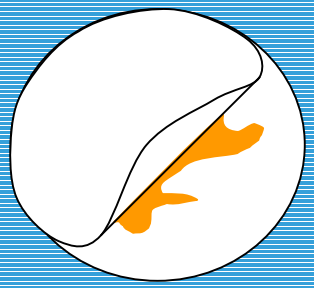
Figure 3. Typical hydrophobicity range of organic compounds sampled by selected passive sampling devices (characterised by the value of octanol/water partition coefficient, log K_{OW}).

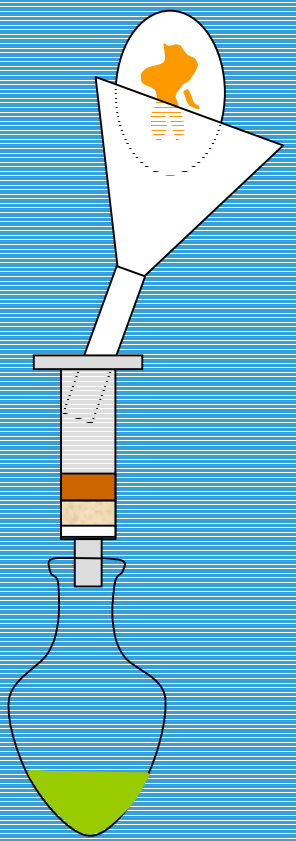
POCIS

Alvarez et al. 2004 ETC 23





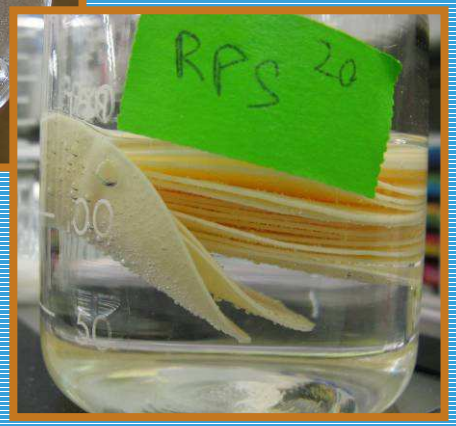




polar organic chemical integrative sampler

Chemcatcher

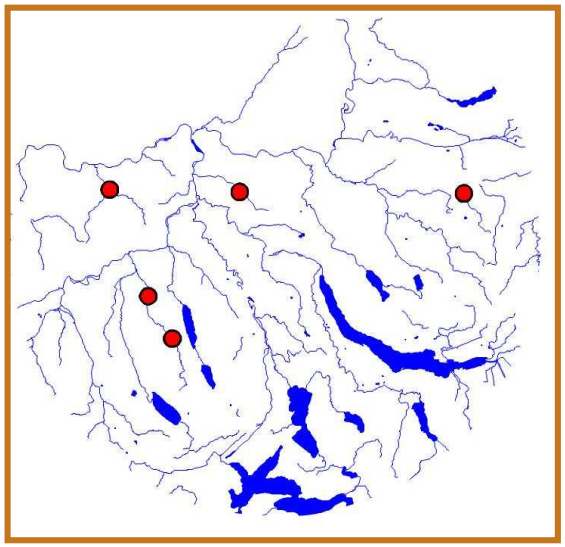
Kingston et al. 2000 JEM 2

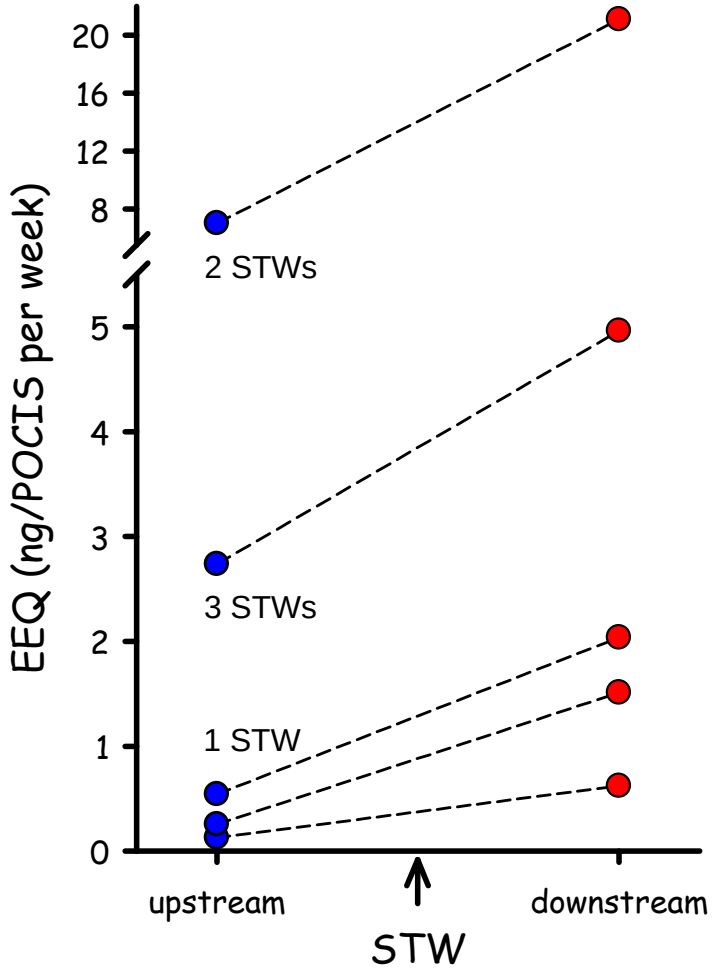


Empore disk in a teflon, polycarbonate or other holder

POCIS around effluent discharges

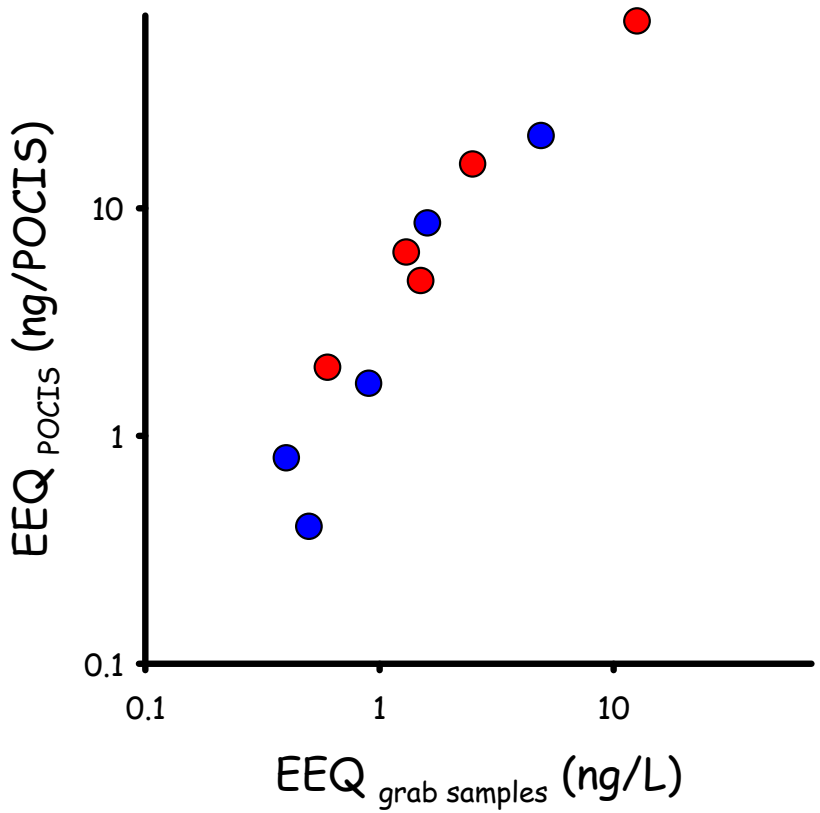
- Do POCIS see the effluent?
- Do POCIS integrate variable EEQ concentrations?
- How do POCIS compare to fish?





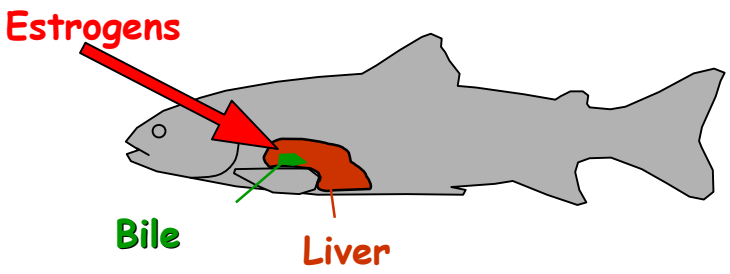
POCIS and grab samples

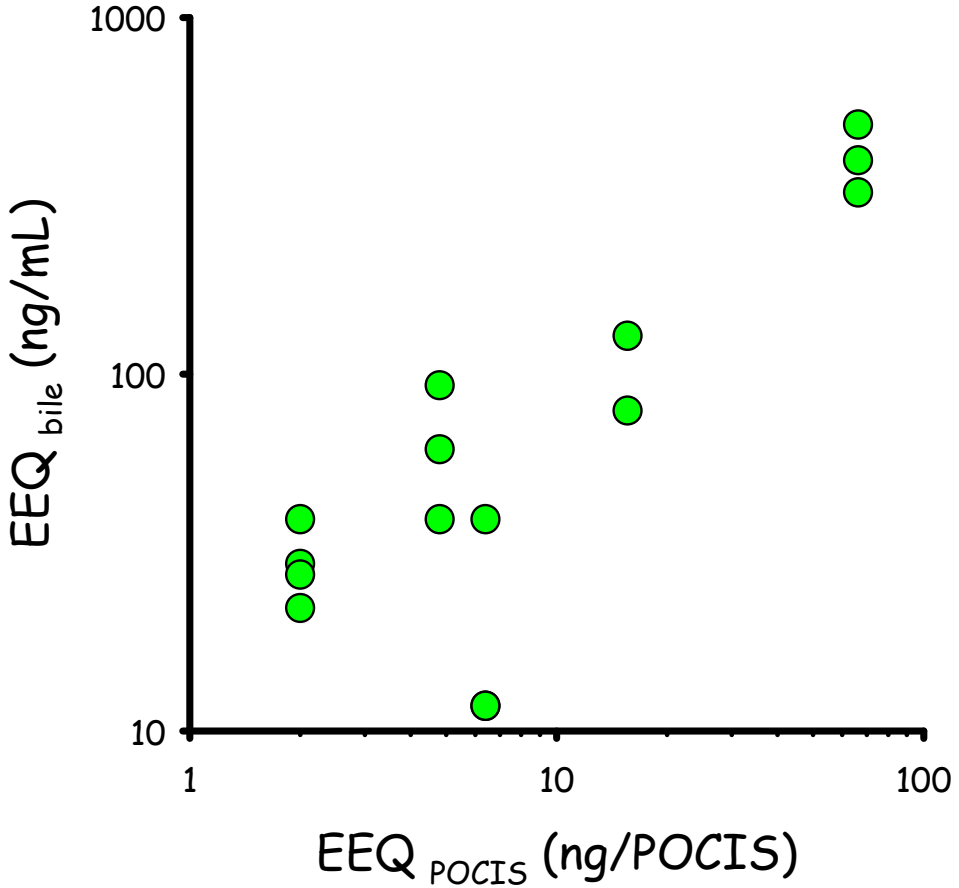
- Do POCIS see the effluent?
- Do POCIS integrate variable EEQ concentrations?
- How do POCIS compare to fish?



POCIS and fish bile

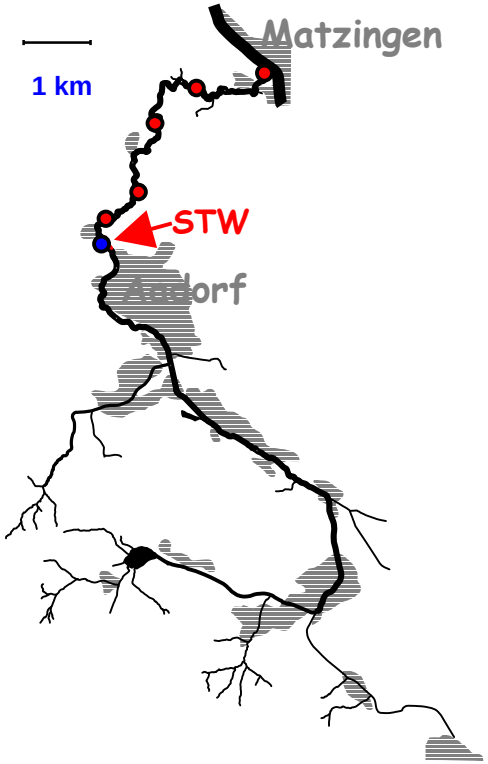
- Do POCIS see the effluent?
- Do POCIS integrate variable EEQ concentrations?
- How do POCIS compare to fish?



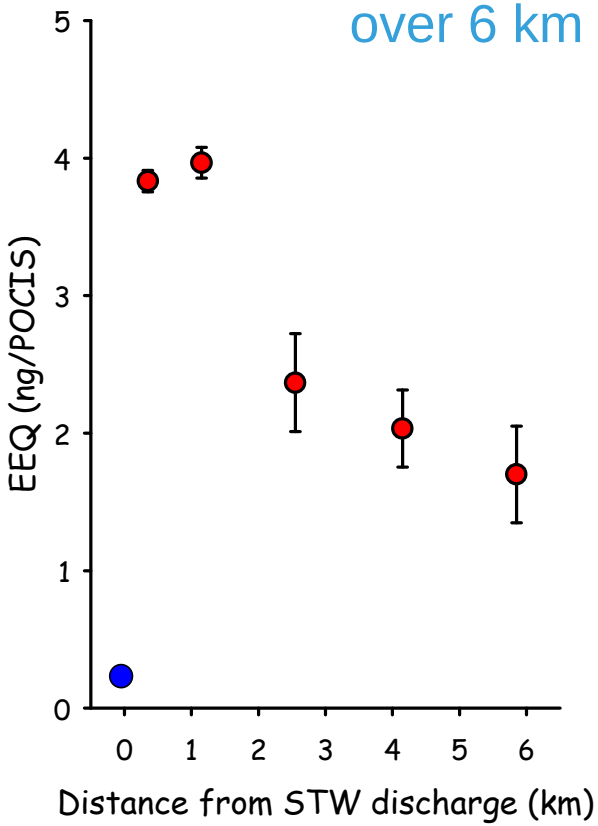


Estrogen plume in a river transect

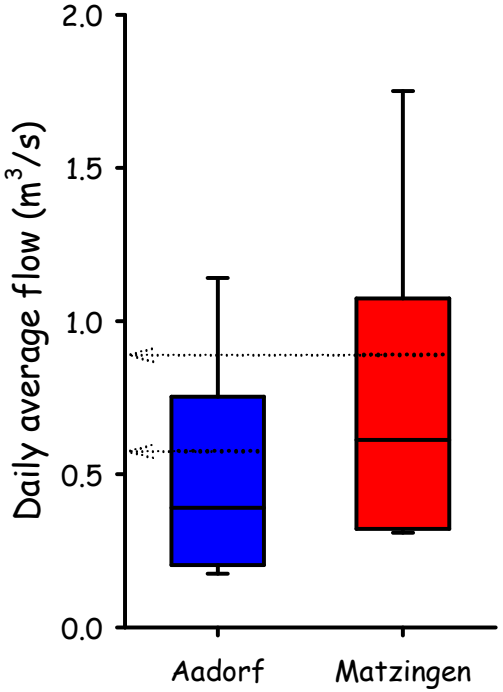
Vermeirssen et al. 2006 ETC 25



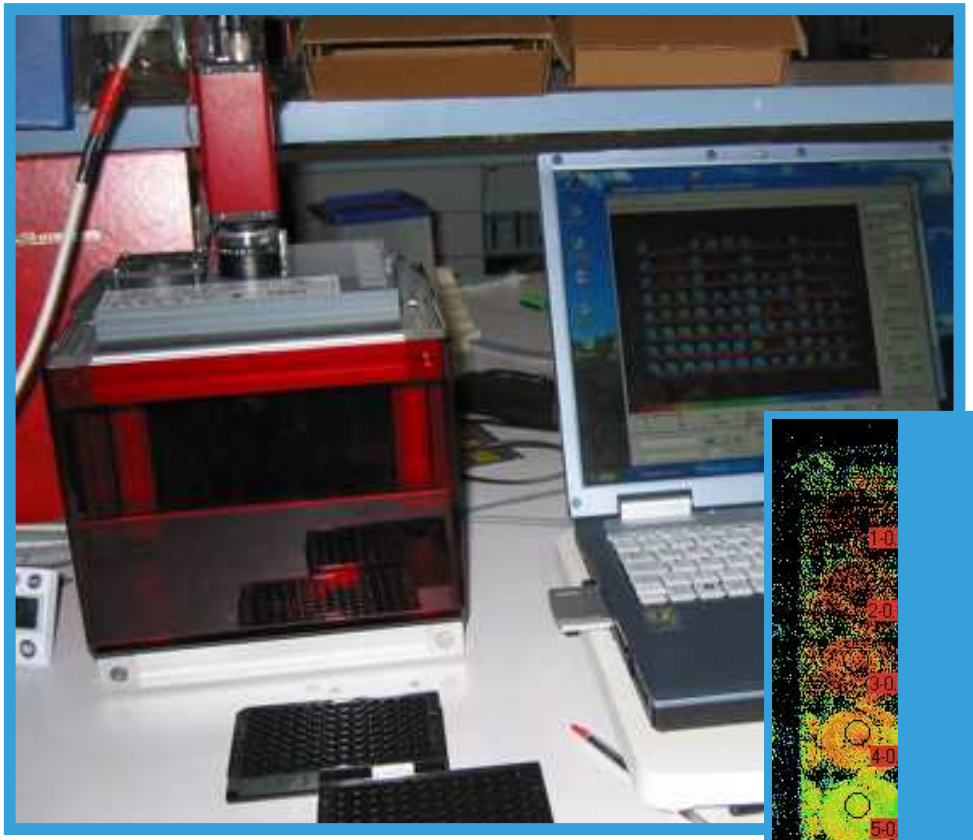
~55% of EEQs lost over 6 km



~30% dilution over 6 km

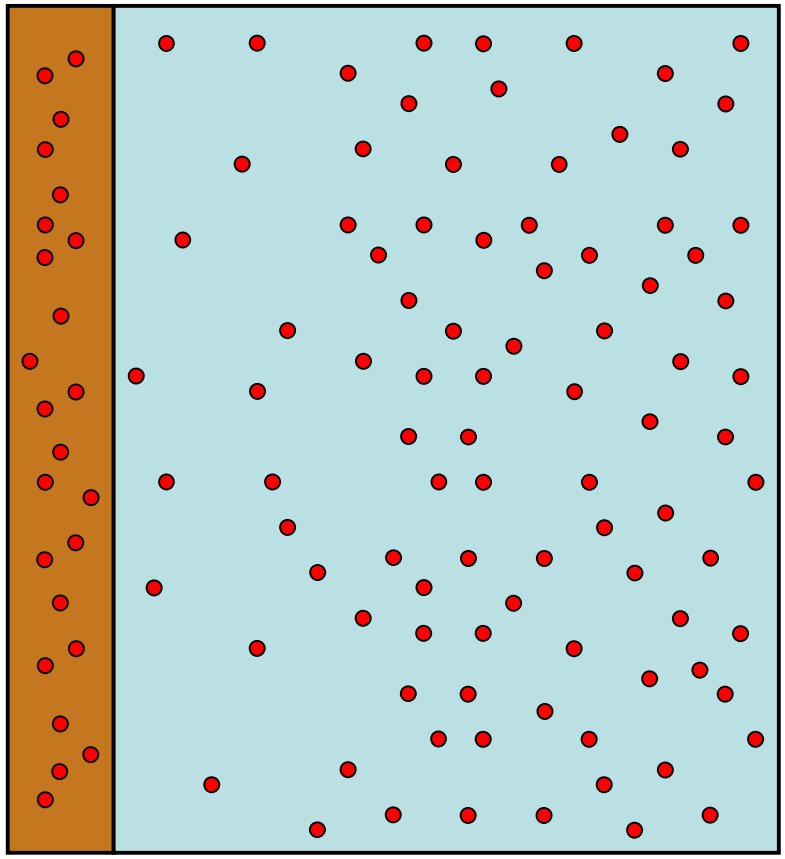


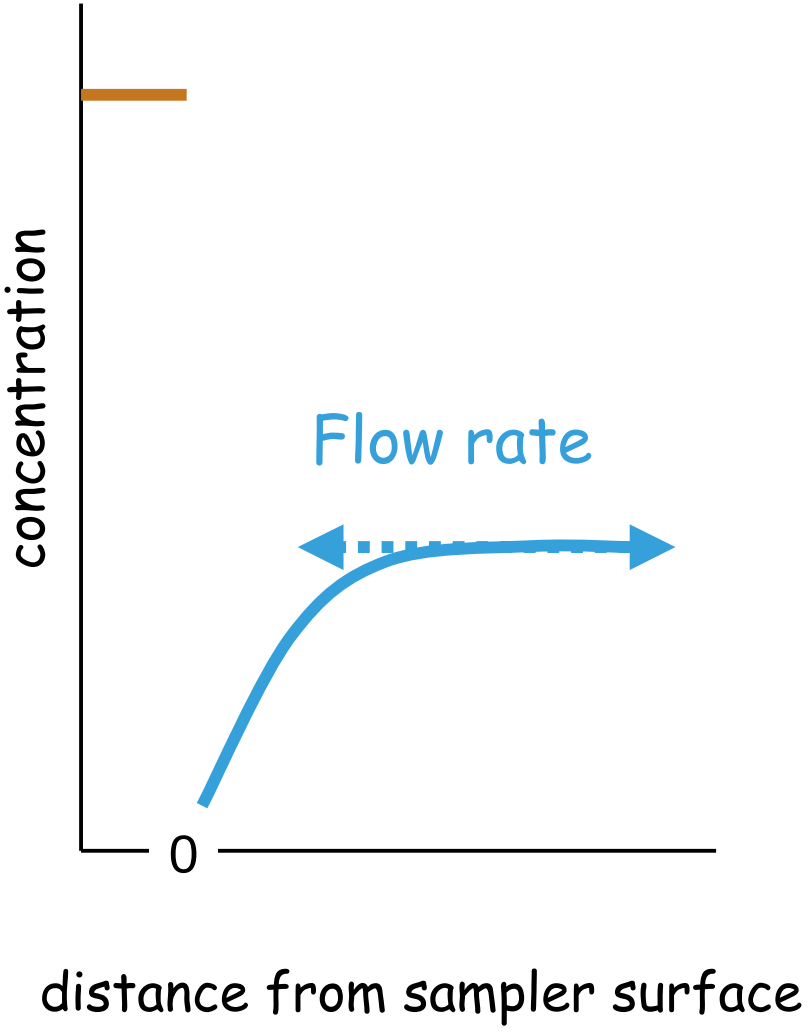
Chemcatcher and photosynthesis inhibition



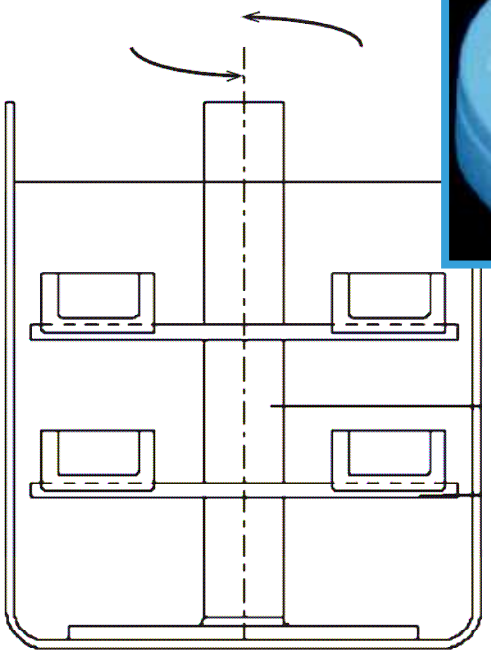
Diuron equivalents
DEQ

Passive sampling: biofouling, ℃, m/s…

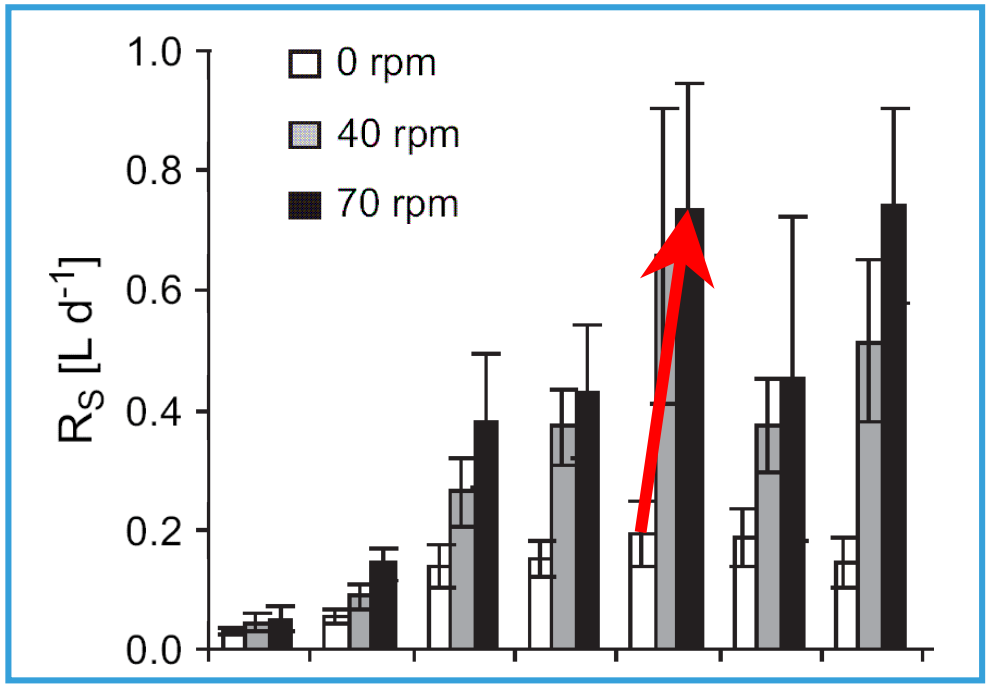




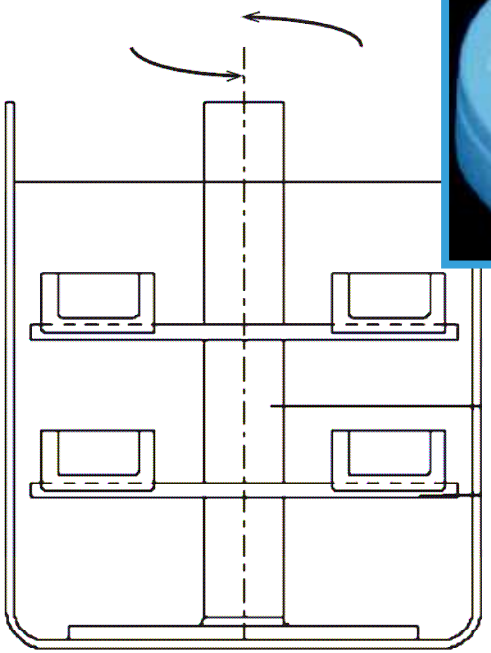
Turbulence and Chemcatcher



Vrana et al. 2006 Environ. Pollut. 142



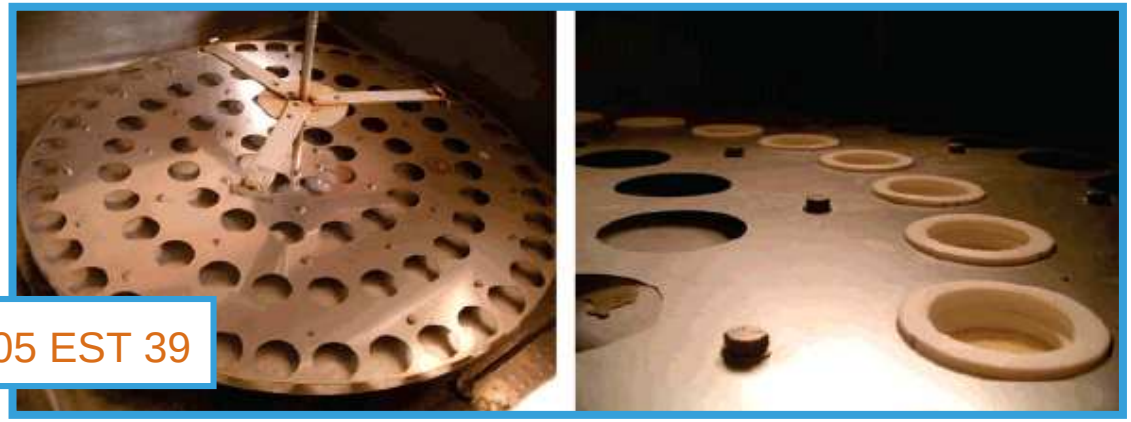
Turbulence and Chemcatcher



Vrana et al. 2006 Environ. Pollut. 142

20 litres

1400 litres



Stephens et al. 2005 EST 39

Flow under environmental conditions

Vermeirssen et al. 2008 JEM 10

20000 L/h

Conclusions

- Passive samplers already provide very valuable data sets

  Is concentration always needed?

- They provide good samples for biological and chemical analysis

- Environmental effects on the sampling rate can be large – a system is needed for correcting field sampling rates

  For SPMDs and non-polar Chemcatcher, performance reference compounds exit

Development of the Permeability/ Performance Reference Compound Approach for In Situ Calibration of Semipermeable Membrane Devices

JAMES N. HUCKINS,*,†

Huckins et al. 2002 EST 36

Acknowledgements

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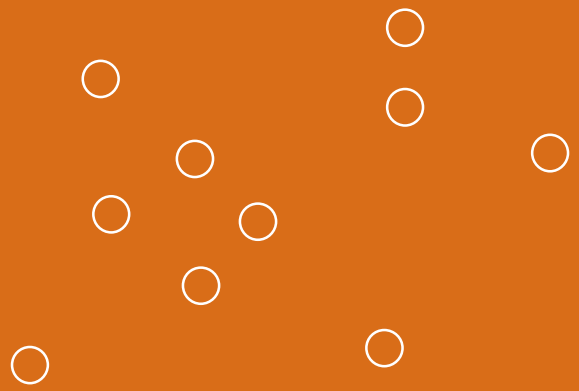
Thank you for your attention !



Eawag: Das Wasserforschungs-Institut des ETH-Bereichs