NORMAN WWTP Project

European case study on wastewater treatment plant effluents

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Leipzig

Objectives

- Identify relations between measurable contamination and effects in biotests
- Identify typical drivers of effects
- Identify typical chemical and effect patterns

Sampling campaign – 57 LVSPE WWTP effluent samples

Jörg Ahlheim (WANA/UFZ)

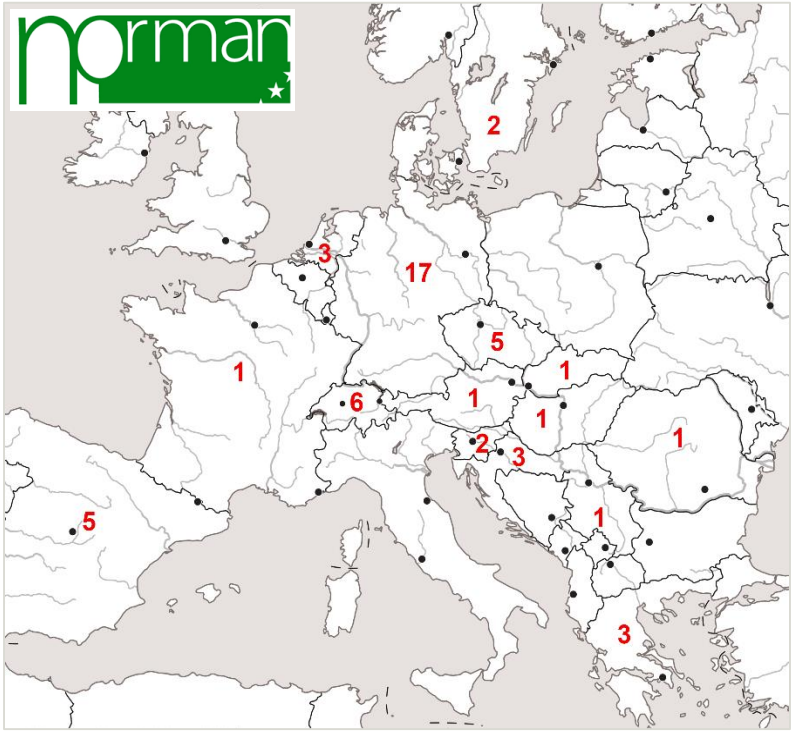
Foto by Jörg Ahlheim

Foto by USDA (www.wikipedia.org)

General information

- Large Volume Solid Phase Extraction (LVSPE)
- 52 European WWTPs (5 sampled 2x)

➢ **57 LVSPE effluent samples**



15 Countries

Germany (17)
Switzerland (6)
Czech Republic (5)
Spain (5)
Croatia (3)
Greece (3)
Netherlands (3)
Slovenia (2)
Sweden (2)
Austria (1)
France (1)
Hungary (1)
Rumania (1)
Serbia (1)
Slovakia (1)

Chemical target screening

- ✓ **Wide-scope target screening (~500 compounds)** (WANA, UFZ)
- ✓ **Screening of 80 steroids and phenols** (WANA, UFZ)

Effect screening – *in vivo*

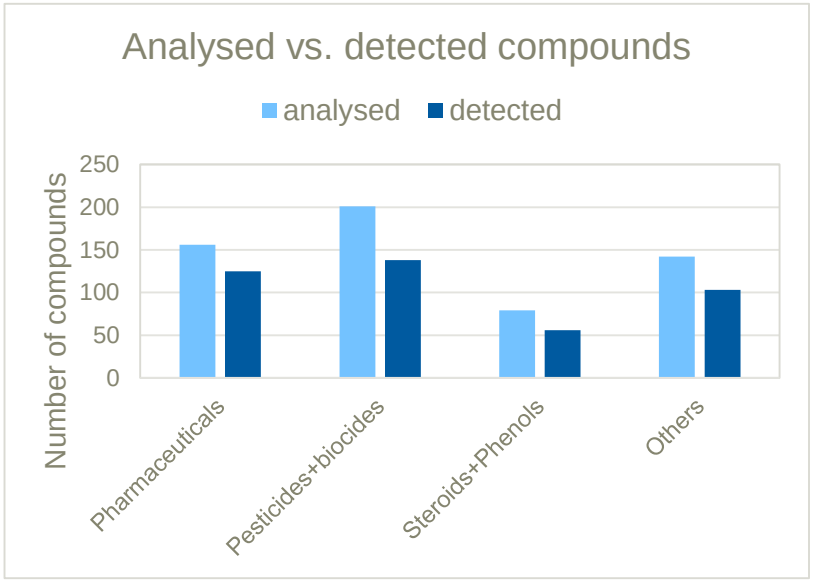
- ✓ **Algae bioassay I** (ÖZ/EAWAG)
- (✓) **Algae bioassay II** (BIOTOX, UFZ)
- (✓) **Daphnia bioassay** (BIOTOX, UFZ)

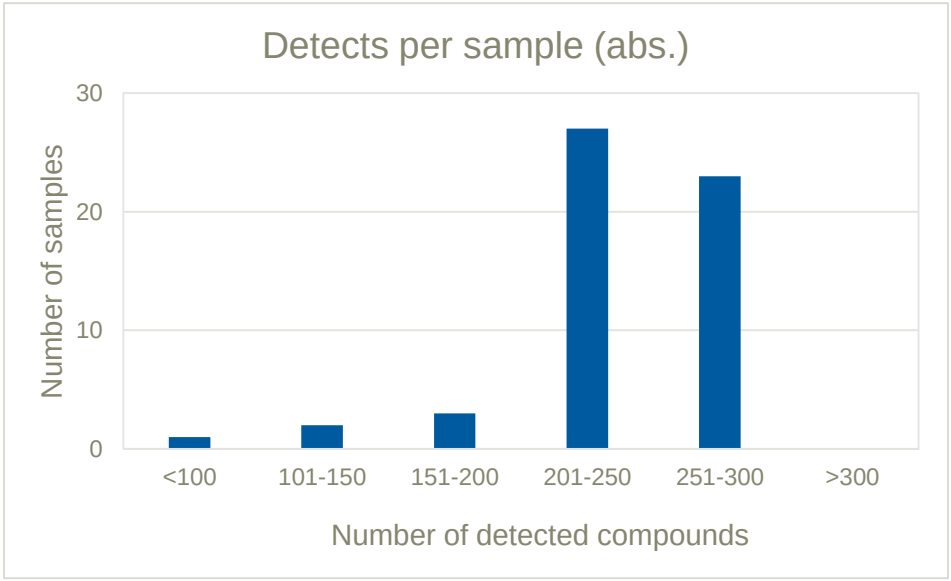
Effect screening – *in vitro*

- ✓ **GeneBLAzer assays: ERα, GR, AR, PR** (CELLTOX, UFZ)
- (✓) **CALUX assays: ERα, Anti-AR** (RWTH Aachen)
- ✓ **Planar Yeast Estrogen Screen (p-YES)** (BfG)

Detected compounds

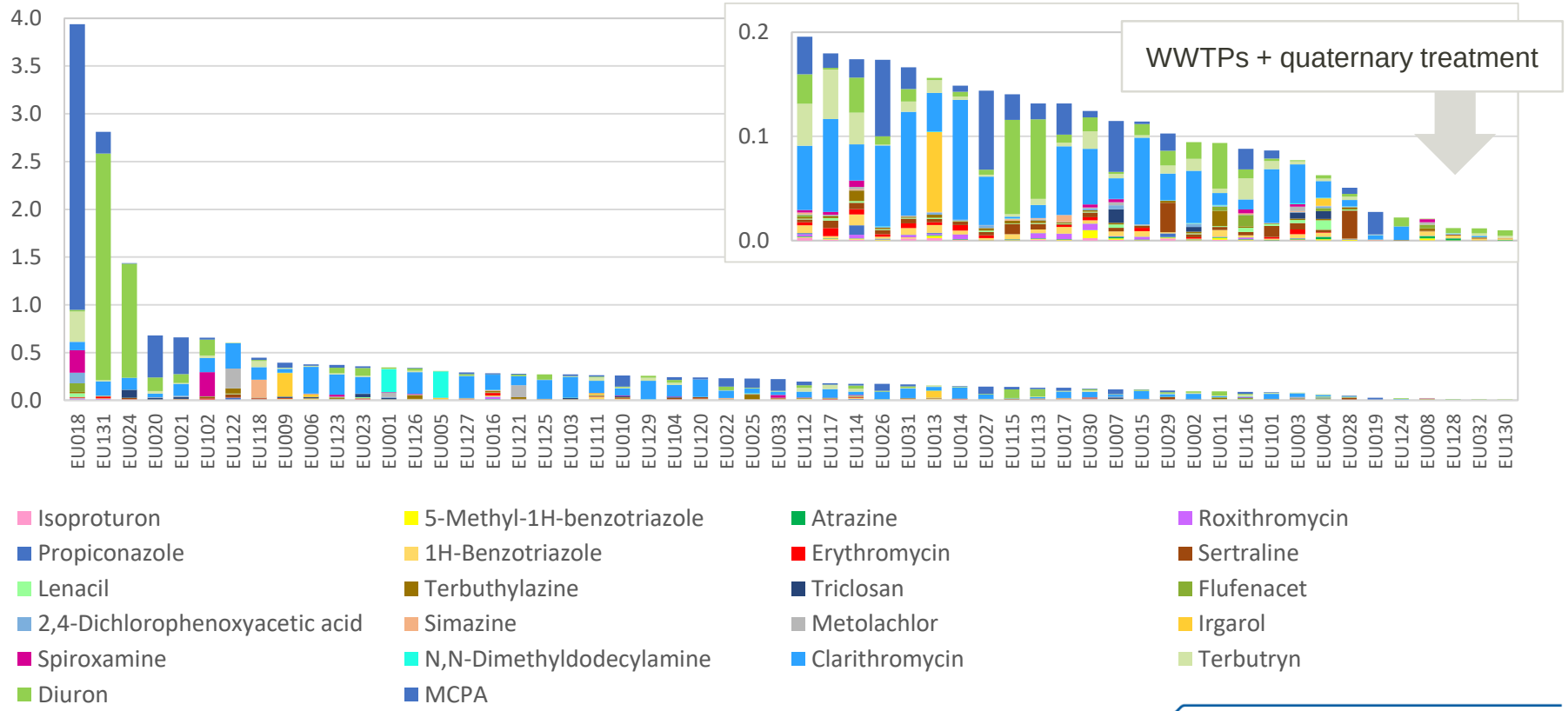
S. Finckh and W. Leekitratanapisan (WANA/UFZ)



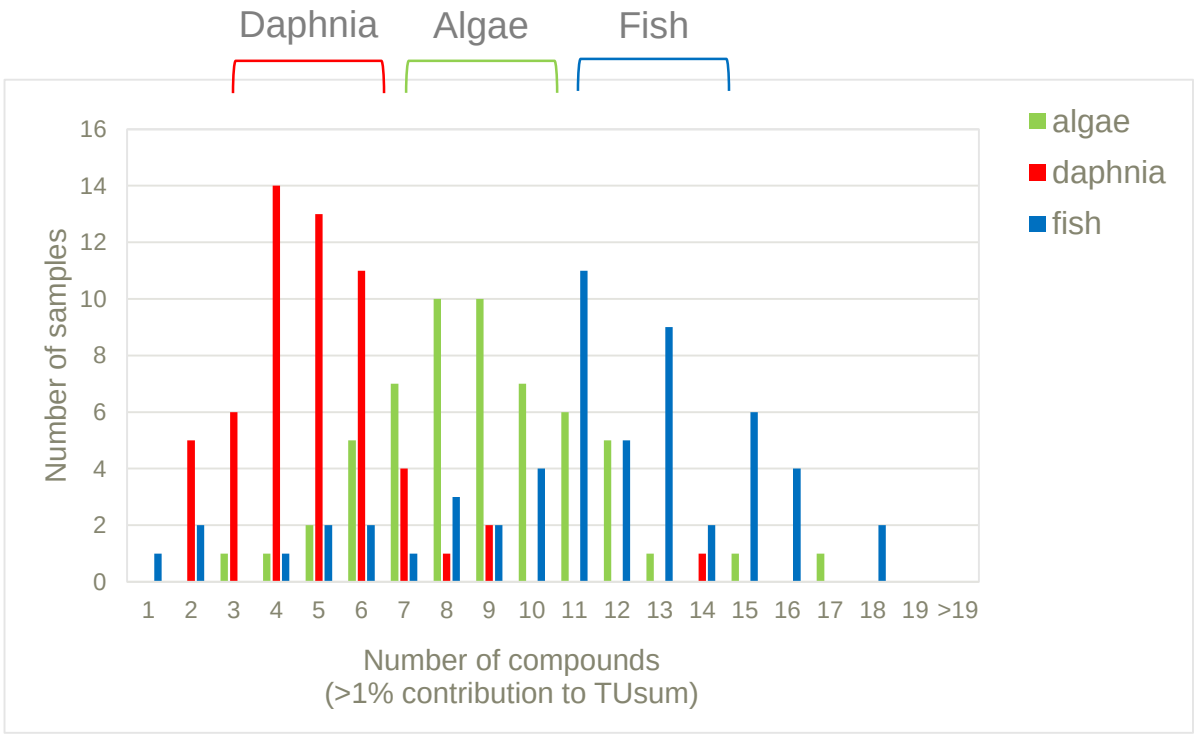


- Analysed compounds: 578
- Detected compounds: 422
- Detected compounds per sample: 200-300
- Many target compounds frequently detected

Risk assessment – Algae toxicity (TU approach)



TUsum: How many compounds contribute >1% ?



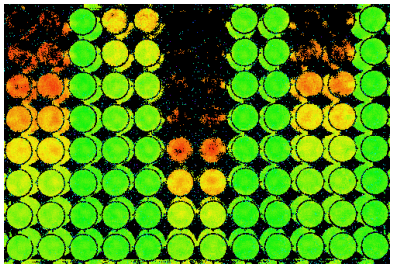
Drivers of Toxicity

- **Daphnia**
  - 4-6 compounds
- **Algae**
  - 8-10 compounds
- **Fish**
  - 11-13 compounds

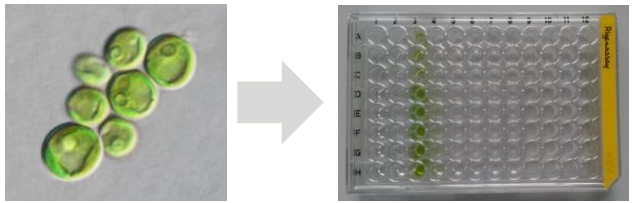
Algae bioassays – PSII and growth

E. Vermeirssen (ÖZ/EAWAG), M. Schmitt-Jansen (BIOTOX/UFZ)

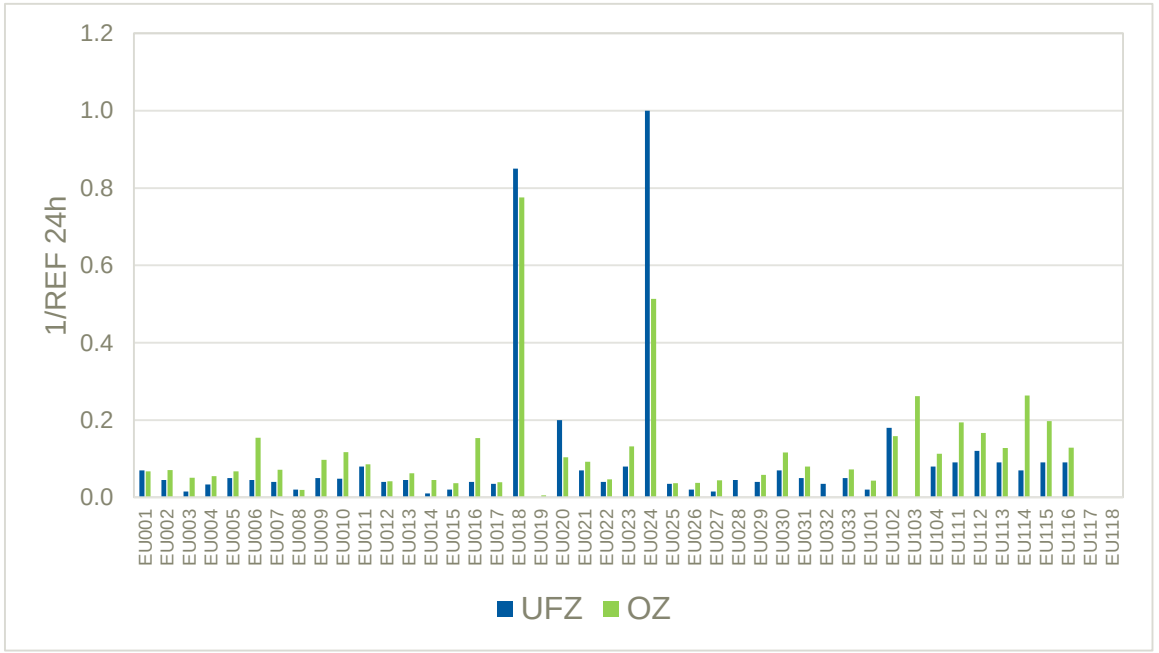
Pseudokirchneriella subcapitata



Scenedesmus vacuolatus



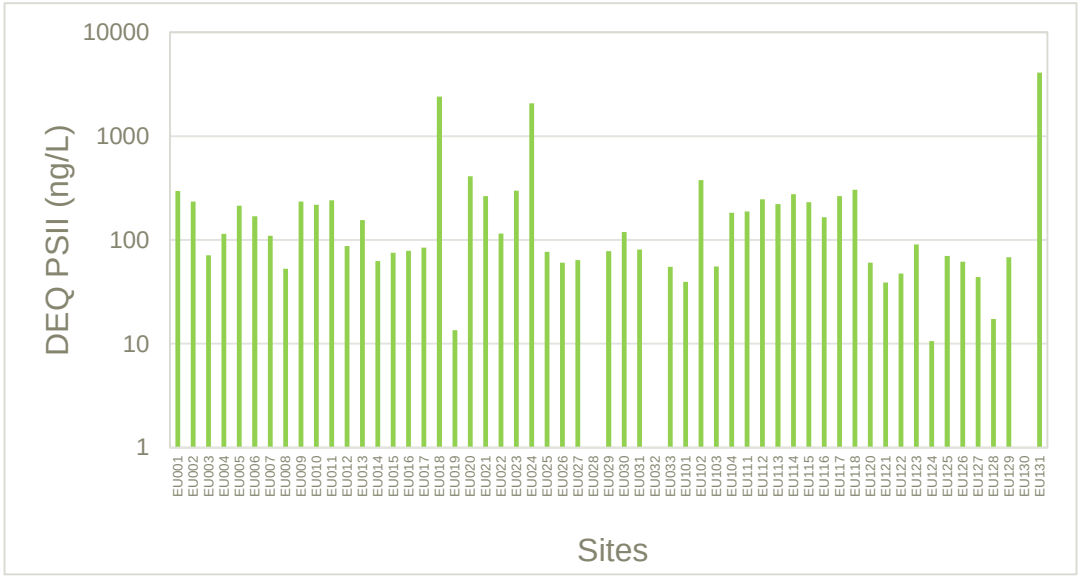
PSII inhibition – REF = Relative Enrichment Factor

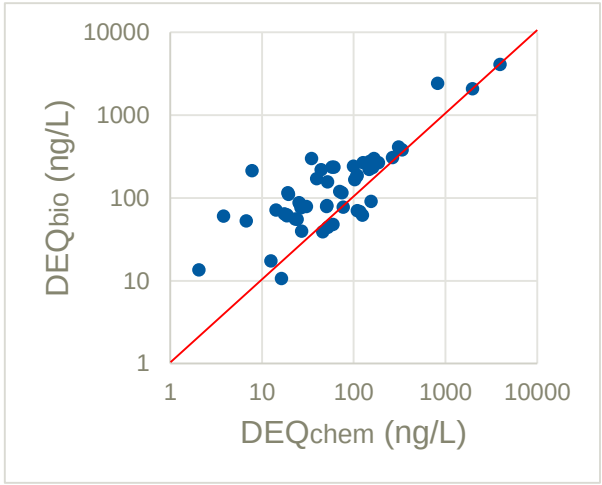


Algae toxicity – chemical vs. effect data

E. Vermeirssen (ÖZ/EAWAG), S. Finckh (WANA/UFZ)

PSII inhibition (algae bioassay I) – DEQ = Diuron Equivanlents



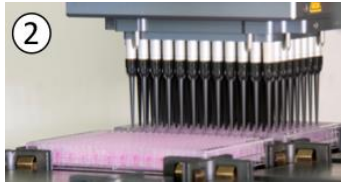


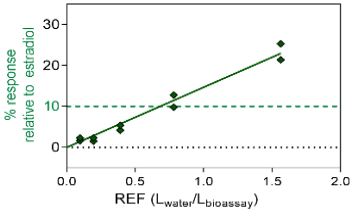
Diuron	Terbuthylazine
Isoproturon	Terbutryn
Chlorotoluron	Atrazine
Metribuzin	Irgarol
Metamitron	Simazine
Chloridazon	Lenacil
Linuron	

Estrogenicity – GeneBLAzer ER and pYES

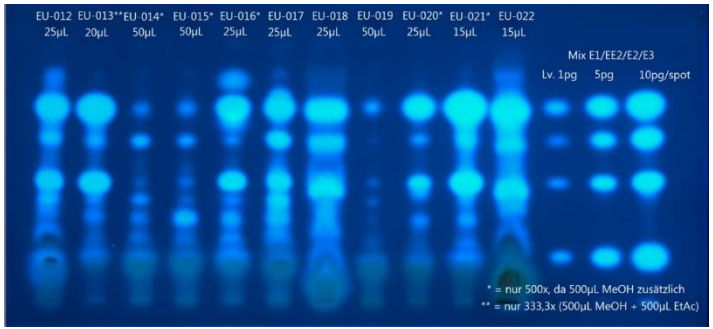
S. Buchinger (BfG), W. Leekitratanapisan (WANA/UFZ), B. Escher (CELLTOX/UFZ)

GeneBLAzer ER





Planar Yeast Estrogen Screen (pYES)



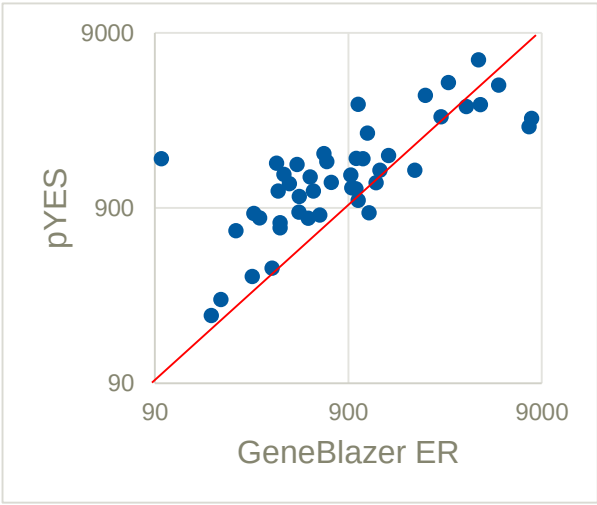
E1
EE2
E2

E3

Samples

References

Estradiol Equivalents EEQ (pg_{E2}/L)



Next steps...

- 1st publication in progress (chemical target screening)
- December 2020: Collect all final data
- January 2021: Virtual project meeting
- Discussion on further publications:
  - "*in-vivo* publication"
  - "*in-vitro* publication"

Thank you!