Foto: Andre Künzelmann

Assessing the potential impact of complex mixtures on water quality and aquatic ecosystems - What can we learn from SOLUTIONS?

solutions

Werner Brack and more than 100 scientists from 39 institutions

Towards a non-toxic environment strategy

Living well, within
the limits of our planet

7th Environment Action Programme

1. The European Parliament and the Council shall adopt specific measures against pollution of water by individual pollutants or groups of pollutants presenting a significant risk to or via the aquatic environment, including such risks to waters used for the abstraction of drinking water. For those

Water Framework Directive

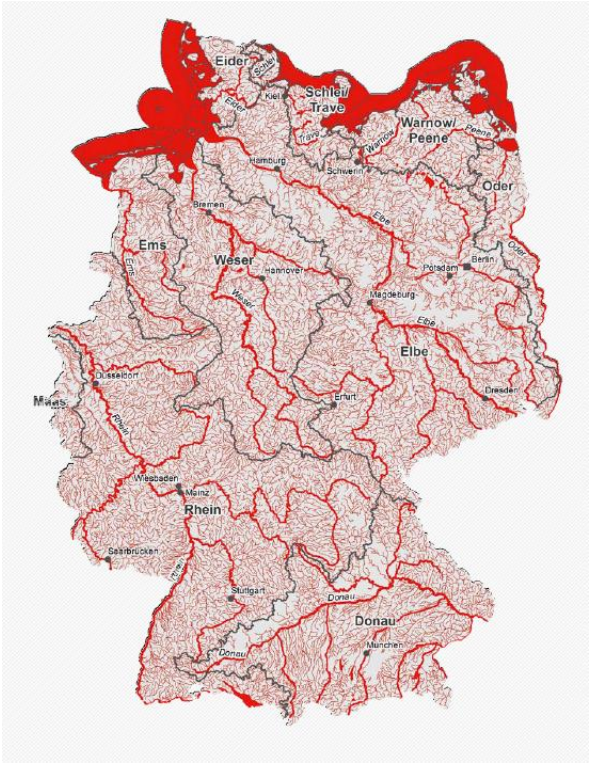
solutions

Towards a non-toxic environment strategy

Chemical Status based on 45 Priority Substances

- not appropriate
- ignores most of the chemicals
- ignores mixtures
- gives incentives for „bad“ substitutions
- not solution-oriented, no differentiation

Chemical Status Germany

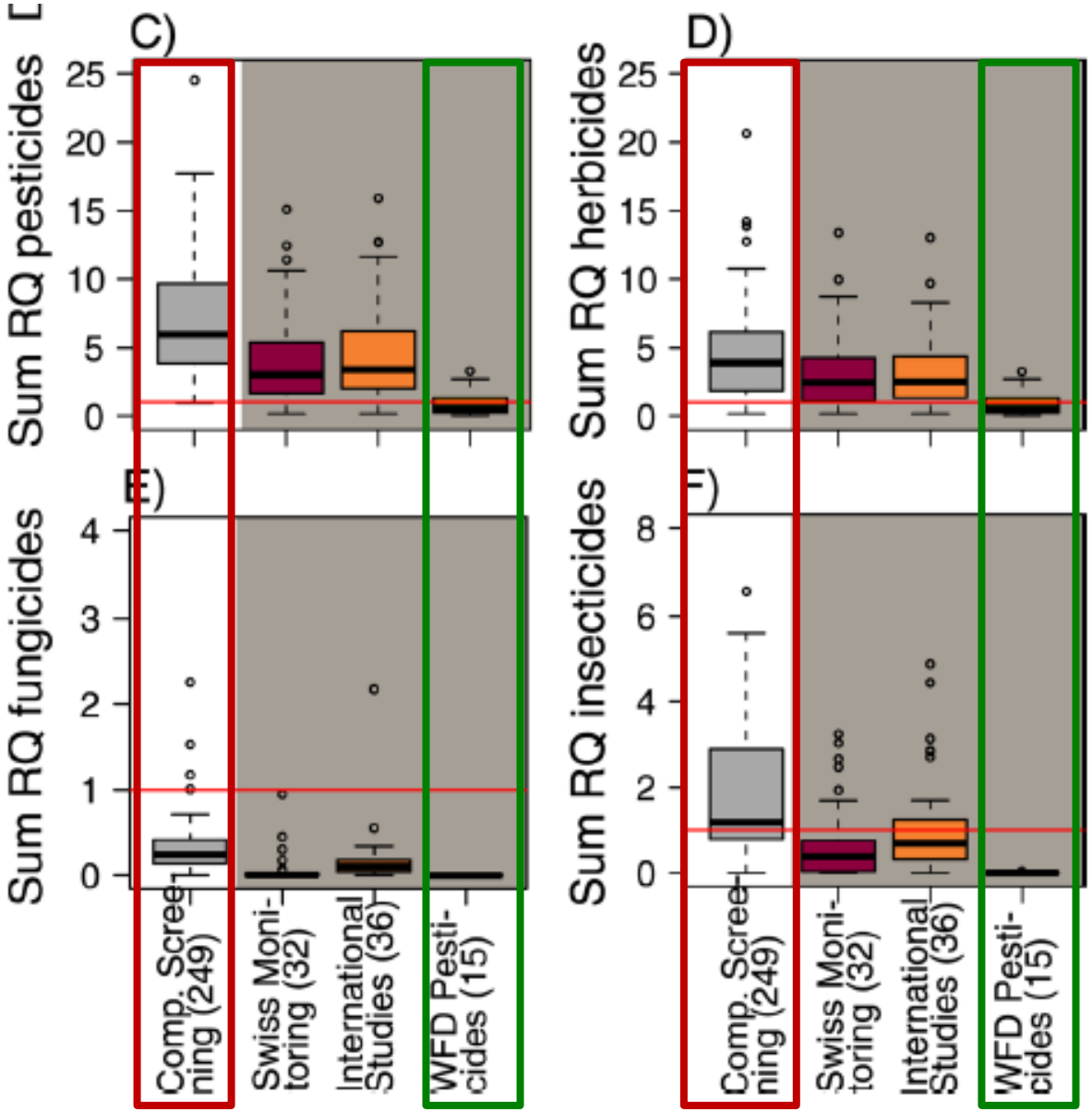


solutions

Example: Pesticide monitoring in Switzerland

Strong underestimation of risks based on WFD PS only

PS-based abatement is **no solution** to reduce toxic risks



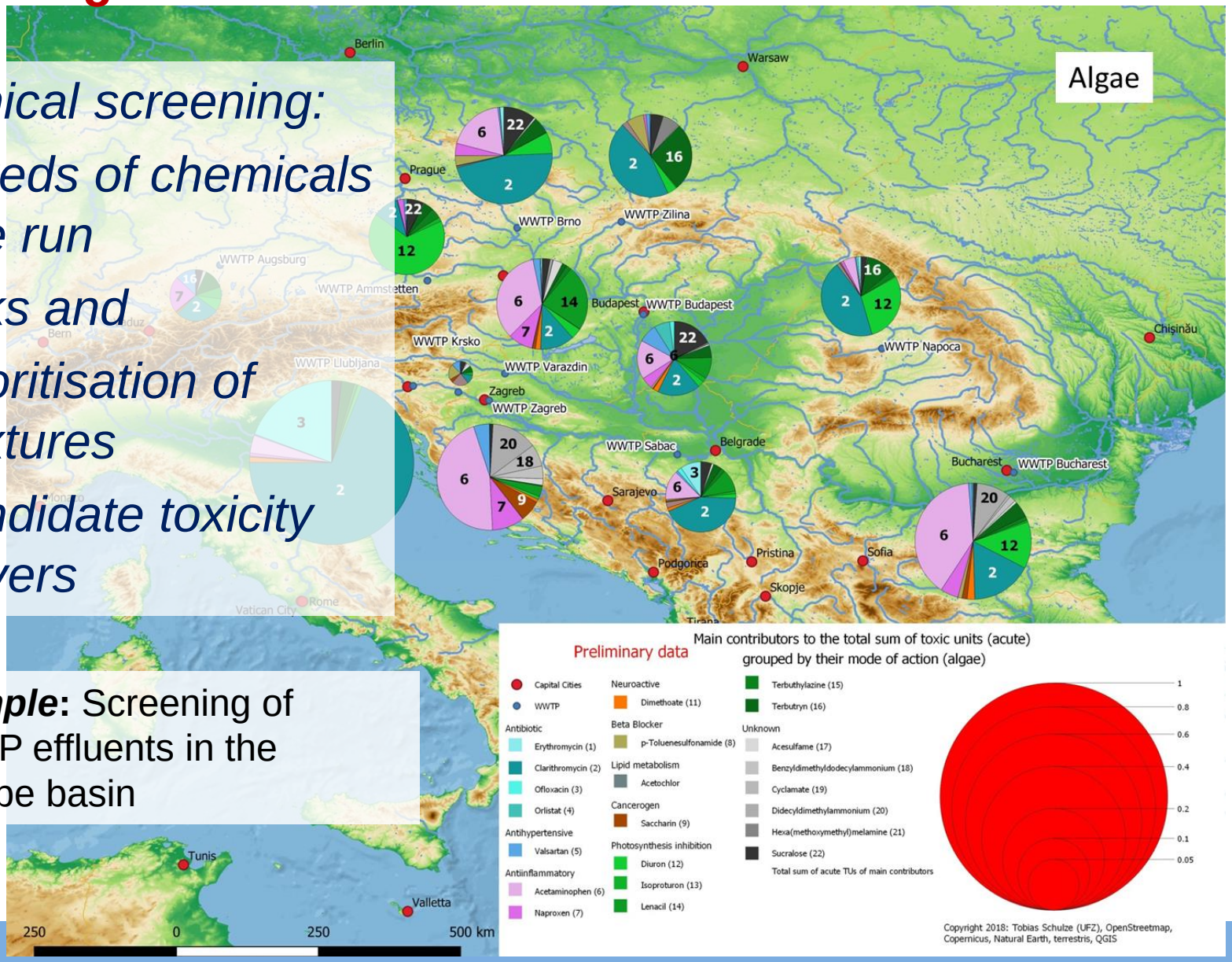
Risk drivers for BQEs: Multi-Target Screening and TU evaluation

Chemical screening:

hundreds of chemicals in one run

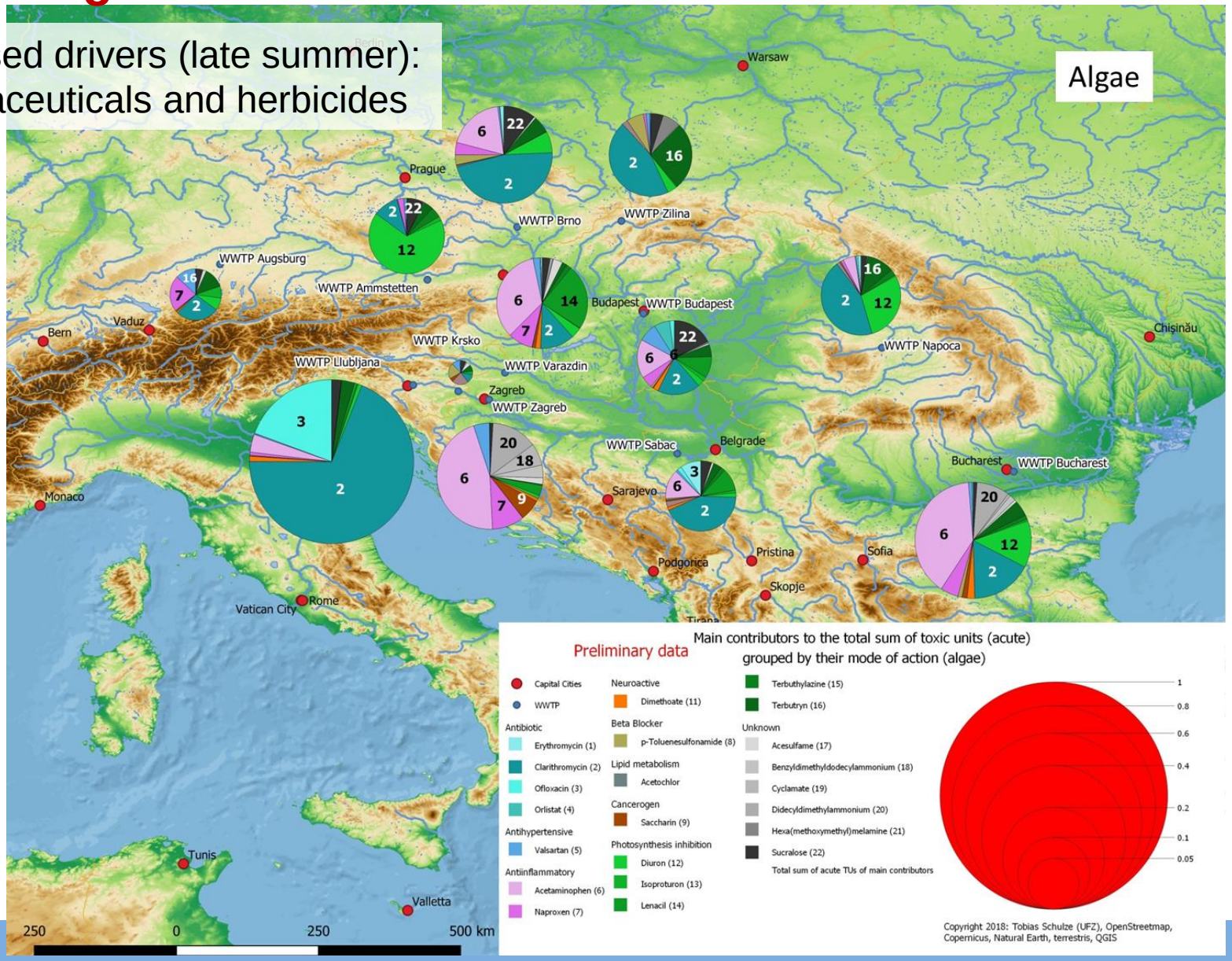
- *risks and*
- *prioritisation of mixtures*
- *candidate toxicity drivers*

***Example*:** Screening of WWTP effluents in the Danube basin



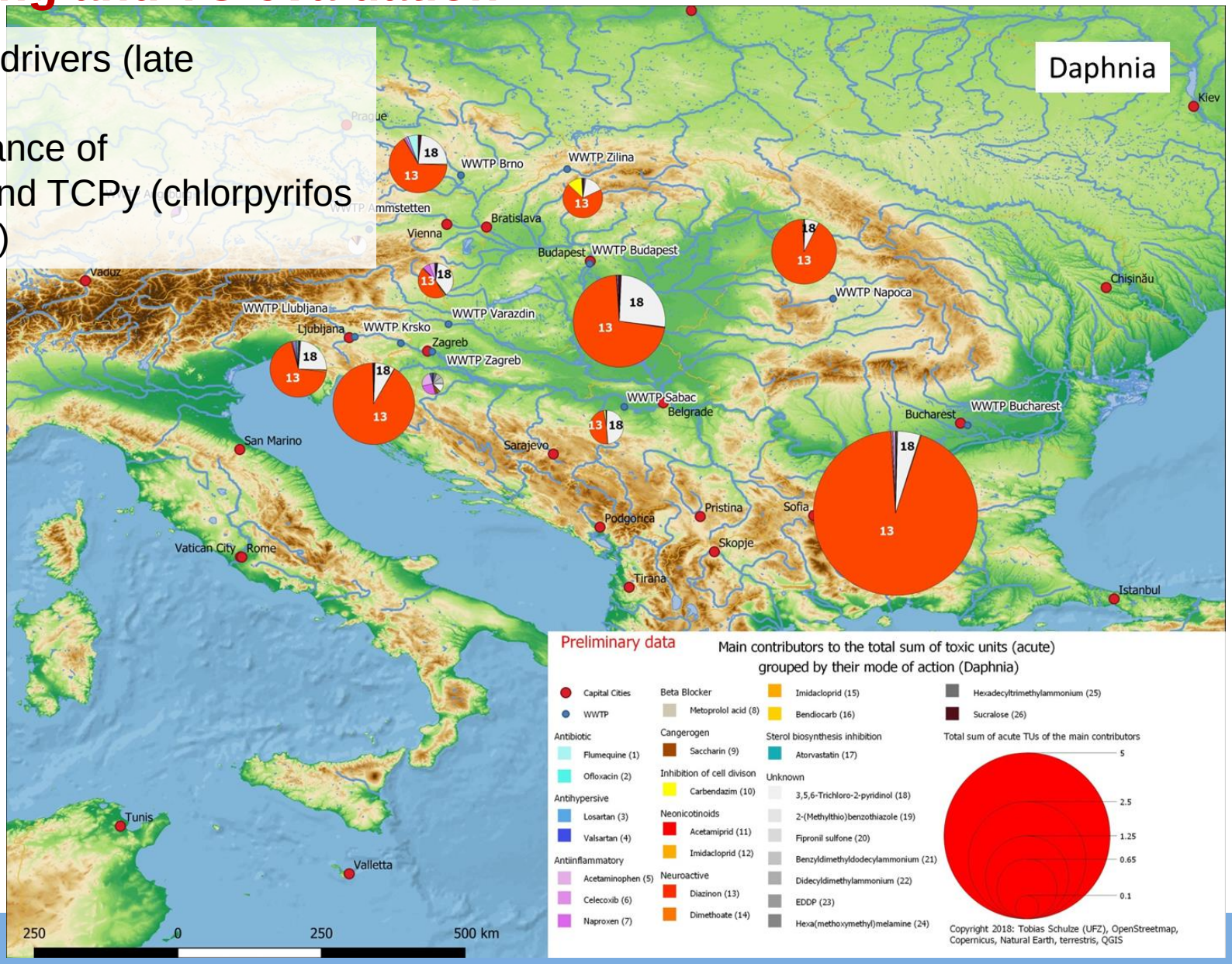
Risk drivers for BQEs: Multi-Target Screening and TU evaluation

TU-based drivers (late summer): pharmaceuticals and herbicides



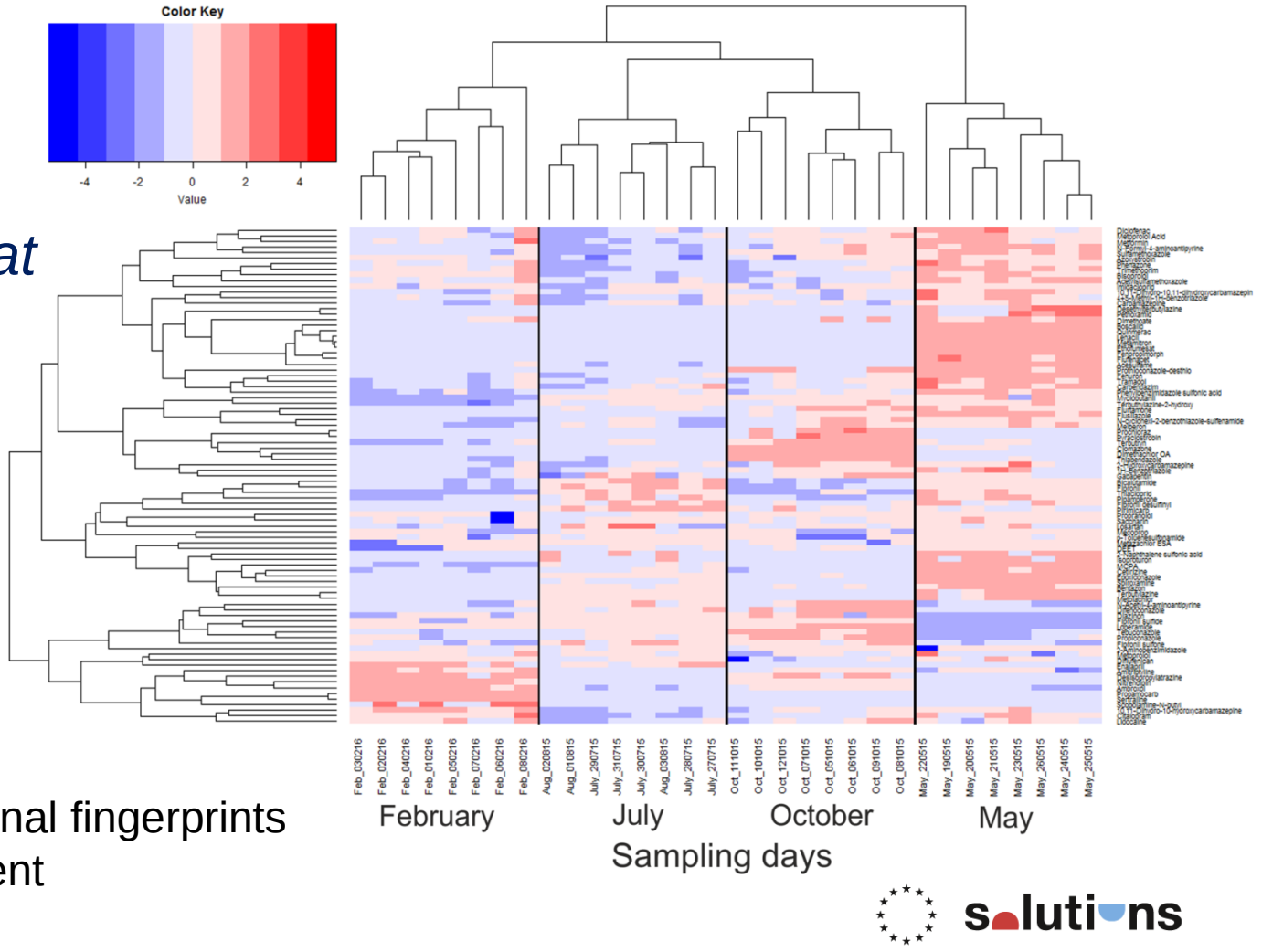
Risk drivers for BQEs: Multi-Target Screening and TU evaluation

TU-based drivers (late summer):
Predominance of diazinon and TCPy (chlorpyrifos metabolite)



Monitoring of complex contamination

Are there seasonal dynamics and fingerprints that should be considered?

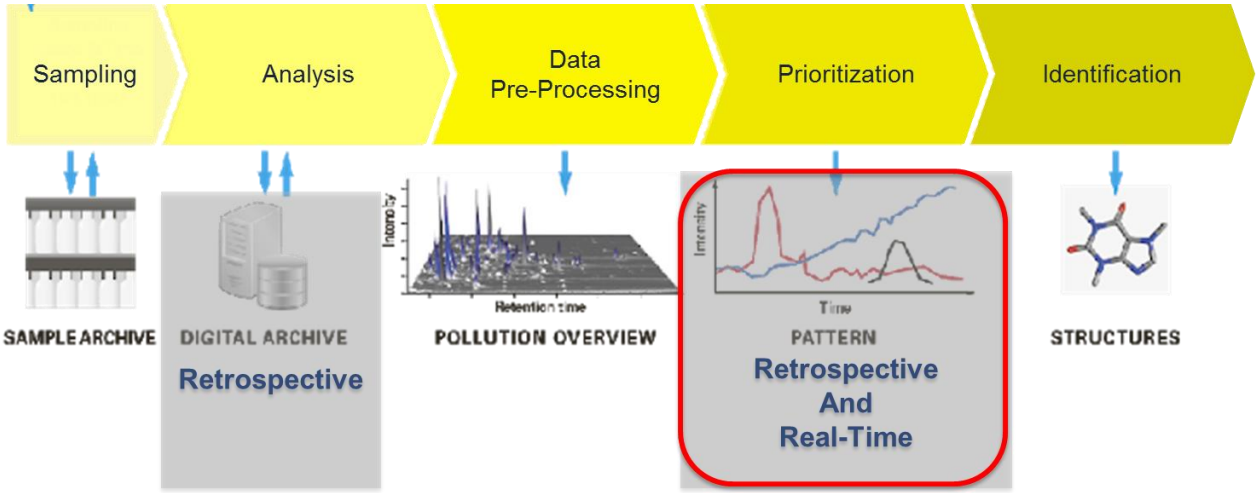


***Example*: Seasonal fingerprints in a WWTP effluent**

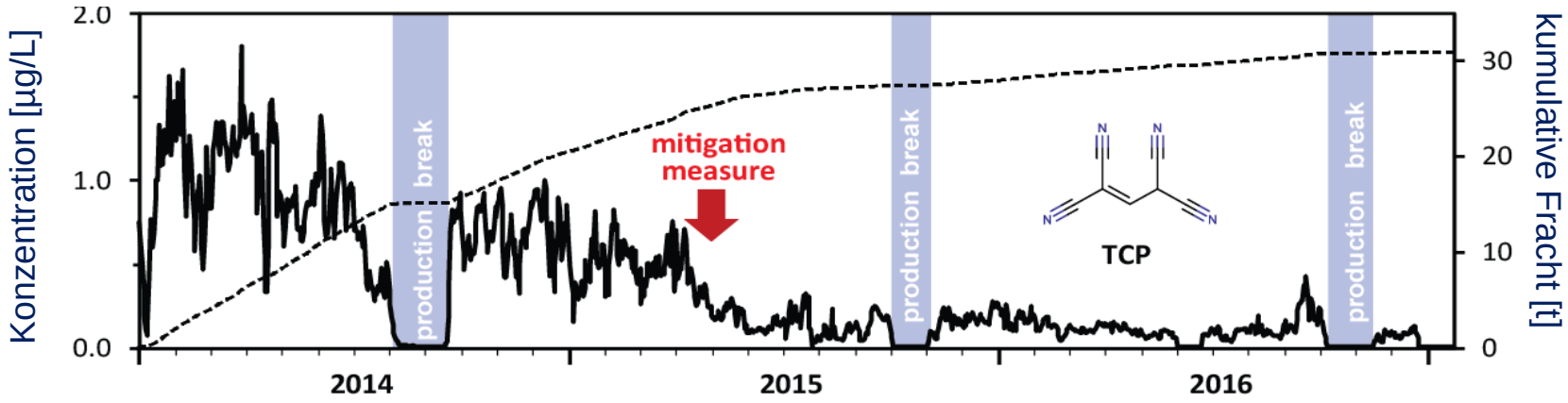
solutions

Chemical: Non-Target Screening

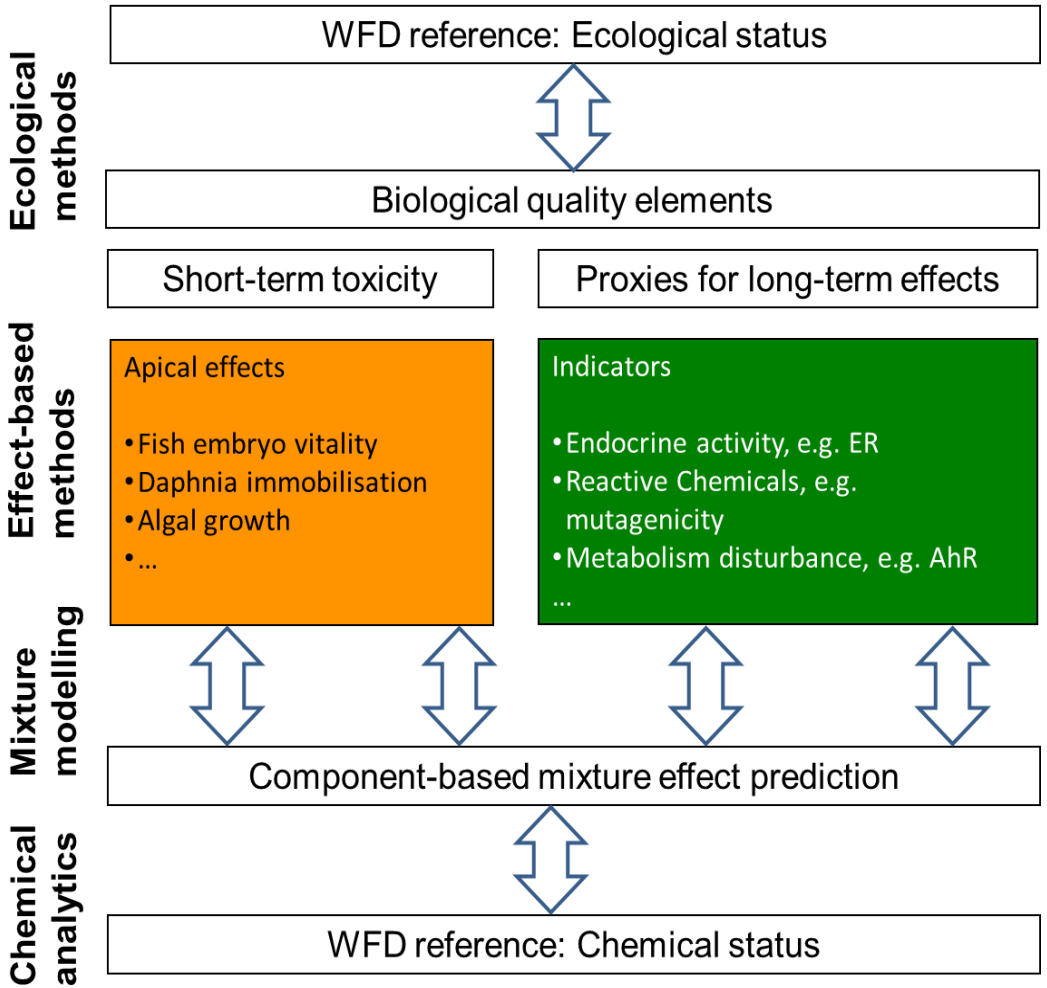
- *Discovery and management of new compounds*
- *Ubiquitous and site-specific compounds*
- *Source-related patterns*



***Example*: Tetracarbonitril-1-propene in the River Rhine**



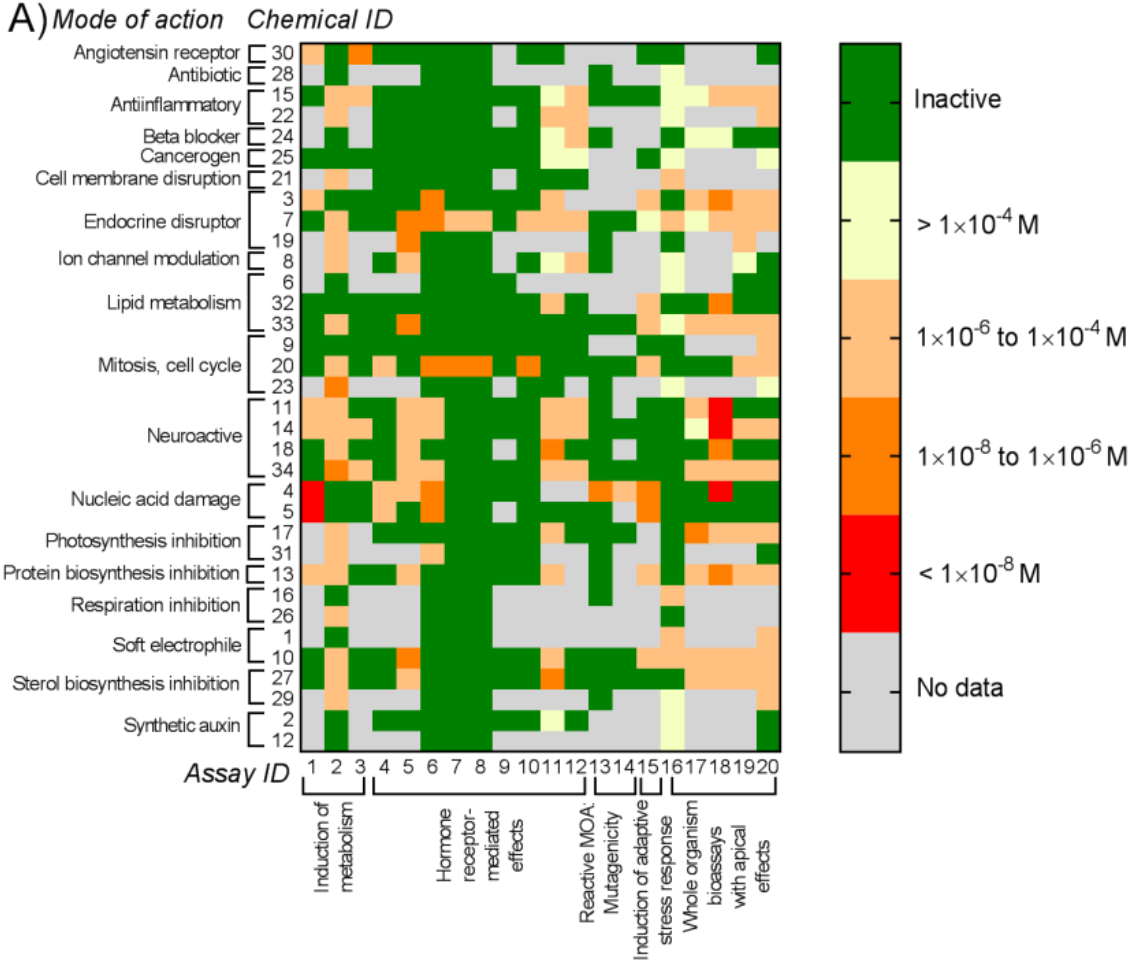
Effect-based: Recommended test battery



Effect-based monitoring:

- *modular*
- *in vitro + in vivo*
- *bridges chemistry and ecology*
- *addresses mixtures and all compounds (incl. substitutes) with similar effects*

Effect-based: Validated test battery



Validation for

- *individual compounds with different MoAs*
- *designed mixtures thereof*
- *complex environmental mixtures*

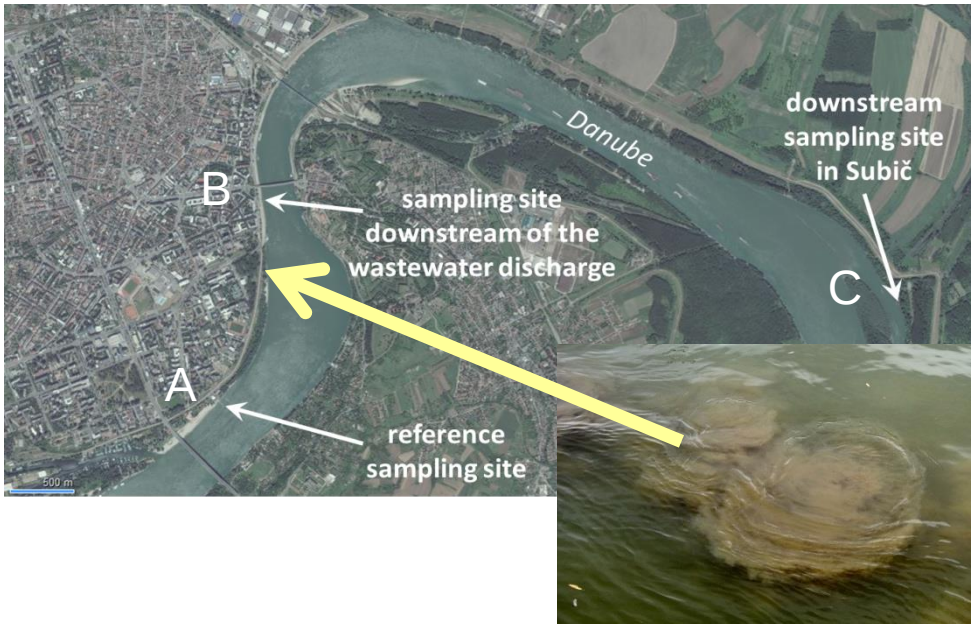
Effect-based: Validated test battery

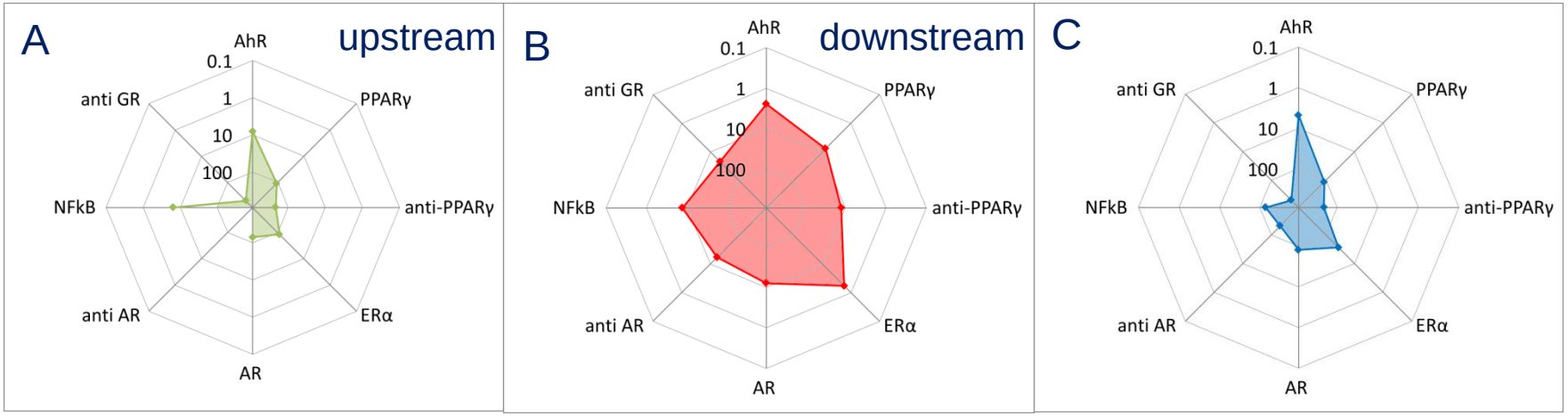
Validation in case studies

Discrimination of more from less contaminated sites?

Consistent effect profiles?

Example: Novi Sad/River Danube





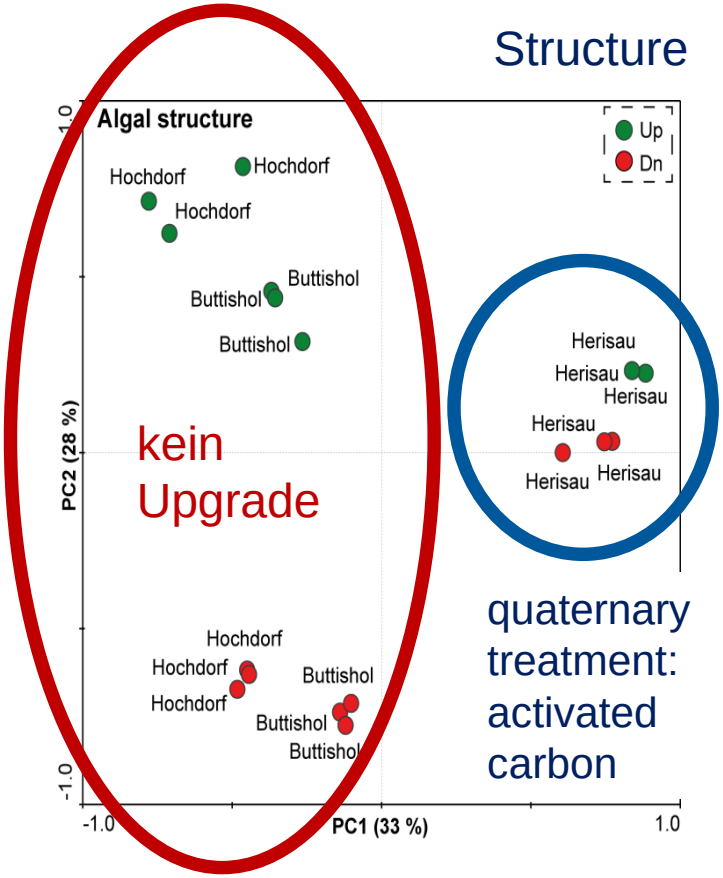
König et al., 2017. Environ. Pollut. 220:1220

Ecological monitioring tools

Success control of abatement measures

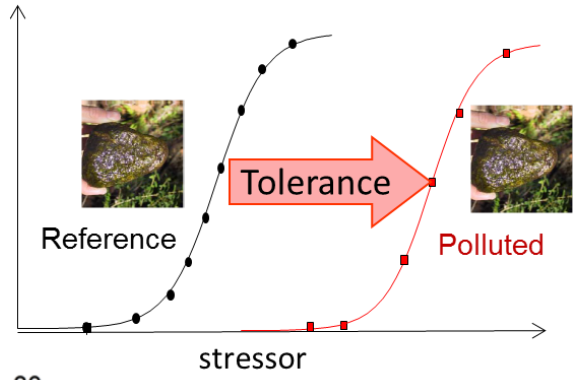
Example: Upgrade of WWTPs in Switzerland - Impact on biofilms:

Structure



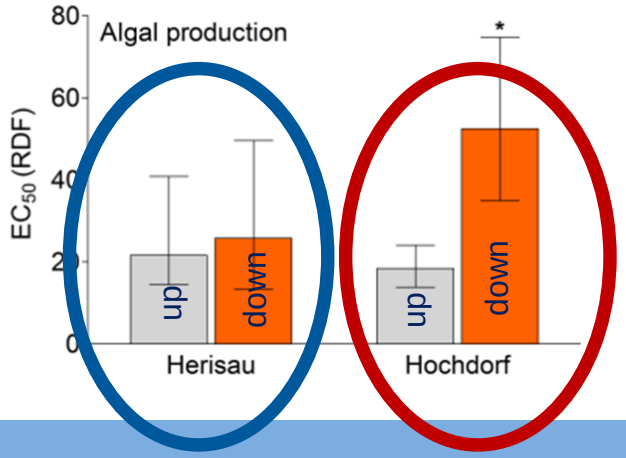
Pollution-induced community tolerance (PICT)

Disappearance of sensitive species results in higher tolerance



No upgrade: enhanced tolerance

After upgrade: no difference

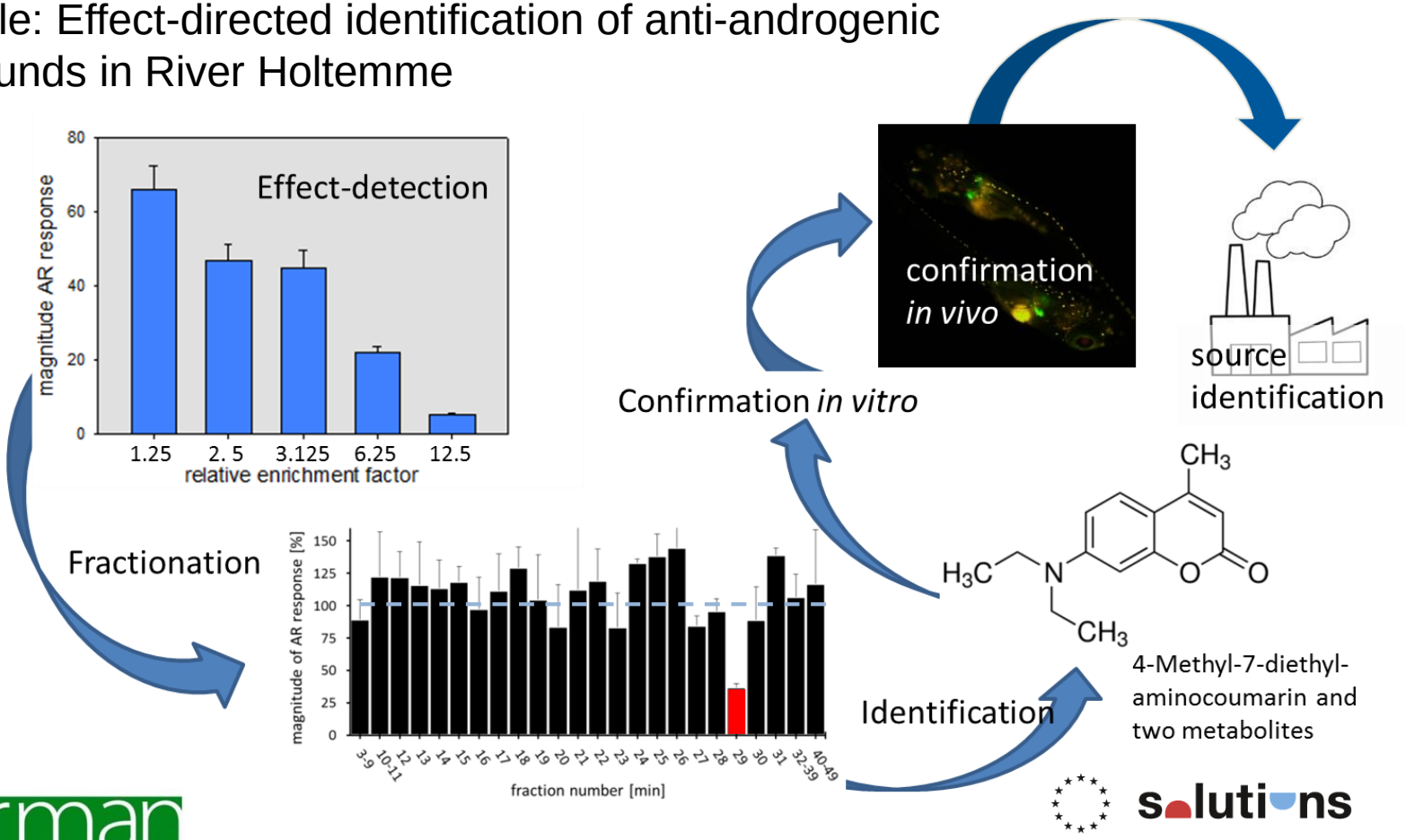


Integrated tools: Driver identification

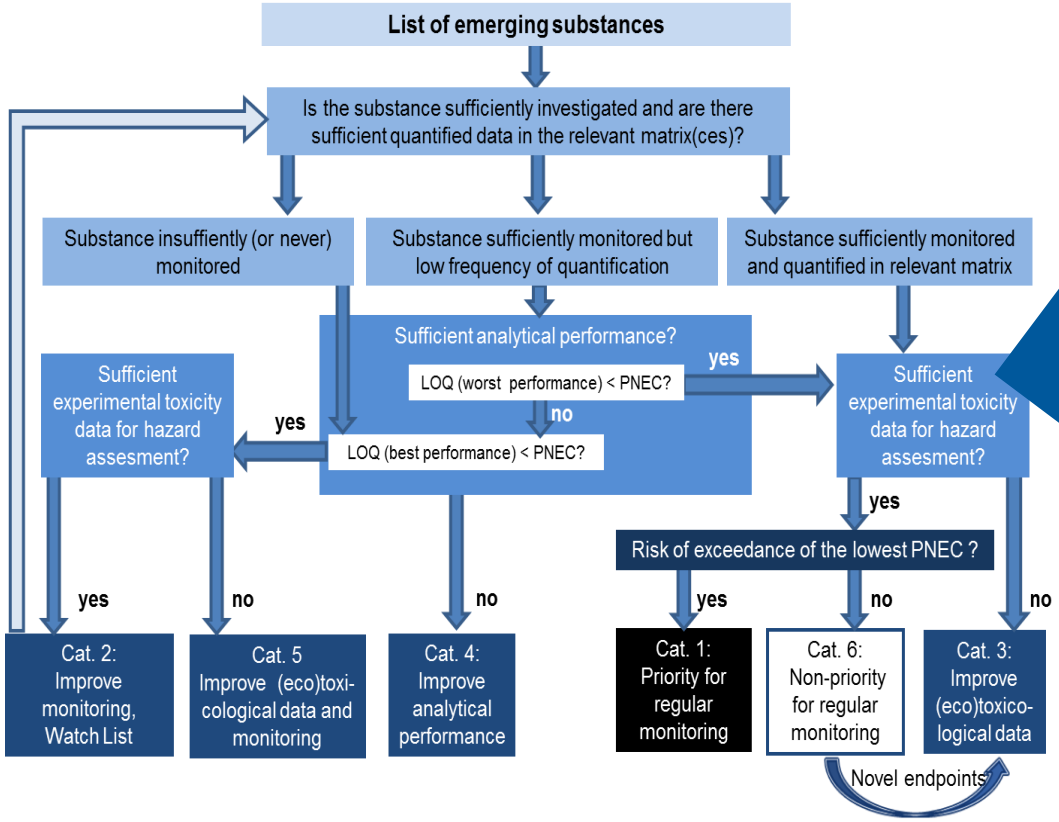
If effect-based monitoring gives an alarm: How to identify causes?

Effect-directed analysis (EDA)

Example: Effect-directed identification of anti-androgenic compounds in River Holtemme

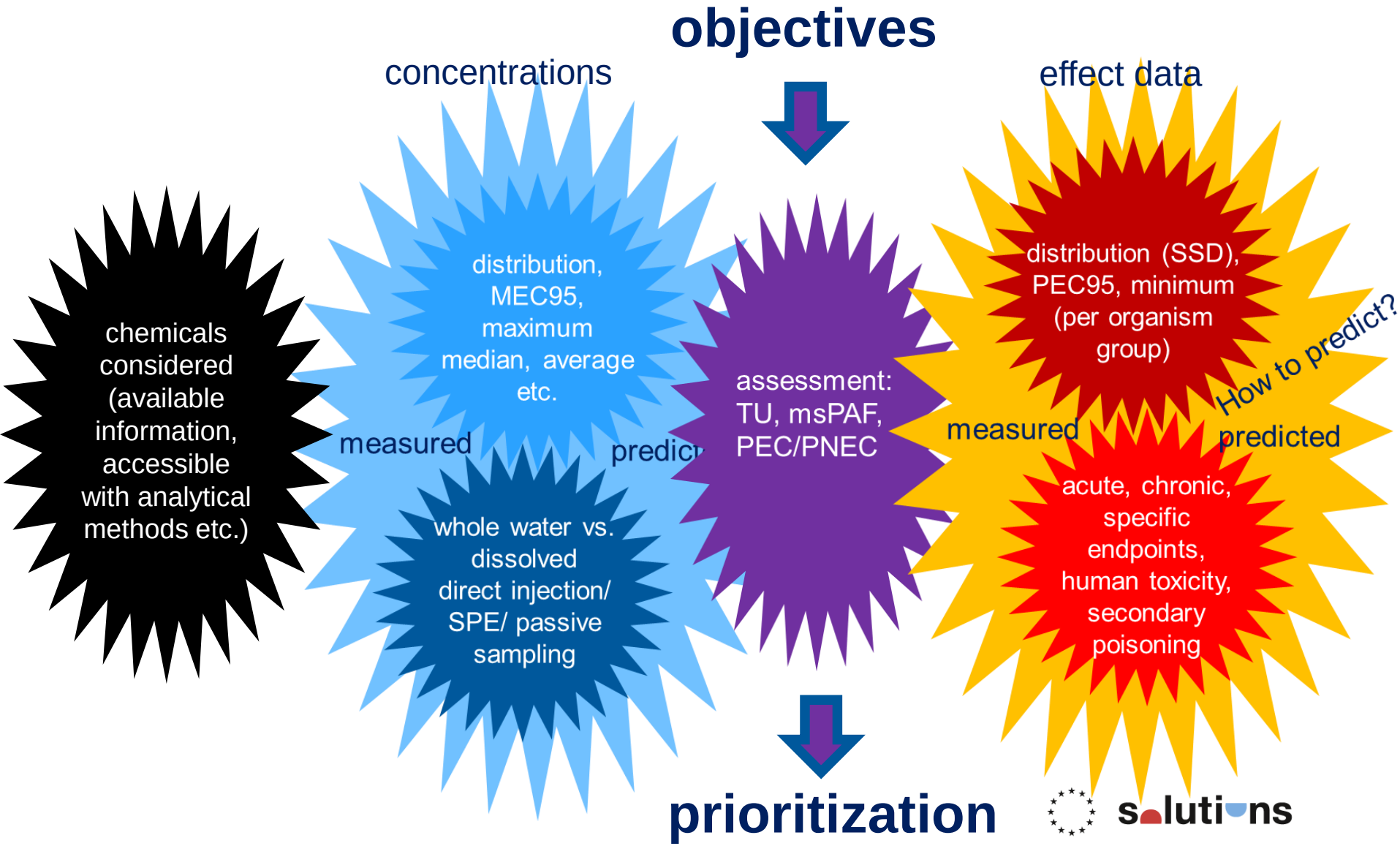


Prioritisation for legal purposes



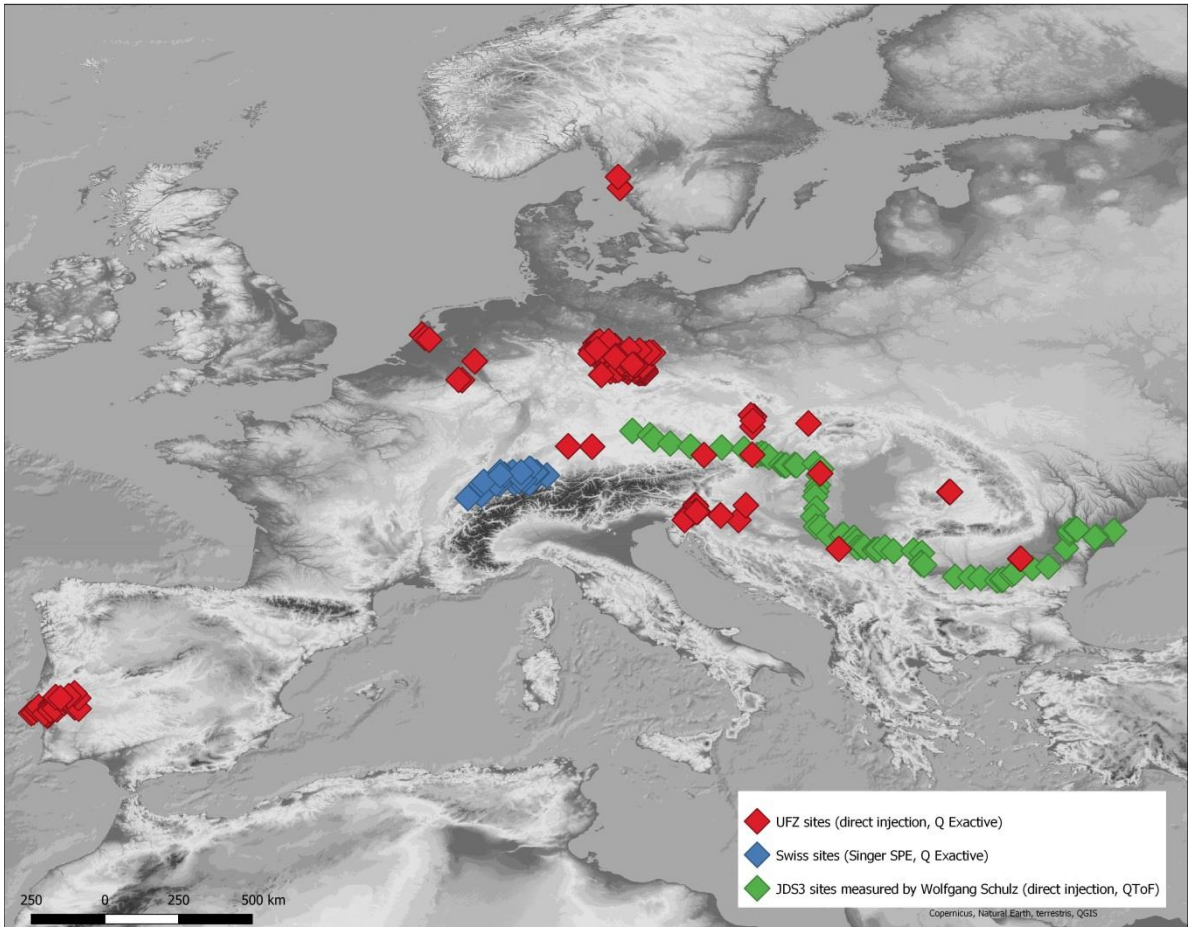
River Basin Specific Pollutants Danube

Challenge: Compound prioritisation



Solution: Evaluation of rich SOLUTIONS datasets recorded with harmonized/comparable method

- EDA-EMERGE
- JDS3
- Swiss dataset
- UFZ dataset Elbe catchment
- UFZ agricultural streams, event-based
- NORMAN WWTP effluents + receiving waters
- Watchlist sites
- ……



Thanks to a great consortium

More Information: http://www.solutions-project.eu/