Deltares

The solutions EU FP7 project about emerging chemicals in water resources management

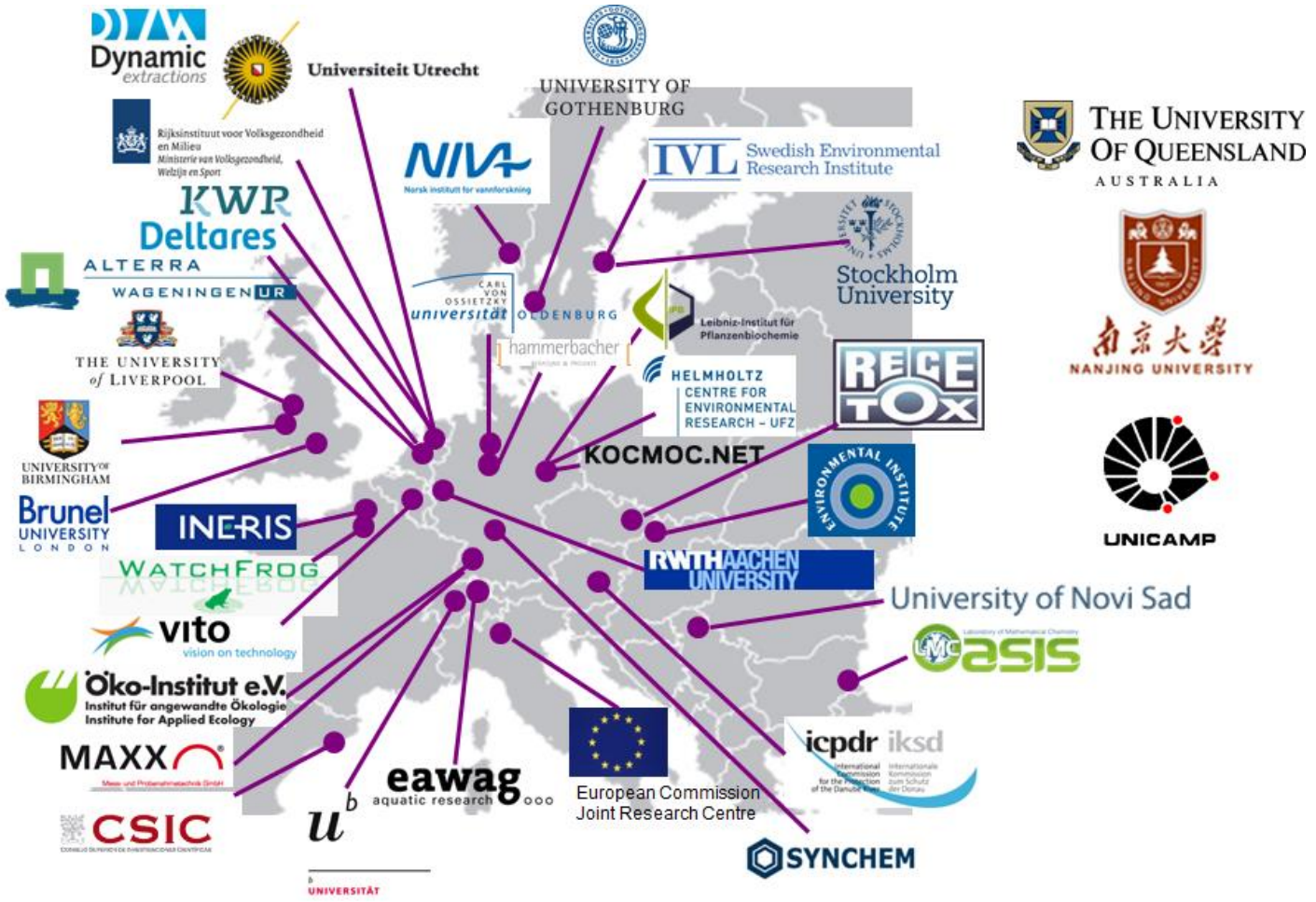
lessons learnt and remaining questions

Jos van Gils

23 September

Interreg
EUROPEAN UNION
Danube Transnational Programme
Danube Hazard m³c

The Project



39 partners
12 mio Euro
Start: 1.10.2013
End: 30.9.2018

Overview of project

Overview of project results

Policy Briefs

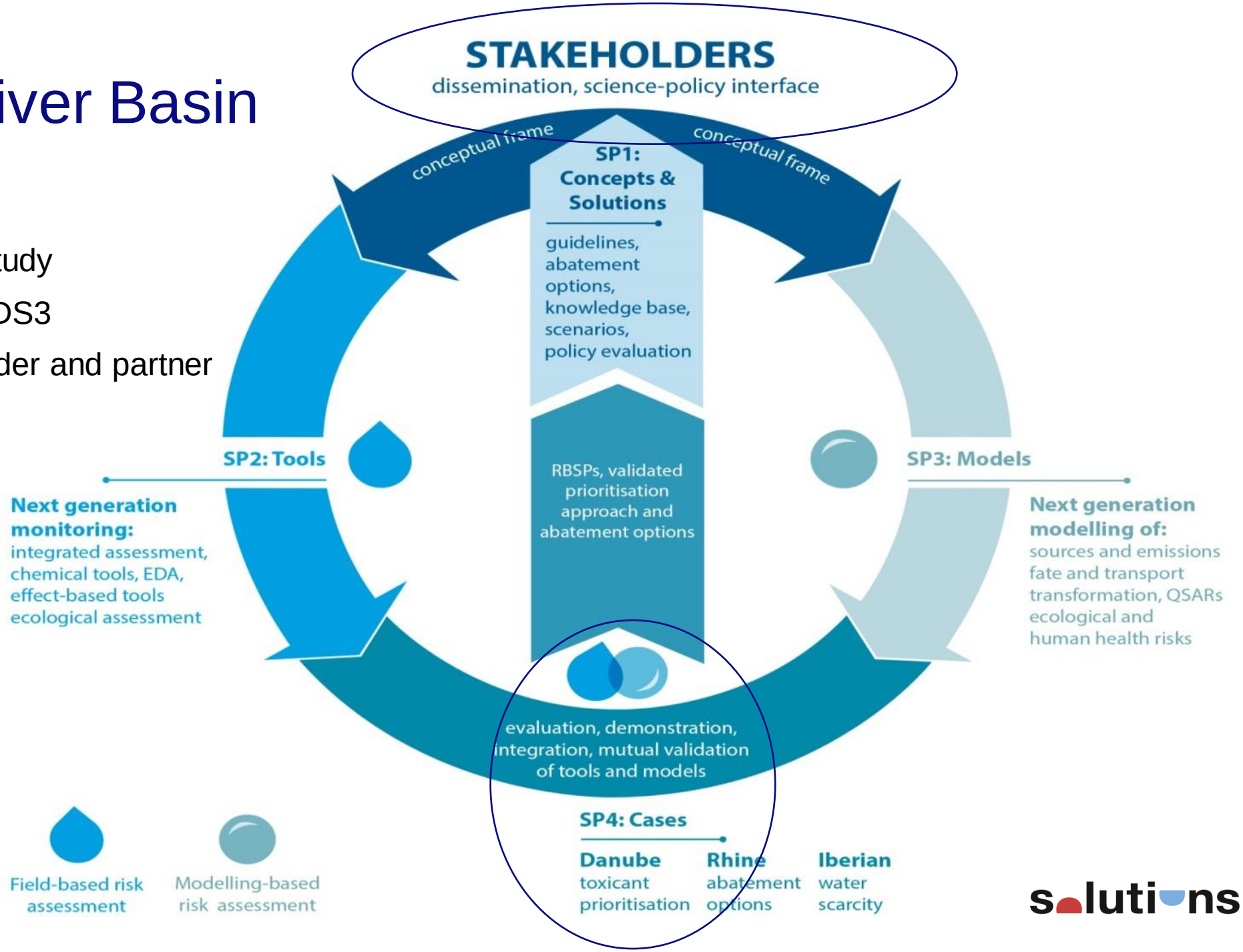
available open access
https://enveurope.springeropen.com/

Policy Briefs of the EU Project SOLUTIONS

Read the latest published collection in *Environmental Sciences Europe*. The policy briefs in this collection are a direct outcome of the EU project "SOLUTIONS for present and future emerging pollutants in land and water resources management (Grant agreement no. 603437)". They translate emerging research on European water resource management into actionable information that is useful for decision making and water quality protection.

Danube River Basin

- Danube Case Study
- Important role JDS3
- ICPDR stakeholder and partner



Deltares

solutions

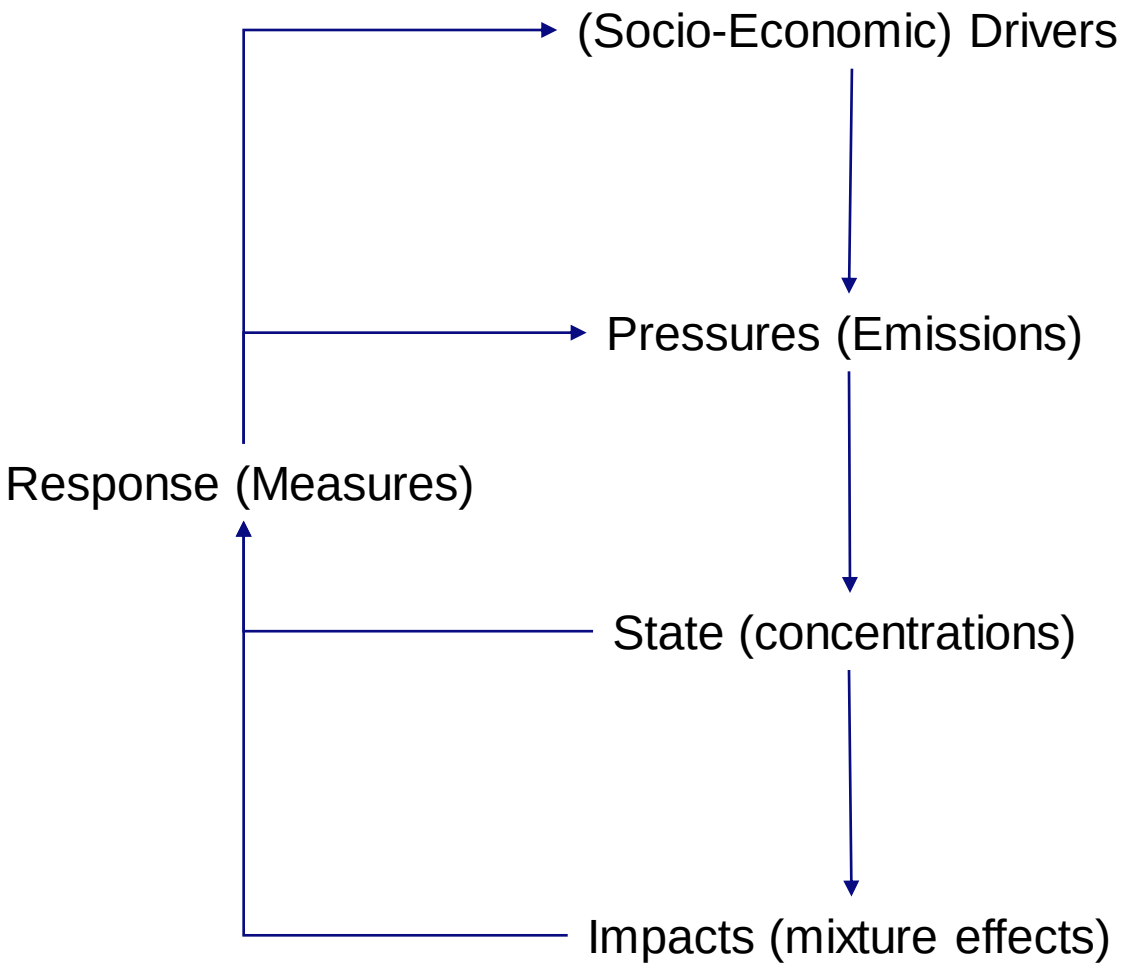
Important findings

- WFD Chemical Status ≠ Chemical contamination (https://doi.org/10.1038/s41598-020-71537-2)
  - water bodies with insufficient Chemical Status show Good Ecological Status
  - effects from other substances than Priority Substances not included in Chemical Status
- Toxic stress from chemicals is one of the multiple stressors determining river ecological status at the European scale (Lemm et al., provisionally accepted)
- So, river Basin Specific Pollutants are important
- Complicated to determine priority pollutants (unambiguously)
  - uncertain concentration data (measured or modelled)
  - uncertain hazard data
  - details of methodology used matter
- There was a prioritization done for the Danube Basin
  - based on monitoring data JDS3 + …
  - following NORMAN methodology
  - shared with relevant ICPDR expert groups

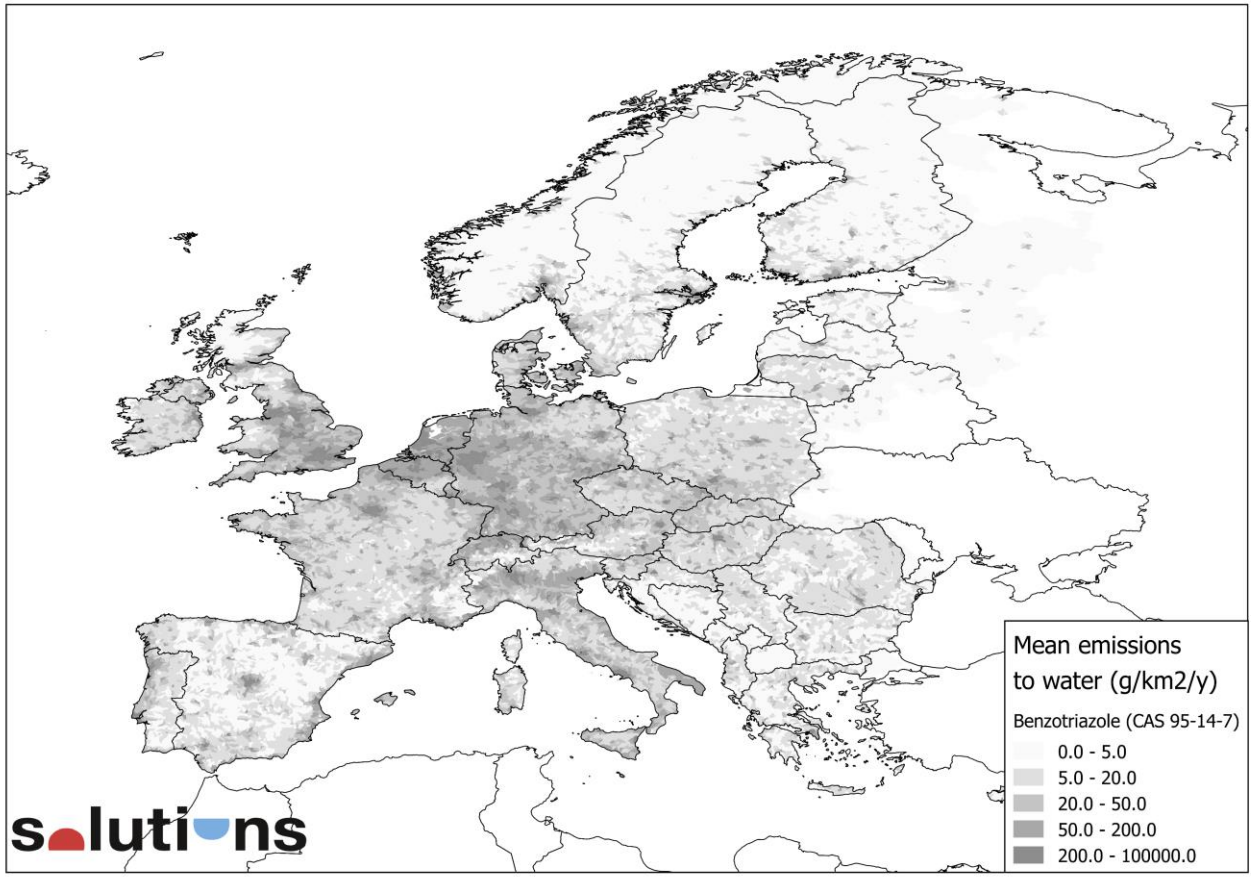
Sub-project Models

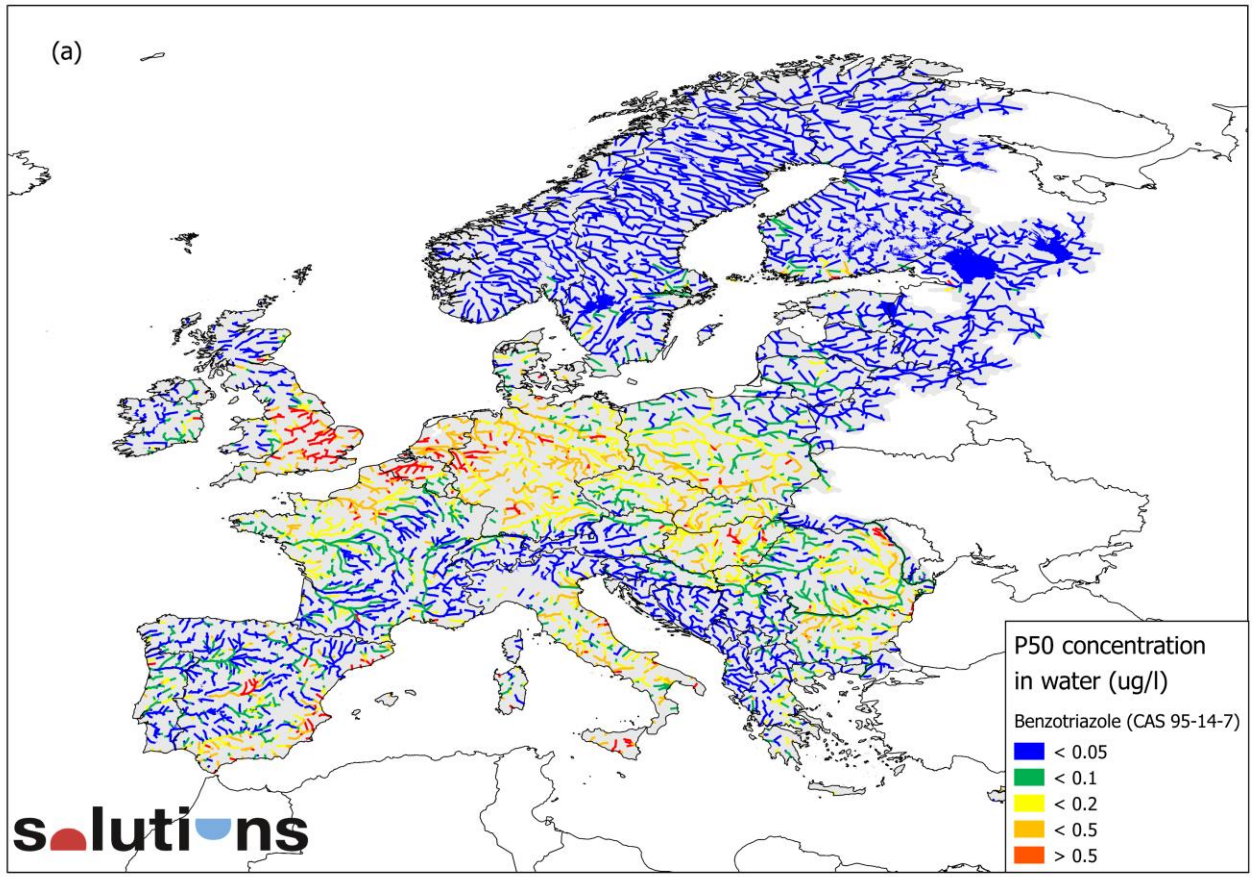
- DPSIR
- From drivers to Impacts
- To better understand
- Basis for cost-effective response

- As many chemicals as possible
- (single organic)
- (no metals)
- (no legacy chemicals)



Simulated Pressures, State

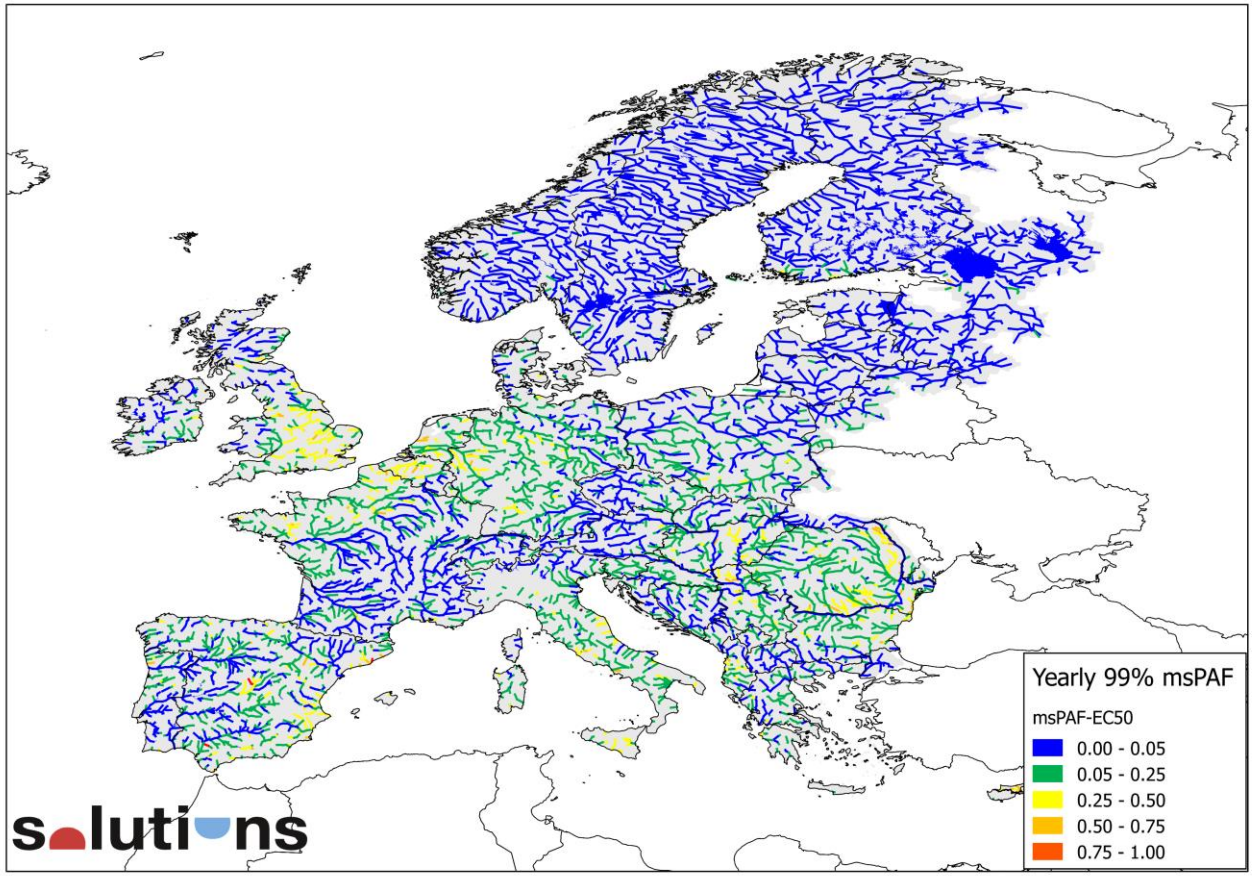




https://doi.org/10.1016/j.jhazmat.2020.122655

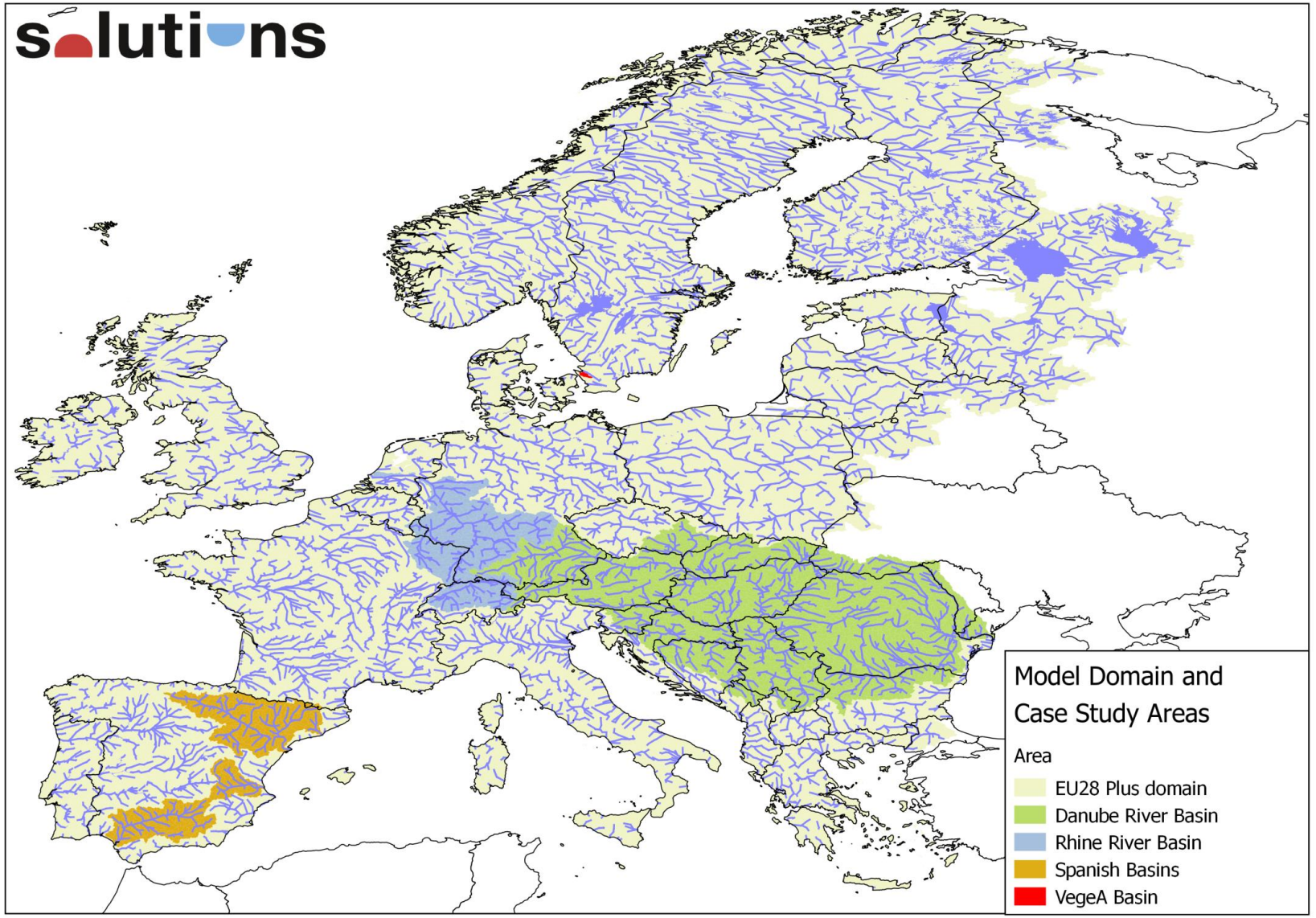
Simulated Mixture Effects

- 1,785 chemicals
- > 10,000 water bodies
- daily concentrations
- Mixture effects by
  Species Sensitivity Distribution method
  - based on ecotox tests
    for different aquatic secies
- Shown here:
  - EC50 ecotoxity endpoint
  - 99 percentile
    (exceeded 4 days per year)
  - indicative of expected species loss



https://doi.org/10.1002/etc.4373

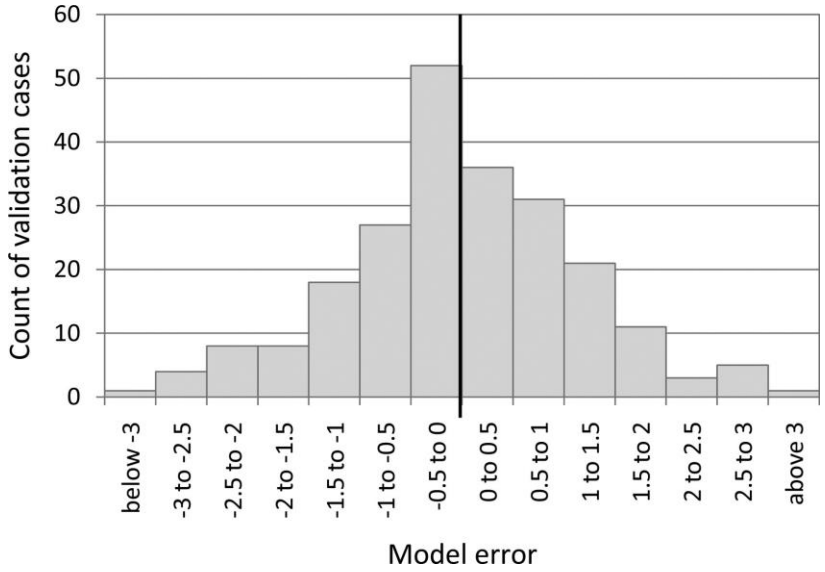
How accurate are these simulations?



Deltares

Accuracy for various groups of Chemicals

Accuracy not as good as we want, error up to 2 orders of magnitude for 90% of chemicals



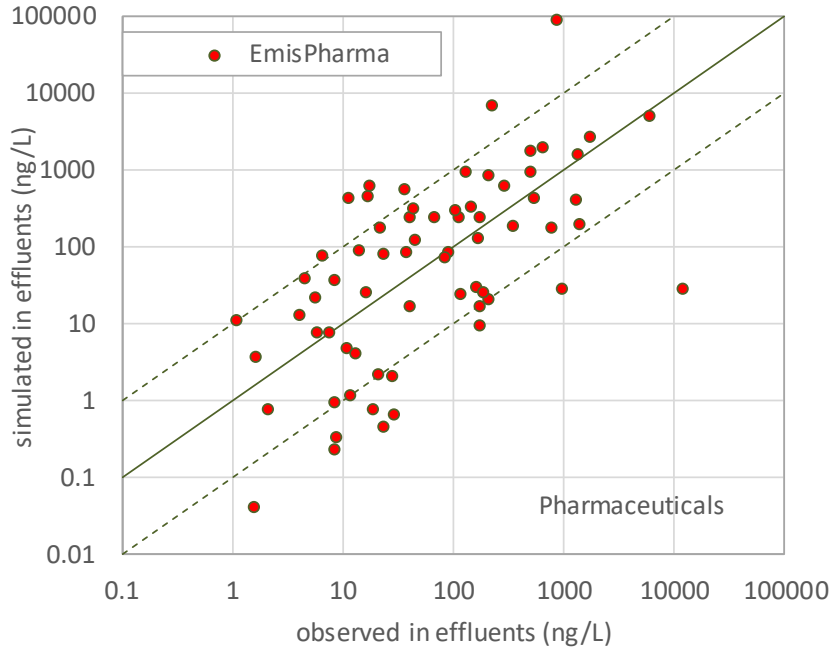
- Pharmas
  - we think we understand, we can do better with better data
  - was confirmed in NL Case Study
- Pesticides
  - we think we understand, we can do better with better data
  - complex to model because of strong heterogeneity in emissions (both time and space)
  - maybe even more complex to monitor, especially in smaller streams
- Industrial chemicals
  - we do not understand yet …

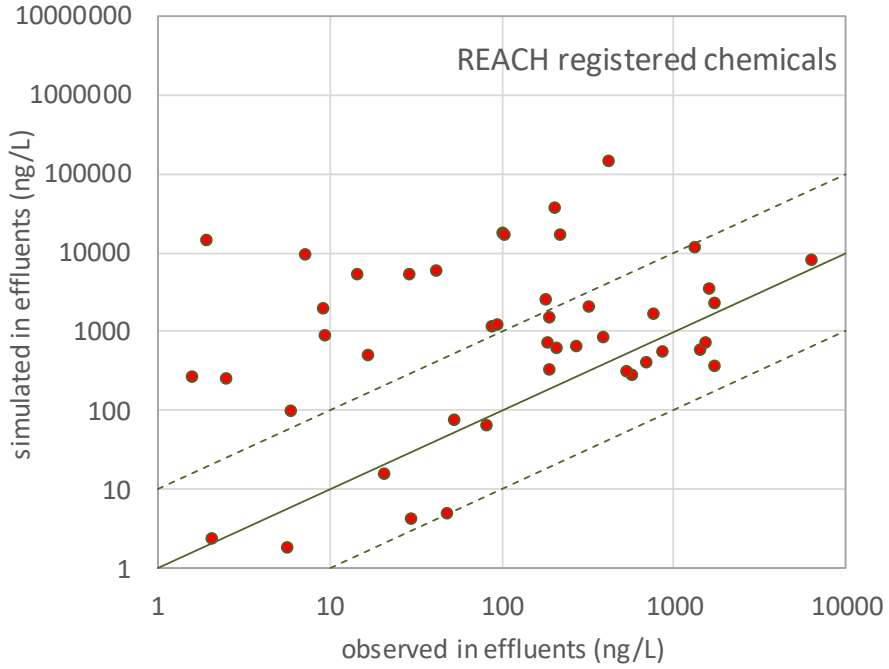
Complexity of industrial chemicals

- Illustrated by two plots from the Danube Case Study
  - simulated vs observed concentrations in WWTP effluents
  - pharmaceuticals (top) and industrial chemicals (bottom)

- Pharma's:
  - some correlation, even though we had no consumption data specific for Danube countries (hence the scatter)

- Chemicals
  - almost NO correlation
  - more scatter
  - lower quantity of data
    (though # chemicals >> # pharma's)





Way forward

- For regulatory frameworks related to admission of substances:
  - take out the “bad guys” before they reach the environment (e.g. Substances of Very High Concern , REACH)
  - we demonstrated in a scenario simulation that this concept is very powerful
  - avoid “regrettable substitutions” (do not replace a bad guy by an equally bad brother)
- For regulatory frameworks related to envieonmental management:
  - shift focus from substances to pathways (domestic wastewater, industrial wastewater, runoff in relation to land use, etc.)
  - better representation of these pathways in the models, “marker substances” for specific pathways

  WHY?
  - just too many substances out there
  - interventions will be directed at pathways, not primarily at substances
- Select “priority pathways” instead of “priority pollutants”
- ….. and collect data … much more data… especially for this wider group of industrial chemicals.

Lessons learned

- Yes, we learned a lot …
- .. but there is also a lot of remaining uncertainty.
- Application in water policy is still difficult.
- From the perspective of 2020, human health aspects need more attention.

(See e.g. topics 8.1-8.2 from the latest H2020 “Green Deal” call)

Thank you on behalf of ….

Deltares

all SOLUTIONS scientists and stakeholders are acknowledged

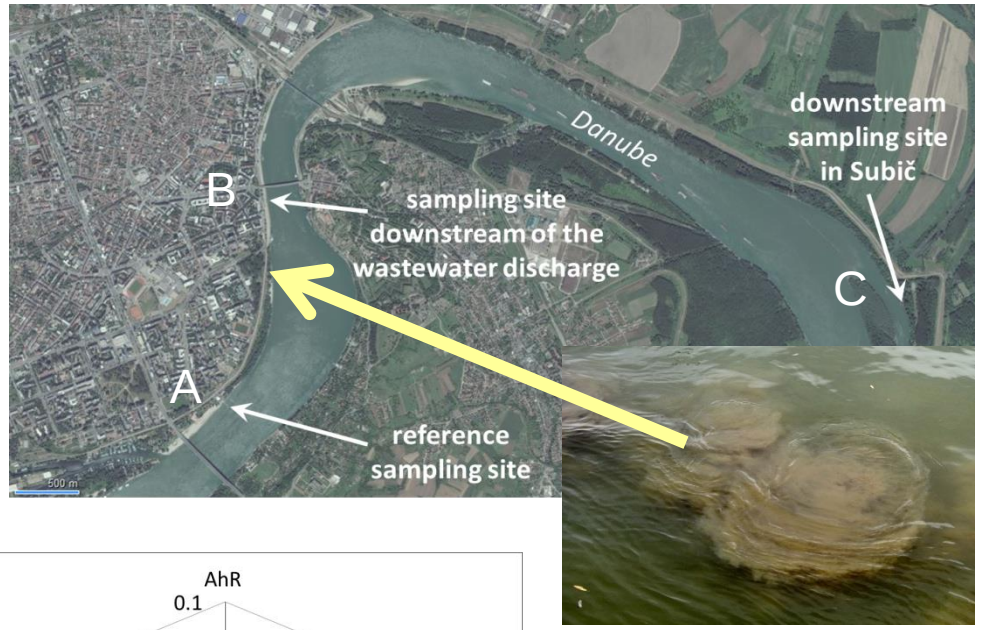
Some extra slides

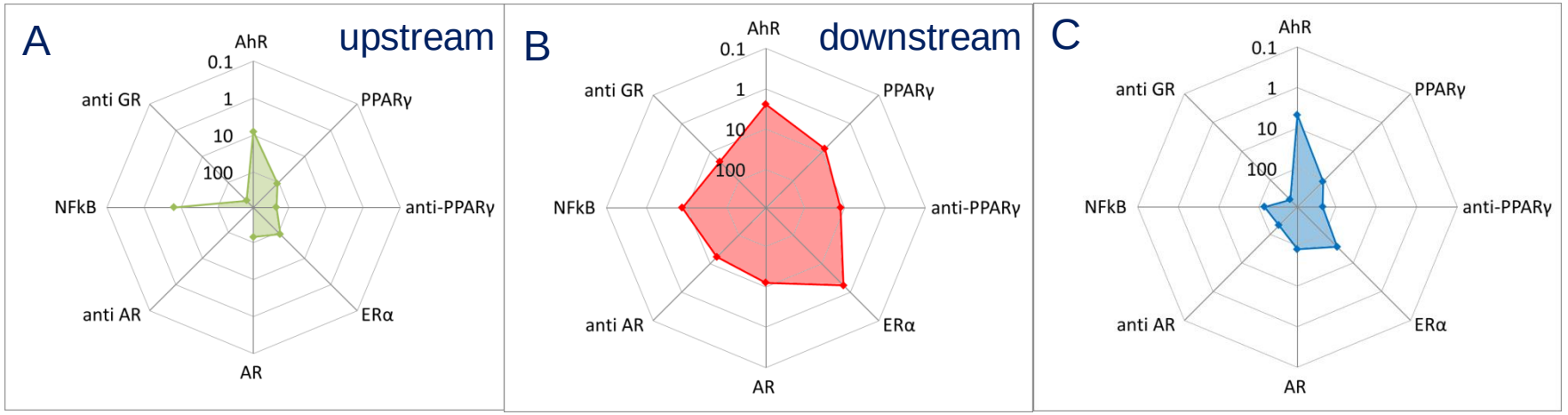
Effect-based monitoring in the Danube

Can effect-based monitoring discriminate contaminated from less contaminated sites?

Do we get consistent effect profiles?

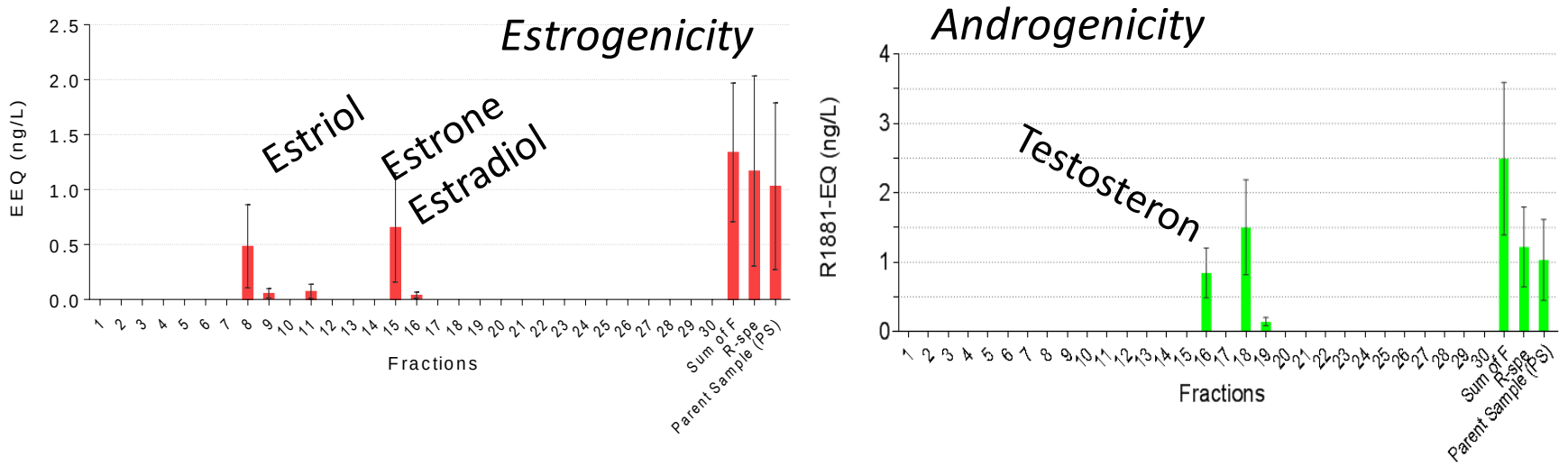
Example: Novi Sad/Donau





Effect directed analysis in the Danube

Example: Endocrine effects in the River Danube (Novi Sad)



- Detection of estrogenic and androgenic effects in the extract
- Identification of drivers in the fractions