Für Mensch & Umwelt

Umwelt Bundesamt

Removing Micropollutants Efficiently: WWTP Selection Options on the MS Level

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Advanced Wastewater Treatment: which WWTPs do we focus on?

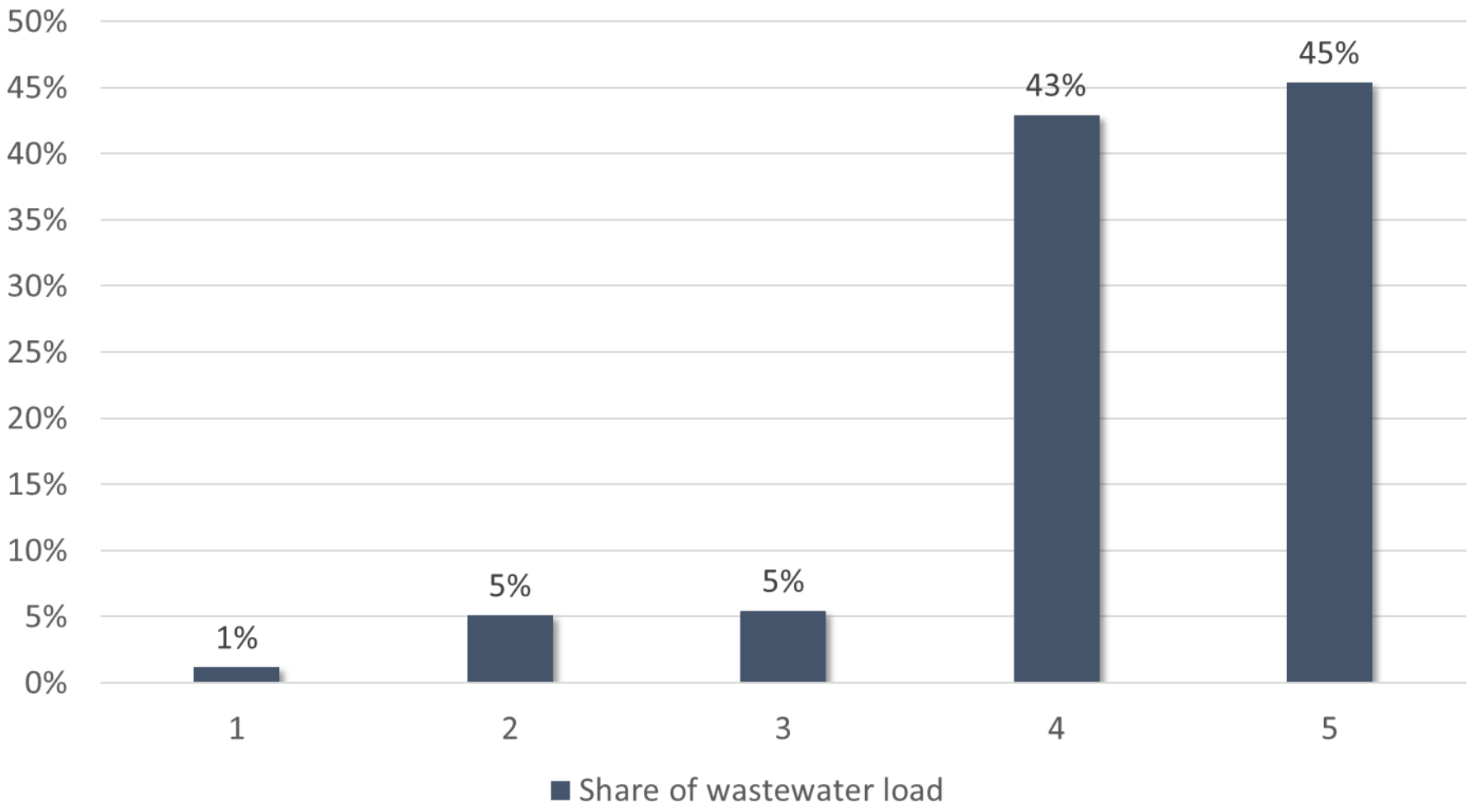
Goal: reduce micropollutants in water bodies

Problem description:

- Little information on micropollutant load (no reporting), WWTP capacity/PE used as an approximation
- Little information on (long-term) effects in receiving water bodies
- Little information on effects induced by multiple substances
- Little information on effects induced by multiple substances and multiple other stresses
- poor prediction quality regarding specific further climate development and correlating effects

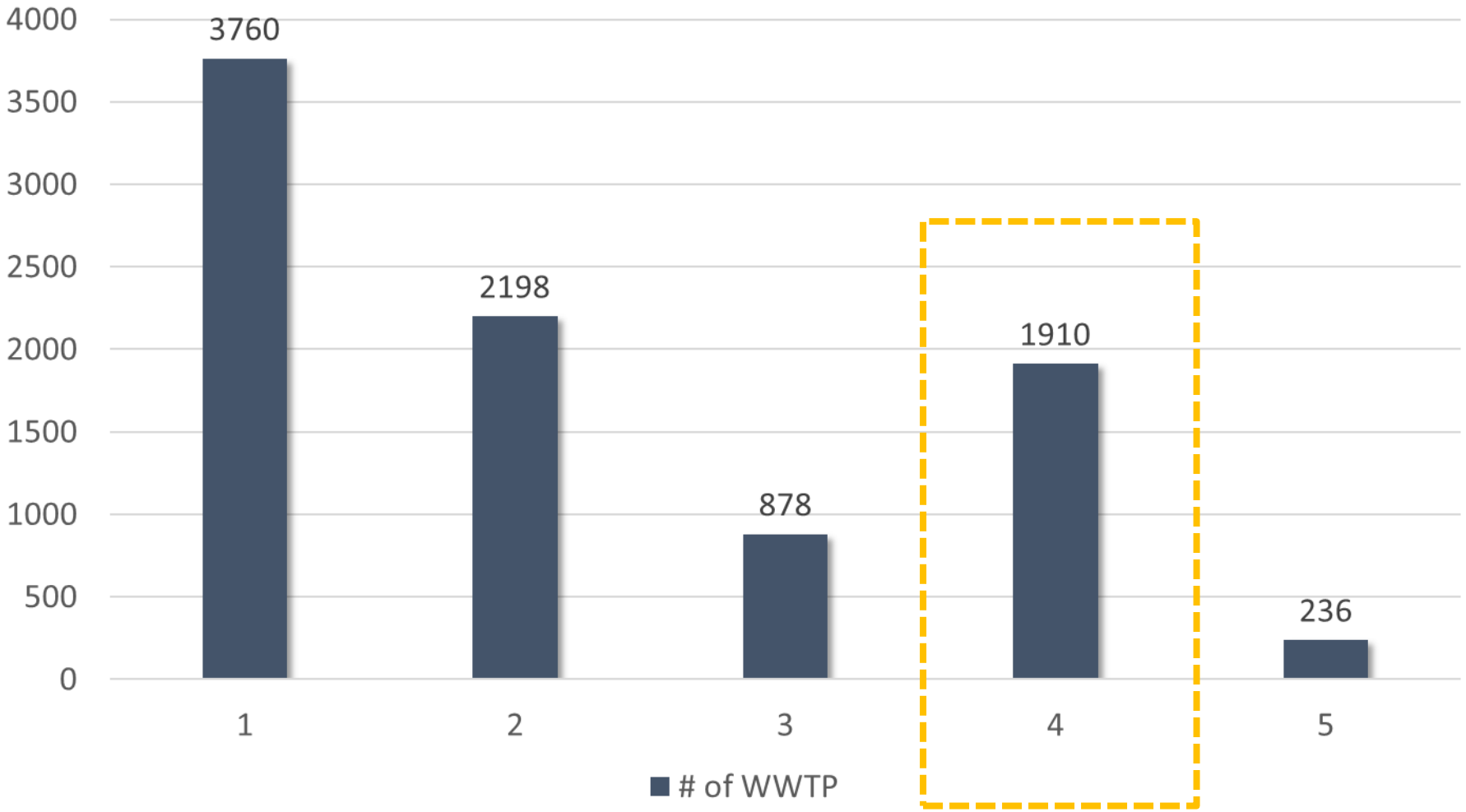
Task: efficient selection of WWTPs to reduce micropollutant loads with a quaternary treatment

Wastewater Treatment in Germany
Share of wastewater load in different size classes



1: < 1 000 PE
2: 1 000 - 5 000 PE
3: 5 000 - 10 000 PE
4: 10 000 - 100 000 PE
5: >100 000 PE

Wastewater Treatment in Germany
Number of WWTPs in different size classes



1: < 1 000 PE
2: 1 000 - 5 000 PE
3: 5 000 - 10 000 PE
4: 10 000 - 100 000 PE
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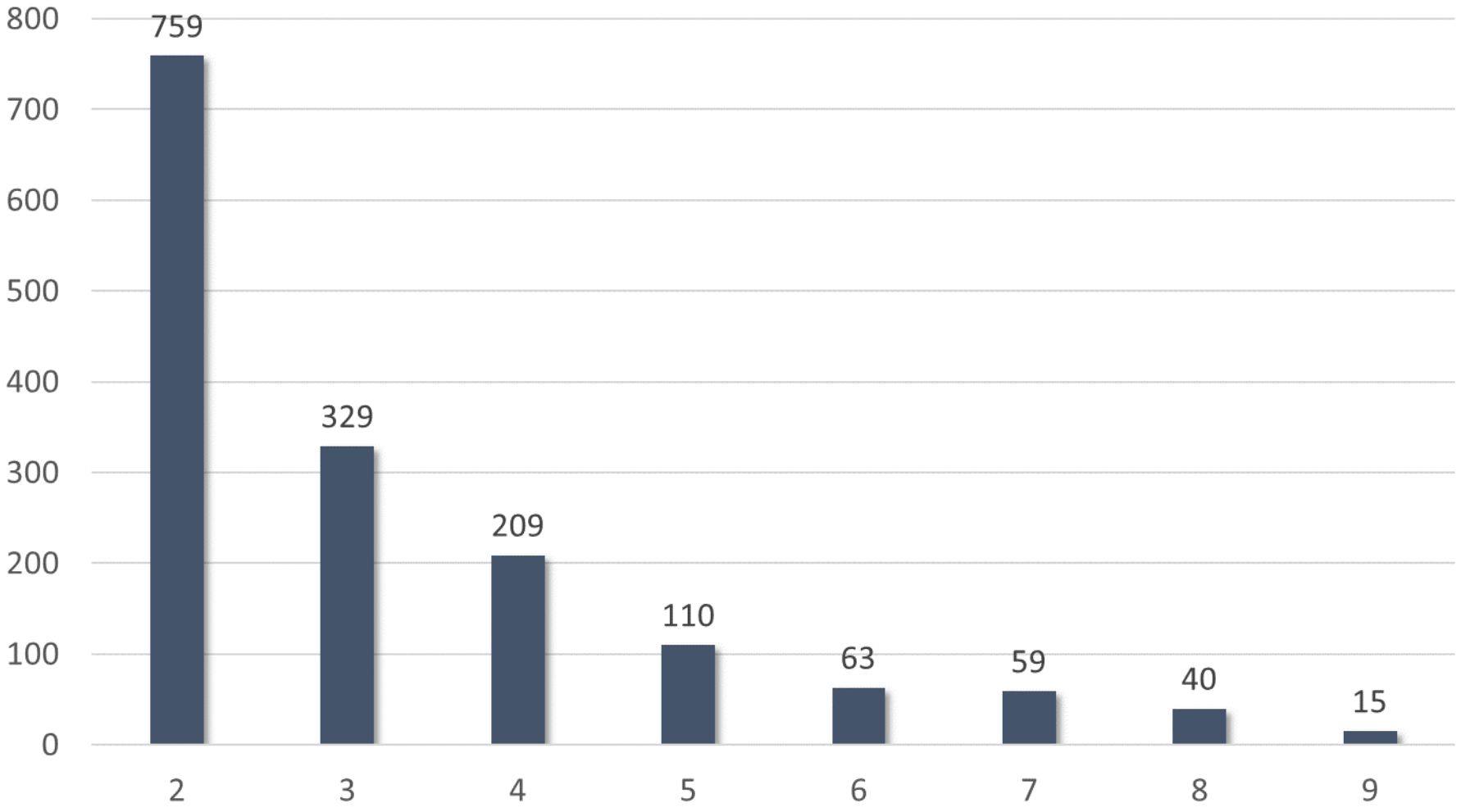
Wastewater Treatment in Germany
Number of WWTPs in size class 4



2: 10 000 - 20 000 PE
3: 20 000 - 30 000 PE
4: 30 000 - 40 000 PE
5: 40 000 - 50 000 PE

Advanced Wastewater Treatment: which WWTPs do we focus on?

Different selection methods:

- UBA position 2015 [1]: 4T for WWTP > 100 000 PE & 4T for WWTP that discharge into sensitive water bodies
- Trace substance dialogue: started in 2016, developed guideline / a framework in 2019 to identify relevant WWTP [2]: 4T mostly risk based. The continuation of the trace substance dialogue is one measure of the national water strategy (so is the upgrade of specific WWTP with a 4T).

Umwelt Bundesamt

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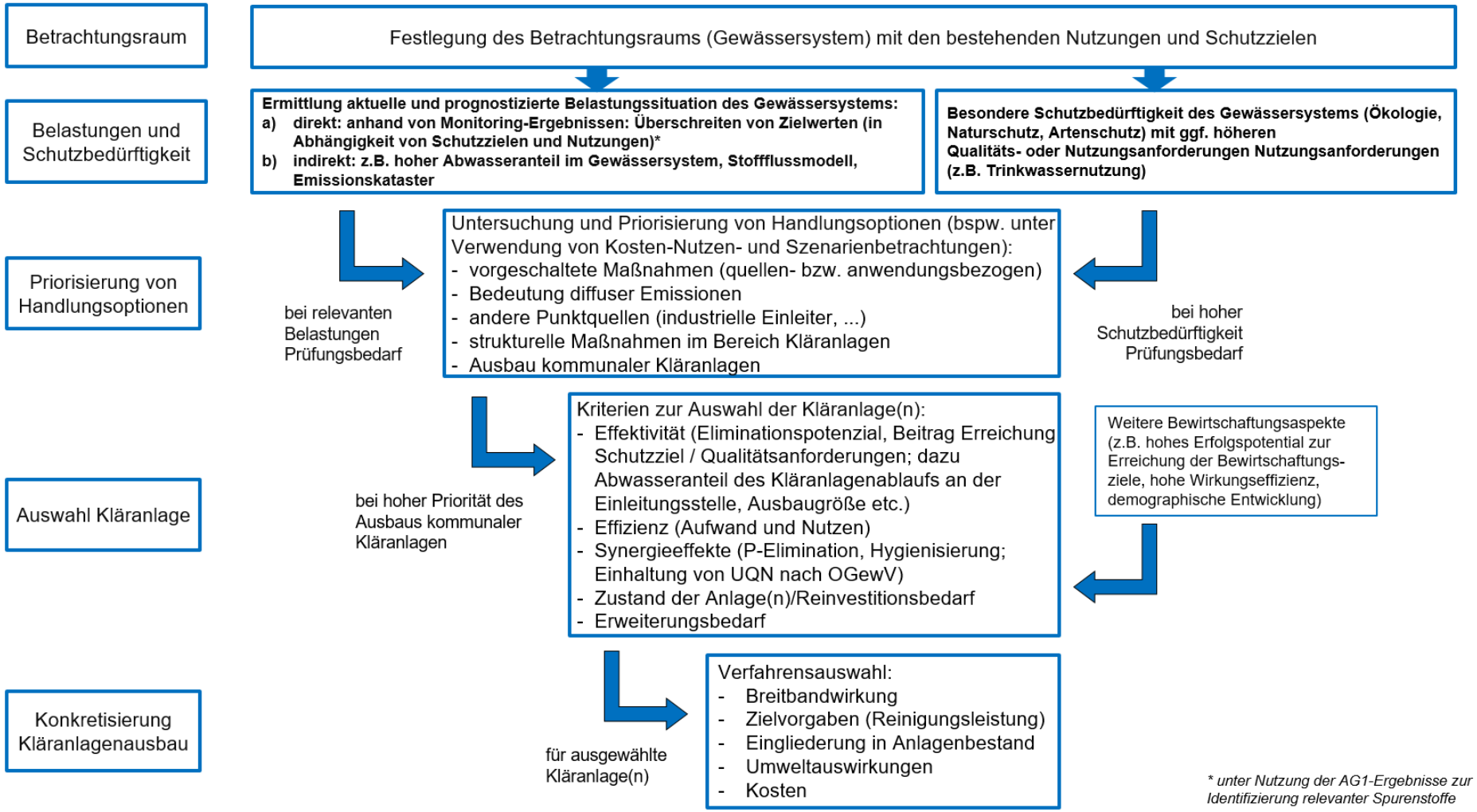
Spurenstoffzentrum des Bundes

- UWWTD 2023: 4T for WWTP > 100 000 PE & 4T risk based for KA 10 000 – 100 000 PE

[1]: https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/organische_mikroverunreinigungen_in_gewassern_vierte_reinigungsstufe_0.pdf
[2]: https://www.bmuv.de/fileadmin/Daten_BMU/Download_PDF/Binnengewaesser/ergebnispapier_stakeholder_dialog_phase2_bf.pdf

Advanced Wastewater Treatment: which WWTPs do we focus on?



[1]: https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/organische_mikroverunreinigungen_in_gewassern_vierte_reinigungsstufe_0.pdf
[2]: https://www.bmuv.de/fileadmin/Daten_BMU/Download_PDF/Binnengewaesser/ergebnispapier_stakeholder_dialog_phase2_bf.pdf

Advanced Wastewater Treatment: which WWTPs do we focus on?

Scope	Selection of the water body (part), setting goals, also based on the water body's use	
Pollution stress and vulnerability	Identification of the pollution stress (directly/measuring or indirectly/modelling)	Special interests (ecology, drinking water abstraction etc.)
Prioritization of measures	Scenarios, cost benefit analyses of different measures, such as reduction at the source and application, reduction of diffuse emissions, reduction of point source emissions, measures on WWTPs	

⇩ if WWTPs are identified as priorities

Selection	Selecting the WWTPs based on effectiveness, efficiency, synergies with other goals (e.g. EQS), WWTP status
Implementation	Selecting a treatment option

[1]: https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/organische_mikroverunreinigungen_in_gewassern_vierte_reinigungsstufe_0.pdf
[2]: https://www.bmuv.de/fileadmin/Daten_BMU/Download_PDF/Binnengewaesser/ergebnispapier_stakeholder_dialog_phase2_bf.pdf

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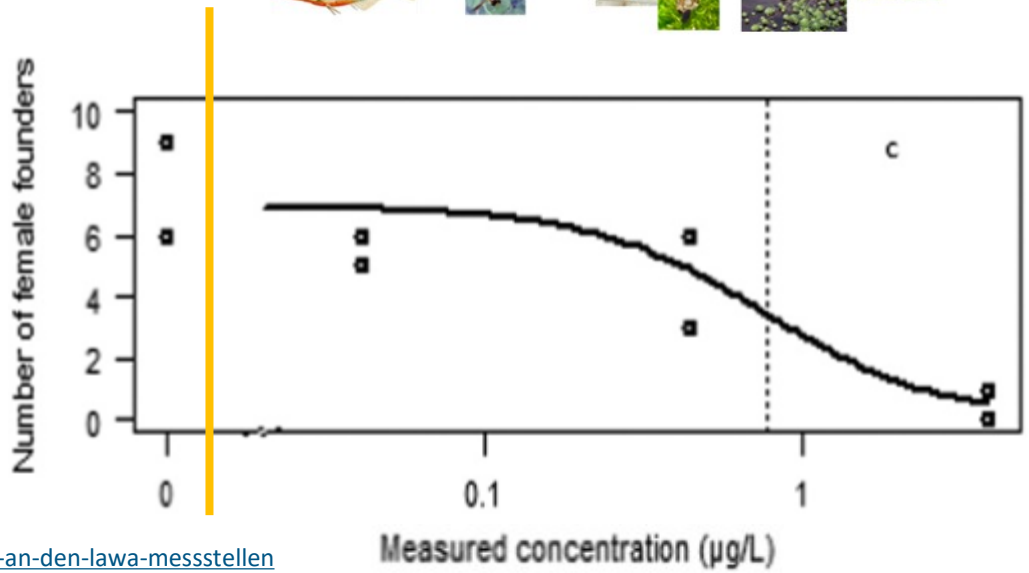
What are the risks?

Micropollutants in the UWWTD 2023 and the proposed EQSD
Single substance effects: Diclofenac

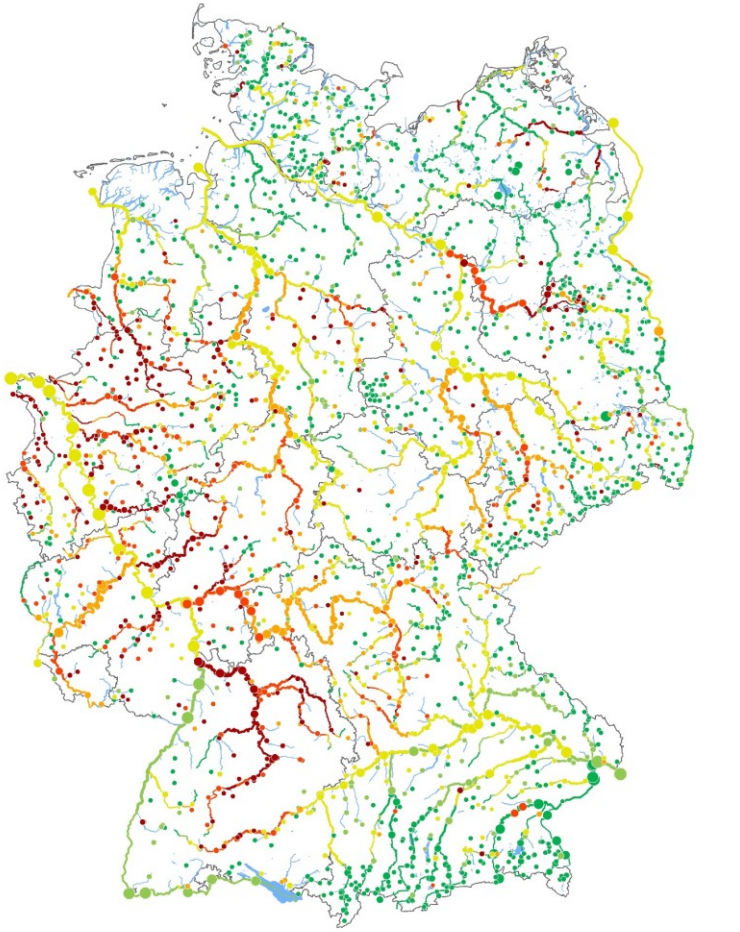
Diclofenac:

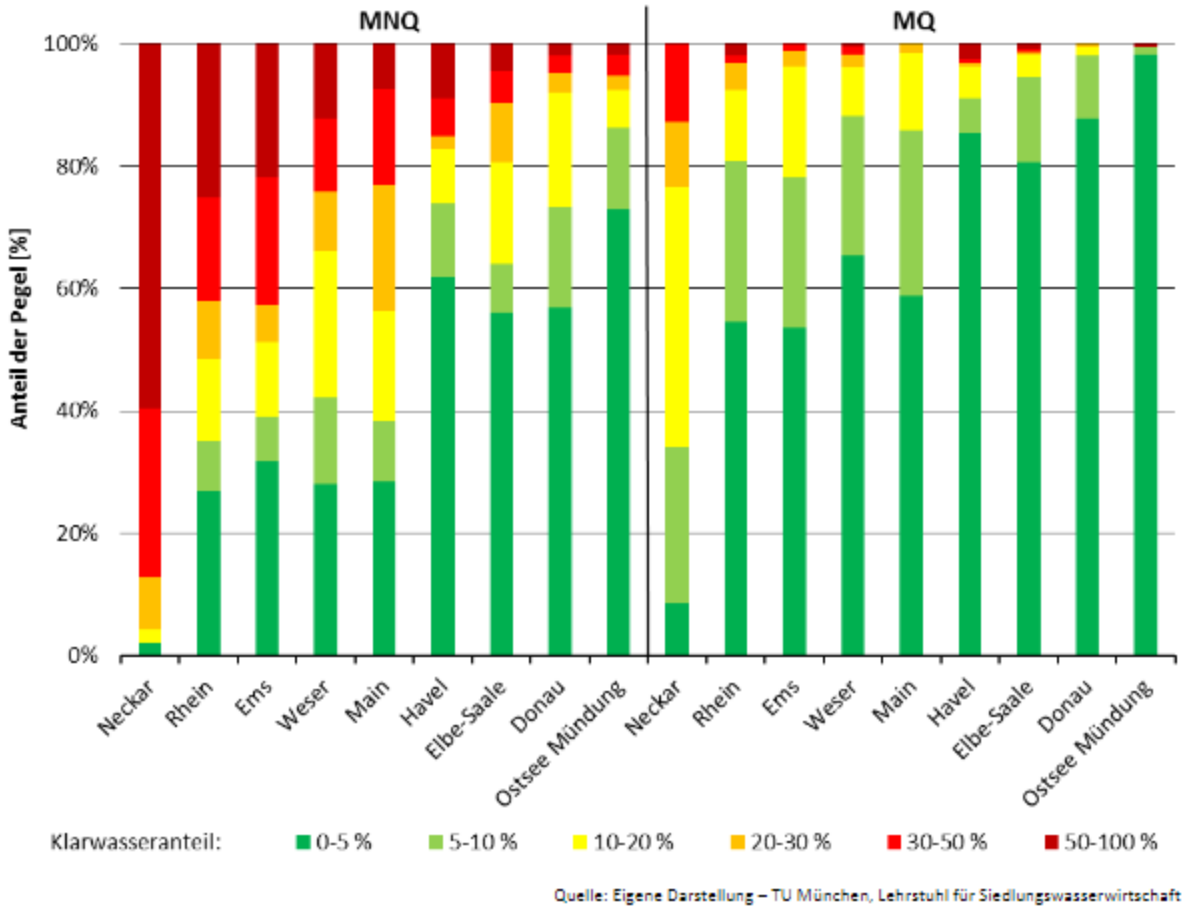
- Oral and topical application
- ecotoxic
- Proposed as a priority substance to describe the chemical status of a water body, using an annual-average EQS_{fw} of 0,04 µg/L (as proposed in the EQSD proposal 26.10.22 [1])
- In Germany, a PNEC of 0,05 µg/L was exceeded around 75% of the measuring stations (measuring programs of the federal states 2016-2018 [2])



[1]: Vorschlag Änderung Richtlinie 2000/60/EC, Richtlinie 2006/118/EC, Richtlinie 2008/105/EC
[2]: https://www.umweltbundesamt.de/themen/wasser/fluesse/zustand/arzneimittelwirkstoffe#auswertung-der-messungen-an-den-lawa-messstellen
[3]: Joachim et al. 2021, https://doi.org/10.1016/j.ecoenv.2020.111812

Wastewater Discharge in Germany
Share of wastewater discharge during mean low water conditions





Quelle: Eigene Darstellung – TU München, Lehrstuhl für Siedlungswasserwirtschaft

Quelle: TU München, Lehrstuhl für Siedlungswasserwirtschaft
In: UBA-Texte 59/2018; https://www.umweltbundesamt.de/publikationen/dynamik-der-klarwasseranteile-in

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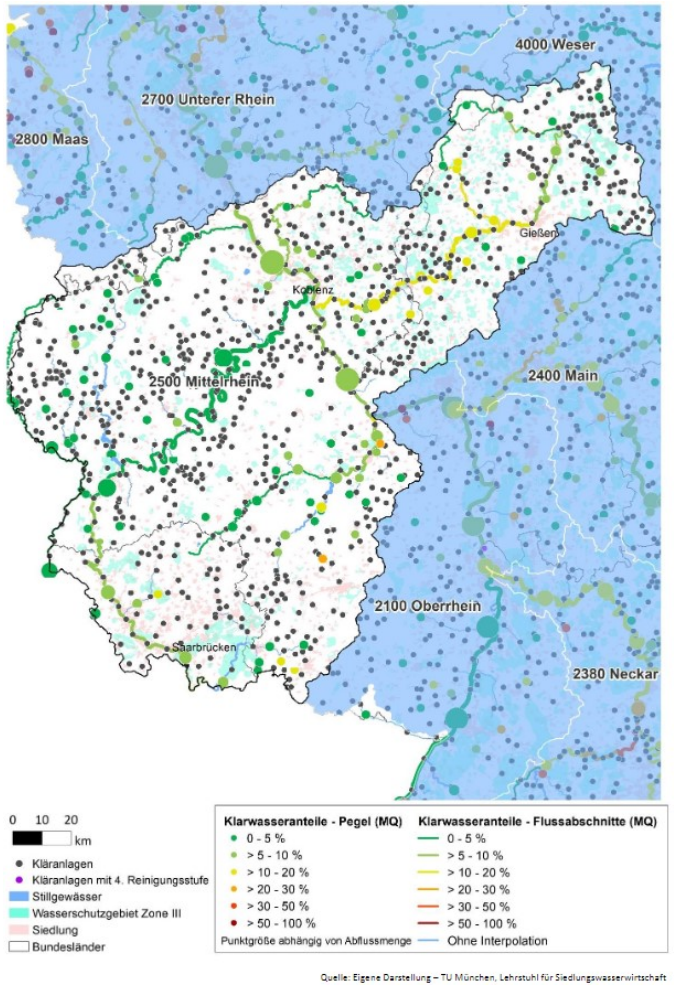
MQ:



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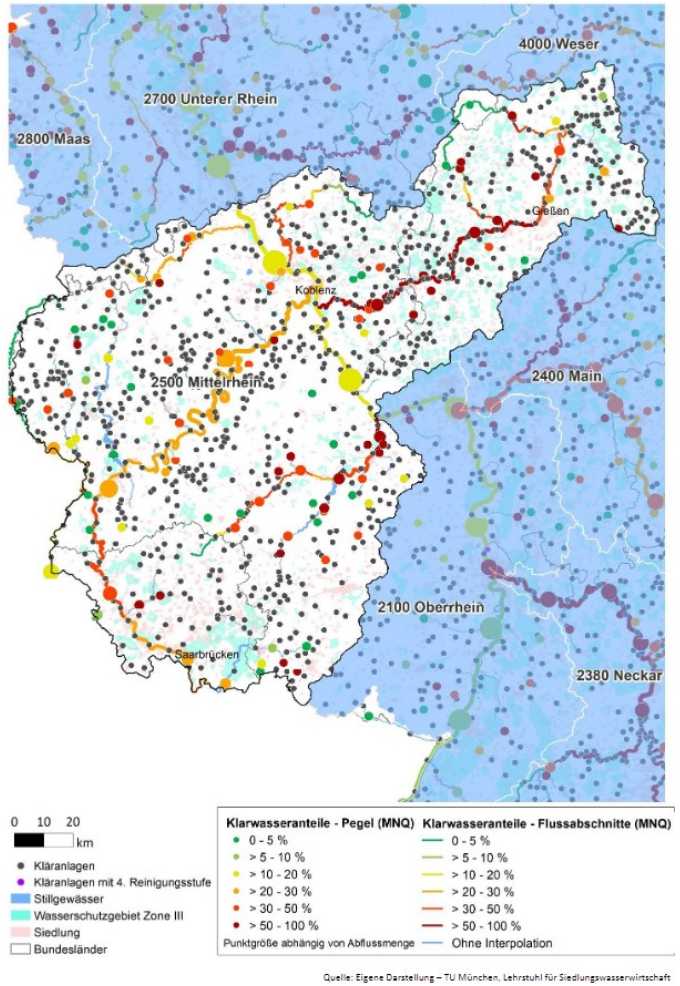
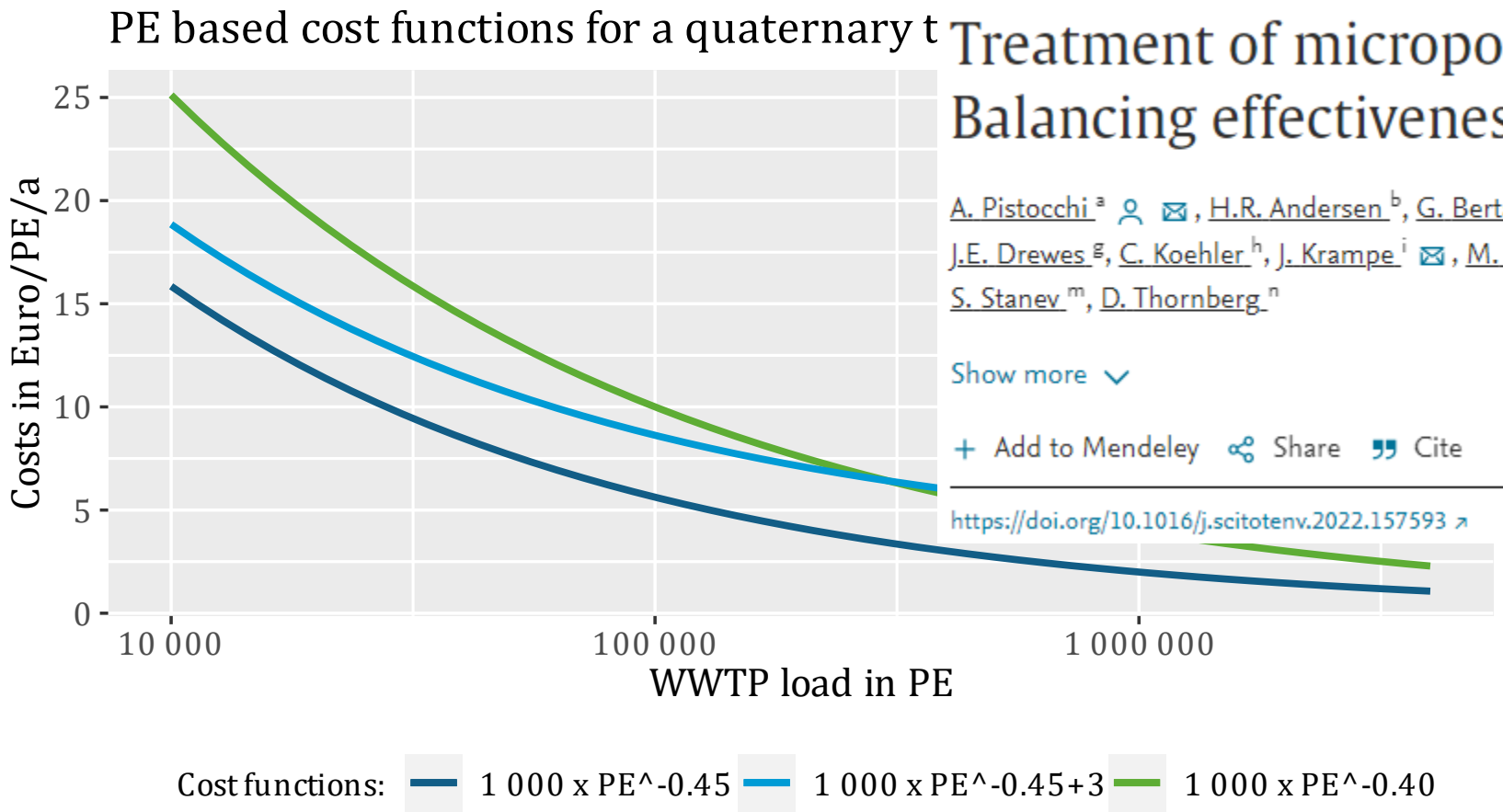


What is efficient?
Cost Efficient Selection of WWTPs



Treatment of micropollutants in wastewater: Balancing effectiveness, costs and implications

A. Pistocchi [a], H.R. Andersen [b], G. Bertanza [c], A. Brander [d], J.M. Choubert [e], M. Cimbritz [f], J.E. Drewes [g], C. Koehler [h], J. Krampe [i], M. Launay [j], P.H. Nielsen [k], N. Obermaier [l], S. Stanev [m], D. Thornberg [n]

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https://doi.org/10.1016/j.scitotenv.2022.157593

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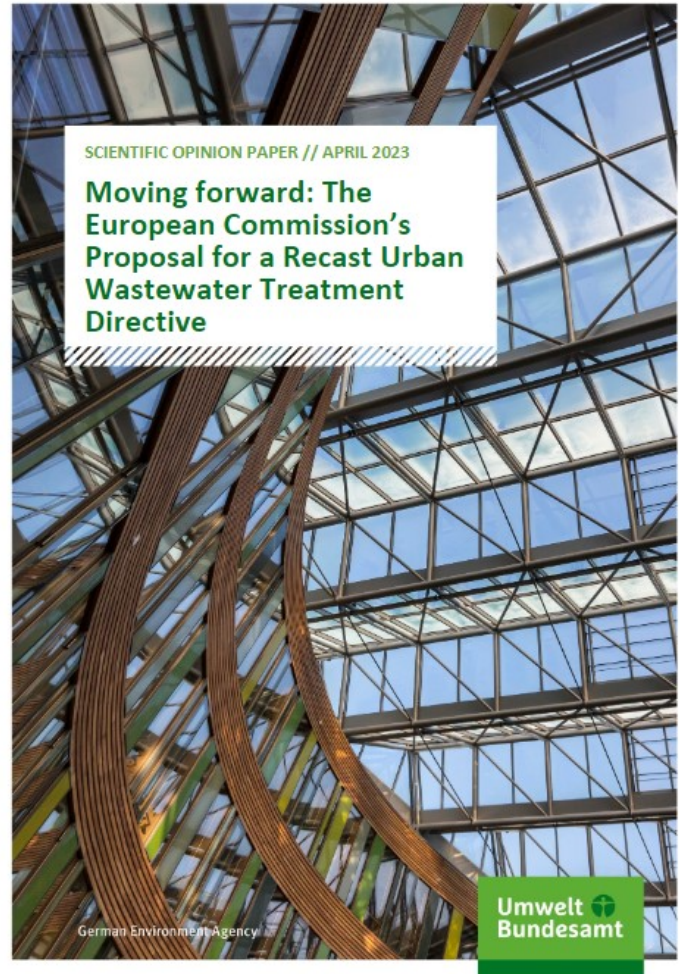
Summary

A quaternary treatment is mandatory to reduce micropollutant loads:

- Introducing a quaternary treatment as part of a multiple-barrier concept helps to reach environmental protection goals
- efficiency is hard to define: several different aspects must be considered, scenarios and models are mandatory. Uncertainties with respect to risks are quite high. RBA must be updated regularly.
- The German Environment Agency wrote a Scientific Opinion Paper des Umweltbundesamtes and discusses other aspects of the UWWTD in detail



Thank you for your attention!