

Mapping micropollutants emitted in the Baltic Sea catchment via municipal wastewater

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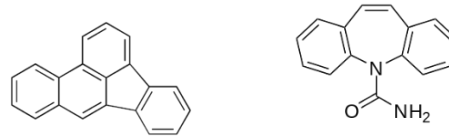
Surface waters are impacted by “micropollutants”



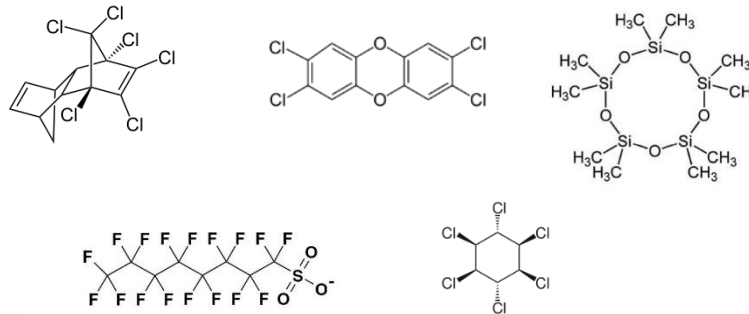
industrial chemicals
and byproducts



chemicals in articles



pesticides



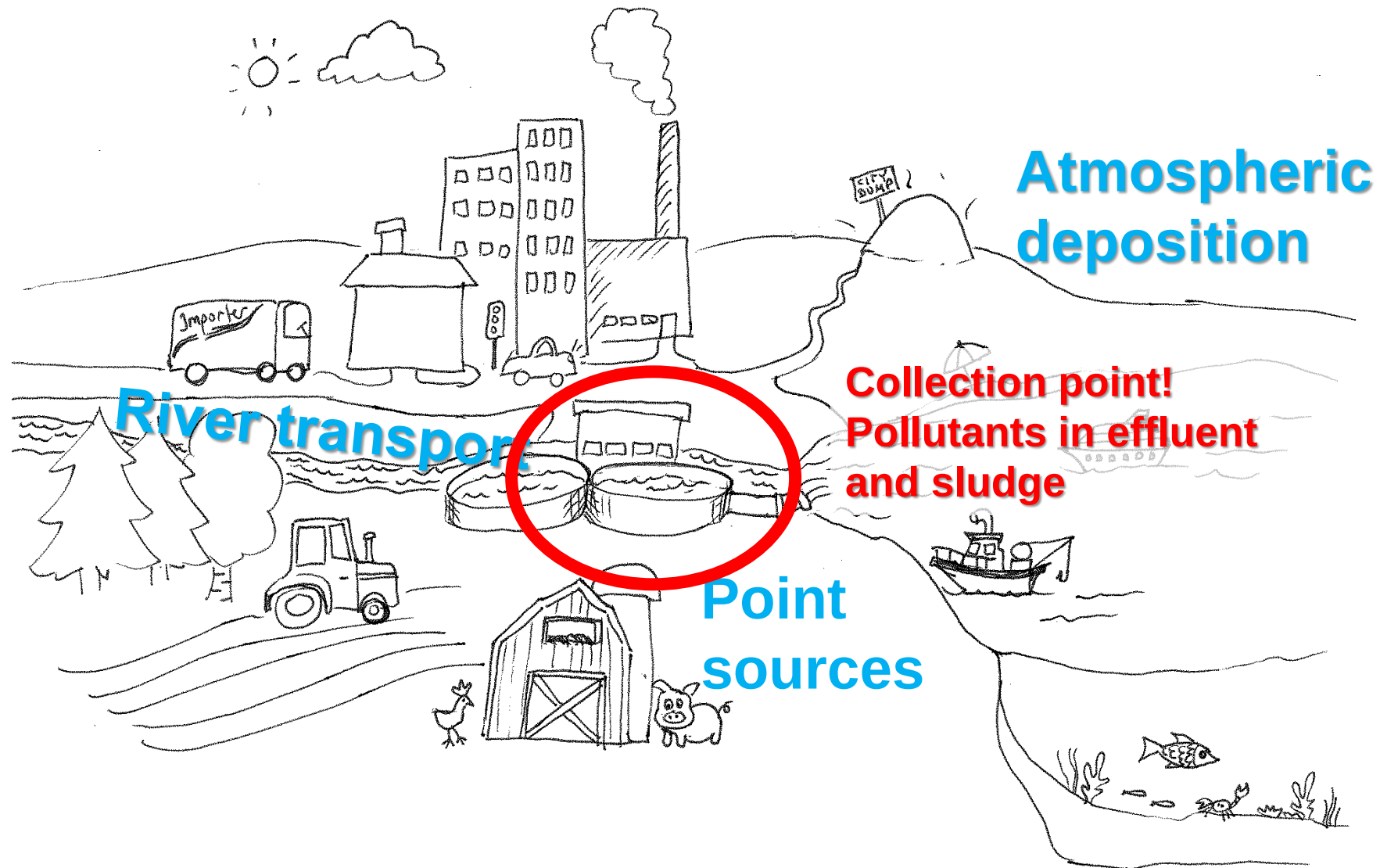
personal care products

household chemicals



pharmaceuticals

Many pathways to and from the sea



How can chemicals reach the WWTPs?



**Dammråttor är fulla
med kemikalier.
Spola inte ner dem,
sug upp dem.**



Damm drar till sig skadliga kemikalier från till exempel elektronik och plast. Kemikalier som vårt reningsverk inte kan rena bort. Om du våttorkar och spolar ner dammet i avloppet hamnar kemikalierna i naturen. Använd dammsugare och mikrofiberduk i stället så hamnar dammet på rätt ställe.
På www.kappala.se finns fler miljötips och vår film om läskiga dammråttor!

**KEMIKALIER
I AVLOPPET
NEJ TACK!**

KÄPPALA
För renare sjöar och skärgård

How can chemicals reach the wastewater?



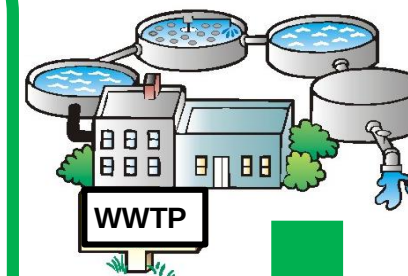
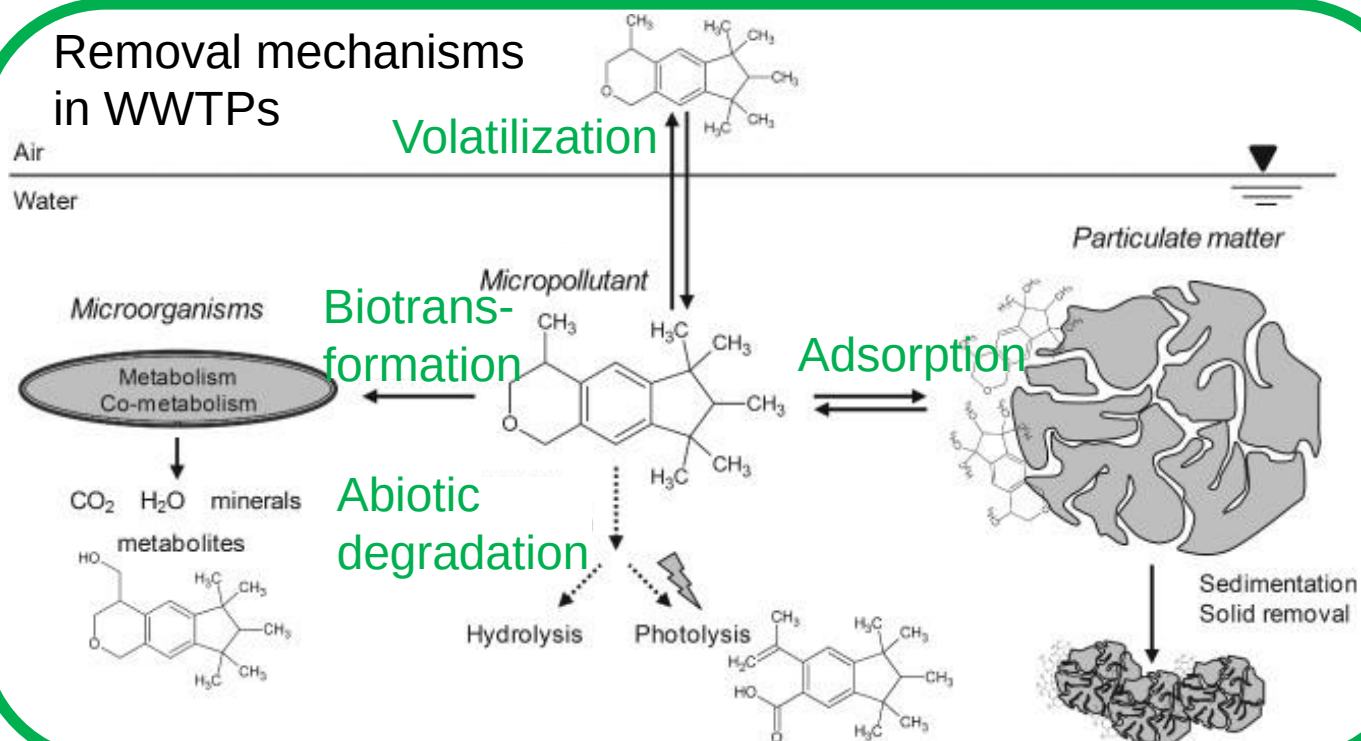


Conventional
WWTPs
designed to
remove N, P,
BOD

What happens to “micropollutants” in WWTPs?

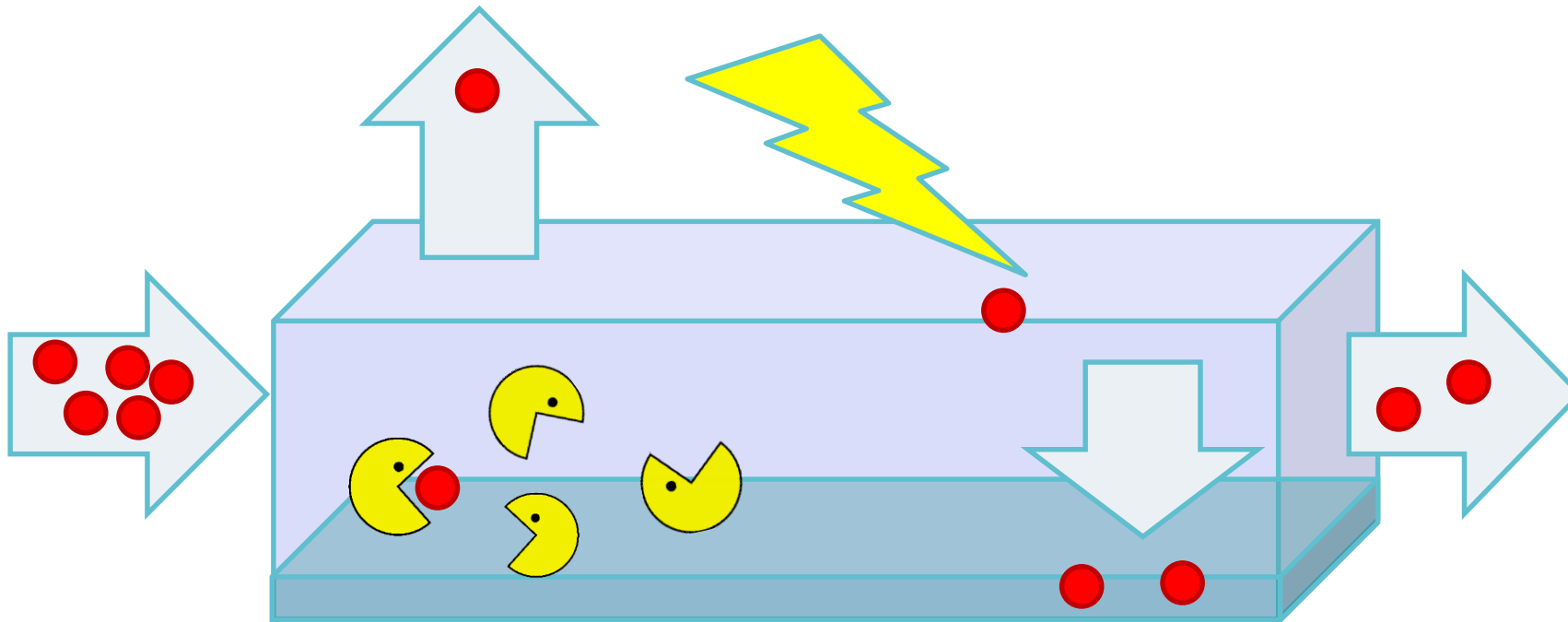


Removal mechanisms in WWTPs



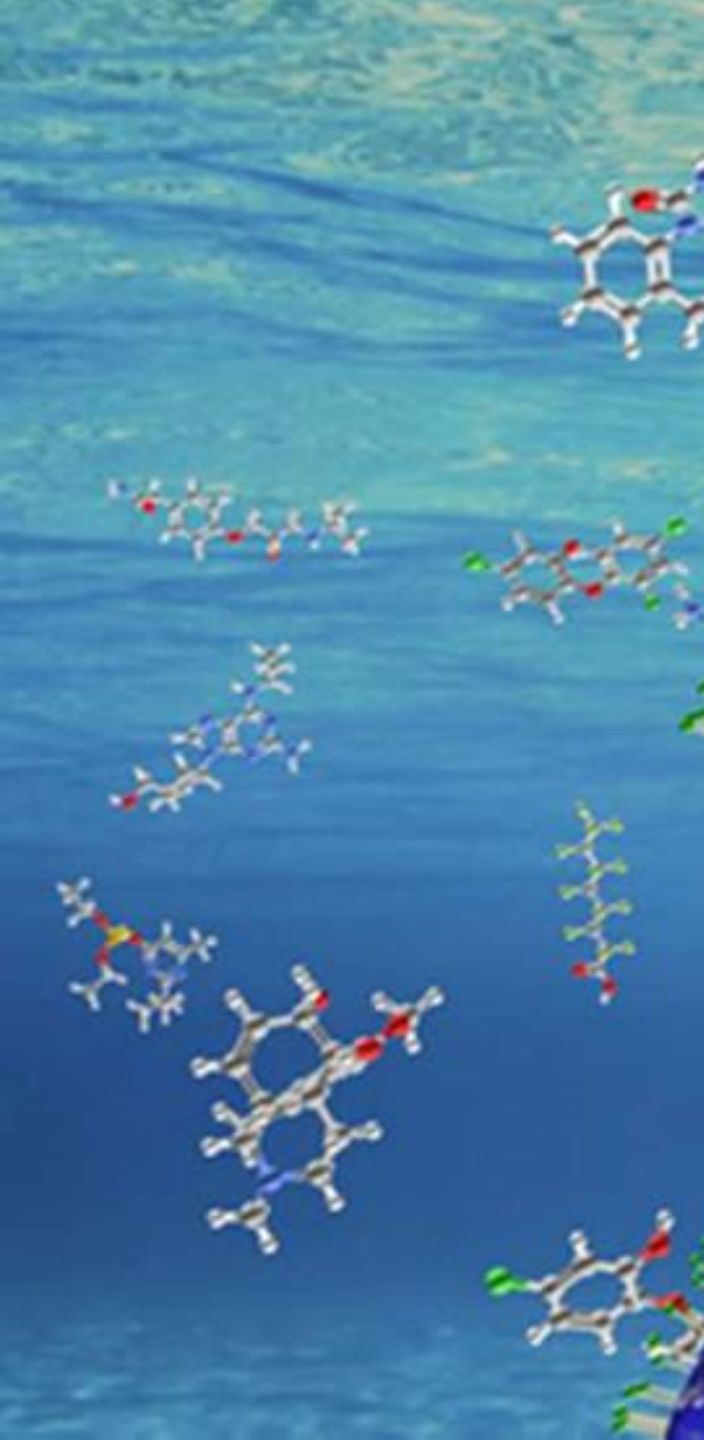
Removal of micropollutants in conventional WWTPs

- Chemicals that typically escape: Persistent and Mobile (P and M)
- But large input → large output in absolute numbers → also other types of substances in effluents

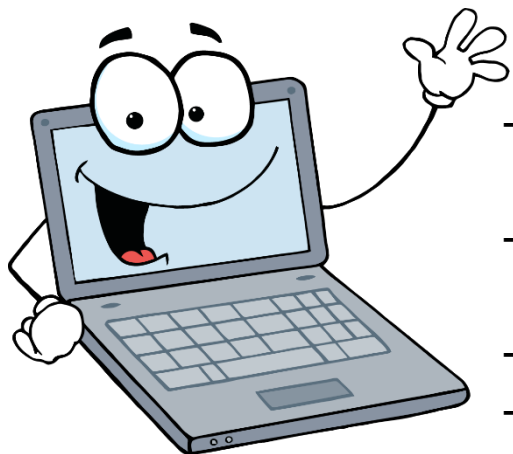


What's in the effluents?

- CHEMPACT project
- How important are municipal WWTPs as entry routes?
- Which chemicals are present in effluents emitted in the Baltic Sea catchment?
- Which concentrations are observed, which chemicals are present in highest concentrations?
- How large are the loads emitted via municipal WWTPs?



CHEMPACT project – a literature study



- measured concentrations of metals and organic chemicals
- municipal WWTPs within BS catchment
- national monitoring data
- scientific literature
- grey literature

Data from ~725 MWWTPs
~ 640 WWTPs with known identity
~ 70 000 entries
~ 1100 unique substances

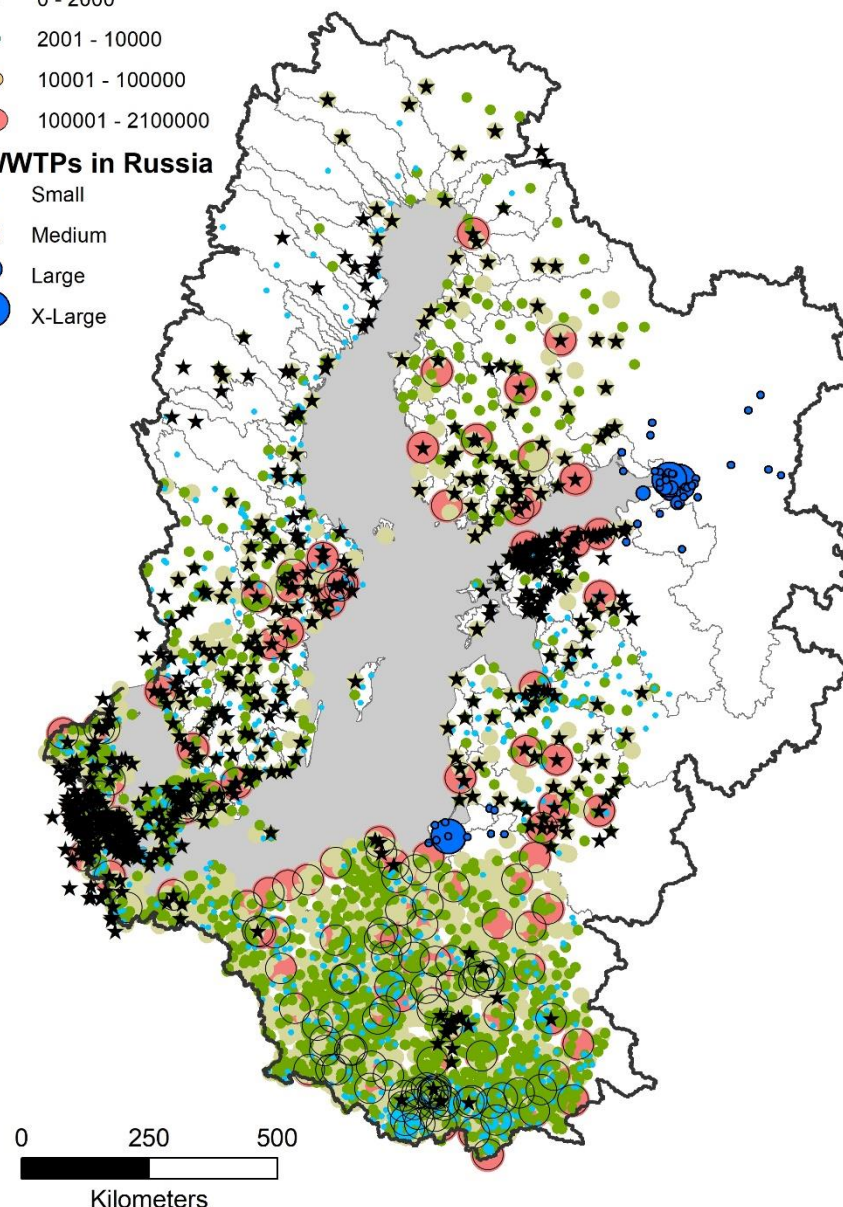
MWWTPs in the database
Where have we looked?

WWTPs in EU

- 0 - 2000
- 2001 - 10000
- 10001 - 100000
- 100001 - 2100000

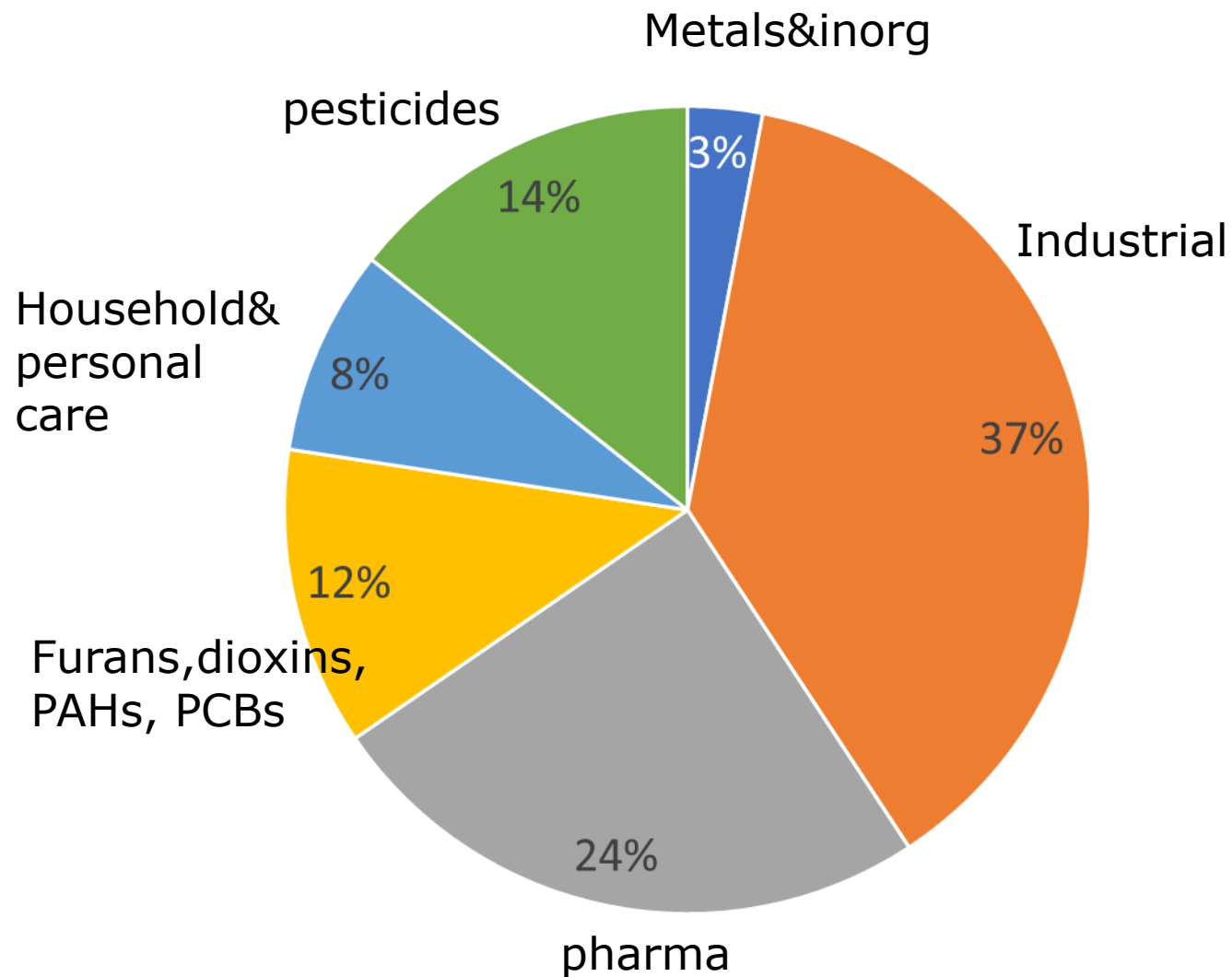
WWTPs in Russia

- Small
- Medium
- Large
- X-Large

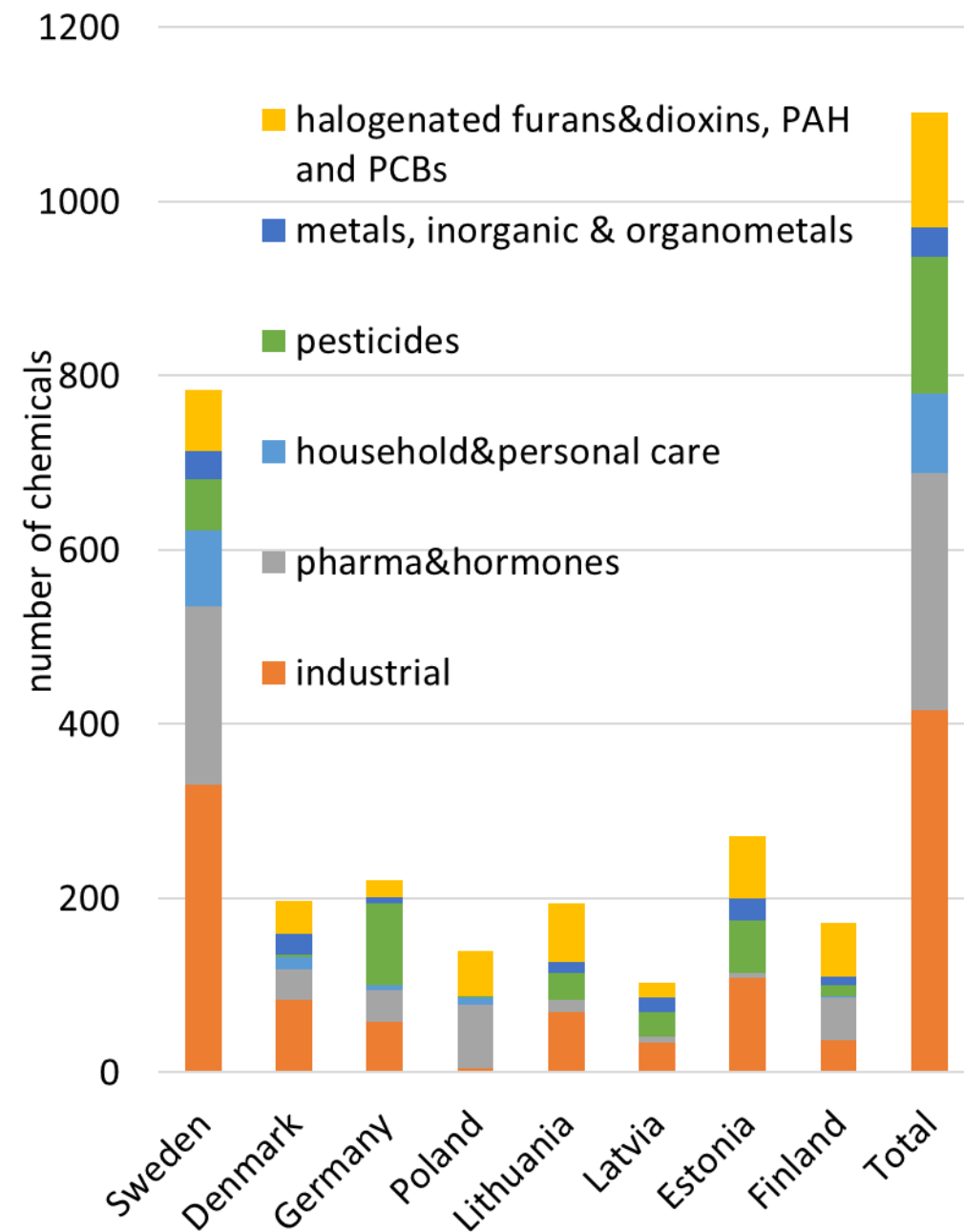


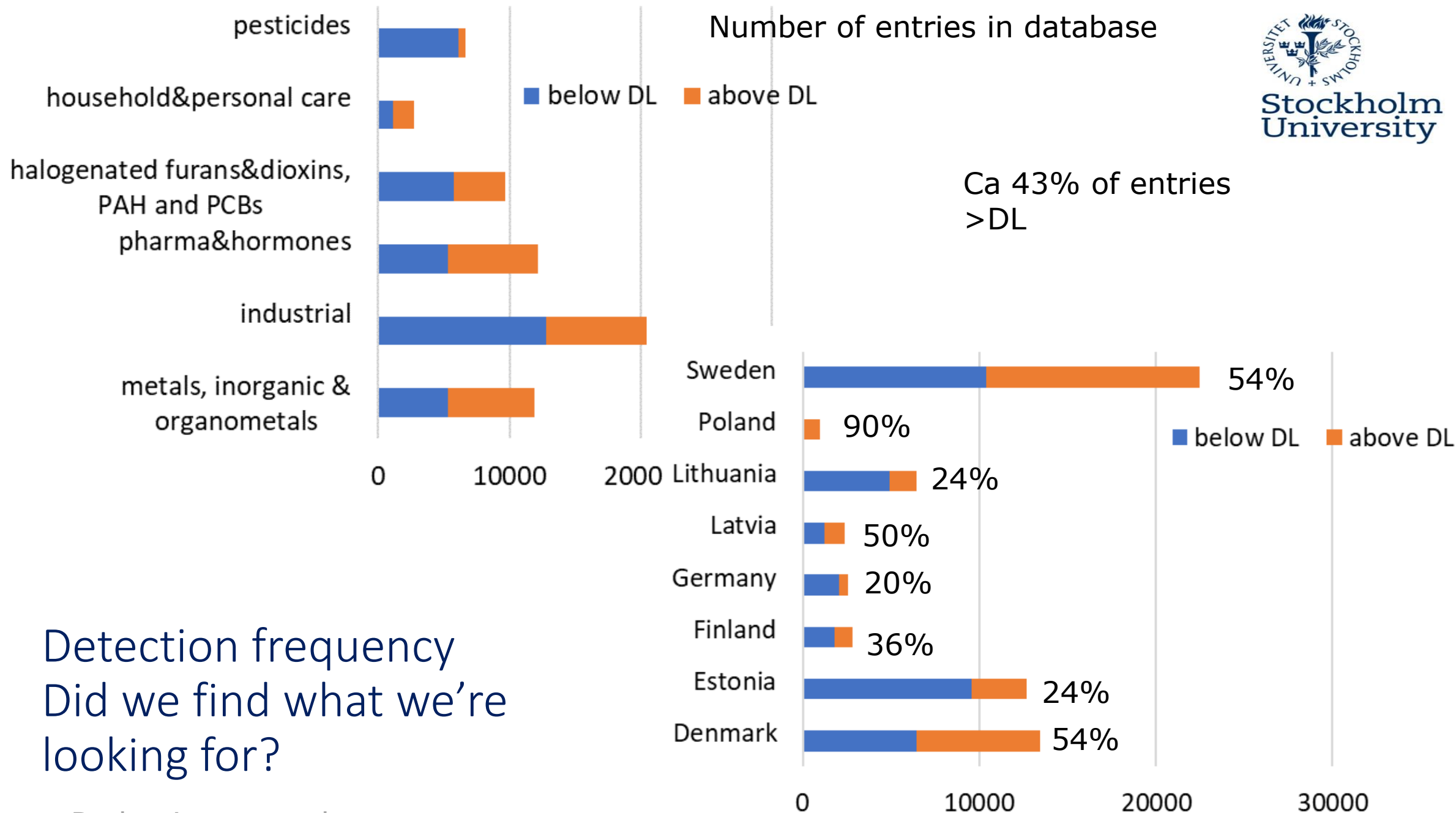
Number of unique substances analyzed

What have we been looking for?



Note: Preliminary results

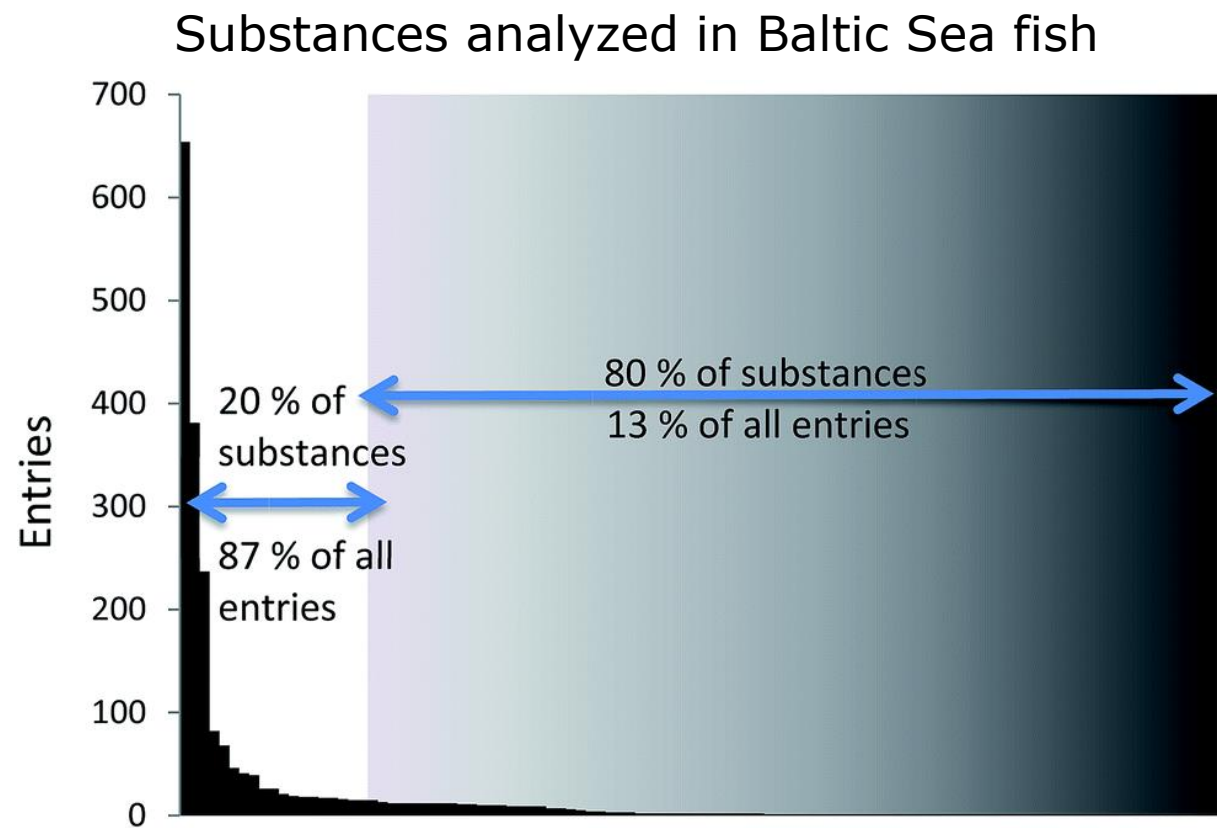
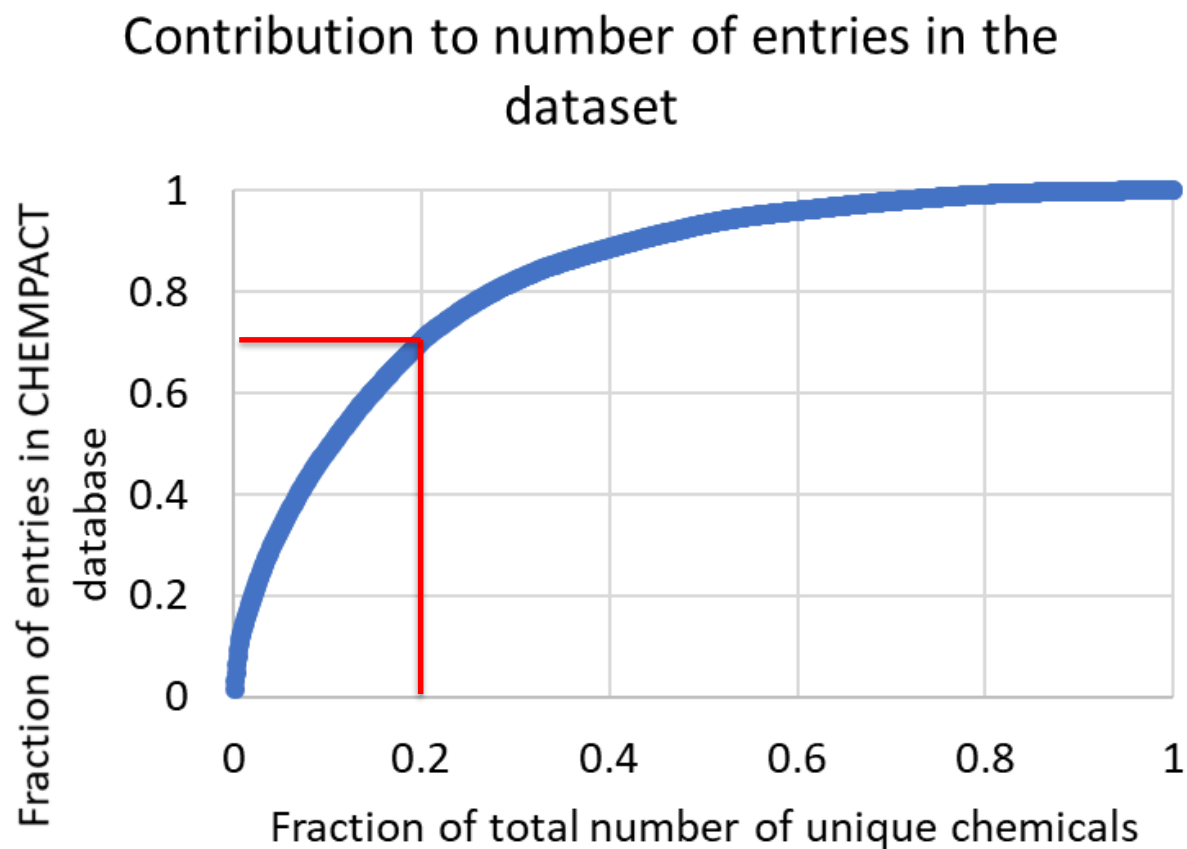




Detection frequency
Did we find what we're
looking for?

Note: Preliminary results

20% of substances make up ca 70% of the database



Sobek et al 2016

Note: Preliminary results

Aggregated data – concentrations and loads

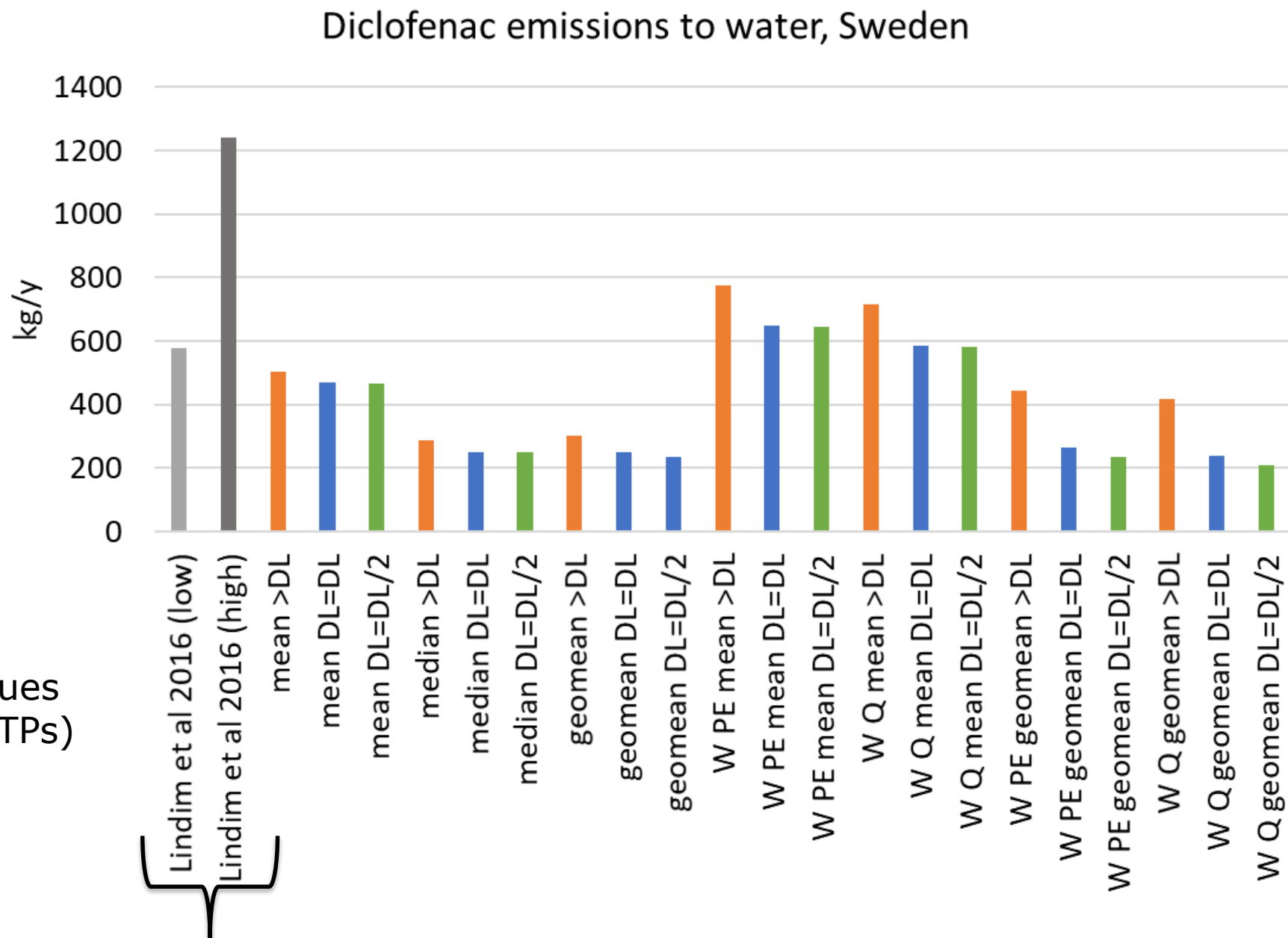
How to calculate this?

- What to do with $<DL$?
- Type of aggregated value? Arithmetic average, median, geometric mean, weighted aggregated values (to PE, Q, people connected)?
- Years to include?
- How many countries and/or WWTPs analysed per chemical?
- Different substances in different countries

Type and DLs Weighted or not

Example: Diclofenac

- Range ca factor 4
- Mean
- Median
- Geometric mean
- Values < DL
- Weighted aggregated values (according to size of WWTPs)



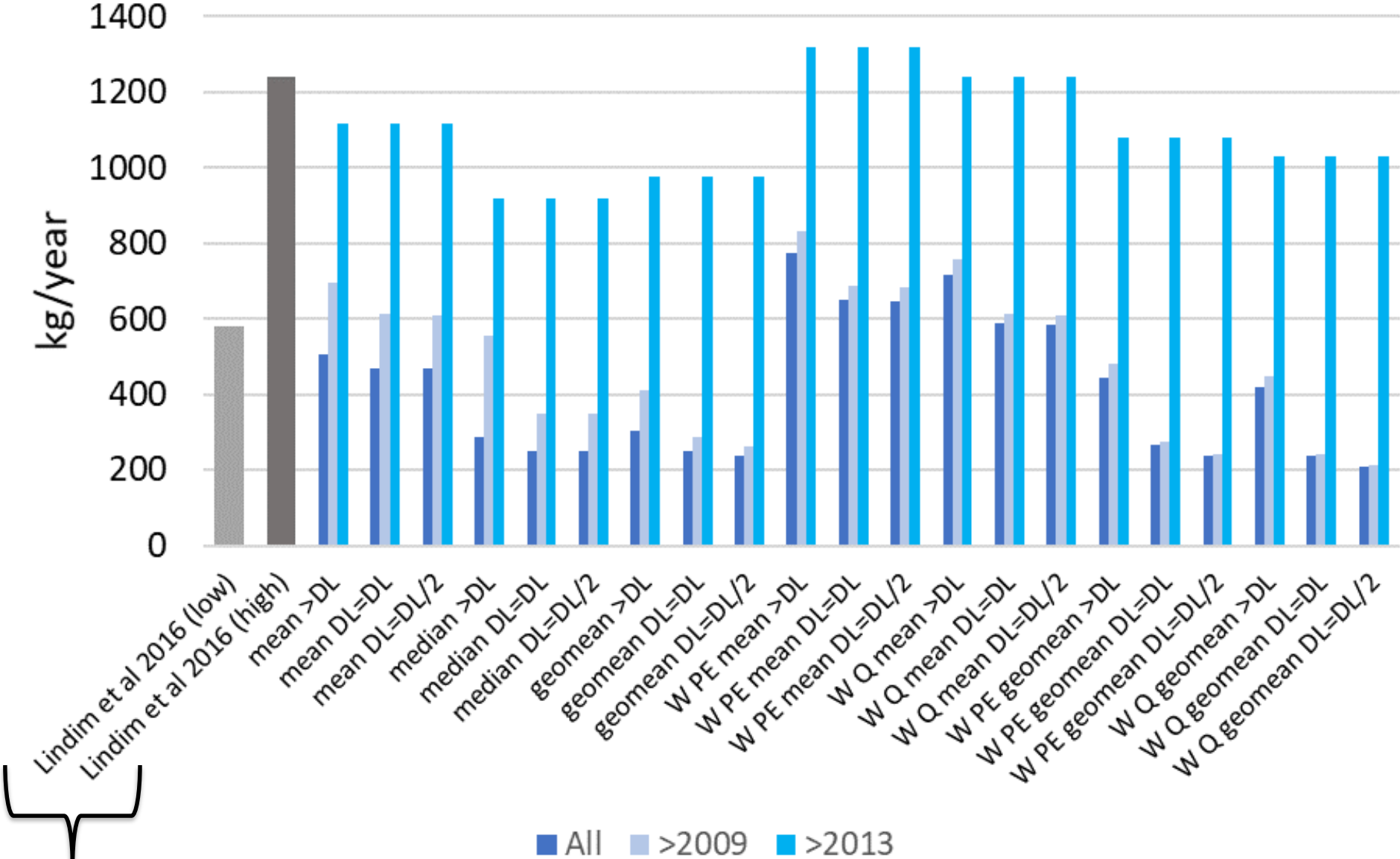
Note: Preliminary results

Calculated from sales

Diclofenac mass loads Sweden

Time span
to include

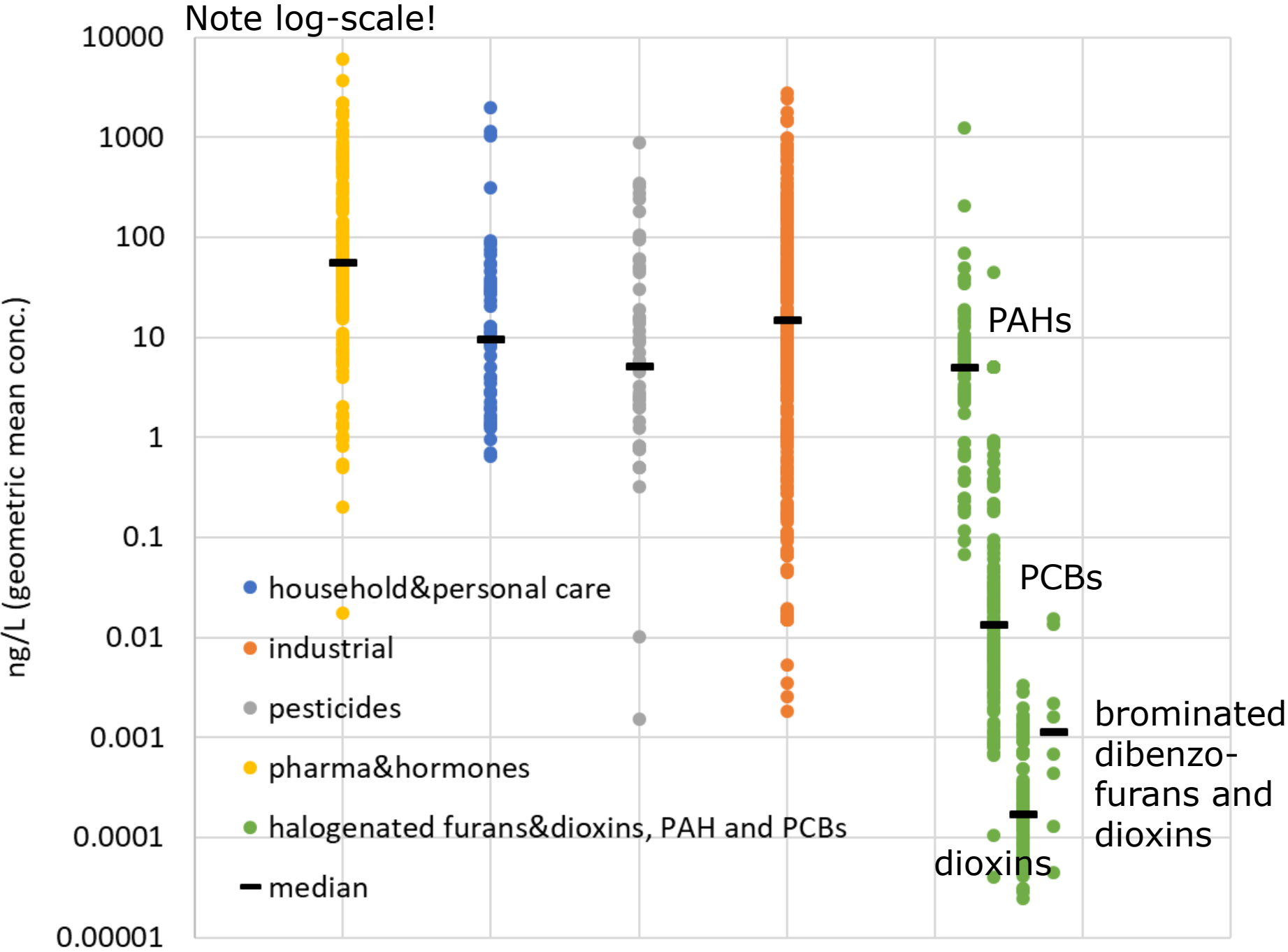
Range ca factor 6-7



Note: Preliminary results

Calculated from sales

Concentration
range of
different
groups



Note: Preliminary results

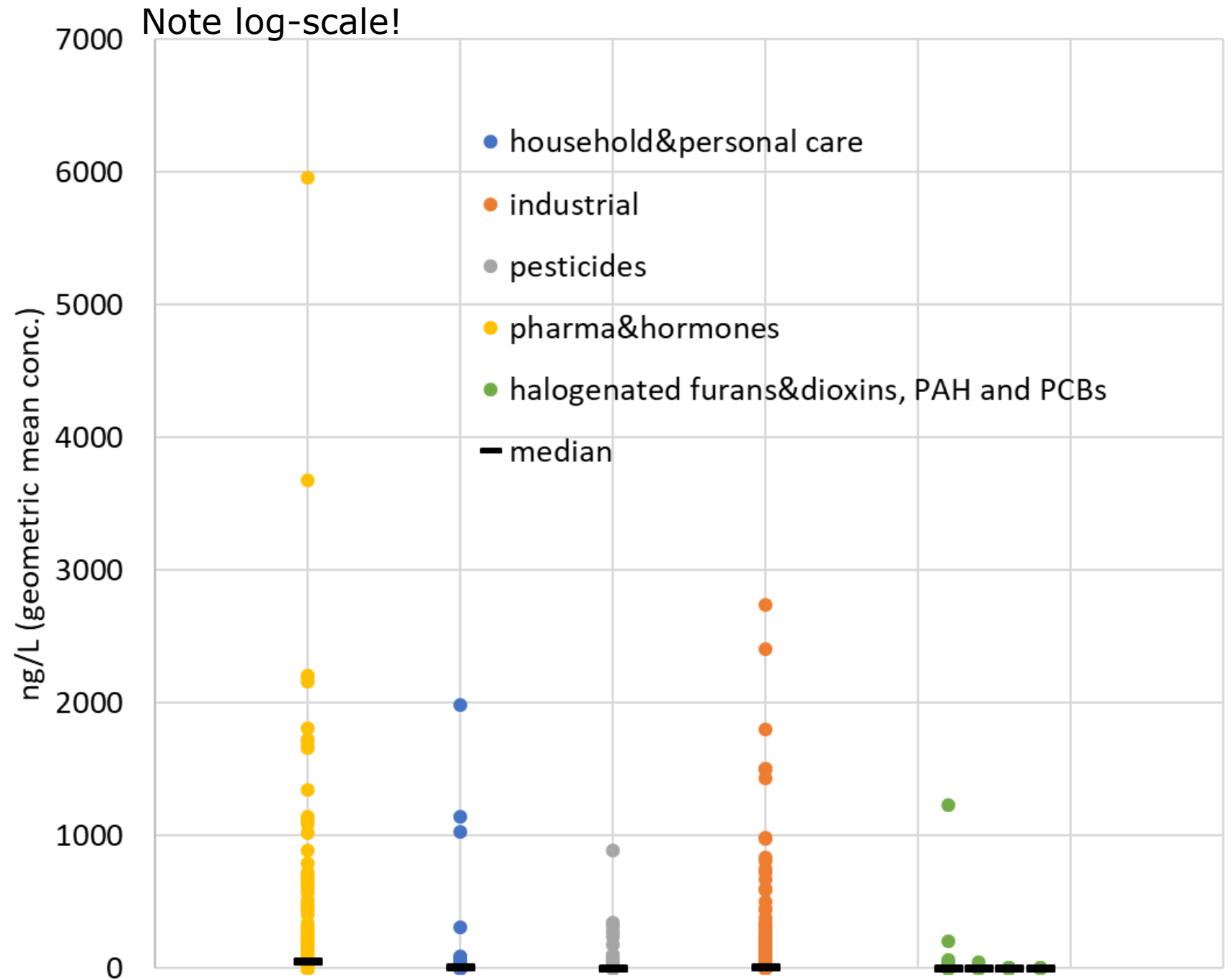
Concentration range of different groups

Sweeteners
PersCareProd ingredients
UV filters

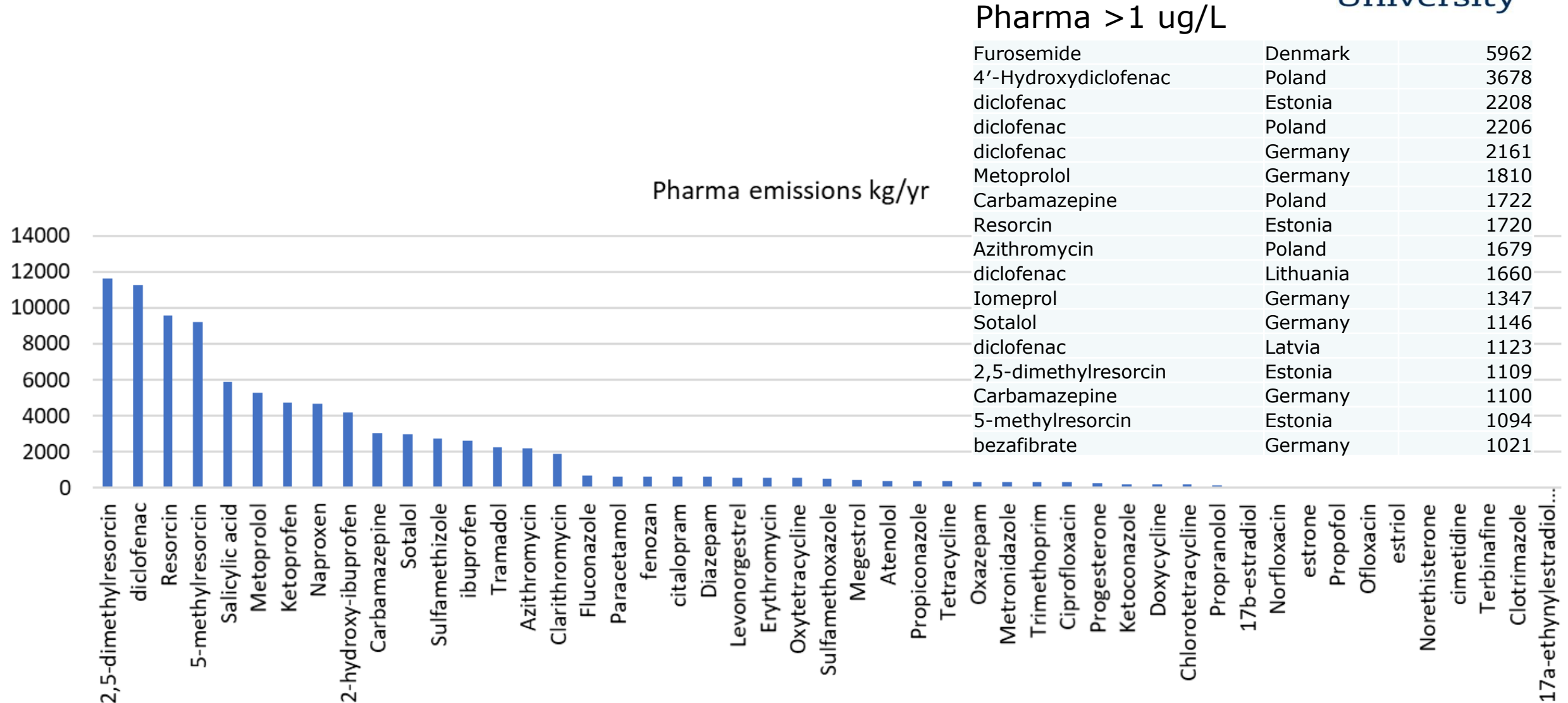
Various industrial
Organophosphates
Phthalates
Fluorescent whitening agents
Phenolic substances

Glyphosate + AMPA
DEET (diethyltoluamide)
Diuron
Alachlor
endosulfan

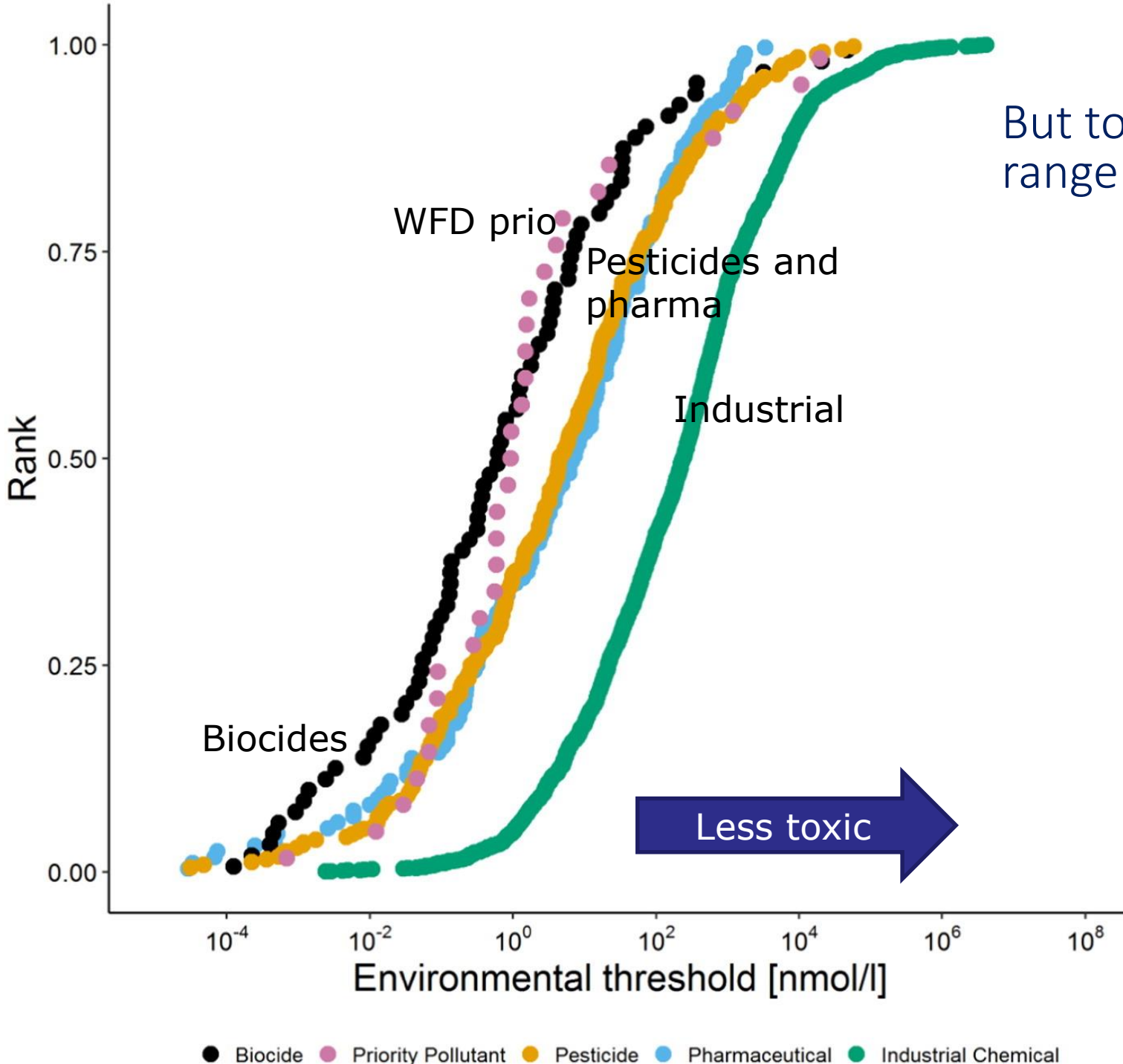
Note: Preliminary results



A few substances responsible for large share of total load



Note: Preliminary results



But toxicity threshold range is large

- REACH hazard evaluation of 2244 registered industrial chemicals
- Compared to pharma, pesticides, biocides, Water Framework Directive prio substances
- Industrial chemicals in general less hazardous
- But 280 of them more toxic than median pesticide

Some conclusions

- Database for the Baltic Sea catchment compiled – micropollutants measures in effluents
- Relatively few substances make up large fraction of database
- Detection frequencies vary between chemical groups and countries – ca 43% detection frequency overall
- Large variation in aggregated values depending on calculation method
- A limited number of substances responsible for large fraction of emissions
- Large emissions can compensate for relatively lower toxicity
- Analysis of dataset is ongoing...

What happens in Europe?

- Urban Wastewater Directive (UWWTD) → micropollutants not criteria for wastewater quality
 - UWWTD → currently under revision. Will criteria be developed? Will more advanced treatment technologies be demanded?
- REACH regulation → does not identify persistent and mobile substances as hazardous
 - EU Chemicals Strategy for Sustainability Towards a Toxic-Free Environment → PMT and vPvM will be introduced as criteria
 - This targets chemicals likely to escape MWWTPs
 - ...



Thank you

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Interreg BSR

