Photo Credit: Merel Kooi

Dealing with the diversity of microplastics for the assessment of external exposure

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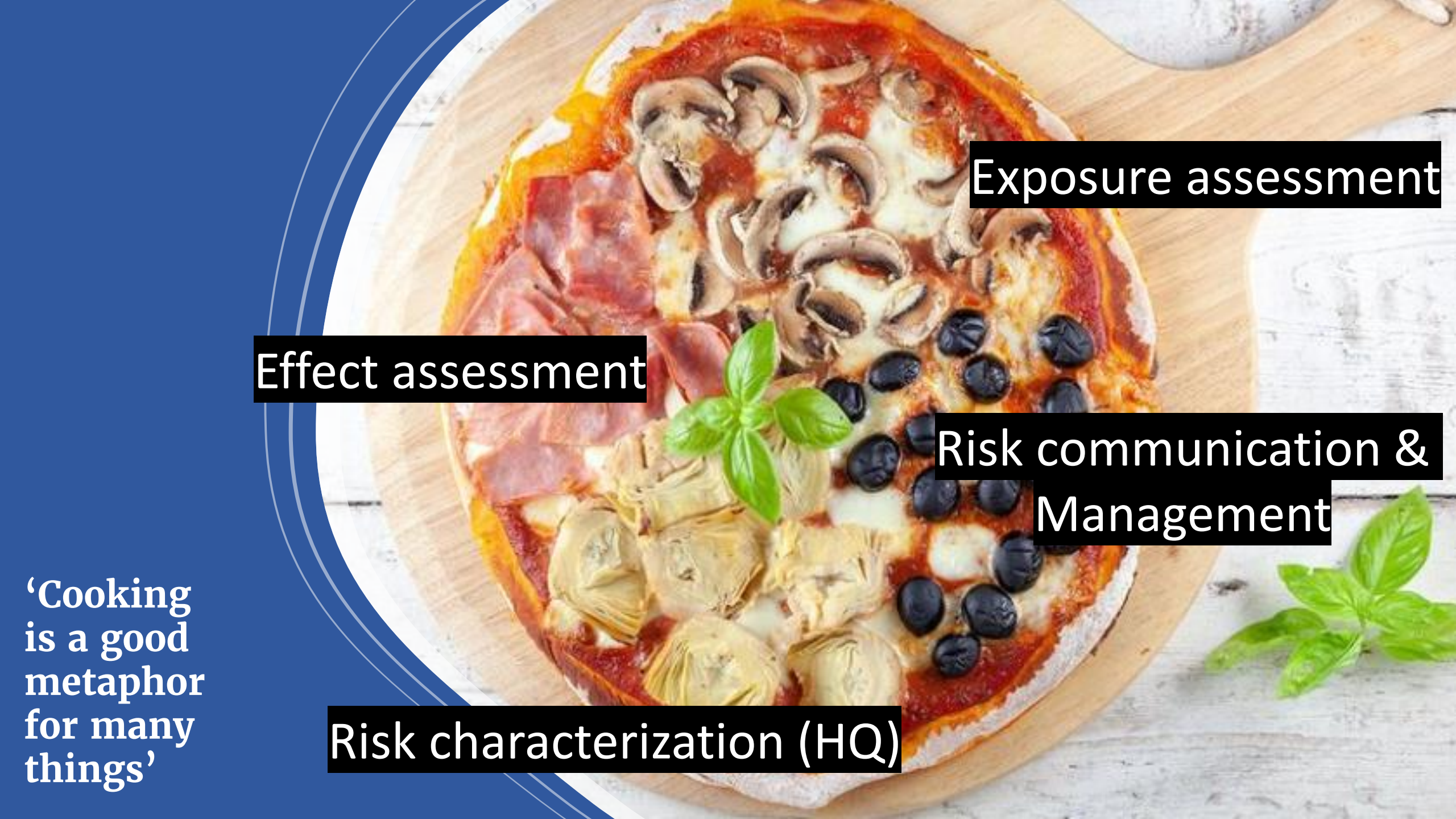
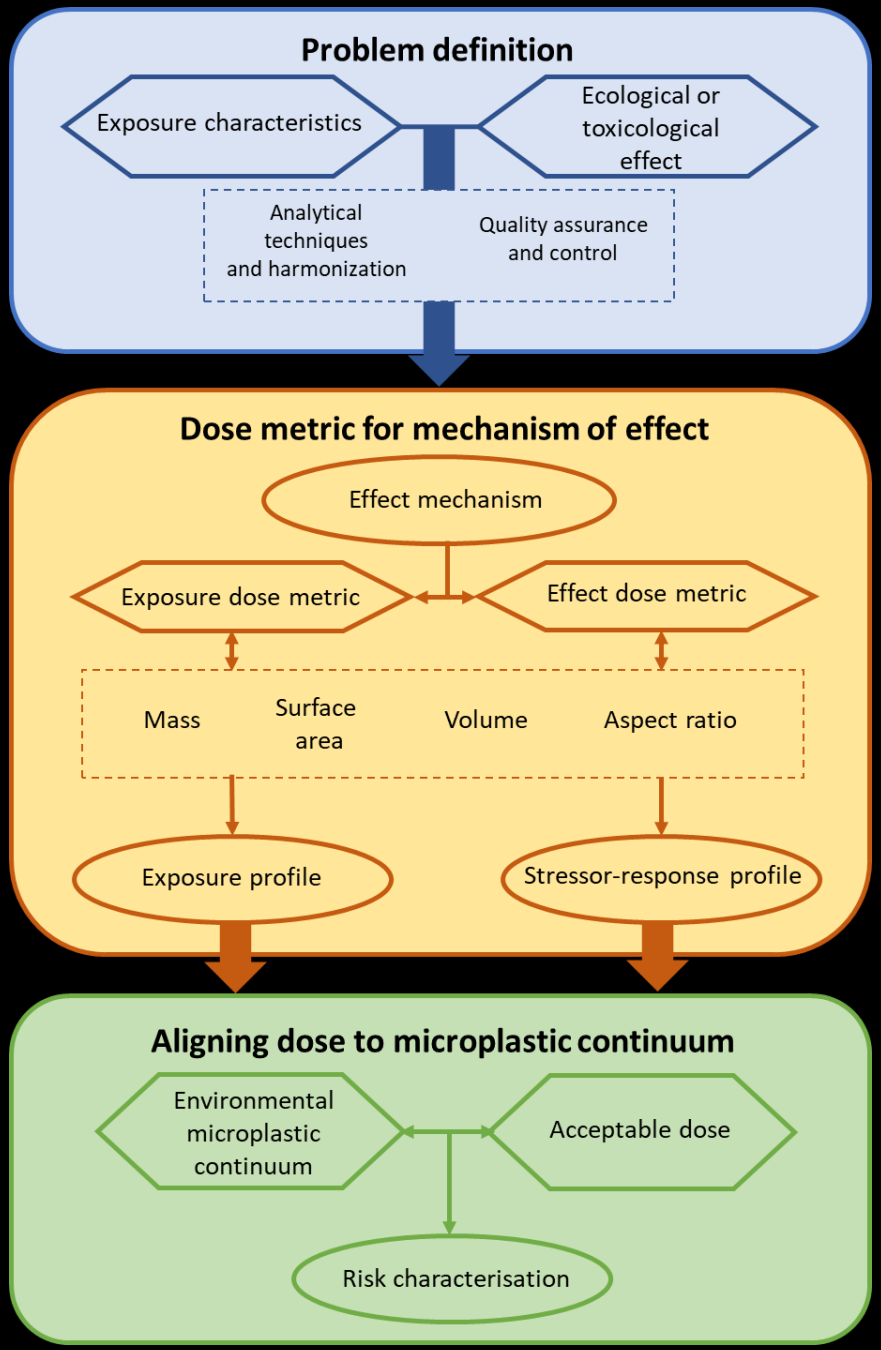
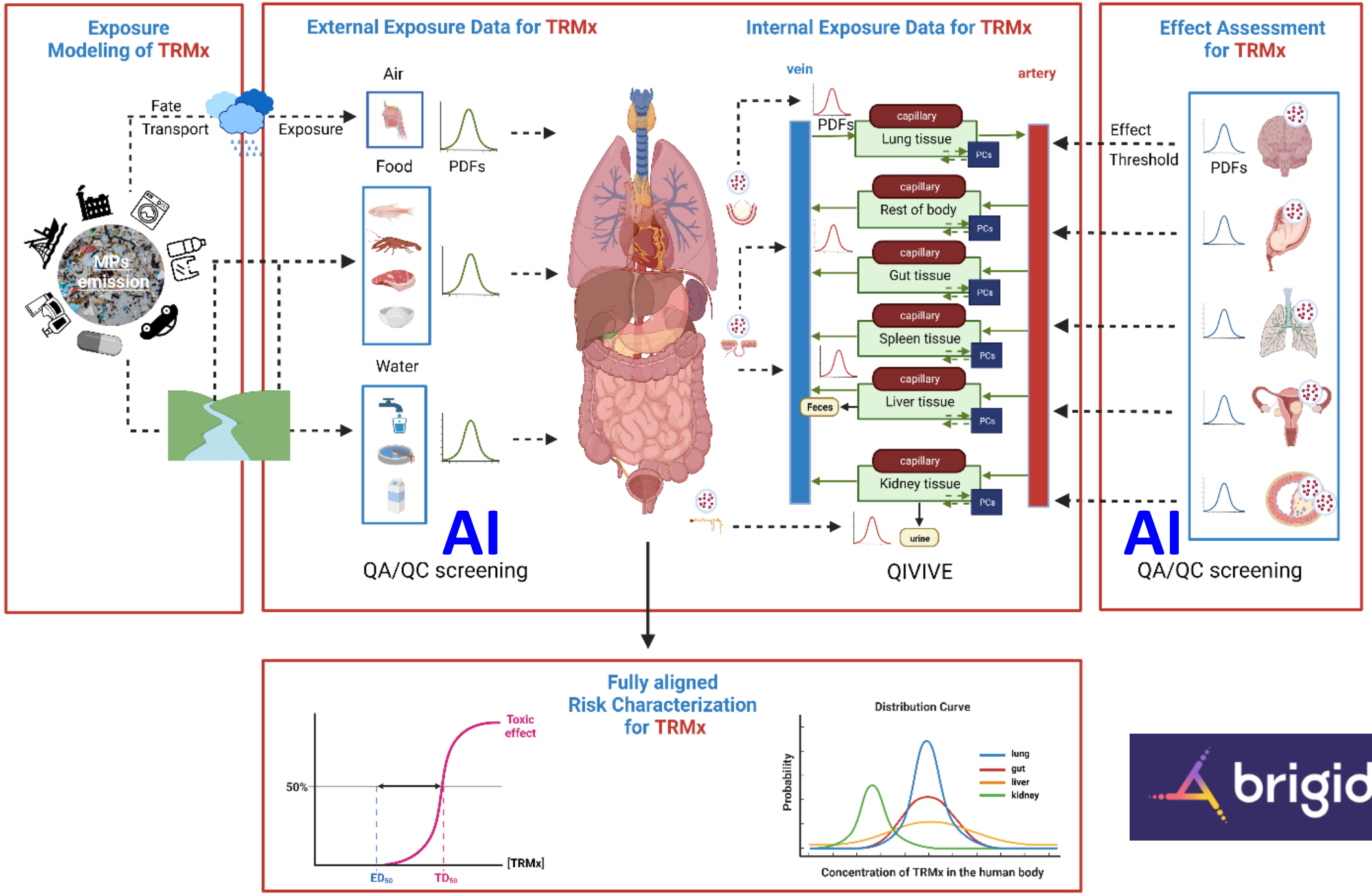


‘Cooking is a good metaphor for many things’



← Toxicologically Relevant Metrics (**TRM**)

Koelmans, A.A. et al. (2022). Risk assessment of microplastics. *Nature Reviews Materials*

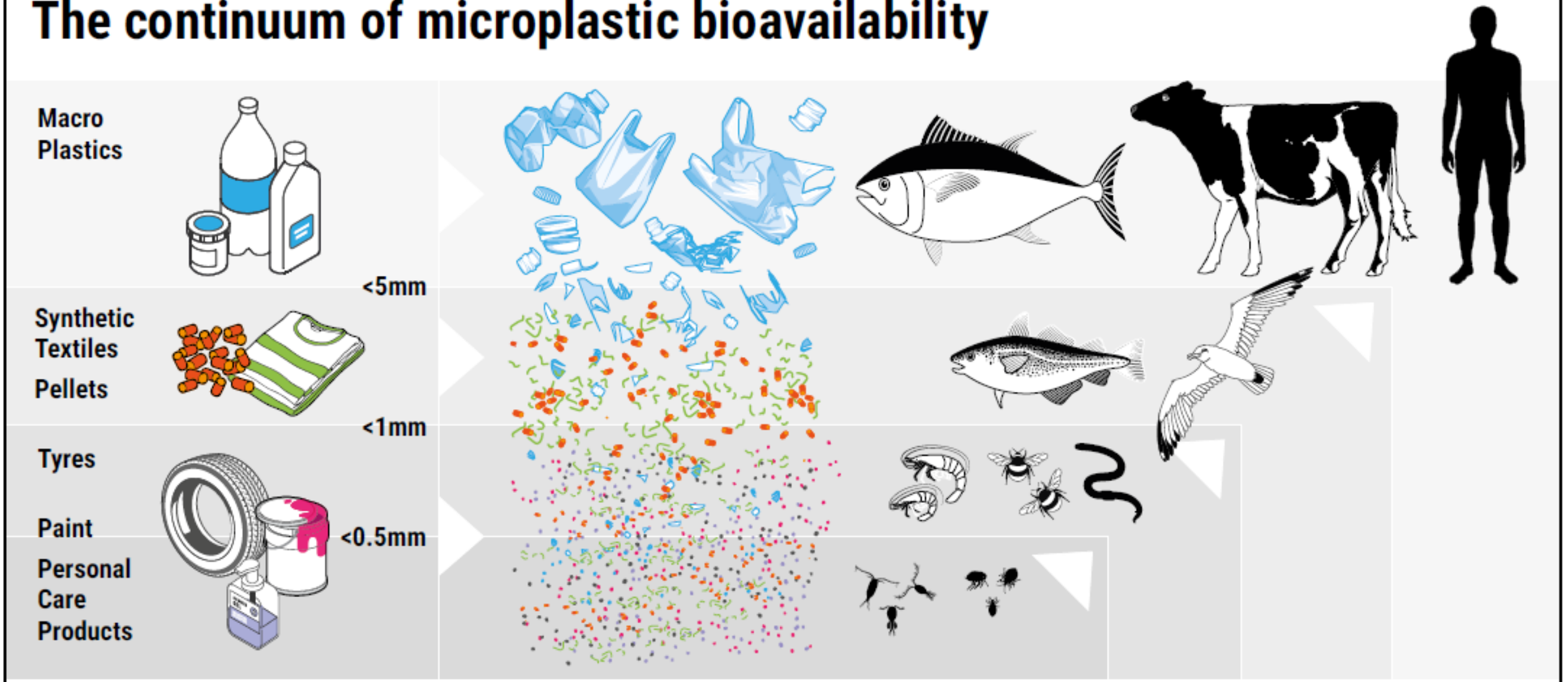


Wardani, I., Mohamed Nor, N.H., Wright, S., Kooter, I., Koelmans, A.A. 2024.

Microplastic PBPK modeling in the context of human exposure and risk assessment, *Environ. Internat*

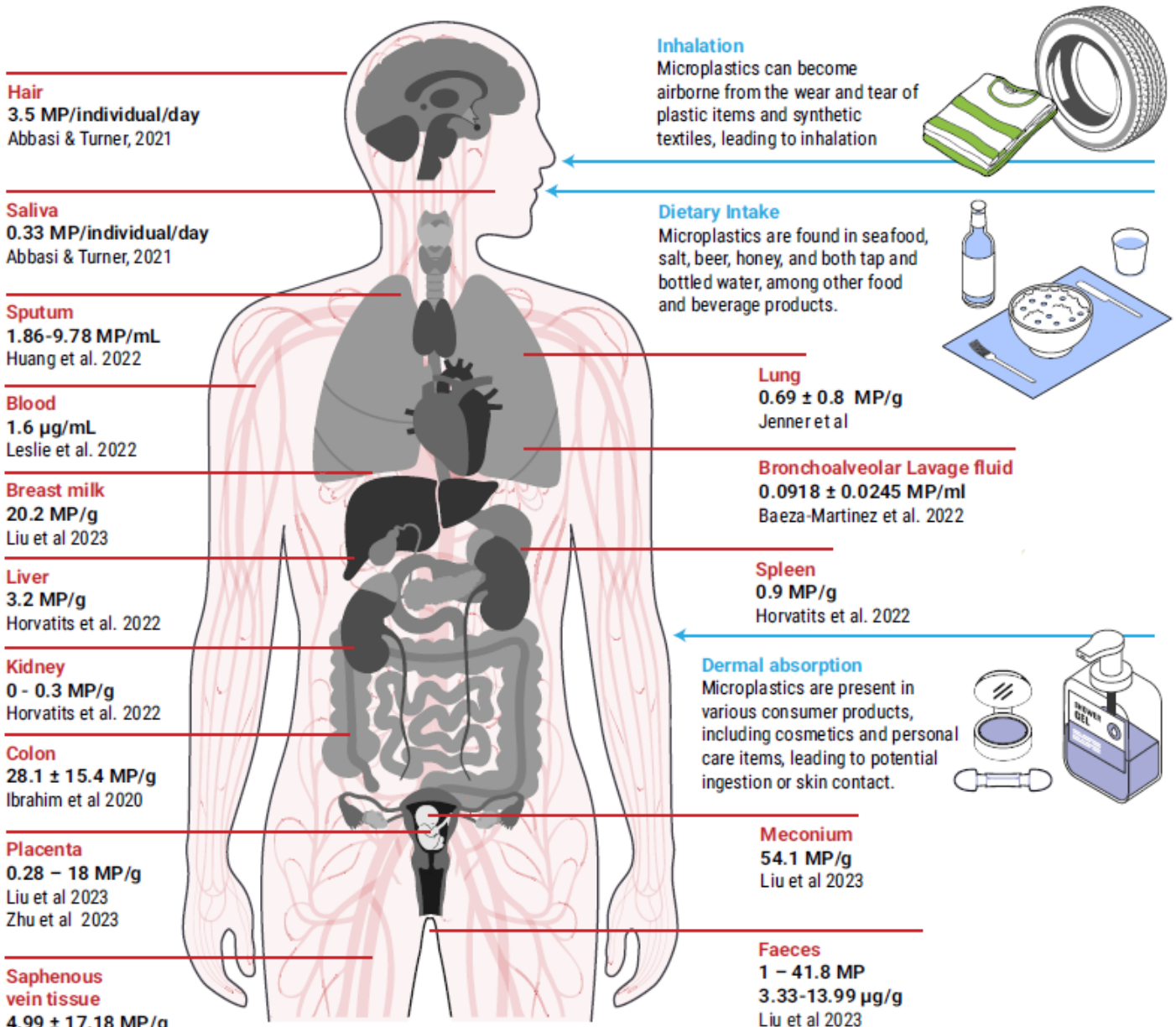
brigid
bridging the gap between microplastics and human health

The continuum of microplastic bioavailability



Thompson, R.C., Courtene-Jones, W., Boucher, J., Pahl, S., Raubenheimer, K., Koelmans, A.A. 2024.
Twenty years of microplastics pollution research – what have we learned? *Science*

Reported microplastics concentrations in the human body



Clear:

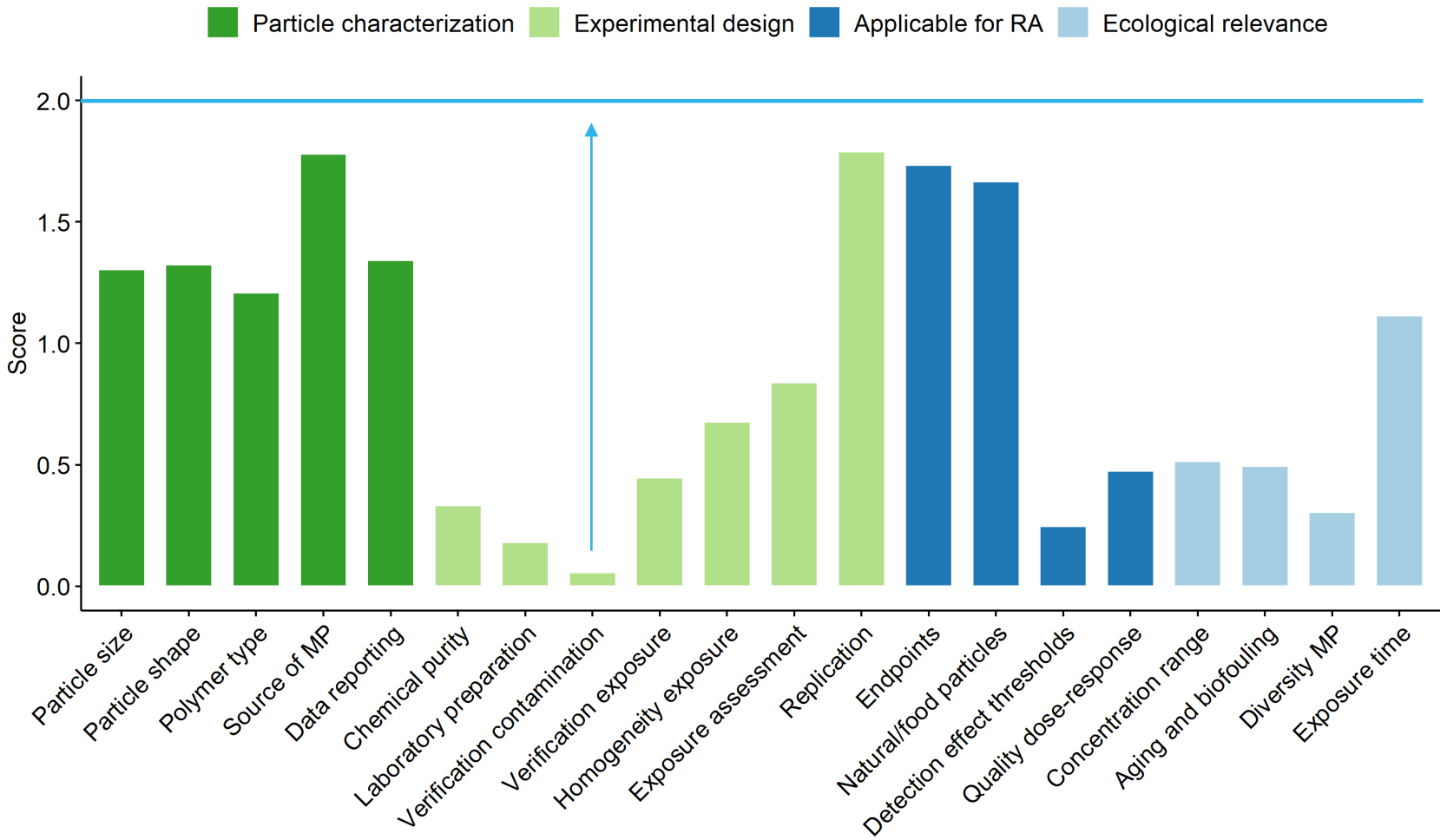
NMPs are in our body.

Challenge:

<u>Exposure</u> data are uncertain, fragmentary and not aligned.
Same for <u>effects data</u>

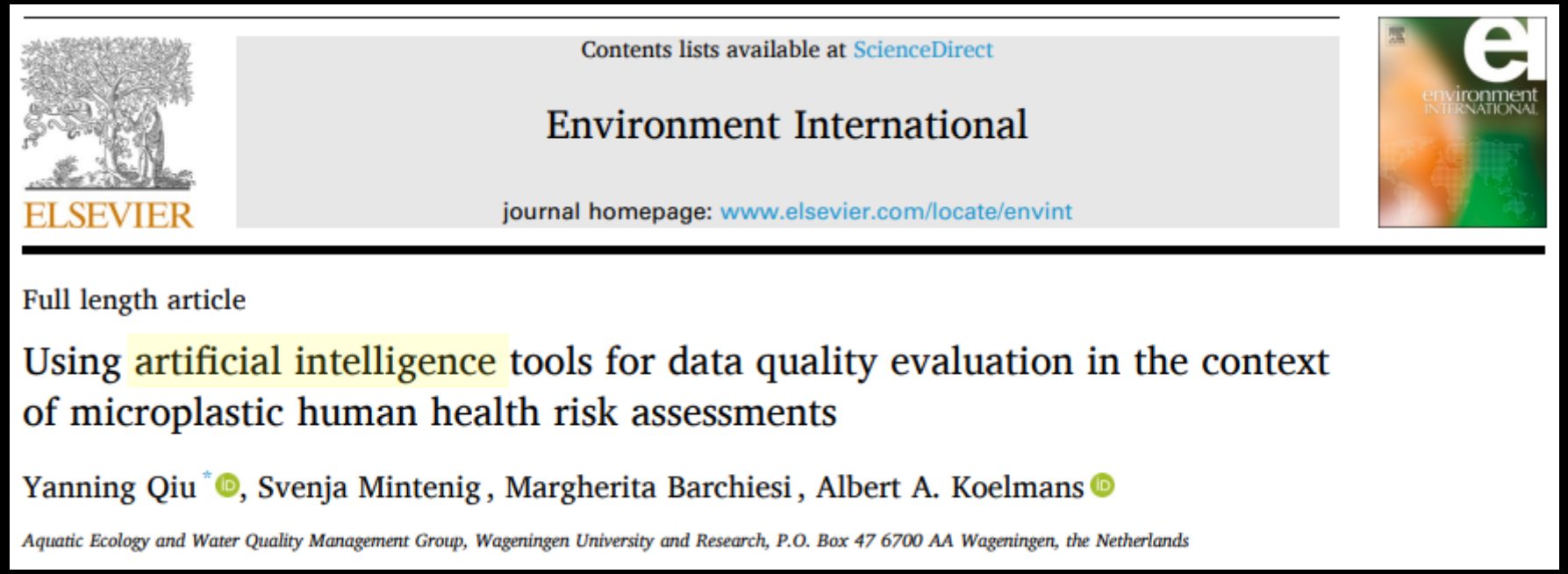
Thompson, R.C., Courtene-Jones, W., Boucher, J., Pahl, S., Raubenheimer, K., Koelmans, A.A. 2024.
Twenty years of microplastics pollution research – what have we learned? *Science*

Challenge! Data not ‘fit for purpose’ due to low quality



de Ruijter, V.N., Redondo-Hasselerharm, P.E., Gouin, T., Koelmans, A.A. 2020. Quality criteria for microplastic effect studies in the context of risk assessment: A critical review. Environ. Sci. Technol.

How should we deal with the enormous and growing volume of published data?



Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

Full length article

Using artificial intelligence tools for data quality evaluation in the context of microplastic human health risk assessments

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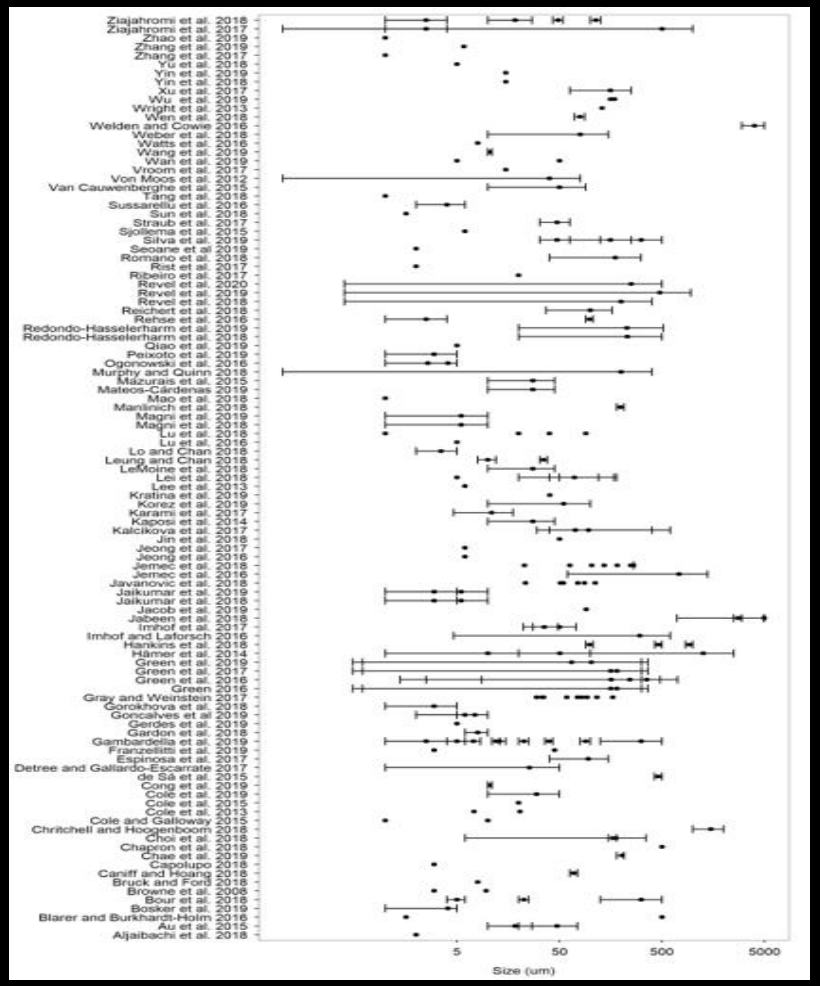
Aquatic Ecology and Water Quality Management Group, Wageningen University and Research, P.O. Box 47 6700 AA Wageningen, the Netherlands

Qiu, Y., Mintenig, S., Barchiesi, M., Koelmans, A.A. 2025. Using artificial intelligence tools for data quality evaluation in the context of microplastic human health risk assessments. Environment International.

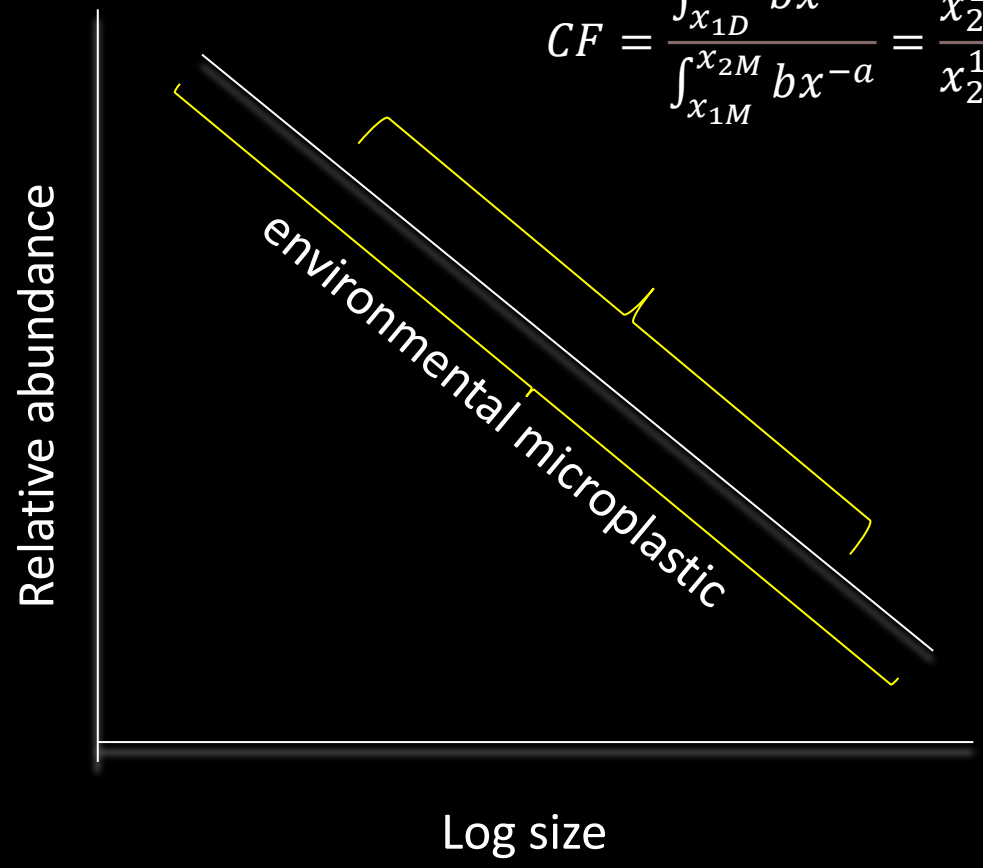
Alignment of data that are obtained with methods that target different size ranges

Imagine: ‘default’ microplastic 1 to 5000 μm

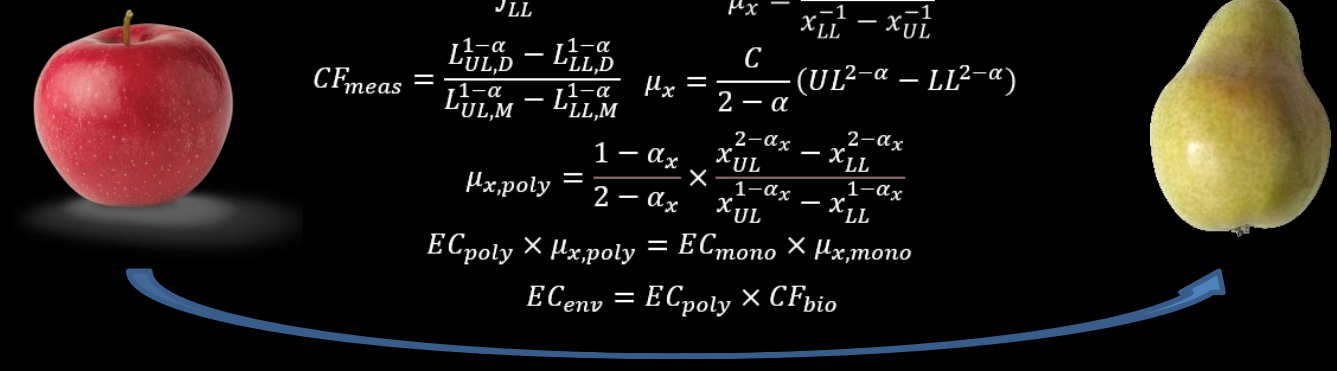


Koelmans et al. 2019. Water Research. © Elsevier

$$CF = \frac{\int_{x_{1D}}^{x_{2D}} bx^{-a}}{\int_{x_{1M}}^{x_{2M}} bx^{-a}} = \frac{x_{2D}^{1-a} - x_{1D}^{1-a}}{x_{2M}^{1-a} - x_{1M}^{1-a}}$$



Koelmans, A.A., et al. 2020. Solving the non-alignment of methods and approaches used in microplastic research in order to consistently characterize risk. Environ. Sci. Technol. © American Chemical Society



$$\mu_x = \frac{x_{UL} - x_{LL}}{ln\left(\frac{x_{UL}}{x_{LL}}\right)}$$

$$P(x) = Cx^{-\alpha}$$

$$\int_{LL}^{UL} P(x)dx = 1$$

$$\mu_x = \frac{ln\left(\frac{x_{UL}}{x_{LL}}\right)}{x_{LL}^{-1} - x_{UL}^{-1}}$$

$$CF_{meas} = \frac{L_{UL,D}^{1-\alpha} - L_{LL,D}^{1-\alpha}}{L_{UL,M}^{1-\alpha} - L_{LL,M}^{1-\alpha}} \quad \mu_x = \frac{C}{2-\alpha}(UL^{2-\alpha} - LL^{2-\alpha})$$

$$\mu_{x,poly} = \frac{1-\alpha_x}{2-\alpha_x} \times \frac{x_{UL}^{2-\alpha_x} - x_{LL}^{2-\alpha_x}}{x_{UL}^{1-\alpha_x} - x_{LL}^{1-\alpha_x}}$$

$$EC_{poly} \times \mu_{x,poly} = EC_{mono} \times \mu_{x,mono}$$

$$EC_{env} = EC_{poly} \times CF_{bio}$$

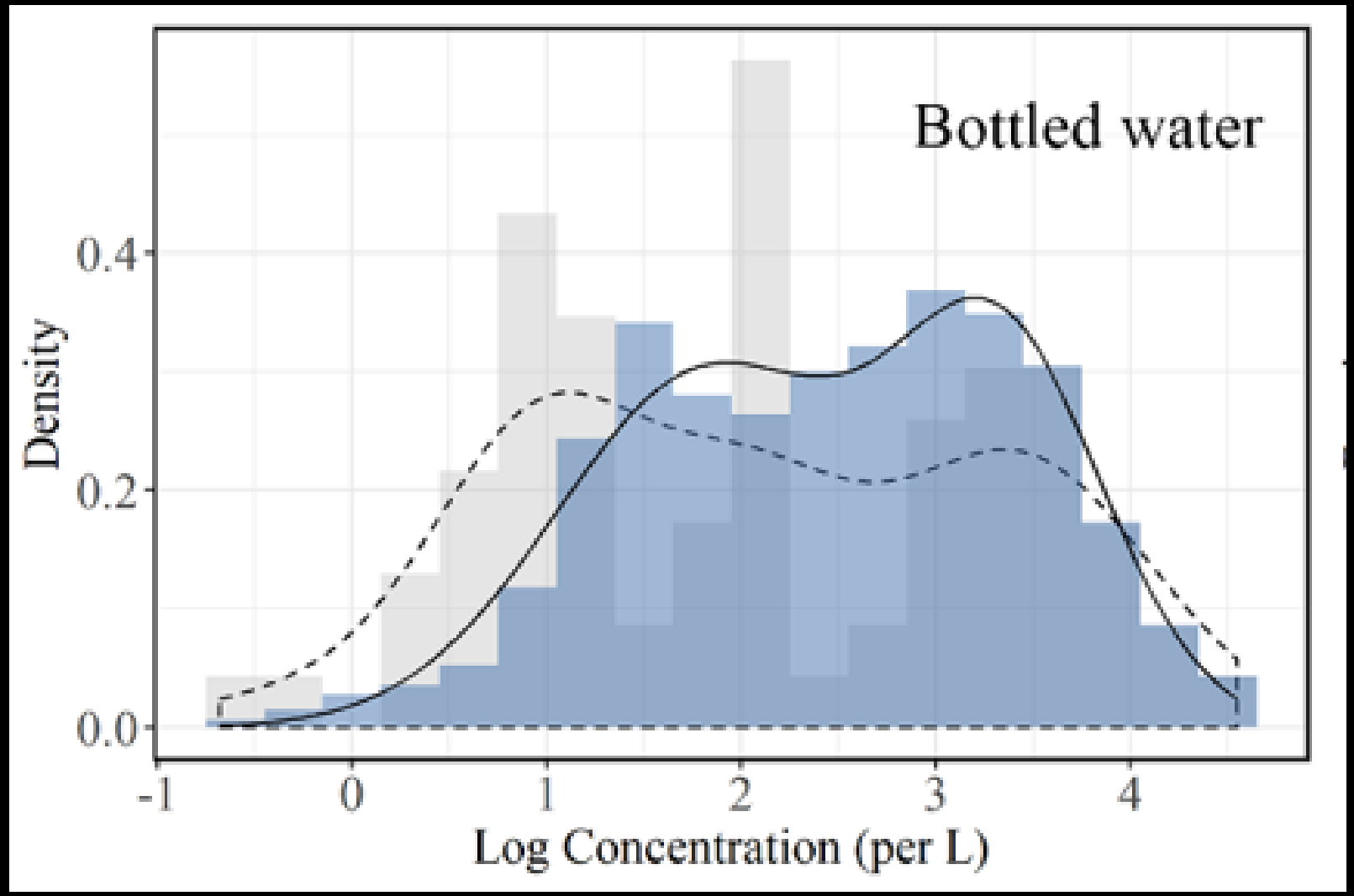
Koelmans et al (2020, 2022), Kooi et al (2021)

Aligning incomparable exposure & effects data

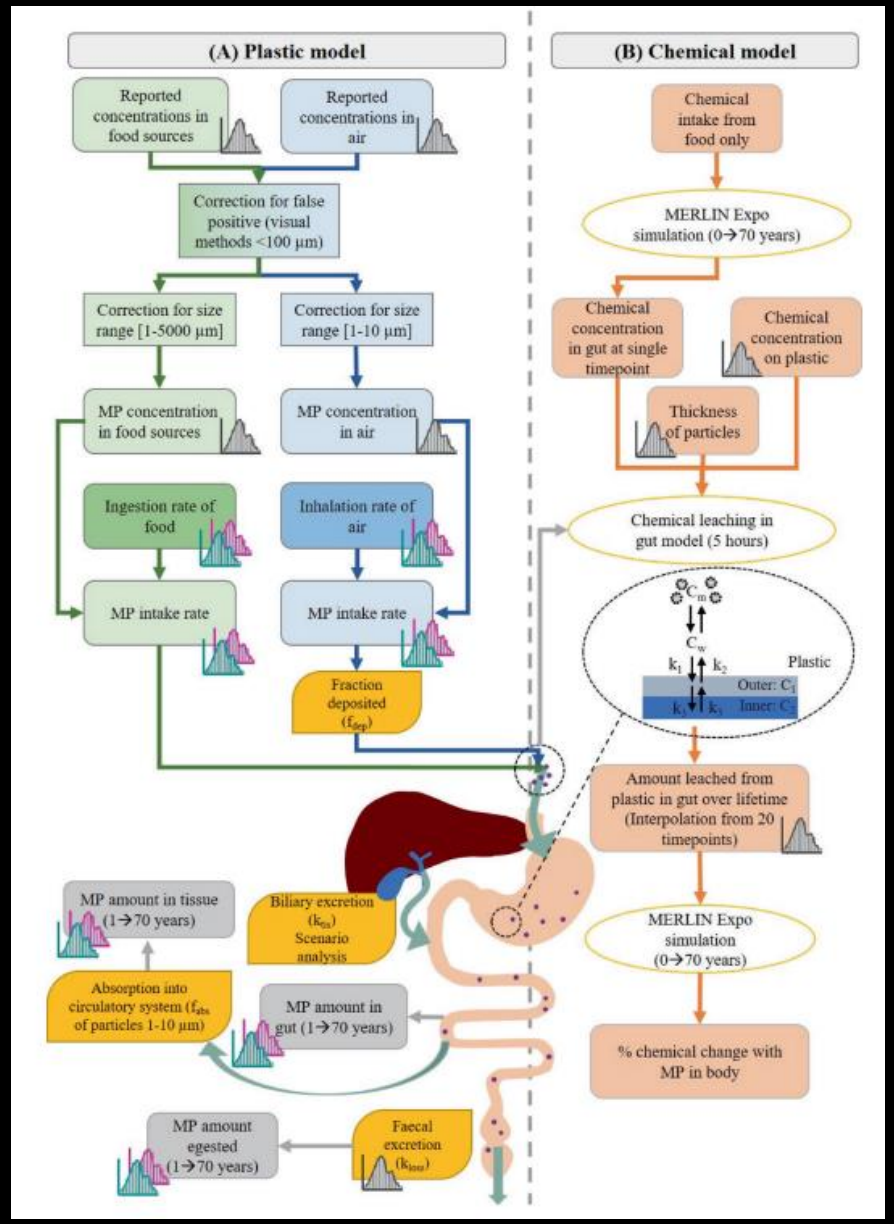
$$HQ = \frac{\text{Exposure}}{\text{Reference Dose (RfD) or Acceptable Daily Intake (ADI}}$$

Koelmans, A.A., et al. 2020. Solving the non-alignment of methods and approaches used in microplastic research in order to consistently characterize risk. Environ. Sci. Technol.

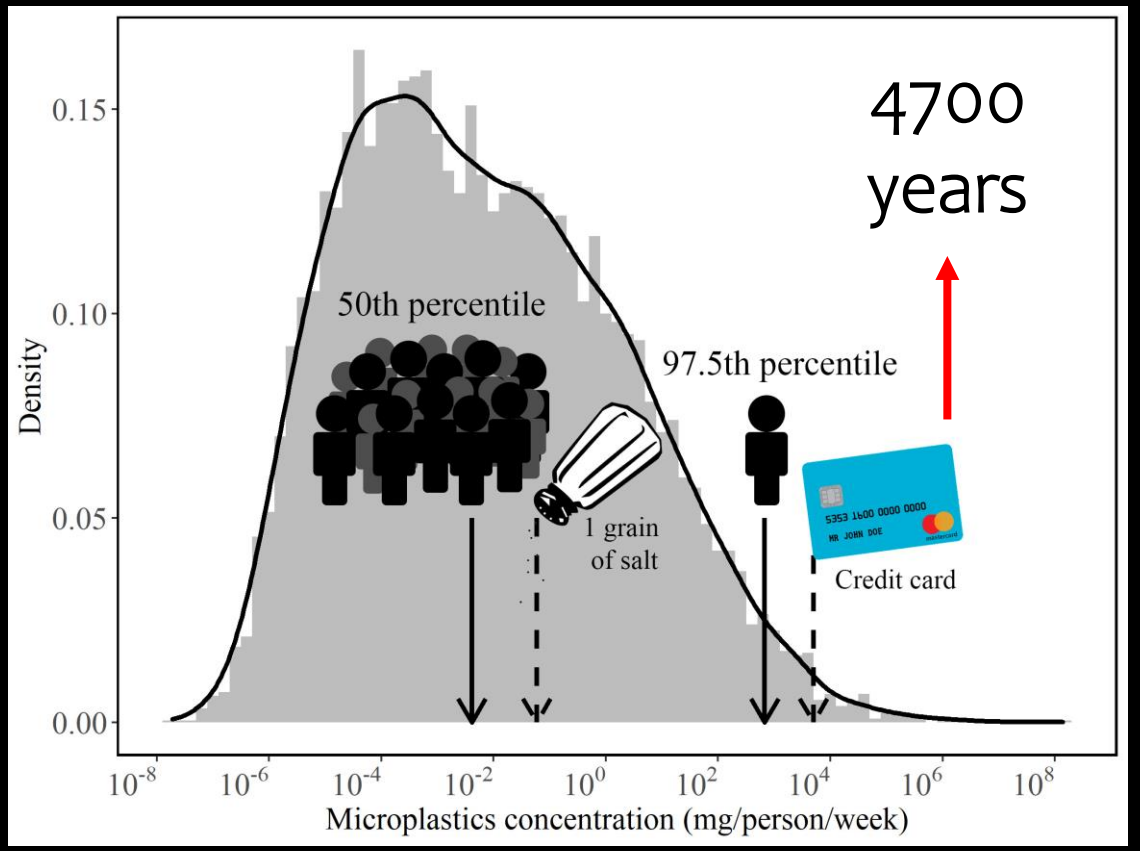
ALIGNMENTS EXAMPLE Probabilistically Aligning Microplastics data in media relevant for Human Exposure



Mohamed Nor, Kooi, M., Diepens N., Koelmans AA, 2021. Lifetime accumulation of microplastic in children and adults. ES&T.



PBK modeling of particles & chemicals



- Mohamed Nor, N.H., Kooi, M., Diepens, N.J. Koelmans, A.A. 2021. Lifetime accumulation of nano- and microplastic in children and adults. *ES&T*

Take home

1. Exposure gains significance in the context of effect and risk assessment; therefore, the entire framework must be properly aligned from the outset.
2. There are tools available for aligning data and determining data quality. Unfortunately, in media relevant to human exposure—or in organs and tissues—the quality of the data is too often insufficient for a reliable exposure (and thus risk) assessment.

Thank You !