Supplementary Material for

Unravelling the magnitude and drivers of PFAS trophic magnification: a meta-analysis

Ricolfi *et al.*

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The PDF file includes:

- Supplementary Method 4: Eligibility criteria.
- Supplementary Method 5: Trophic magnification factor calculations

- **Supplementary Tables from Supplementary Table 1 to Supplementary Table 9**
  - Supplementary Table 1: List of studies included in the meta-analysis.
  - Supplementary Table 2: Number of effect sizes (TMF) across food webs in different world regions.
  - Supplementary Table 3: Summary of international regulation status of selected per- and polyfluoroalkyl substances (PFAS).
  - Supplementary Table 4: Strategies used to handle undetected values.
  - Supplementary Table 5: Deviations and additions to the research protocol.
  - Supplementary Table 6: PRISMA Eco-Evo checklist.
  - Supplementary Table 7: Digital Object Identifiers (DOIs) of the 25 benchmark bibliographic records.
  - Supplementary Table 8: Searches records from six online databases.
  - Supplementary Table 9: Excluded studies at the full-text screening stage.

Supplementary Figures

Supplementary Figure 1

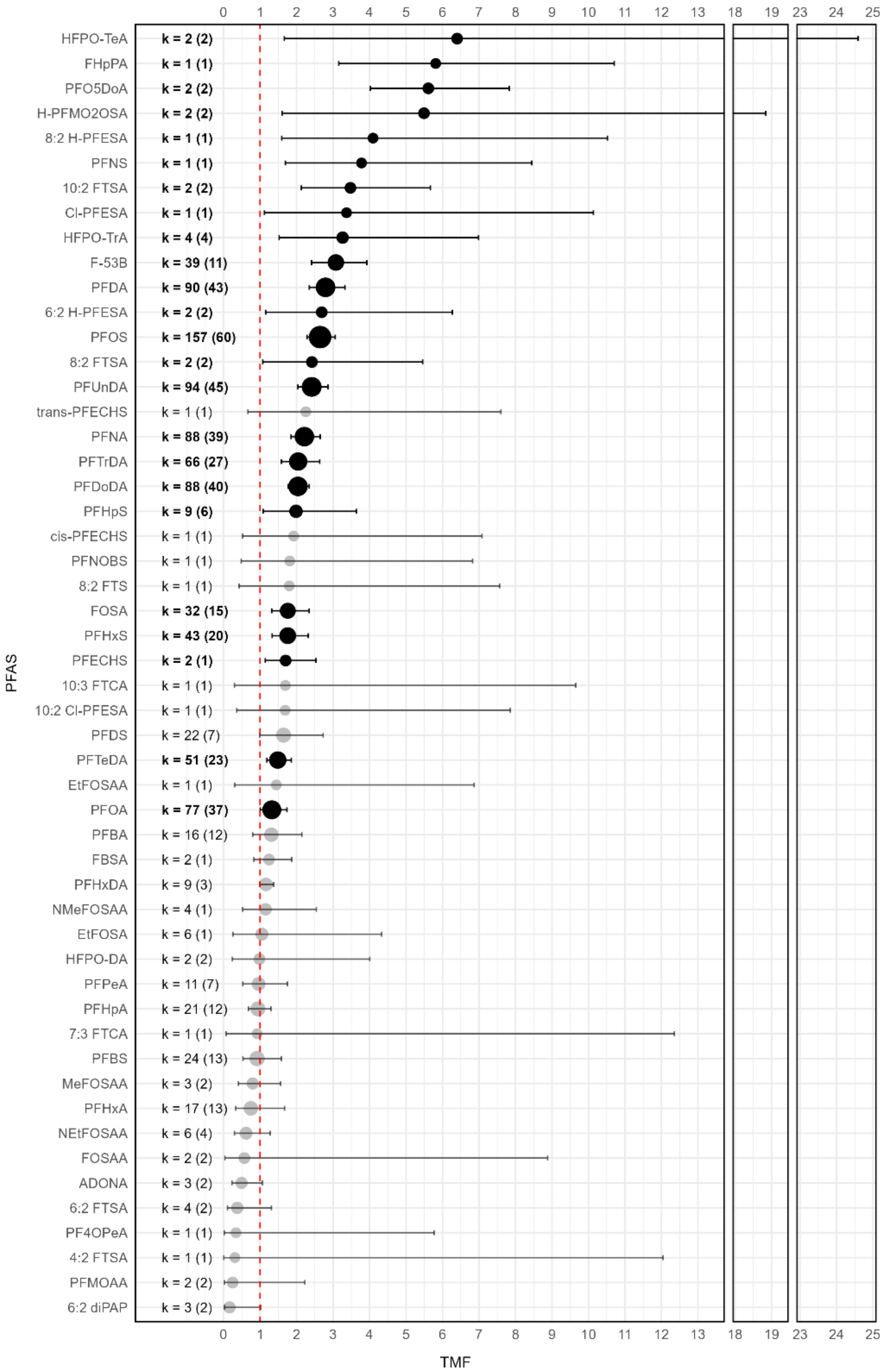

Fig. S1. Trophic magnification of per- and polyfluoroalkyl substances (PFAS) in aquatic and terrestrial food webs. The plot is the full version of Figure 2 in the main text, showing the subgroup correlated effects model results for each PFAS regardless of their number of effect sizes.

Supplementary Figure 2

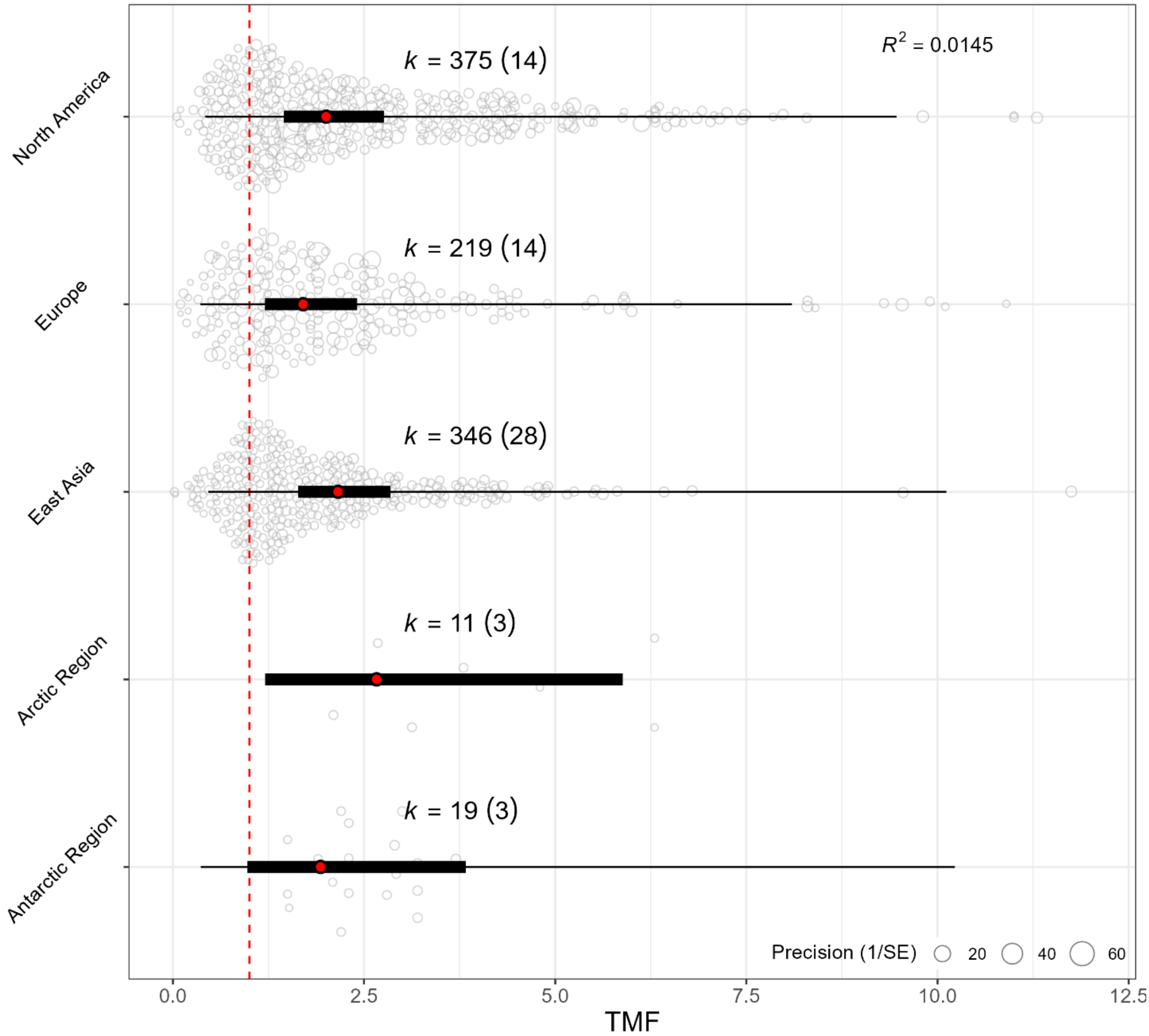

Fig. S2. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS), stratified by geographic location of food webs. The meta-analytic mean estimate for each stratification is represented by a red-filled circle with a black outline. Thicker bars denote the 95% confidence interval, while thinner bars represent the 95% prediction interval. Light grey circles show individual effect sizes, scaled by precision (inverse of the standard error, as indicated in the legend). The number of effect sizes is represented by "k" while the number in parentheses indicates the number of studies. The red dotted line marks a trophic magnification factor (TMF) of 1, with values above 1 indicating biomagnification and those below 1 indicating biodilution. TMF values are capped at 12.5 for improved visual readability. The R^2 value represents the proportion of variance explained only by the fixed effect in the model (marginal R^2).

Supplementary Figure 3

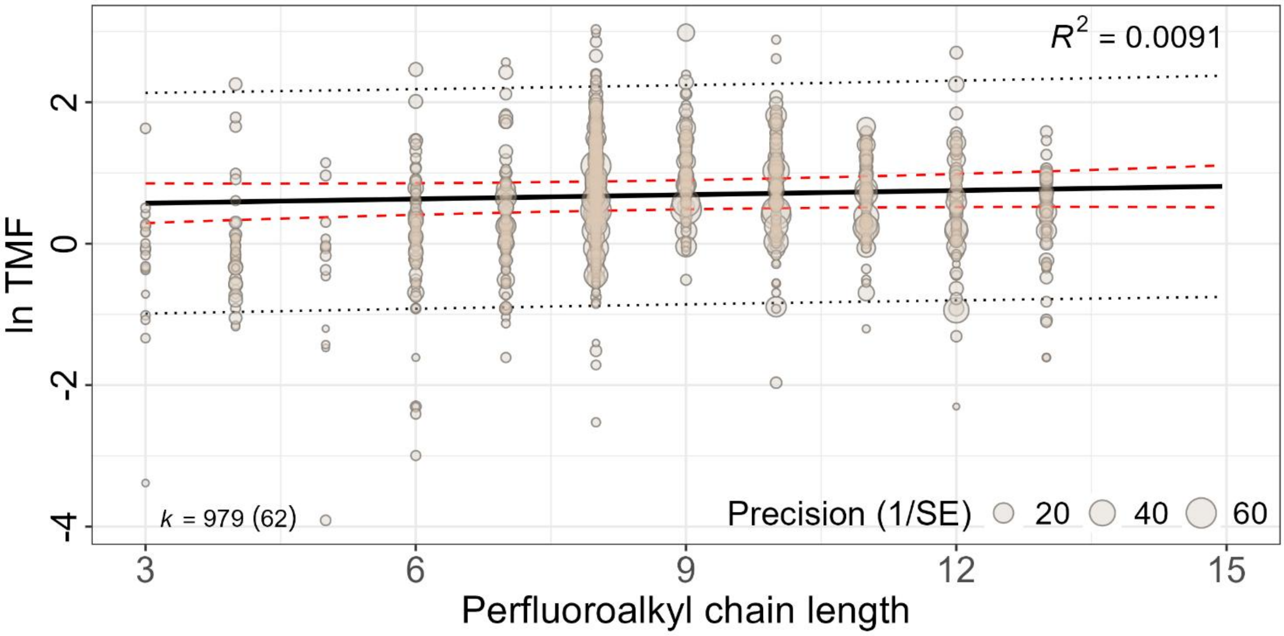

Fig. S3. The relationship between trophic magnification of per- and polyfluoroalkyl substances (PFAS) and perfluoroalkyl chain length. The uni-moderator fitted model is depicted as a thick black line, with its 95% confidence intervals shown as red dashed lines and 95% prediction intervals represented by dotted black lines. Light orange circles represent the individual effect sizes (k), and the size of each circle reflects its precision (inverse of standard error). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The TMF is on the natural logarithm scale to enhance visual readability of results. The R^2 value represents the proportion of variance explained only by the fixed effects in the model (marginal R^2).

Supplementary Figure 4

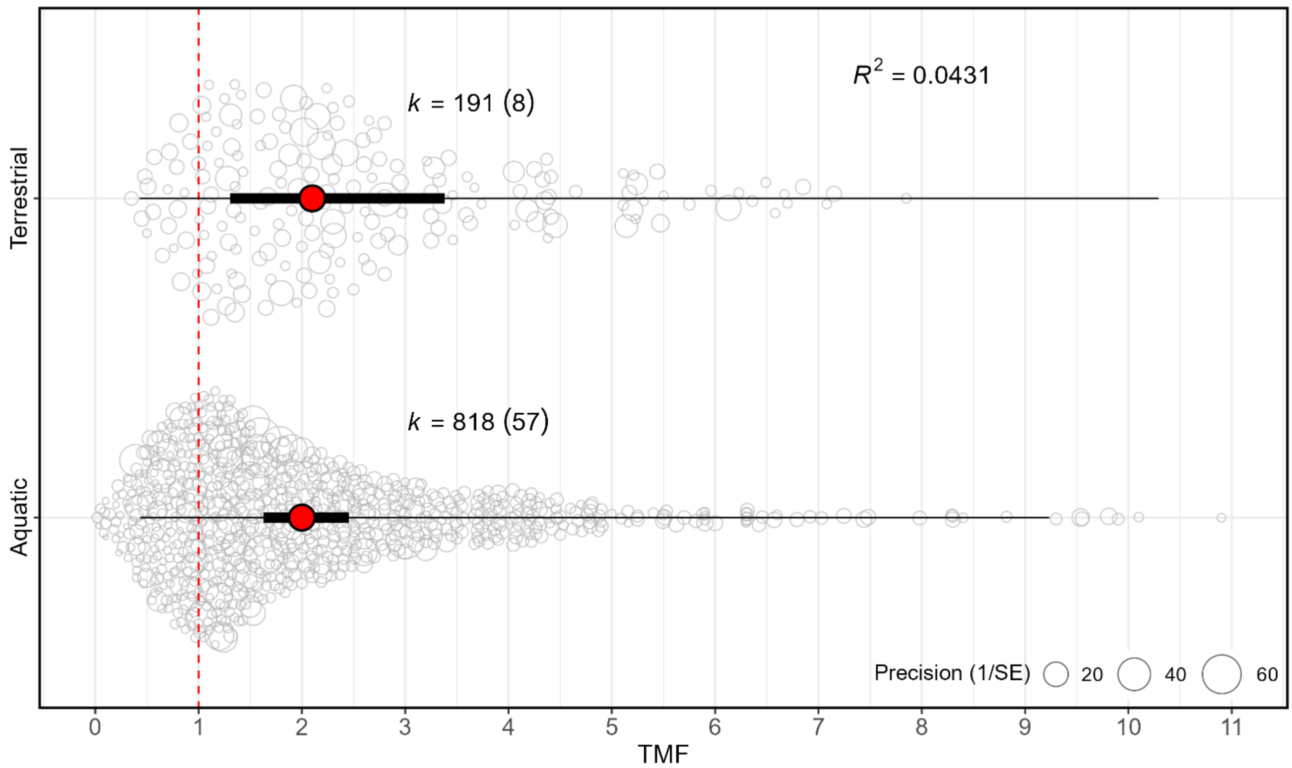

Fig. S4. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS), stratified by ecosystem type (aquatic *vs* terrestrial). The meta-analytic mean estimate for each stratification is represented by a red-filled circle with a black outline. Thicker bars denote the 95% confidence interval, while thinner bars represent the 95% prediction interval. Light grey circles show individual effect sizes, scaled by precision (inverse of the standard error, as indicated in the legend). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The red dotted line marks a trophic magnification factor (TMF) of 1, with values above 1 indicating biomagnification and those below 1 indicating biodilution. TMF values are capped at 11 for improved visual readability. The R^2 value represents the proportion of variance explained only by the fixed effect in the model (marginal R^2).

Supplementary Figure 5

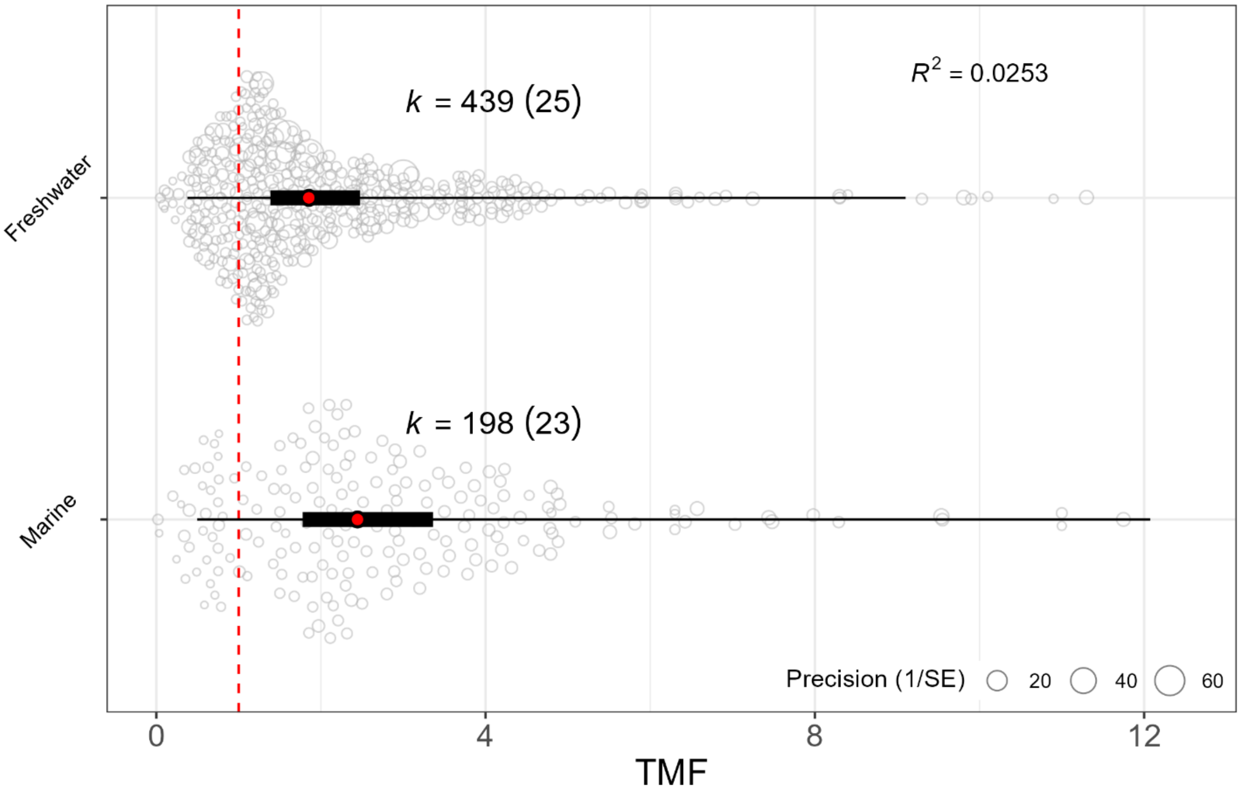

Fig. S5. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS) in aquatic ecosystems, stratified by ecosystem type (marine *vs* freshwater). The meta-analytic mean estimate for each stratification is represented by a red-filled circle with a black outline. Thicker bars denote the 95% confidence interval, while thinner bars represent the 95% prediction interval. Light grey circles show individual effect sizes, scaled by precision (inverse of the standard error, as indicated in the legend). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The red dotted line marks a trophic magnification factor (TMF) of 1, with values above 1 indicating biomagnification and those below 1 indicating biodilution. TMF values are capped at 12 for improved visual readability. The R^2 value represents the proportion of variance explained only by the fixed effect in the model (marginal R^2).

Supplementary Figure 6

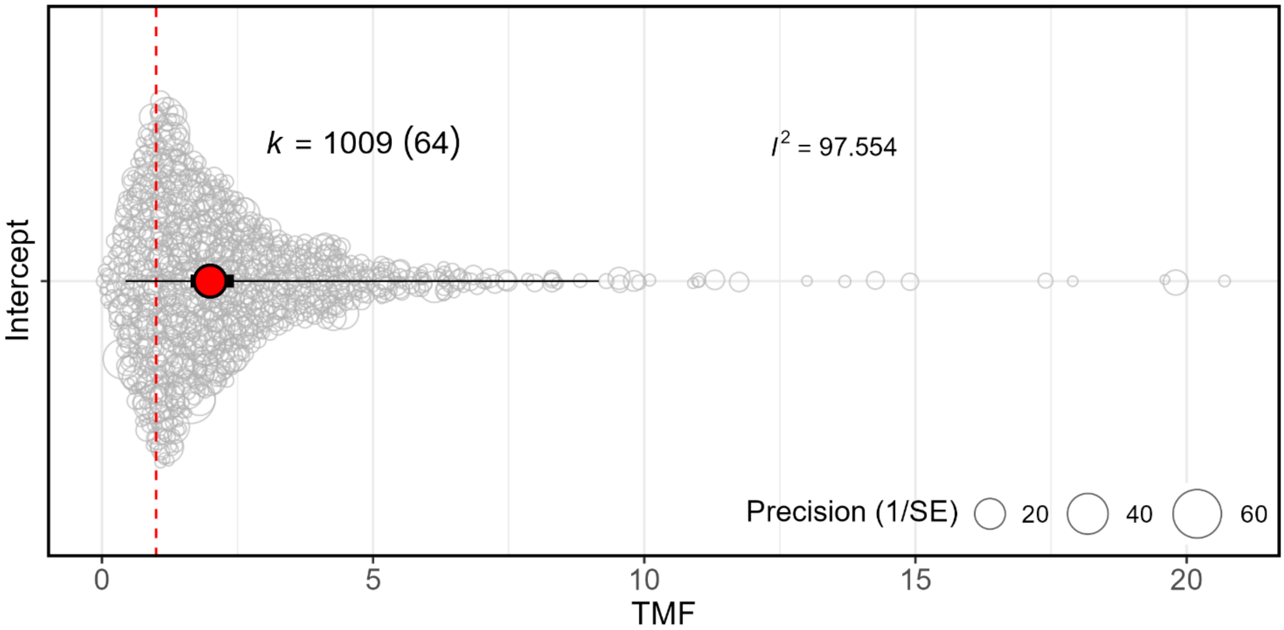

Fig. S6. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS) in food webs. Overall TMF based on a meta-analysis of 1,009 effect sizes from 119 aquatic and terrestrial food webs. The mean meta-analytic estimate is represented by a black circle filled with red. The thicker bars indicate the 95% confidence interval, while the thinner bars represent the 95% prediction interval. Light grey circles depict individual effect sizes scaled by precision (inverse of the standard error, as shown in the legend). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The red dotted line highlights a TMF of 1 (biomagnification above 1 and biodilution below 1).

Supplementary Figure 7

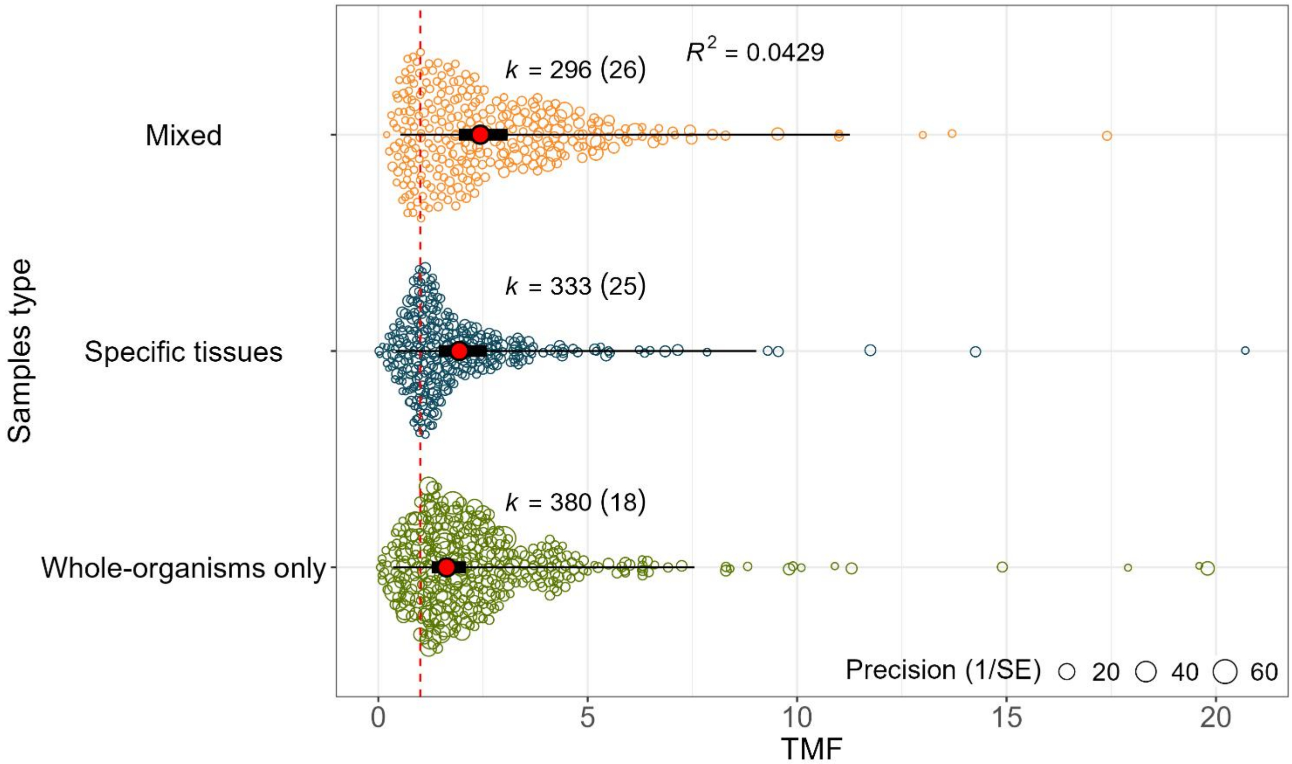

Fig. S7. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS), stratified by sample type. The meta-analytic mean estimate for each stratification is represented by a red-filled circle with a black outline. Thicker bars denote the 95% confidence interval, while thinner bars represent the 95% prediction interval. Light grey circles show individual effect sizes, scaled by precision (inverse of the standard error, as indicated in the legend). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The red dotted line marks a TMF of 1, with values above 1 indicating biomagnification and those below 1 indicating biodilution. “Mixed” refers to a combination of specific tissue and whole-organism samples. The R^2 value represents the proportion of variance explained only by the fixed effect in the model (marginal R^2).

Supplementary Figure 8

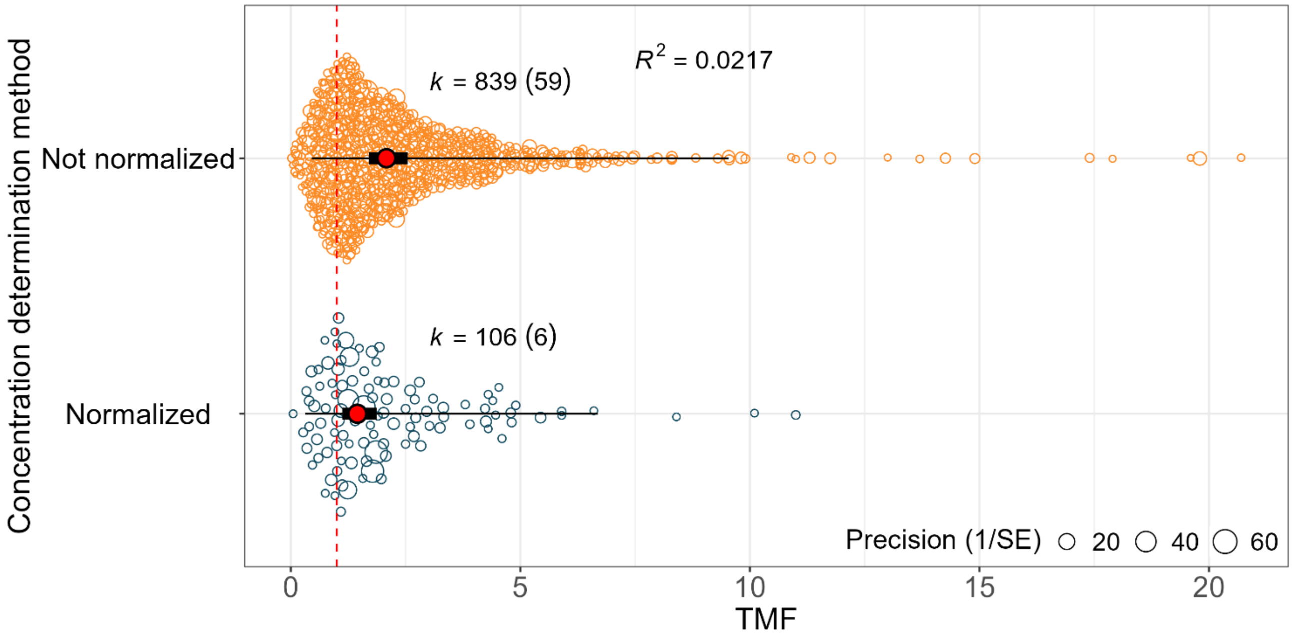

Fig. S8. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS), stratified by concentration determination method. The meta-analytic mean estimate for each stratification is represented by a red-filled circle with a black outline. Thicker bars denote the 95% confidence interval, while thinner bars represent the 95% prediction interval. Light grey circles show individual effect sizes, scaled by precision (inverse of the standard error, as indicated in the legend). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The red dotted line marks a TMF of 1, with values above 1 indicating biomagnification and those below 1 indicating biodilution. The R^2 value represents the proportion of variance explained only by the fixed effect in the model (marginal R^2).

Supplementary Figure 9

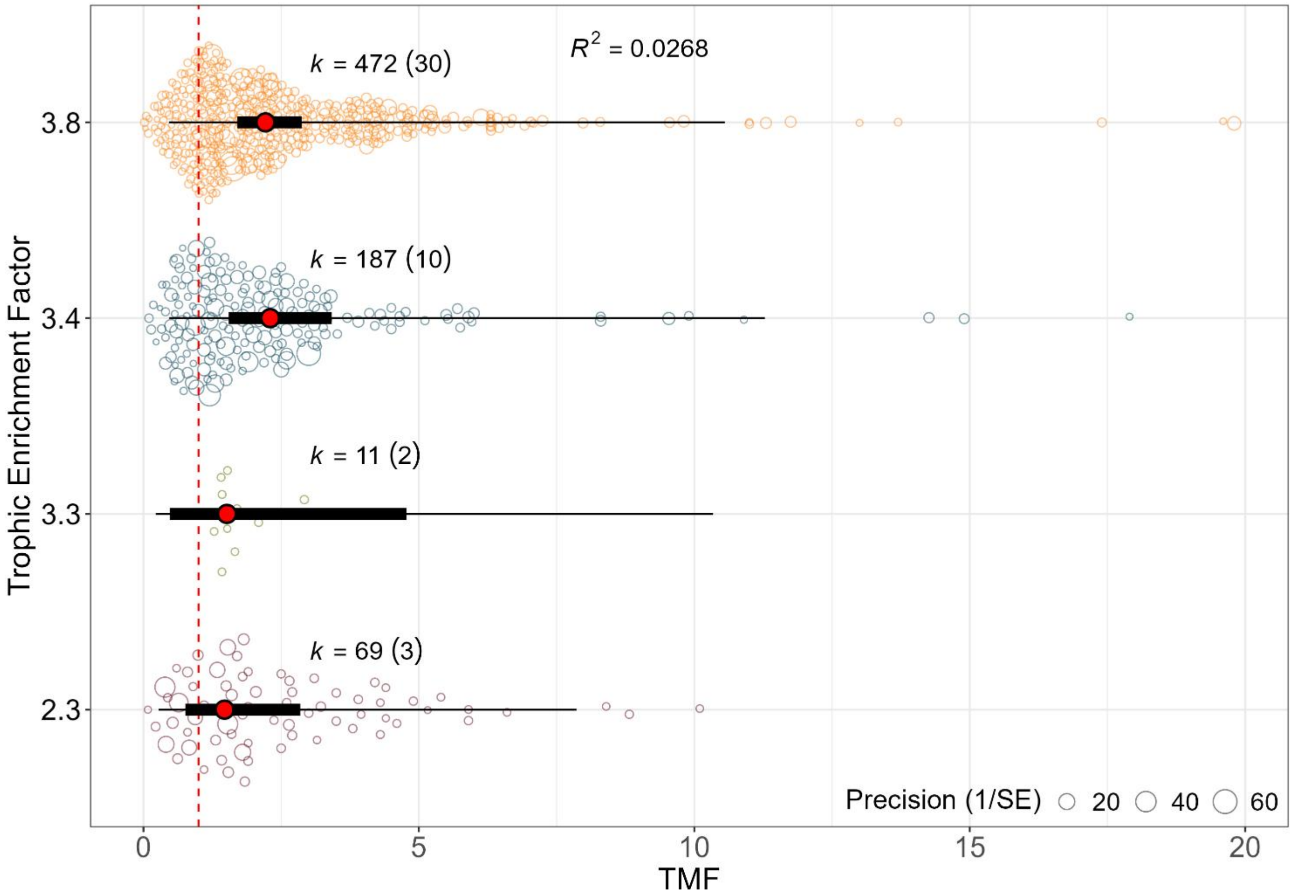

Fig. S9. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS), stratified by trophic enrichment factor. The meta-analytic mean estimate for each stratification is represented by a red-filled circle with a black outline. Thicker bars denote the 95% confidence interval, while thinner bars represent the 95% prediction interval. Light grey circles show individual effect sizes, scaled by precision (inverse of the standard error, as indicated in the legend). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The red dotted line marks a TMF of 1, with values above 1 indicating biomagnification and those below 1 indicating biodilution. The R^2 value represents the proportion of variance explained only by the fixed effect in the model (marginal R^2).

Supplementary Figure 10

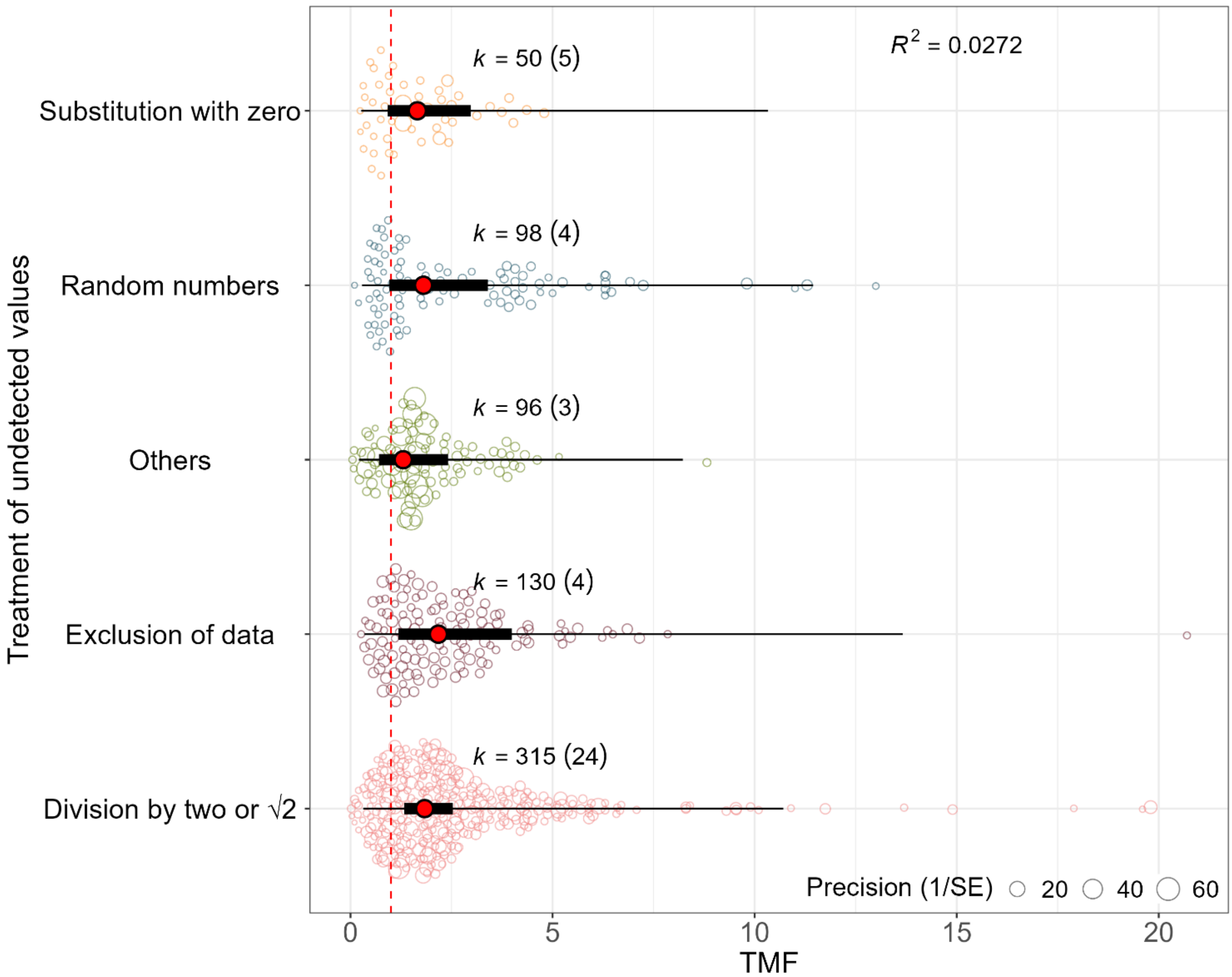

Fig. S10. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS), stratified by treatment strategy of undetected values. The meta-analytic mean estimate for each stratification is represented by a red-filled circle with a black outline. Thicker bars denote the 95% confidence interval, while thinner bars represent the 95% prediction interval. Light grey circles show individual effect sizes, scaled by precision (inverse of the standard error, as indicated in the legend). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The red dotted line marks a TMF of 1, with values above 1 indicating biomagnification and those below 1 indicating biodilution. The R^2 value represents the proportion of variance explained only by the fixed effect in the model (marginal R^2).

Supplementary Figure 11

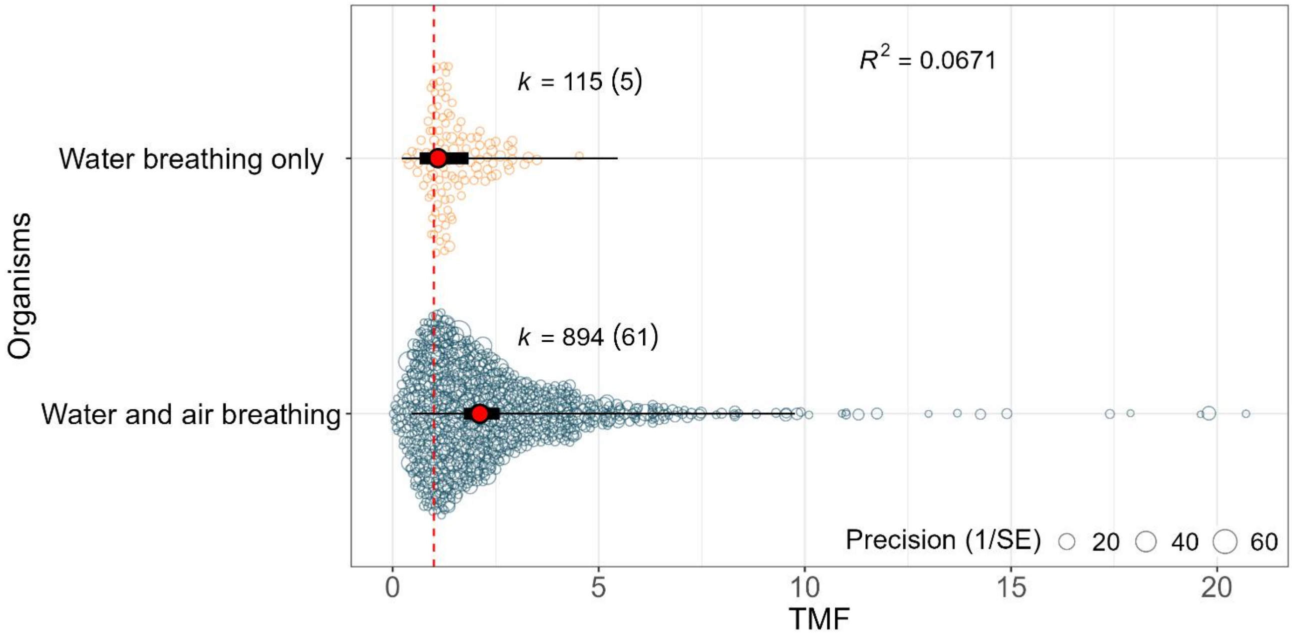

Fig. S11. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS), stratified by food webs of exclusively water breathing organisms versus mixed breathing types. The meta-analytic mean estimate for each stratification is represented by a red-filled circle with a black outline. Thicker bars denote the 95% confidence interval, while thinner bars represent the 95% prediction interval. Light grey circles show individual effect sizes, scaled by precision (inverse of the standard error, as indicated in the legend). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The red dotted line marks a TMF of 1, with values above 1 indicating biomagnification and those below 1 indicating biodilution. The R^2 value represents the proportion of variance explained only by the fixed effect in the model (marginal R^2).

Supplementary Figure 12

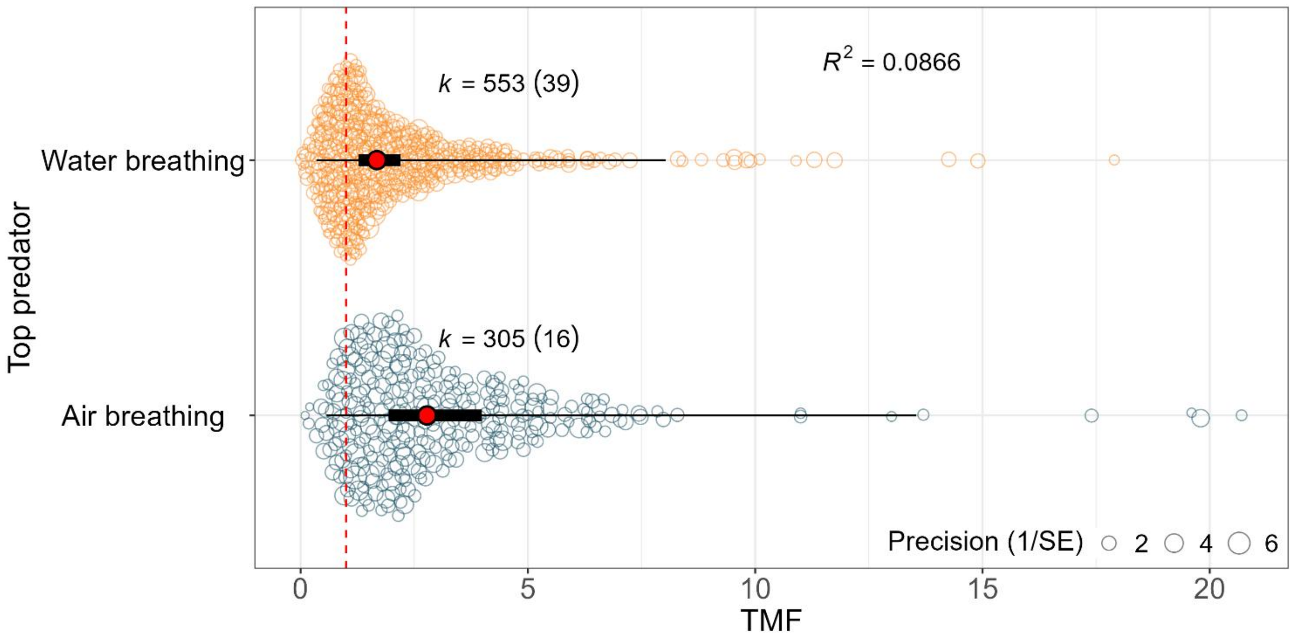

Fig. S12. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS), stratified by food webs with either air breathing or water breathing top predators. The meta-analytic mean estimate for each stratification is represented by a red-filled circle with a black outline. Thicker bars denote the 95% confidence interval, while thinner bars represent the 95% prediction interval. Light grey circles show individual effect sizes, scaled by precision (inverse of the standard error, as indicated in the legend). The number of effect sizes is represented by "k", while the number in parentheses indicates the number of studies. The red dotted line marks a TMF of 1, with values above 1 indicating biomagnification and those below 1 indicating biodilution. The R^2 value represents the proportion of variance explained only by the fixed effect in the model (marginal R^2).

Supplementary Figure 13

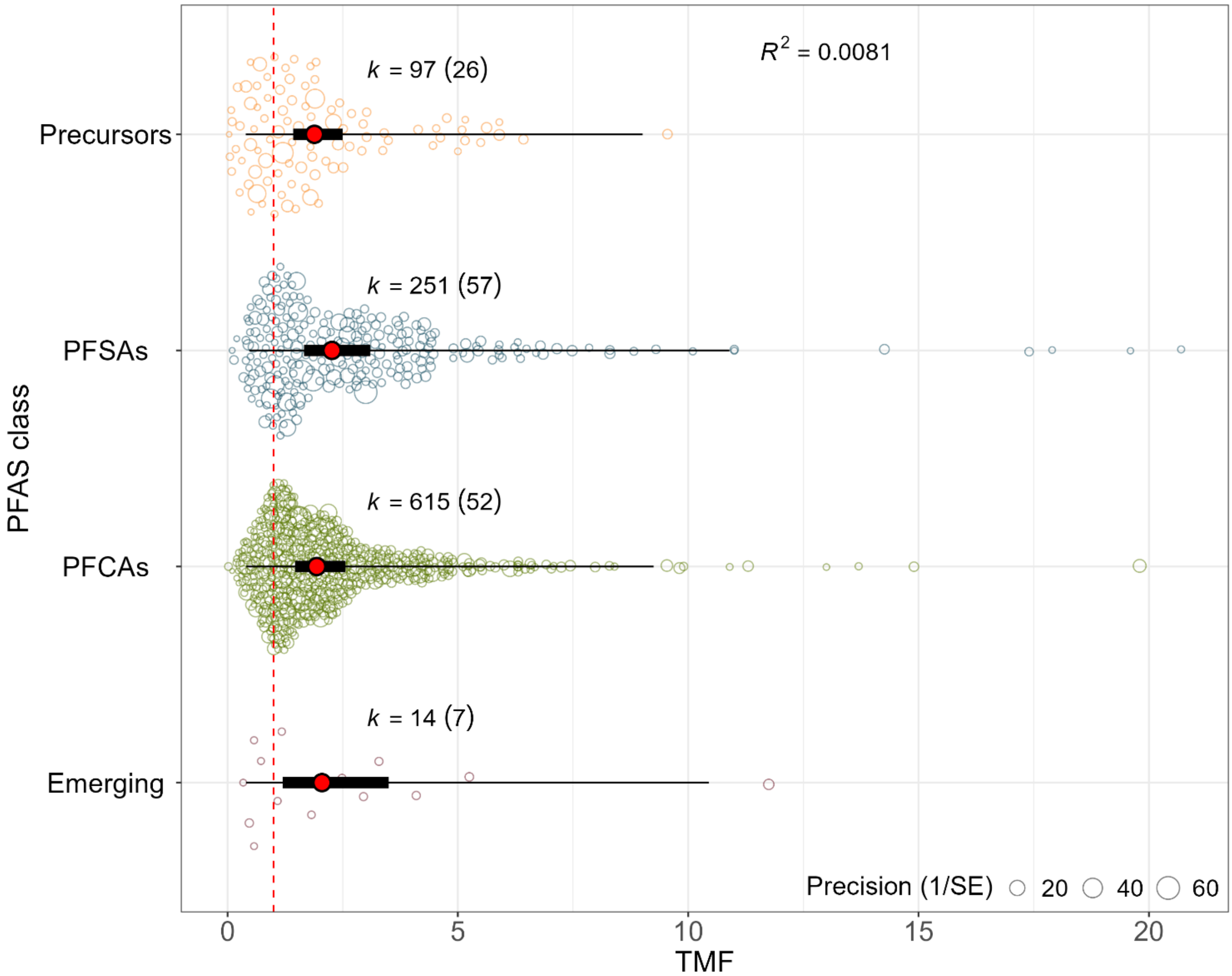

Fig. S13. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS), stratified by PFAS chemical class. The meta-analytic mean estimate for each stratification is represented by a red-filled circle with a black outline. Thicker bars denote the 95% confidence interval, while thinner bars represent the 95% prediction interval. Light grey circles show individual effect sizes, scaled by precision (inverse of the standard error, as indicated in the legend). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The red dotted line marks a TMF of 1, with values above 1 indicating biomagnification and those below 1 indicating biodilution. The R^2 value represents the proportion of variance explained only by the fixed effect in the model (marginal R^2).

Supplementary Figure 14

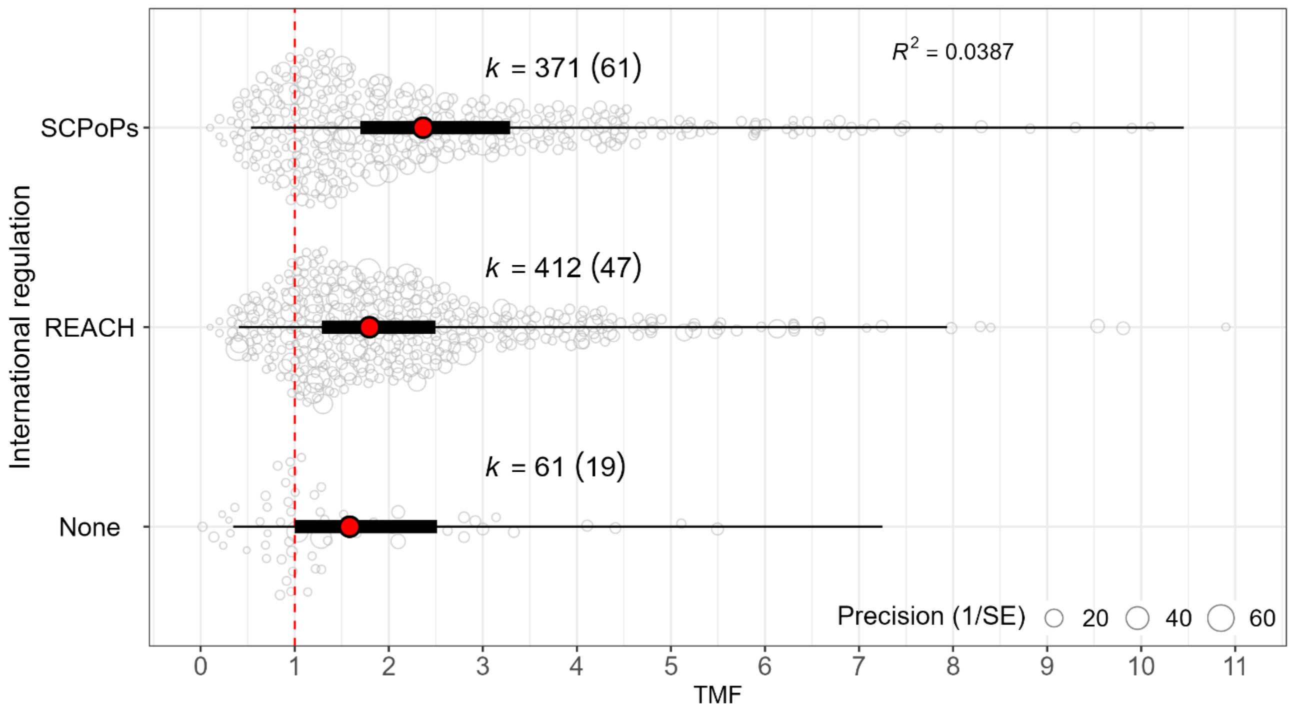

Fig. S14. Trophic magnification factor (TMF) of per- and polyfluoroalkyl substances (PFAS), stratified by chemicals' international regulation status. 'SCPoPs' refers to PFAS listed under one of the annexes of the Stockholm Convention on Persistent Organic Pollutants. 'REACH' represents PFAS regulated within the European Union under the REACH framework. 'None' indicates PFAS that are not subject to any international regulation. The meta-analytic mean estimate for each stratification is represented by a red-filled circle with a black outline. Thicker bars denote the 95% confidence interval, while thinner bars represent the 95% prediction interval. Light grey circles show individual effect sizes, scaled by precision (inverse of the standard error, as indicated in the legend). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The red dotted line marks a trophic magnification factor (TMF) of 1, with values above 1 indicating biomagnification and those below 1 indicating biodilution. TMF values are capped at 11 for improved visual readability. The R^2 value represents the proportion of variance explained only by the fixed effect in the model (marginal R^2).

Supplementary Figure 15

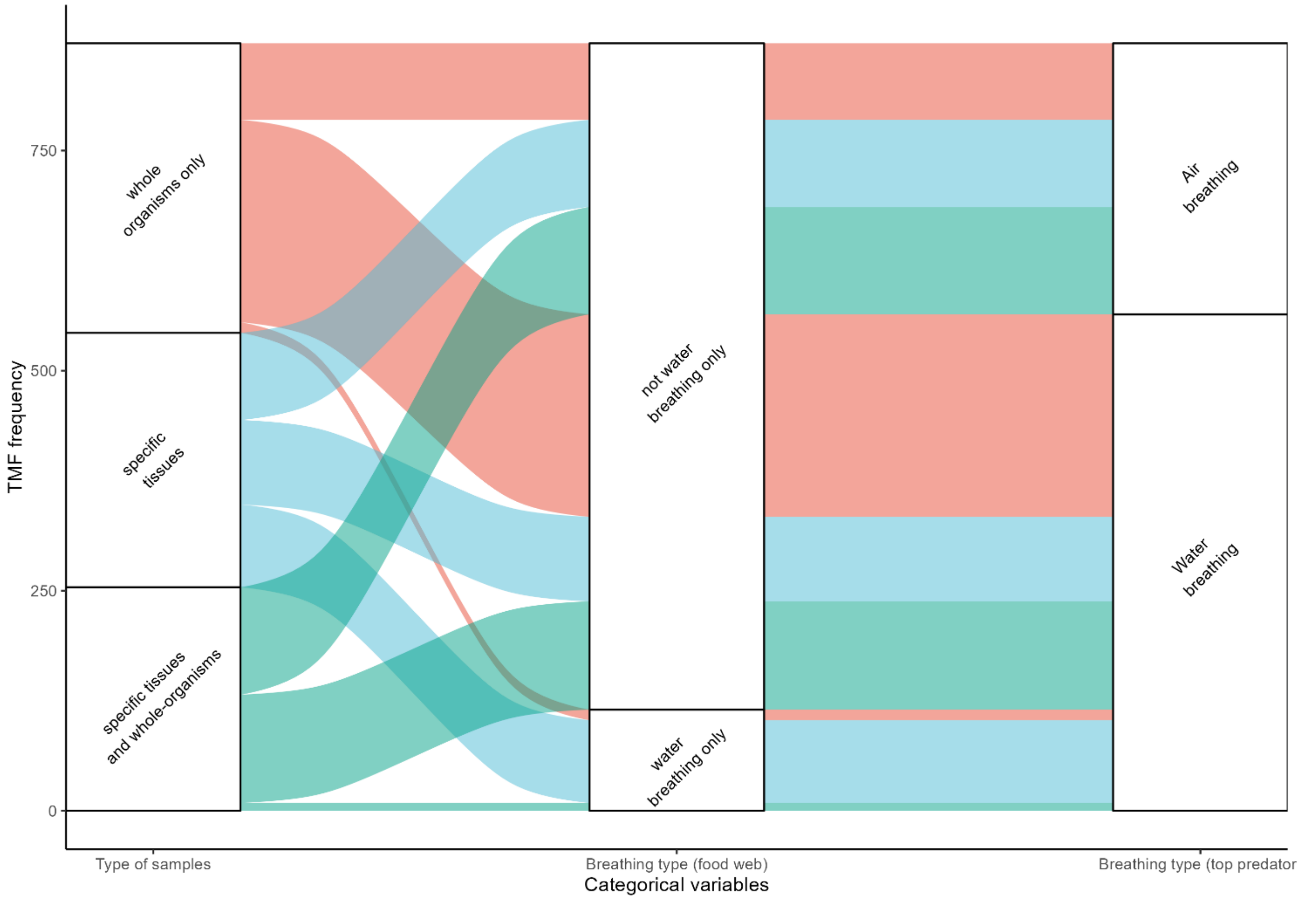

Fig. S15. Alluvial plot of the overlap among the three categorical variables included in the full model (see Methods). The plot visualises the interrelationships between the categorical variables, providing a clear overview of data distributions and overlaps. TMF frequency defines the number of TMFs. It serves as a tool to identify potential multicollinearity issues that may affect the full model.

Supplementary Figure 16

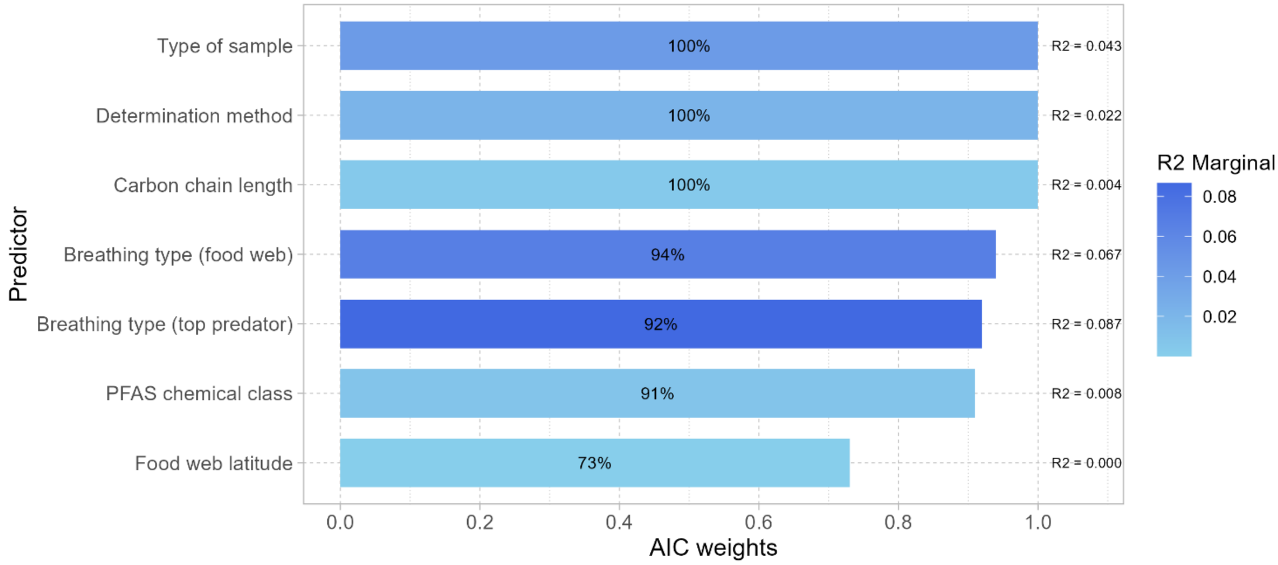

Fig. S16. Relative importance of tested moderator variables based on Akaike weights, calculated from the Akaike Information Criterion (AIC). Importance was assessed across 256 candidate models by summing the Akaike weights of each moderator variable appearing in all models. These weights indicate the probability of a given candidate model being the best, derived from a Bayesian framework with a prior distribution. Additionally, the marginal R^2 (indicated in red) was estimated using a uni-moderator model, where each moderator variable served as the fixed effect, representing the proportion of variance explained. R^2 values represent the proportion of variance explained only by the fixed effects in the model (marginal R^2).

Supplementary Figure 17

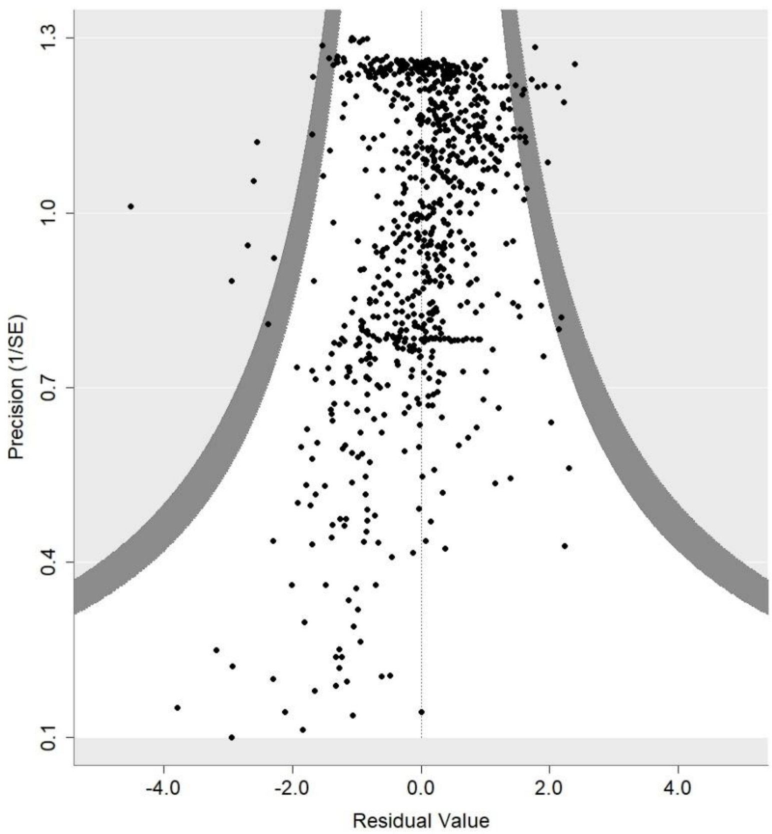

Fig. S17. Funnel plot for visual inspection of studies' precision. The plot shows the distribution of residual values of effect sizes in relation to their precision (inverse of standard error) from the full model (see the 'Statistical modelling overview' paragraph).

Supplementary Figure 18

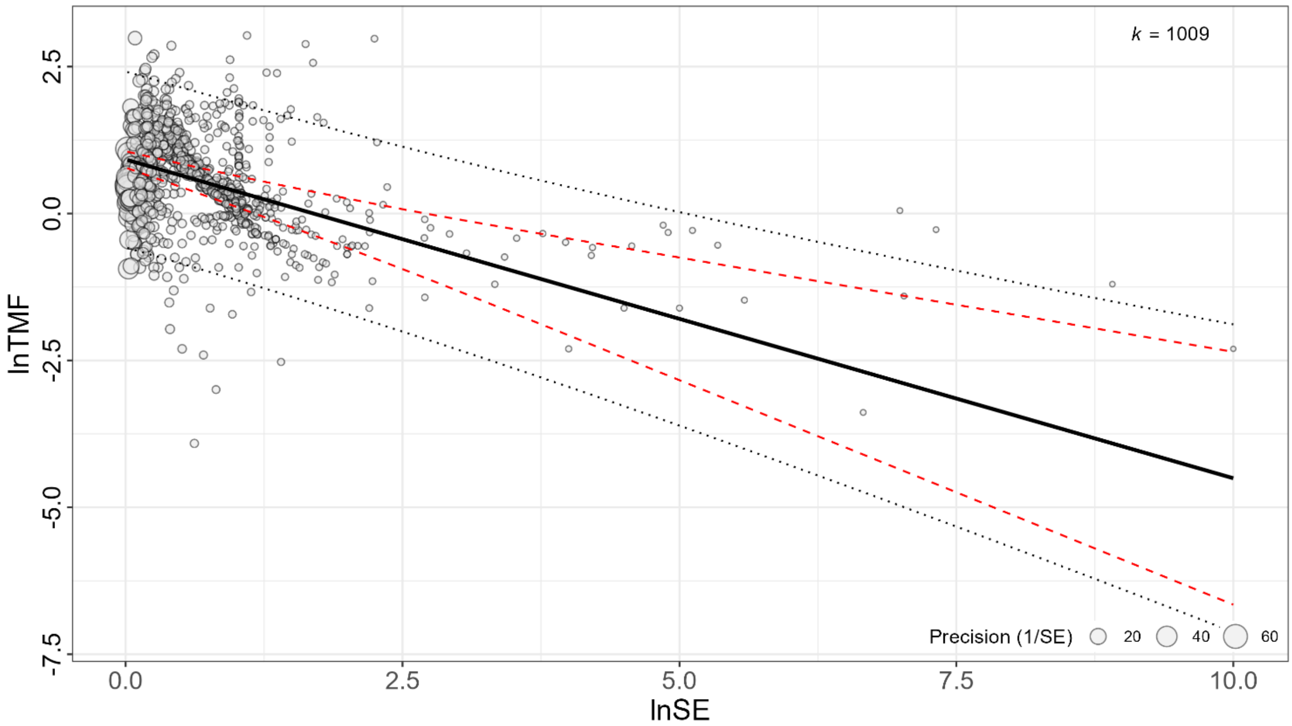

Fig. S18. Publication bias test. The plot presents the results of a meta-regression using the logarithmic standard error of lnTMF as a moderator. The regression suggests a moderate publication bias ($F(df1 = 1, df2 = 1007) = 22$, $p < 0.001$). To account for this, we applied a two-step robust point and variance estimation to evaluate whether the direction and magnitude of the effect changed significantly (see 'Publication bias and sensitivity analysis' section in the main text).

Supplementary Figure 19

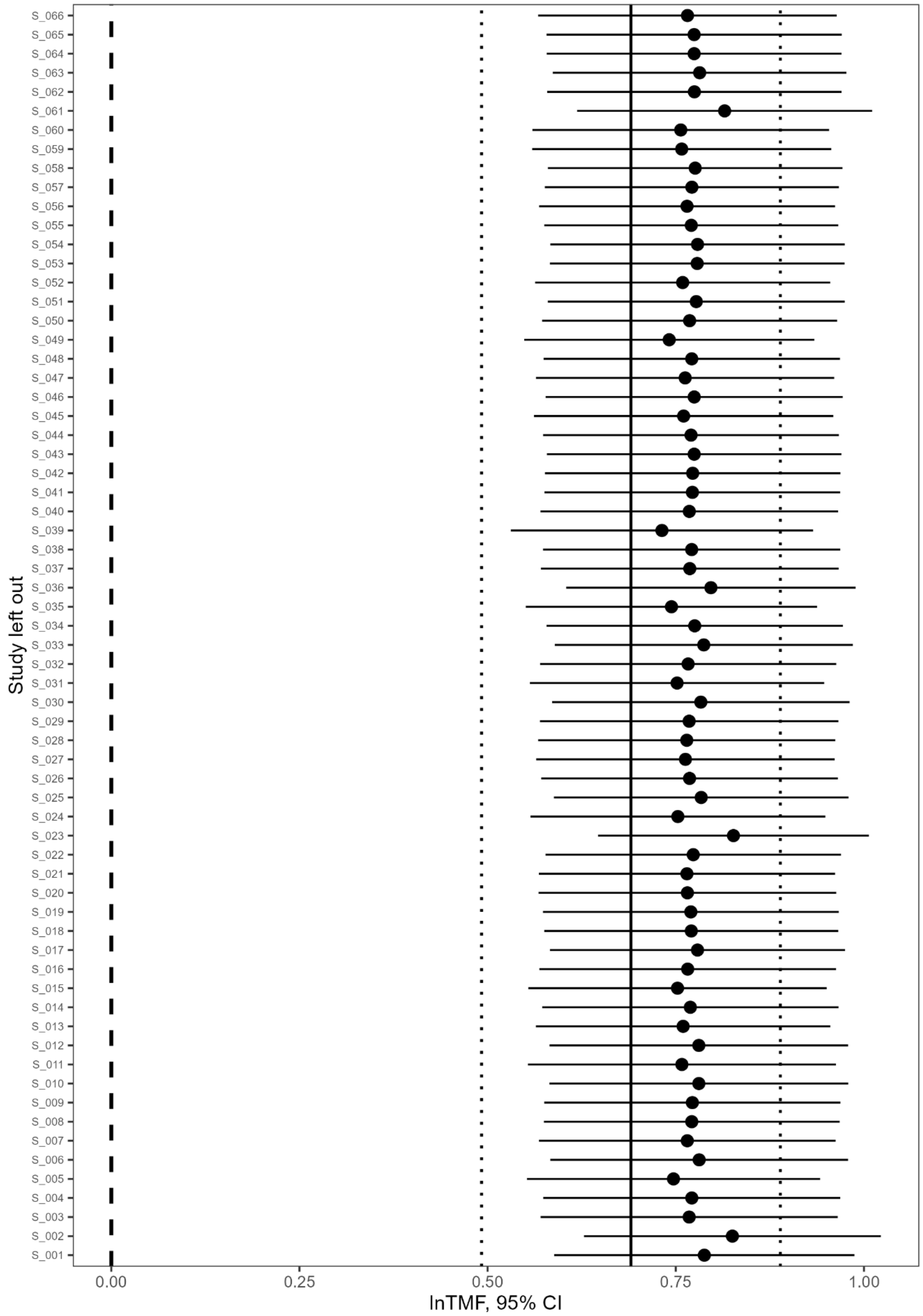

Fig. S19. Forest plot illustrating the results of leave-one-out sensitivity analyses. The vertical solid line represents the overall meta-analytic estimate, with the dotted lines marking its 95% confidence intervals. Each black point and solid line show the meta-analytic estimate and its confidence intervals, respectively, after excluding individual studies. The plot indicates that no single study significantly influenced the overall meta-analytic result.

Supplementary Figure 20

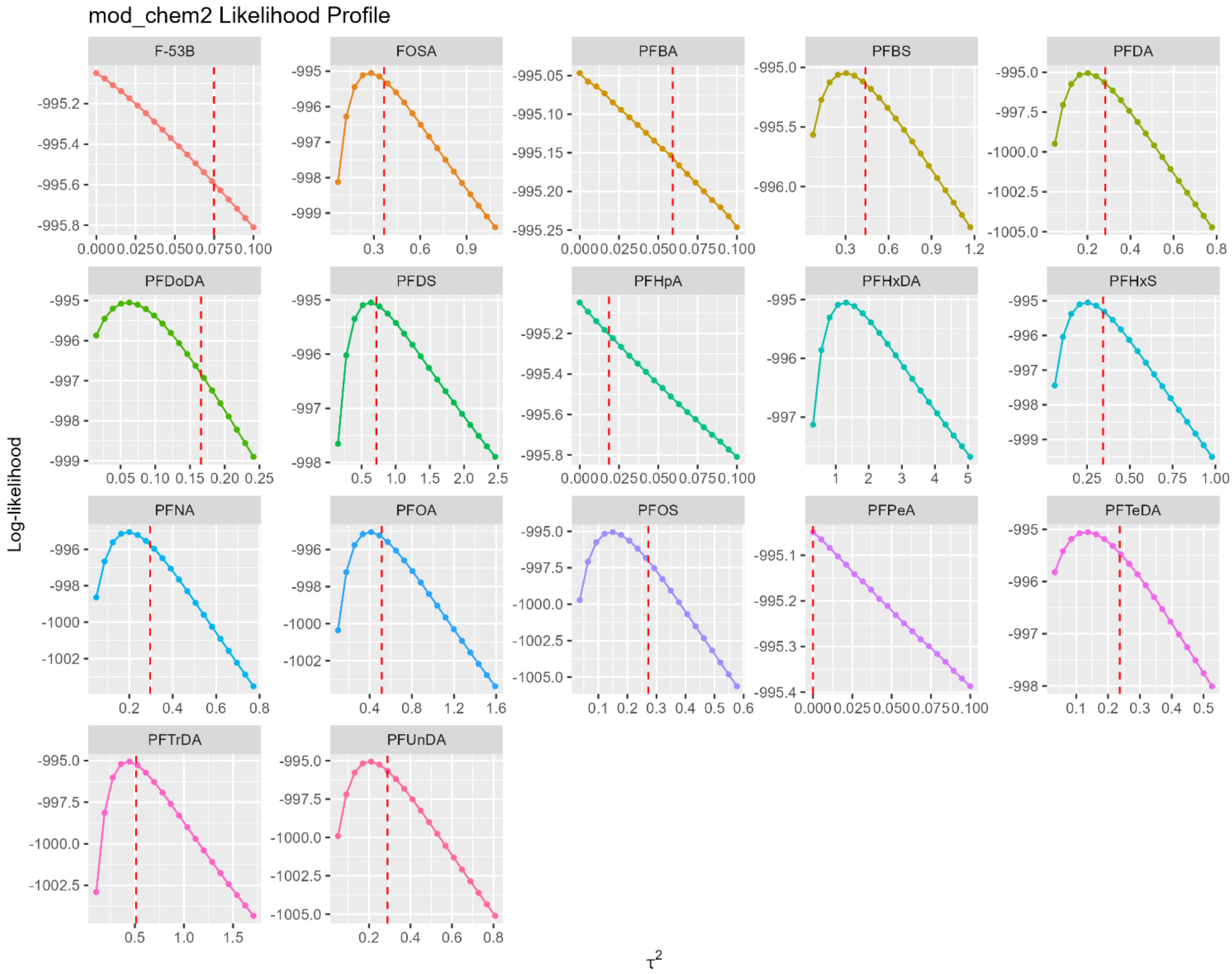

Fig. S20. Model validation and profile likelihood for the 17 PFAS included in the subgroup-correlated effects model. Profile likelihood plots show how the log-likelihood changes with different values of the between-study variance for various PFAS in the model. The subgroup-correlated effects meta-regression model included PFAS identity as a fixed effect. The red dashed vertical lines represent the variance component relative to the individual PFAS, which resulted from a subgroup analysis, in which the dataset was restricted to observations related to each specific PFAS (see Method S1 for details). Clear peaks indicate a well-defined estimate for the between-study variance, and the maximum log-likelihood (highest point) suggests the best estimate of the between-study variance. If a profile is flat or constantly decreasing, the estimate of the between-study variance might be unreliable or close to zero, meaning there's little between-study variation.

Supplementary Figure 21

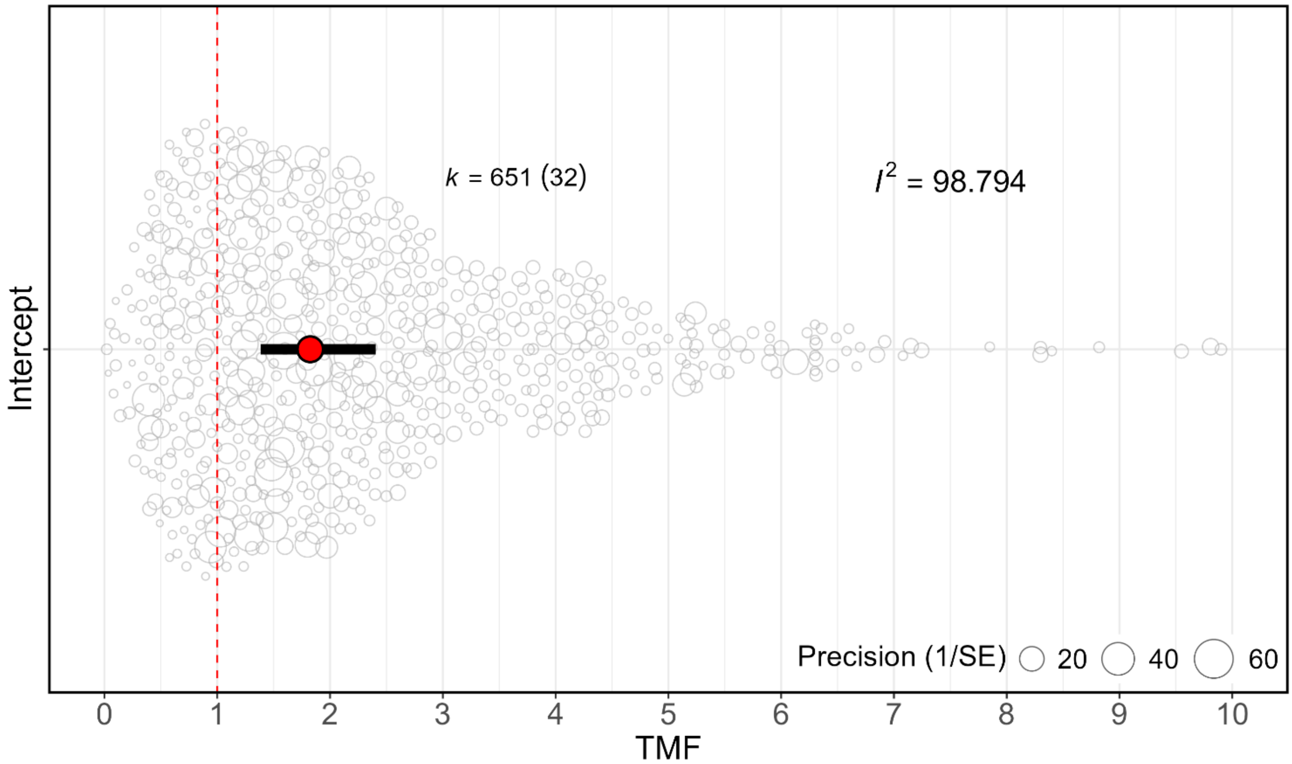

Fig. S21. Overall TMF after filtering out studies flagged by the study validity assessment. The model excludes any study with at least one high-risk-of-bias item. The mean meta-analytic estimate is represented by a black circle filled with red. The thicker bars indicate the 95% confidence interval, while the thinner bars represent the 95% prediction interval. Light grey circles depict individual effect sizes scaled by precision (inverse of the standard error, as shown in the legend). The number of effect sizes is represented by "k," while the number in parentheses indicates the number of studies. The red dotted line highlights a TMF of 1 (biomagnification above 1 and biodilution below 1). The x-axis was capped at 10 for improved visual readability.

Supplementary Figure 22

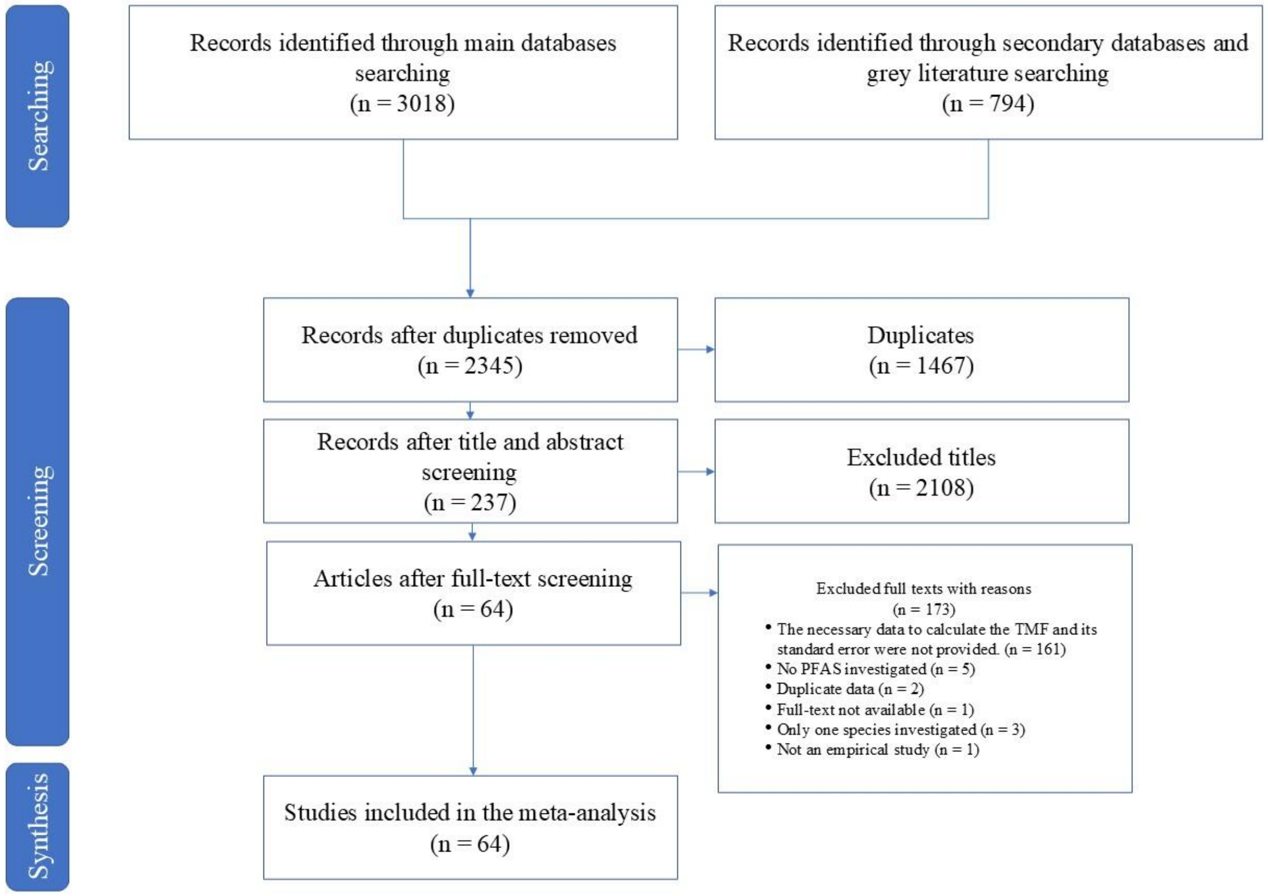

Fig. S22. Search and screening flow PRISMA diagram. The diagram illustrates the number of records at different stages of the selection process for studies incorporated in the meta-analysis.

Supplementary Figure 23

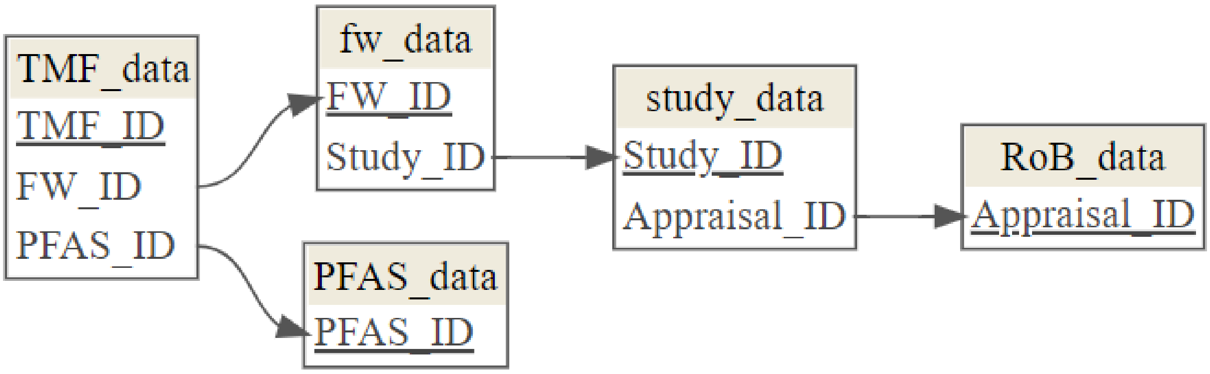

Fig. S23. Diagram illustrating the structure of the relational database of the extracted data. The database consists of five interconnected tables linked through primary and foreign keys. TMF_data contains quantitative datasets for effect size calculations, PFAS_data includes details on PFAS analytes, fw_data represents food web parameters, study_data captures study characteristics, and RoB_data presents quality assessment results for study validity.

Supplementary Text

Supplementary Method 1

We validated our subgroup-correlated effects meta-regression model [1] using a three-step approach to ensure the robustness and reliability of our variance estimates:

1) **Model fit comparison**: We evaluated our model's relative fit by comparing its Akaike Information Criterion corrected for small sample sizes (AICc) with the AICc values of two alternative candidate models. We excluded models with higher AICc. A lower AICc value indicates a better balance between model fit and complexity, providing evidence that our model effectively captures key patterns in the data.
2) **Profile likelihood examination**: To assess whether variance components were well-estimated and consistent with model assumptions, we examined the profile likelihood for each individual PFAS. The profile likelihood plots, presented in Fig. S18, depict how the log-likelihood changes across different values of the variance parameter (τ^2). A well-defined peak suggests stable and identifiable variance estimates, whereas a flat or irregular likelihood profile could indicate estimation challenges or weak identifiability of variance parameters. The clear peaks observed in our plots suggest that our variance estimates are well-supported by the data.
3) **Subgroup analysis for variance components**: We further validated our variance estimates by comparing the profile likelihood for each individual PFAS to variance components derived from a subgroup analysis (red dashed lines in plots of Fig. S18), where we restricted the dataset to observations related to each specific PFAS. This step ensured that our model-derived variance estimates were consistent with those obtained from a more traditional subgroup analysis. By demonstrating alignment between the two approaches, we confirmed that the subgroup-correlated effects model appropriately accounts for within-PFAS variation while leveraging information across the full dataset.

Supplementary Method 2

We assessed the internal validity of the included studies using a modified version of SYRCLE's risk of bias tool for animal studies [2]. This tool was applied to each study to evaluate five types of bias: selection bias, performance bias, measurement bias, reporting bias, and funding bias. The table below defines each type of bias and outlines the key questions we considered to evaluate the potential risk of bias.

Type of bias	**Definition**	**Evaluated criteria**
Selection bias	Occurs when the sample selected for a study is not representative of the population it is drawn from, leading to results that are not generalisable.	- All organisms were collected within an appropriate or consistent sampling period (e.g., the same season). - Adequate number of trophic levels.
Measurement bias	Occurs when systematic differences exist in how outcomes are measured or assessed between studies.	- The study reports the TMF and its error. If not, it provides data for their calculation. High risk arises when we extract raw data from plots and calculate the TMF and its error by ourselves.
Reporting bias	Happens when certain results are selectively reported based on their nature or direction, often favoring statistically significant findings that are more likely to be published.	- Is there evidence of incomplete or selective reporting of results (e.g., only statistically significant slopes)? - Are measured contaminant concentrations in biota samples above the detection limit? If not, does the study provide an appropriate strategy for handling undetected values?
Funding bias	Occurs when the source of funding influences the study's design, conduct,	- Are there any apparent conflicts of interest or undue

	analysis, or reporting, often in ways that favor the sponsor's interests.	influence from funding sources?

Supplementary Method 3

We defined the research question components according to the PICO/PECO framework [3] as follows:

- Population: The population in this study refers to the global aquatic and terrestrial food webs (including plants and animals) affected by PFAS contamination.
- Intervention/Exposure: The exposure of interest is the exposure to any PFAS. Thus, PFAS contamination must be present and quantitatively measured in (whole or any part of) organisms within the studied ecosystem.
- Comparator: Not applicable. Instead, we quantitatively assess the effects of factors that might influence PFAS trophic magnification. These factors include research methodologies, geographical variables, ecosystem characteristics, and food web composition (see Table 1 in the article).
- Outcome: The outcome of interest is the trophic magnification factor (TMF) within a studied food web. The TMF is the anti-log of the slope of the relationship between logarithm-transformed PFAS concentrations and trophic levels of biota within a food web.
- Study design: Any study design, such as field-based observational and mesocosms-based studies, is eligible. Studies must estimate and provide the trophic magnification factor or the trophic magnification slope.
- Other restrictions:
    - Time range: No restrictions.
    - Languages: Only studies published in English or a language spoken by any of the authors (i.e., Italian, Japanese, Polish, Russian, Traditional and Simplified Chinese, French, Portuguese, Spanish) are eligible due to language constraints.

Supplementary Method 4

Eligibility criteria at the title plus abstract level:

- The study's title and, optionally, its abstract are available.
- The study is a peer-reviewed journal article, a pre-print, or a thesis (i.e., bachelor's thesis, master's thesis, doctoral and postdoctoral thesis).
- The study likely is an empirical study, not a review.
- The study likely quantified at least one PFAS concentration in more than two organisms in the same food web.

Eligibility criteria at the full-text level:

- The full text is available for examination and data extraction.
- The full text is written in English or any eligible language (i.e., Italian, Japanese, Polish, Russian, Traditional and Simplified Chinese, French, Portuguese, Spanish).
- The study is an empirical study.
- The study quantified at least one PFAS concentration in more than two organisms from the same food web.
- The study provided the trophic magnification factor (TMF) of at least one PFAS and its standard error or 95% confidence intervals. Alternatively, it must provide the trophic magnification slope (TMS) and its standard error or 95% confidence intervals. If neither TMF nor TMS values were provided, the study must report linear regression plots of PFAS concentrations versus trophic levels of organisms or nitrogen isotope analysis (proxy of trophic levels).

Supplementary Method 5

If the included studies did not provide the trophic magnification factor (TMF) and/or its standard error, we adopted the following calculation scenarios:

1. The study provides the trophic magnification slope (TMS) and its standard error. We calculated the TMF and its standard error back-transforming the TMS by doing an anti-log of the slope and error.
2. The study provides the TMF and its 95% confidence intervals. We calculated the standard error by dividing the difference between the upper and lower confidence intervals by 1.96.
3. The study provides the TMF or TMS and the p-value. We calculated the standard error by dividing the TMS by the z-value. We calculated the z-value by taking the p-value, dividing it by 2, subtracting this result from 1, and then finding the corresponding z-value from the standard normal distribution.
4. The study provides a plot illustrating the regression between PFAS concentrations and trophic levels of organisms or stable nitrogen isotope analysis. We employed the *metaDigitise* R package (version 1.0.1) or its graphical user interface *shinyDigitise* [4] to extract the x- and y-axis coordinates (i.e., trophic levels of organisms or stable nitrogen isotope analysis and PFAS concentrations). Then, we run linear regression models to calculate the TMS and its error (see the following GitHub page for details: https://thisislorenzo.github.io/PFAS_Trophic_Magnification/R/Slope_calculations.html).

Supplementary Tables

Supplementary Table 1

Tab. S1. List of studies included in the meta-analysis.

Reference	Title	DOI
5	Perfluoroalkyl contaminants in an Arctic marine food web: trophic magnification and wildlife exposure	10.1021/es9003894
6	Investigation of the spatial variability of poly-and perfluoroalkyl substance trophic magnification in selected riverine ecosystems	10.1016/j.scitotenv.2019.05.461
7	Trophic magnification and isomer fractionation of perfluoroalkyl substances in the food web of Taihu Lake, China	10.1021/es405018b
8	Trophic Magnification of Legacy (PCB, DDT and Hg) and Emerging Pollutants (PFAS) in the Fish Community of a Small Protected Southern Alpine Lake (Lake Mergozzo, Northern Italy)	10.3390/w12061591
9	Biomagnification of perfluoroalkyl compounds in the bottlenose dolphin (Tursiops truncatus) food web	10.1021/es060233b
10	Fractionation and bioaccumulation of perfluorooctane sulfonate (PFOS) isomers in a Lake Ontario food web	10.1021/es800906r
11	Trophodynamics of some PFCs and BFRs in a western Canadian Arctic marine food web	10.1021/es900162n
12	Fluorinated organic compounds in an eastern Arctic marine food web	10.1021/es049620g
13	Trophic magnification of poly-and perfluorinated compounds in a subtropical food web	10.1021/es200432n
14	Evidence for the trophic transfer of perfluoroalkylated substances in a temperate macrotidal estuary	10.1021/acs.est.7b02399
15	Biomagnification of perfluoroalkyl acids (PFAAs) in the food web of an urban river: Assessment of the trophic transfer of targeted and unknown precursors and implications.	10.1039/C9EM00322C
16	Bioaccumulation of per- and polyfluoroalkyl substances (PFASs) in a tropical estuarine food web.	10.1016/j.scitotenv.2020.142146
17	Perfluoroalkyl contaminants in a food web from Lake Ontario.	10.1021/es049331s

18	Bioaccumulation and trophic transfer of perfluorinated compounds in a eutrophic freshwater food web.	10.1016/j.envpol.2013.09.011
19	Isomer-specific trophic transfer of perfluorocarboxylic acids in the marine food web of Liaodong Bay, North China.	10.1021/es504445x
20	Distribution, bioaccumulation and trophic transfer of chlorinated polyfluoroalkyl ether sulfonic acids in the marine food web of Bohai, China.	10.1016/j.envpol.2018.05.087
21	Residues, bioaccumulations and biomagnification of perfluoroalkyl acids (PFAAs) in aquatic animals from Lake Chaohu, China.	10.1016/j.envpol.2018.05.001
22	Occurrence and trophic transfer of per- and polyfluoroalkyl substances in an Antarctic ecosystem.	10.1016/j.envpol.2019.113383
23	Fluorinated precursor compounds in sediments as a source of perfluorinated alkyl acids (PFAA) to biota.	10.1021/acs.est.0c04587
24	Occurrence, partitioning and bioaccumulation of emerging and legacy per- and polyfluoroalkyl substances in Taihu Lake, China	10.1016/j.scitotenv.2018.03.301
25	Managing health risks of perfluoroalkyl acids in aquatic food from a riverestuary- sea environment affected by fluorochemical industry.	10.1016/j.envint.2020.105621
26	Bioaccumulation, trophic transfer and biomagnification of perfluoroalkyl acids (PFAAs) in the marine food web of the South China Sea.	10.1016/j.jhazmat.2020.124681
27	First report on the bioaccumulation and trophic transfer of perfluoroalkyl ether carboxylic acids in estuarine food web.	10.1021/acs.est.1c00965
28	Legacy and alternative per- and polyfluoroalkyl substances in a subtropical marine food web from the Beibu Gulf, South China: Fate, trophic transfer and health risk assessment.	10.1016/j.jhazmat.2020.123618
29	Biomagnification and health risks of perflfluoroalkyl acids (PFAAs) in seafood from the Yangtze river estuary of China	10.1016/j.envpol.2023.122930
30	Chlorinated polyfluoroalkyl ether sulfonic acids in marine organisms from Bohai Sea, China: occurrence, temporal variations, and trophic transfer behavior	10.1021/acs.est.6b06593
31	Trophic magnification of short-chain per-and polyfluoroalkyl substances in a terrestrial food chain from the Tibetan Plateau	10.1021/acs.estlett.1c01009

32	Biomagnification of perfluorinated compounds in a remote terrestrial food chain: lichen–caribou–wolf	10.1021/es201353v
33	Comprehensive screening of polar emerging organic contaminants including PFASs and evaluation of the trophic transfer behavior in a freshwater food web	10.1016/j.watres.2022.118514
34	Bioaccumulation and Biomagnification of Perfluoroalkyl Substances (PFAS) in a Subarctic Ringed Seal Food Web in Lake Melville, Northern Labrador, Canada	Thesis
35	Ecological characteristics impact PFAS concentrations in a US North Atlantic food web	10.1016/j.scitotenv.2023.163302
36	Biomanipulation impacts on per-and polyfluoroalkyl substances accumulation and trophic transfer in an eutrophic lake	10.1016/j.envint.2021.107057
37	Food web on ice: A pragmatic approach to investigate the trophic magnification of chemicals of concern	10.1186/s12302-021-00530-x
38	Bioaccumulation of polyfluoroalkyl substances in the Lake Huron aquatic food web	10.1016/j.scitotenv.2022.152974
39	Bioaccumulation and trophic magnification of emerging and legacy per- and polyfluoroalkyl substances (PFAS) in a St. Lawrence River food web	10.1016/j.envpol.2022.119739
40	Sediment-seawater partitioning, bioaccumulation, and biomagnification of perfluorobutane sulfonamide in marine environment	10.1016/j.watres.2024.121466
41	Bioaccumulation and biomagnification of emerging poly- and perfluoroalkyl substances in marine organisms	10.1016/j.scitotenv.2022.158117
42	Legacy and Emerging Per- and Polyfluoroalkyl Substances in a Subtropical Marine Food Web: Suspect Screening, Isomer Profile, and Identification of Analytical Interference	10.1021/acs.est.3c00374
43	PFAS bioaccumulation in Antarctic breeding south polar skua (Catharacta maccormicki) and its prey items	Thesis
44	Perfluoroalkyl acids (PFAAs) in the aquatic food web of a temperate urban lake in East China: Bioaccumulation, biomagnification, and probabilistic human health risk	10.1016/j.envpol.2021.118748
45	Bioaccumulation of per- and polyfluorinated alkyl substances (PFAS) in selected species from the Barents Sea food web	10.1016/j.envpol.2006.09.021
46	Perfluorinated and Polyfluorinated Compounds in Lake Food Websfrom the Canadian High Arctic	10.1021/es5048649

47	PFAS accumulation in indigenous and translocated aquatic organisms from Belgium, with translation to human and ecological health risk	10.1186/s12302-021-00477-z
48	Bioaccumulation and trophic transfer of per- and polyfluoroalkyl substances in a subtropical mangrove estuary food web	10.1016/j.scitotenv.2024.172094
49	Bioaccumulation of perfluoroalkyl substances in the Lake Erie food web	10.1016/j.envpol.2022.120677
50	New insights from an eight-year study on per- and polyfluoroalkyl substances in an urban terrestrial ecosystem	10.1016/j.envpol.2024.123735
51	Uptake of Hydrophobic Organic Compounds, Including Organochlorine Pesticides, Polybrominated Diphenyl Ethers, and Perfluoroalkyl Acids in Fish and Blue Crabs of the Lower Passaic River, New Jersey, USA	10.1002/etc.4354
52	Trophic behaviors of PFOA and its alternatives perfluoroalkyl ether carboxylic acids (PFECAs) in a coastal food web	10.1016/j.jhazmat.2023.131353
53	Disclosing the bioaccumulation and biomagnification behaviors of emerging per/polyfluoroalkyl substances in aquatic food web based on field investigation and model simulation	10.1016/j.jhazmat.2022.130566
54	Comprative study of ecodynamic of halogenated micropollutant of historical and emergent interest in the Seine estuary	Thesis
55	Bioaccumulation and trophic transfer of perfluorinated alkyl substances (PFAS) in marine biota from the Belgian North Sea: Distribution and human health risk implications	10.1016/j.envpol.2022.119907
56	Per-and polyfluoroalkyl-contaminated freshwater impacts adjacent riparian food webs	10.1021/acs.est.0c01640
57	Quantification of Biodriven Transfer of Per- and Polyfluoroalkyl Substances from the Aquatic to the Terrestrial Environment via Emergent Insects	10.1021/acs.est.0c07129
58	Perfluorooctane sulfonate (PFOS) and other fluorochemicals in fish blood collected near the outfall of wastewater treatment plant (WWTP) in Beijing	10.1016/j.envpol.2008.03.008
59	Investigation of perfluorinated compounds (PFCs) in mollusks from coastal waters in the Bohai Sea of China	10.1039/b909302h

60	Perfluorinated Chemicals InfiltrateOcean Waters: Link betweenExposure Levels and Stable IsotopeRatios in Marine Mammals	10.1021/es0345975
61	The occurrence, tissue distribution, and PBT potential of per- and polyfluoroalkyl substances in the freshwater organisms from the Yangtze river via nontarget analysis	10.1016/j.jhazmat.2023.131868
62	Bioaccumulation Patterns of Perfluoroalkyl Acids in an Estuary of the Ariake Sea, Japan	10.1007/s00128-018-2282-z
63	Developing methods for assessing trophic magnification of perfluoroalkyl substances within an urban terrestrial avian food web	10.1021/acs.est.3c02361
64	Persistent toxic substances in Mediterranean aquatic species	10.1016/j.scitotenv.2014.05.131
65	Bioaccumulation and risk mitigation of legacy and novel perfluoroalkyl substances in seafood: Insights from trophic transfer and cooking method	10.1016/j.envint.2023.108023
66	Accumulation and exposure assessment of persistent chlorinated and fluorinated contaminants in Korean birds	10.1016/j.scitotenv.2018.07.040
67	Levels of chlorinated, brominated, and perfluorinated contaminants in birds of prey spanning multiple trophic levels	10.7589/2012-03-084
68	Per-and polyfluoroalkyl substances in waterbird feathers around Poyang Lake, China: Compound and species-specific bioaccumulation	10.1016/j.ecoenv.2024.116141

Supplementary Table 2

Tab. S2. Number of effect sizes (TMF) across food webs in different world regions. Only PFAS with more than 10 effect sizes are reported in the table.

PFAS	Antarctic Region	Arctic Region	East Asia	West Asia	Europe	Mediterranean Region	North America	South America
F-53B	0	0	31	0	0	0	0	0
PFOS	4	4	33	1	19	1	55	0
PFDA	3	2	27	1	18	0	37	0
br-PFOS	0	0	0	0	9	0	0	3
PFUnDA	4	1	32	1	18	0	35	3
l-PFOS	0	0	0	0	15	0	2	3
PFNA	3	2	24	0	15	0	41	3
PFTrDA	1	0	17	0	16	0	29	3
PFDoDA	1	0	28	1	18	0	34	3
FOSA	0	1	2	0	13	0	12	0
PFHxS	1	0	9	1	12	0	20	0
PFDS	0	0	5	0	6	0	11	0
PFTeDA	0	0	6	0	16	0	24	3
PFOA	1	1	23	0	15	0	35	0
PFBA	1	0	14	1	0	0	0	0
PFPeA	0	0	11	0	0	0	0	0
PFHpA	0	0	12	0	3	0	6	0
PFBS	0	0	13	1	0	0	10	0
PFHxA	0	0	13	0	1	0	1	0

Supplementary Table 3

Tab. S3. Summary of international regulation status of selected per- and polyfluoroalkyl substances (PFAS). The table categorises 19 PFAS based on their regulatory status, indicating whether they are listed in the Stockholm Convention, the REACH regulation, or internationally not regulated. A details column provides information on PFAS regulation.

Chemical	Regulation	Details	Sources
PFOS	Stockholm Convention	Listed under the Stockholm Convention on Persistent Organic Pollutants (POPs). It is also listed in the European Drinking Water Directive and Prior Informed Consent (PIC) regulations. It was banned by the Environment and Climate Change Canada (ECCC). Included in the List of New Pollutants for Priority Management of China.	[69], [70], [71], [72]
PFDA	REACH regulation	Listed in the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Annex XIV Restricted Substances List (C_9-C_{14} PFCSs). REACH restricts its use and mandates reporting for specific applications. Also listed in the Classification, Labelling and Packaging (CLP) regulation.	[73], [70]
F-53B	Internationally not regulated	Developed as a PFOS replacement. It is not internationally regulated. Currently, F-53B is only used in China. However, it was ubiquitously detected in rivers and lakes in China and the United States, Germany, the United Kingdom, the Netherlands, and South Korea.	[74]

br-PFOS	Stockholm Convention	Considered part of PFOS regulation under the Stockholm Convention.	[69]
PFUnDA	REACH regulation	Listed in the REACH Annex XVII Restricted C_9-C_{14} PFCSs Substances List.	[75]
l-PFOS	Stockholm Convention	Considered part of PFOS regulation under the Stockholm Convention (Annex B).	[69]
PFNA	REACH regulation	Listed in the REACH Annex XVII Restricted Substances List (C_9-C_{14} PFCSs). Also listed in the CLP regulation.	[75]
PFTrDA	REACH regulation	Listed in the REACH Annex XVII Restricted Substances List (C_9-C_{14} PFCSs).	[75]
PFDoDA	REACH regulation	Listed in the REACH Annex XVII Restricted Substances List (C_9-C_{14} PFCSs).	[75]
FOSA	Stockholm Convention	Regulated as a derivative and degradation product of PFOS under the Stockholm Convention, Annex B, as it can degrade to PFOS in the environment.	[69]
PFHxS	Stockholm Convention	Added to the Stockholm Convention in 2022 under Annex A. Listed in the List of New Pollutants for Priority Management of China.	[76], [72]
PFDS	Internationally not regulated	Not covered under major international regulations.	NA
PFTeDA	REACH regulation	Listed in the REACH Annex XVII Restricted C_9-C_{14} PFCSs Substances List. It was banned by the ECCC.	[75]

PFOA	Stockholm Convention	Listed under Annex A of the Stockholm Convention with restrictions on production and use, effective since 2020. Also listed in the CLP and PIC regulations. It was banned by the ECCC. New Zeland banned Aqueous Film Forming Foam (AFFF) that contain PFOA-related compounds. Listed in the List of New Pollutants for Priority Management of China.	[77], [78], [72]
PFBA	Internationally not regulated	Not regulated internationally and not covered under major regulations.	NA
PFPeA	Internationally not regulated	Not regulated internationally and not covered under major regulations.	NA
PFHpA	REACH regulation	Listed as an SVHC under REACH (group 3). Also listed in the Classification, Labelling and Packaging (CLP) regulation.	[79]
PFBS	REACH regulation	Considered a lower-risk alternative to PFOS. Listed as an SVHC under REACH (group 2).	[80]
PFHxA	Internationally not regulated	Not regulated internationally and not covered under major regulations. However, it is monitored due to its increasing use as a replacement for long-chain PFAS compounds.	NA

Supplementary Table 4

Tab. S4. Strategies used to handle undetected values. The table presents the types of strategies employed by the studies included in the meta-analysis to address concentrations below the limit of detection or quantification, along with the corresponding number of effect sizes and studies.

Strategy for undetected values	**Number of TMFs**	**Number of Studies**
Not provided	337	24
The LOQ value divided by two	81	8
The MDL value divided by two	88	7
The LOD value divided by two	95	5
Zero for values < LOD	24	2
Exclusion of data if values were < LOD	11	1
Exclusion of data if values were < LOQ	96	1
Exclusion of data if values were < MDL.	16	1
Exclusion of values < LOD. The LOQ value divided by two for values < LOQ	7	1
Imputation method	31	1
Models accounting for values below the LOD	32	1
Random numbers below half of the MDL	20	1
Random numbers between 0 and the LOD value	36	1
Random numbers between 0 and the LOD value divided by two	24	1
Random numbers between 0 and the MDL value	20	1
The LOD value divided by the square root of two	10	1
The LOD value divided by the square root of two for values < LOD. The LOQ value divided by two for values < LOQ	7	1
The LOD value divided by two or detection frequency multiplied by LOD value or imputation	35	1
The LOQ value divided by the square root of two	1	1
Three method comparison	33	1
Zero for undetected. The MDL value divided by two for values < MDL	4	1
Zero for values < LOD. The LOQ value divided by the square root of two for values < LOQ	12	1
Zero for values < LOD. The LOQ value divided by two for values < LOQ	10	1

Supplementary Table 5

Tab. S5. Deviations and additions to the research protocol. The table outlines the types of deviations and additions to the research protocol, including their descriptions, justifications, the review stage affected, and the magnitude of each deviation.

Deviation/Addition	**Description**	**Reason**	**Review stage impacted**	**Impact's magnitude**
Changes to the study validity assessment	We removed the performance bias item and rephrased the selection, measurement, and reporting bias	This deviation was necessary to enhance the tool's applicability to the specific types of studies included in the meta-analysis.	Study validity assessment	Low
Changes to grey literature search databases	We replaced the OpenGrey database with the BASE database	The OpenGrey database was not working on the day of the search.	Grey literature search	Low
Changes to the TMF_data spreadsheet	We added the column "Censored_data_strategy"	The column was added to record the strategy to deal with the undetected data	None	NA
Changes to the fw_data spreadsheet	We moved the columns "Sample_type" and "Biomass_conversion" from the fw_data spreadsheet to the TMF_data spreadsheet	Some studies measured TMF in the same food web but using different biomass conversion and or samples	None	NA

Supplementary Table 6

Tab. S6. PRISMA Eco-Evo checklist. This table presents the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Eco-Evo checklist, tailored for ecological and evolutionary research. It includes key reporting items, corresponding checklist sections, and specific guidelines to ensure transparency, reproducibility, and comprehensiveness in systematic reviews and meta-analyses within eco-evolutionary studies.

Checklist item	Sub-item number	Sub-item	Reported by authors?	Notes
Title and abstract	1.1	Identify the review as a systematic review, meta-analysis, or both	Yes	Title and abstract
	1.2	Summarise the aims and scope of the review	Yes	Abstract
	1.3	Describe the data set	Yes	Abstract
	1.4	State the results of the primary outcome	Yes	Abstract
	1.5	State conclusions	Yes	Abstract
	1.6	State limitations	No	Limitations have their own paragraph
Aims and questions	2.1	Provide a rationale for the review	Yes	Introduction
	2.2	Reference any previous reviews or meta-analyses on the topic	Yes	Introduction
	2.3	State the aims and scope of the review (including its generality)	Yes	Introduction
	2.4	State the primary questions the review addresses (e.g. which moderators were tested)	Yes	Introduction
	2.5	Describe whether effect sizes were derived from experimental and/or observational comparisons	Yes	Introduction
Review registration	3.1	Register review aims, hypotheses (if applicable), and methods in a time-stamped and publicly accessible archive and provide a link to the registration in the methods section of the manuscript. Ideally registration occurs before the search, but it can be done at any stage before data analysis.	Yes	PROCEED (https://doi.org/10.57808/proceed.2024.8)

	3.2	Describe deviations from the registered aims and methods	Yes	Supplementary Table 5
	3.3	Justify deviations from the registered aims and methods	Yes	Supplementary Table 5
Eligibility criteria	4.1	Report the specific criteria used for including or excluding studies when screening titles and/or abstracts, and full texts, according to the aims of the systematic review (e.g. study design, taxa, data availability)	Yes	Supplementary Method 3 and 4
	4.2	Justify criteria, if necessary (i.e. not obvious from aims and scope)	Yes	Supplementary Method 3 and 4
Finding studies	5.1	Define the type of search (e.g. comprehensive search, representative sample)	Yes	Supplementary Method 3
	5.2	State what sources of information were sought (e.g. published and unpublished studies, personal communications)	Yes	Supplementary Method 3
	5.3	Include, for each database searched, the exact search strings used, with keyword combinations and Boolean operators	Yes	Supplementary Table 8
	5.4	Provide enough information to repeat the equivalent search (if possible), including the timespan covered (start and end dates)	Yes	Supplementary Table 5
Study selection	6.1	Describe how studies were selected for inclusion at each stage of the screening process (e.g. use of decision trees, screening software)	Yes	Materials and Methods
	6.2	Report the number of people involved and how they contributed (e.g. independent parallel screening)	Yes	Materials and Methods
Data collection process	7.1	Describe where in the reports data were collected from (e.g. text or figures)	Yes	Supplementary Data

	7.2	Describe how data were collected (e.g. software used to digitize figures, external data sources)	Yes	NA
	7.3	Describe moderator variables that were constructed from collected data (e.g. number of generations calculated from years and average generation time)	Yes	Table 1
	7.4	Report how missing or ambiguous information was dealt with during data collection (e.g. authors of original studies were contacted for missing descriptive statistics, and/or effect sizes were calculated from test statistics)	Yes	Materials and Methods
	7.5	Report who collected data	Yes	Materials and Methods
	7.6	State the number of extractions that were checked for accuracy by co-authors	No	NA
Data items	8.1	Describe the key data sought from each study	Yes	Pre-registered protocol
	8.2	Describe items that do not appear in the main results, or which could not be extracted due to insufficient information	No	NA
	8.3	Describe main assumptions or simplifications that were made (e.g. categorising both 'length' and 'mass' as 'morphology')	Yes	Discussion
	8.4	Describe the type of replication unit (e.g. individuals, broods, study sites)	Yes	Materials and Methods
Assessment of individual study quality	9.1	Describe whether the quality of studies included in the systematic review or meta-analysis was assessed (e.g. blinded data collection, reporting quality, experimental *versus* observational)	Materials and Methods	Sensitivity analysis
	9.2	Describe how information about study quality was incorporated into analyses	Materials and Methods	Sensitivity analysis

		(e.g. meta-regression and/or sensitivity analysis)		
Effect size measures	10.1	Describe effect size(s) used	Yes	Materials and Methods
	10.2	Provide a reference to the equation of each calculated effect size (e.g. standardised mean difference, log response ratio) and (if applicable) its sampling variance	Yes	Materials and Methods
	10.3	If no reference exists, derive the equations for each effect size and state the assumed sampling distribution(s)	Yes	Materials and Methods
Missing data	11.1	Describe any steps taken to deal with missing data during analysis (e.g. imputation, complete case, subset analysis)	Yes	Materials and Methods & Supplementary Methods
	11.2	Justify the decisions made to deal with missing data	Yes	Materials and Methods & Supplementary Methods
Meta-analytic model description	12.1	Describe the models used for synthesis of effect sizes	Yes	Materials and Methods
	12.2	The most common approach in ecology and evolution will be a random-effects model, often with a hierarchical/multilevel structure. If other types of models are chosen (e.g. common/fixed effects model, unweighted model), provide justification for this choice	Yes	Materials and Methods
Software	13.1	Describe the statistical platform used for inference (e.g. *R*)	Yes	Materials and Methods
	13.2	Describe the packages used to run models	Yes	Materials and Methods
	13.3	Describe the functions used to run models	Yes	Materials and Methods
	13.4	Describe any arguments that differed from the default settings	Yes	Materials and Methods
	13.5	Describe the version numbers of all software used	Yes	NA

Non-independence	14.1	Describe the types of non-independence encountered (e.g. phylogenetic, spatial, multiple measurements over time)	Yes	Materials and Methods
	14.2	Describe how non-independence has been handled	Yes	Materials and Methods
	14.3	Justify decisions made	Yes	Materials and Methods
Meta-regression and model selection	15.1	Provide a rationale for the inclusion of moderators (covariates) that were evaluated in meta-regression models	Yes	Table 1
	15.2	Justify the number of parameters estimated in models, in relation to the number of effect sizes and studies (e.g. interaction terms were not included due to insufficient sample sizes)	Yes	Materials and Methods
	15.3	Describe any process of model selection	Yes	Materials and Methods
Publication bias and sensitivity analyses	16.1	Describe assessments of the risk of bias due to missing results (e.g. publication, time-lag, and taxonomic biases)	Yes	Publication bias section
	16.2	Describe any steps taken to investigate the effects of such biases (if present)	Yes	Publication bias section
	16.3	Describe any other analyses of robustness of the results, e.g. due to effect size choice, weighting or analytical model assumptions, inclusion or exclusion of subsets of the data, or the inclusion of alternative moderator variables in meta-regressions	Yes	Publication bias and sensitivity analyses
Clarification of *post hoc* analyses	17.1	When hypotheses were formulated after data analysis, this should be acknowledged.	Yes	Table 1
Metadata, data, and code	18.1	Share metadata (i.e. data descriptions)	Yes	Pre-registered protocol and Supplementary Data
	18.2	Share data required to reproduce the results presented in the manuscript	Yes	Supplementary Data

	18.3	Share additional data, including information that was not presented in the manuscript (e.g. raw data used to calculate effect sizes, descriptions of where data were located in papers)	Yes	Supplementary Data
	18.4	Share analysis scripts (or, if a software package with graphical user interface (GUI) was used, then describe full model specification and fully specify choices)	Yes	GitHub Repository
Results of study selection process	19.1	Report the number of studies screened	Yes	Results
	19.2	Report the number of studies excluded at each stage of screening	Yes	Results
	19.3	Report brief reasons for exclusion from the full text stage	Yes	Supplementary Table 9
	19.4	Present a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)-like flowchart (www.prisma-statement.org).	Yes	Supplementary Figure 22
Sample sizes and study characteristics	20.1	Report the number of studies and effect sizes for data included in meta-analyses	Yes	Results
	20.2	Report the number of studies and effect sizes for subsets of data included in meta-regressions	Yes	Results
	20.3	Provide a summary of key characteristics for reported outcomes (either in text or figures; e.g. one quarter of effect sizes reported for vertebrates and the rest invertebrates)	Yes	Results
	20.4	Provide a summary of limitations of included moderators (e.g. collinearity and overlap between moderators)	Yes	Results
	20.5	Provide a summary of characteristics related to individual study quality (risk of bias)	Yes	Results

Meta-analysis	21.1	Provide a quantitative synthesis of results across studies, including estimates for the mean effect size, with confidence/credible intervals	Yes	Results
Heterogeneity	22.1	Report indicators of heterogeneity in the estimated effect (e.g. I^2, tau^2 and other variance components)	Yes	Results
Meta-regression	23.1	Provide estimates of meta-regression slopes (i.e. regression coefficients) and confidence/credible intervals	Yes	Results
	23.2	Include estimates and confidence/credible intervals for all moderator variables that were assessed (i.e. complete reporting)	Yes	Results
	23.3	Report interactions, if they were included	Yes	Results
	23.4	Describe outcomes from model selection, if done (e.g. R2 and AIC)	Yes	Results
Outcomes of publication bias and sensitivity analyses	24.1	Provide results for the assessments of the risks of bias (e.g. Egger's regression, funnel plots)	Yes	Results
	24.2	Provide results for the robustness of the review's results (e.g. subgroup analyses, meta-regression of study quality, results from alternative methods of analysis, and temporal trends)	Yes	Results
Discussion	25.1	Summarise the main findings in terms of the magnitude of effect	Yes	Discussion
	25.2	Summarise the main findings in terms of the precision of effects (e.g. size of confidence intervals, statistical significance)	Yes	Discussion
	25.3	Summarise the main findings in terms of their heterogeneity	Yes	Discussion
	25.4	Summarise the main findings in terms of their biological/practical relevance	Yes	Discussion
	25.5	Compare results with previous reviews on the topic, if available	Yes	Discussion

	25.6	Consider limitations and their influence on the generality of conclusions, such as gaps in the available evidence (e.g. taxonomic and geographical research biases)	Yes	Discussion
Contributions and funding	26.1	Provide names, affiliations, and funding sources of all co-authors	Yes	NA
	26.2	List the contributions of each co-author	Yes	NA
	26.3	Provide contact details for the corresponding author	Yes	NA
	26.4	Disclose any conflicts of interest	Yes	NA
References	27.1	Provide a reference list of all studies included in the systematic review or meta-analysis	Yes	NA
	27.2	List included studies as referenced sources (e.g. rather than listing them in a table or supplement)	Yes	NA

Supplementary Table 7

Tab. S7. Digital Object Identifiers (DOIs) of the 25 banchmark bibliographic records. These records were specifically selected to validate the thoroughness of the search methodology, evaluating our search strategy's sensitivity and comprehensiveness.

DOIs:
10.1021/es049331s
10.1021/es049620g
10.1021/es060233b
10.1021/es800906r
10.1021/es9003894
10.1021/es900162n
10.1021/es200432n
10.1016/j.envpol.2013.09.011
10.1021/es405018b
10.1021/es504445x
10.1021/acs.est.7b02399
10.1016/j.envpol.2018.05.087
10.1016/j.envpol.2018.05.001
10.1039/C9EM00322C
10.1016/j.scitotenv.2019.05.461
10.1021/acs.est.9b05007
10.1016/j.envpol.2019.113383
10.3390/w12061591
10.1021/acs.est.0c04587
10.1016/j.envint.2020.105621
10.1016/j.scitotenv.2020.142146
10.1016/j.jhazmat.2020.124681
10.1021/acs.est.1c00965
10.1016/j.jhazmat.2020.123618
10.1016/j.jglr.2021.08.013
Benchmark query:
DOI(10.1021/es049331s) OR DOI(10.1021/es049620g) OR DOI(10.1021/es060233b) OR DOI(10.1021/es800906r) OR DOI(10.1021/es9003894) OR DOI(10.1021/es900162n) OR DOI(10.1021/es200432n) OR DOI(10.1016/j.envpol.2013.09.011) OR DOI(10.1021/es405018b) OR DOI(10.1021/es504445x) OR DOI(10.1021/acs.est.7b02399) OR DOI(10.1016/j.envpol.2018.05.087) OR DOI(10.1016/j.envpol.2018.05.001) OR DOI(10.1039/C9EM00322C) OR DOI(10.1016/j.scitotenv.2019.05.461) OR DOI(10.1021/acs.est.9b05007) OR DOI(10.1016/j.envpol.2019.113383) OR

DOI(10.3390/w12061591) OR DOI(10.1021/acs.est.0c04587) OR
DOI(10.1016/j.envint.2020.105621) OR DOI(10.1016/j.scitotenv.2020.142146) OR
DOI(10.1016/j.jhazmat.2020.124681) OR DOI(10.1021/acs.est.1c00965) OR
DOI(10.1016/j.jhazmat.2020.123618) OR DOI(10.1016/j.jglr.2021.08.013)

Supplementary Table 8

Tab. S8. Searches records from six online databases. This table provides details of the systematic searches conducted across six online databases. It includes the database names, search strings tailored to each database's structure, the dates of the searches, and the number of resulting records (hits). The search strings were designed to be comprehensive, aiming to capture all relevant studies on PFAS concentrations within food webs.

Source	Search string	Date of search	Number of hits
PubMed	("fluoroalkyl" OR perfluo* OR polyfluo* OR organofluorine OR pfas OR pfass OR pfba OR pfpea OR pfhxa OR pfhpa OR pfoa OR pfna OR pfda OR pfdea OR pfdca OR pfunda OR pfuna OR pfua OR pfuda OR pfdoa OR pfdoda OR pftrda OR pftrida OR pftra OR pfta OR pfteda OR pfo4da OR pfo5doda OR pfbs OR pfbus OR pfpes OR pfhxs OR pfhps OR pfos OR pfns OR pfds OR fts OR ftsa OR pfechs OR fosa OR pfosa OR netfosaa OR "Et-PFOSA-AcOH" OR nmefosaa OR "Me-PFOSA-AcOH" OR adona OR "Cl-PFAES" OR "F-53B" OR genx OR "HFPO-TA" OR "Hydro-Eve" OR "Nafion BP2" OR teflon OR tefal OR c8 OR "emerging pollutant*" OR organohalogen* OR ptfe OR fluorotelomer*) AND ("trophic level*" OR "trophic position*" OR tropho* OR "trophic amplification" OR "trophic magnification*" OR "trophic transfer" OR bioamplification* OR biomagnif* OR "biological magnification*"OR "cumulative concentration*" OR "food chain*" OR "food web*" OR TMF OR "magnification factor*") NOT review[pt]	08/04/2024	526
Web of Science (Core Collection)	TS=("fluoroalkyl*" OR perfluo* OR polyfluo* OR organofluorine OR pfas OR pfass OR pfba OR pfpea OR pfhxa OR pfhpa OR pfoa OR pfna OR pfda OR pfdea OR pfdca OR pfunda OR pfuna OR pfua OR pfuda OR pfdoa OR pfdoda OR pftrda OR pftrida OR pftra OR pfta OR pfteda OR pfo4da OR pfo5doda OR pfbs OR pfbus OR pfpes OR pfhxs OR pfhps OR pfos OR pfns OR pfds OR fts OR ftsa OR pfechs OR fosa OR pfosa OR netfosaa OR "Et-PFOSA-AcOH" OR nmefosaa OR "Me-PFOSA-AcOH" OR adona OR "Cl-PFAES" OR "F-53B" OR genx OR "HFPO-TA" OR "Hydro-Eve" OR "Nafion BP2" OR teflon OR tefal OR c8 OR "emerging	08/04/2024	949

	pollutant*" OR organohalogen* OR ptfe OR fluorotelomer*) AND TS=("nitrogen isotope*" OR "stable isotope*" OR "trophic level*" OR "trophic position*" OR tropho* OR "trophic amplification" OR "trophic magnification*" OR "trophic transfer" OR bioamplification* OR biomagnif* OR "biological magnification*" OR "cumulative concentration*" OR "food chain*" OR "food web*" OR TMF OR "magnification factor*") NOT DT=(Review)		
Scopus	TITLE-ABS-KEY (*fluoroalkyl* OR perfluo* OR polyfluo* organofluorine OR pfas OR pfass OR pfba OR pfpea OR pfhxa OR pfhpa OR pfoa OR pfna OR pfda OR pfdea OR pfdca OR pfunda OR pfuna OR pfua OR pfuda OR pfdoa OR pfdoda OR pftrda OR pftrida OR pftra OR pfta OR pfteda OR pfo4da OR pfo5doda OR pfbs OR pfbus OR pfpes OR pfhxs OR pfhps OR pfos OR pfns OR pfds OR fts OR ftsa OR pfechs OR fosa OR pfosa OR netfosaa OR "Et-PFOSA-AcOH" OR nmefosaa OR "Me-PFOSA-AcOH" OR adona OR "Cl-PFAES" OR "F-53B" OR genx OR "HFPO-TA" OR "Hydro-Eve" OR "Nafion BP2" OR teflon OR tefal OR c8 OR "emerging pollutant*" OR organohalogen* OR ptfe OR fluorotelomer*) AND ("trophic level*" OR "trophic position*" OR "trophic amplification" OR "trophic magnification*" OR "trophic transfer" OR bioamplification* OR biomagnif* OR "biological magnification*" OR "magnification factor*" OR TMF) AND (EXCLUDE (DOCTYPE,"re"))	08/04/2024	1543
GreenFile (EBSCO)	(fluoroalkyl OR perfluo* OR polyfluo* OR organofluorine OR pfas OR pfass OR pfba OR pfpea OR pfhxa OR pfhpa OR pfoa OR pfna OR pfda OR pfdea OR pfdca OR pfunda OR pfuna OR pfua OR pfuda OR pfdoa OR pfdoda OR pftrda OR pftrida OR pftra OR pfta OR pfteda OR pfo4da OR pfo5doda OR pfbs OR pfbus OR pfpes OR pfhxs OR pfhps OR pfos OR pfns OR pfds OR fts OR ftsa OR pfechs OR fosa OR pfosa OR netfosaa OR "Et-PFOSA-AcOH" OR nmefosaa OR "Me-PFOSA-AcOH" OR adona OR "Cl-PFAES" OR "F-53B" OR genx OR "HFPO-TA" OR "Hydro-Eve" OR "Nafion BP2" OR teflon OR tefal OR c8 OR "emerging pollutant*" OR organohalogen* OR ptfe OR fluorotelomer*) AND (nitrogen isotope* OR stable isotope* OR trophic level* OR "trophic position*" OR tropho* OR "trophic amplification" OR	08/04/2024	392

	"trophic magnification*" OR "trophic transfer" OR bioamplification* OR biomagnif* OR "biological magnification*" OR "cumulative concentration*" OR "food chain*" OR "food web*" OR "magnification factor*" OR TMF)		
BASE (Bielefeld Academic Search Engine)	(PFAS* OR *fluoroalkyl* OR PFOS OR PFOA) AND (trophic magnification OR tmf OR biomagnification) doctype:(18* 19)	08/04/2024	89
ProQuest - Theses and Dissertations Database	(noft("perfluoroalkyl*") OR noft("polyfluoroalkyl*") OR noft(pfas) OR noft(pfos) noft(pfoa)) AND (noft("biomagnification") OR noft("trophic magnification") OR noft("magnification factor") noft("food web") noft("TMF")) NOT noft(DocumentType:Review)NOT noft(DocumentType:Review)	08/04/2024	313

Supplementary Table 9

Tab. S9. Excluded studies at the full-text screening stage. The table provides detailed information on studies excluded from the meta-analysis following the full-text screening, along with specific reasons for their exclusion.

Title	Year	DOI	Exclusion reason
Per-and poly-fluoroalkyl compounds in freshwater fish from the Rhcircumflex˜ ne River: influence of fish size, diet, prey contamination and biotransformation.	2017	10.1016/j.scitotenv.2017.06.111	The necessary data to calculate TMF and standard error were not provided.
Identification, Tissue Distribution, and Bioaccumulation Potential of Cyclic Perfluorinated Sulfonic Acids Isomers in an Airport Impacted Ecosystem	2016	10.1021/acs.est.6b01980	The necessary data to calculate TMF and standard error were not provided.
Bioaccumulation of Fluorotelomer Sulfonates and Perfluoroalkyl Acids in Marine Organisms Living in Aqueous Film-Forming Foam Impacted Waters	NA	10.1021/acs.est.9b00927	The necessary data to calculate TMF and standard error were not provided.
The driving factors of per- and polyfluorinated alkyl substance (PFAS) accumulation in selected fish species: The influence of position in river continuum, fish feed composition, and pollutant properties	NA	10.1016/j.scitotenv.2021.151662	The necessary data to calculate TMF and standard error were not provided.
Bioaccumulation of emerging organic compounds (perfluoroalkyl substances and halogenated flame retardants) by earthworm in biosolid amended soils	2016	10.1016/j.envres.2016.05.004	The necessary data to calculate TMF and standard error were not provided.
Perfluorinated compounds in aquatic organisms at various	NA	10.1007/s00244-004-0133-x	The necessary data to calculate TMF and

trophic levels in a Great Lakes food chain			standard error were not provided.
Polyfluorinated chemicals in a spatially and temporally integrated food web in the Western Arctic	NA	10.1016/j.chemosphere.2007.06.067	The necessary data to calculate TMF and standard error were not provided.
The impact of precursors on aquatic exposure assessment for PFAS: Insights from bioaccumulation modeling	NA	10.1002/ieam.4414	The necessary data to calculate TMF and standard error were not provided.
A nationwide survey of perfluorinated alkyl substances in waters, sediment and biota collected from aquatic environment in Vietnam: Distributions and bioconcentration profiles	NA	10.1016/j.jhazmat.2016.04.010	The necessary data to calculate TMF and standard error were not provided.
Bioaccumulation and effects of novel chlorinated polyfluorinated ether sulfonate in freshwater alga <i>Scenedesmus obliquuus</i>	2018	10.1016/j.envpol.2017.10.039	The necessary data to calculate TMF and standard error were not provided.
Persistent organic pollutants in lakes of Broknes peninsula at Larsemann Hills area, East Antarctica	NA	10.1007/s10646-019-02045-x	No PFAS.
Perfluorinated Chemicals in Meromictic Lakes on the Northern Coast of Ellesmere Island, High Arctic Canada	2012	NA	The necessary data to calculate TMF and standard error were not provided.
Bioaccumulation and metabolic response of PFAS mixtures in wild-caught freshwater turtles (Emydura macquarii macquarii) using omics-based ecosurveillance techniques	2022	10.1016/j.scitotenv.2021.151264	The necessary data to calculate TMF and standard error were not provided.
Perfluorinated contaminants in sediments and aquatic organisms collected from shallow water and tidal flat areas	NA	10.1021/es0603195	The necessary data to calculate TMF and standard error were not provided.

of the Ariake Sea, Japan: environmental fate of perfluorooctane sulfonate in aquatic ecosystems			
Characterisation of PFASs and Organofluorine in Freshwater Environments : Transfer from water to land via emergent aquatic insects	2020	NA	Duplicate data
Levels, Patterns, and Biomagnification Potential of Perfluoroalkyl Substances in a Terrestrial Food Chain in a Nordic Skiing Area	NA	10.1021/acs.est.9b02533	The necessary data to calculate TMF and standard error were not provided.
Bioaccumulation and biomagnification of perfluoroalkyl acids and precursors in East Greenland polar bears and their ringed seal prey	NA	10.1016/j.envpol.2019.06.035	The necessary data to calculate TMF and standard error were not provided.
Bioaccumulation of Perfluoroalkyl Sulfonamides (FASA)	2024	10.1021/acs.estlett.4c00143	The necessary data to calculate TMF and standard error were not provided.
Persistent organic pollutants in biotic and abiotic components of the Orange-Senqu River basin	2023	NA	The necessary data to calculate TMF and standard error were not provided.
Pollution Characteristics of Perfluorinated Alkyl Substances (PFASs) in Seawater, Sediments, and Biological Samples from Jiaozhou Bay, China	2019	10.13227/j.hjkx.201901104	Full-text not available.
Perfluoroalkyl acids and sulfonamides and dietary, biological and ecological associations in peregrine falcons from the Laurentian Great Lakes Basin, Canada	NA	10.1016/j.envres.2020.110151	Only one species was investigated.

Levels and profiles of perfluorinated alkyl acids in liver tissues of birds with different habitat types and trophic levels from an urbanized coastal region of South Korea	NA	10.1016/j.scitotenv.2021.151263	The necessary data to calculate TMF and standard error were not provided.
Bioaccumulation characteristics of perfluoroalkyl acids (PFAAs) in coastal organisms from the west coast of South Korea	2015	10.1016/j.chemosphere.2014.06.023	The necessary data to calculate TMF and standard error were not provided.
Dietary bioaccumulation of persistent organic pollutants in the common sole <i>Solea solea</i> in the context of global change. Part 2: Sensitivity of juvenile growth and contamination to toxicokinetic parameters uncertainty and environmental conditions variability in estuaries	2020	10.1016/j.ecolmodel.2020.109196	The necessary data to calculate TMF and standard error were not provided.
Perfluoroalkyl acids in various edible Baltic, freshwater, and farmed fish in Finland	2015	10.1016/j.chemosphere.2014.08.077	The necessary data to calculate TMF and standard error were not provided.
Direct evidence of the important role of proteins in bioconcentration and biomagnification of PFASs in benthic organisms based on comparison with OPEs	NA	10.1016/j.scitotenv.2022.161012	The necessary data to calculate TMF and standard error were not provided.
Dietary bioaccumulation of perfluorophosphonates and perfluorophosphinates in juvenile rainbow trout: evidence of metabolism of perfluorophosphinates	NA	10.1021/es204533m	The necessary data to calculate TMF and standard error were not provided.
A food web bioaccumulation model for the accumulation of per- and polyfluoroalkyl	NA	10.1039/d2em00047d	The necessary data to calculate TMF and standard error were not provided.

substances (PFAS) in fish: how important is renal elimination?			
PFAS and Precursor Bioaccumulation in Freshwater Recreational Fish: Implications for Fish Advisories	NA	10.1021/acs.est.2c03734	The necessary data to calculate TMF and standard error were not provided.
Bioaccumulation of perfluoroalkyl carboxylates (PFCAs) and perfluoroalkane sulfonates (PFSAs) by earthworms (<i>Eisenia fetida</i>) in soil	2013	10.1016/j.envpol.2013.04.002	The necessary data to calculate TMF and standard error were not provided.
Bioaccumulation of perfluoroalkyl substances in exploited fish and crustaceans: Spatial trends across two estuarine systems	2018	10.1016/j.marpolbul.2018.04.029	The necessary data to calculate TMF and standard error were not provided.
Per- and polyfluoroalkyl substances (PFAS) in ski products: Environmental contamination, bioaccumulation and effects in rodents	2021	NA	The necessary data to calculate TMF and standard error were not provided.
Nonlethal detection of PFAS bioaccumulation and biomagnification within fishes in an urban- and wastewater-dominant Great Lakes watershed	NA	10.1016/j.envpol.2023.121123	The necessary data to calculate TMF and standard error were not provided.
Environmental fate of poly- and perfluoroalkyl substances (PFAS) in aquatic systems : identification of urban sources and trophic transfer assessment ; Ecodynamique des substances poly- et perfluoroalkylÃ©es (PFAS) dans les systÃ¨mes aquatiques : identification des sources en milieu urbain et Ã©valu...	NA	NA	Duplicate data
Field-Based Distribution and Bioaccumulation Factors for	2022	10.1021/acs.est.2c01965	The necessary data to calculate TMF and

Cyclic and Aliphatic Per- and Polyfluoroalkyl Substances (PFASs) in an Urban Sedentary Waterbird Population			standard error were not provided.
Understanding PFAAs exposure in a generalist seabird species breeding in the vicinity of a fluorochemical plant: Influence of maternal transfer and diet	2021	10.1016/j.envpol.2020.116355	Only one species investigated.
Bioaccumulation of perfluoroalkyl substances in marine echinoderms: Results of laboratory-scale experiments with <i>Holothuria tubulosa</i> Gmelin, 1791	2019	10.1016/j.chemosphere.2018.10.037	The necessary data to calculate TMF and standard error were not provided.
Effect of abiotic factors and environmental concentrations on the bioaccumulation of persistent organic and inorganic compounds to freshwater fish and mussels	NA	10.1016/j.scitotenv.2021.149448	The necessary data to calculate TMF and standard error were not provided.
Distribution of perfluorooctanesulfonate (PFOS) isomers in a Norwegian arctic food web	2021	NA	The necessary data to calculate TMF and standard error were not provided.
Perfluorinated compounds in surface water and organisms from Baiyangdian Lake in North China: source profiles, bioaccumulation and potential risk	NA	10.1007/s00128-012-0745-1	The necessary data to calculate TMF and standard error were not provided.
First insights into per-and polyfluoroalkyl substance contamination in edible fish species of the Indus water system of Pakistan	NA	10.1016/j.chemosphere.2023.140970	The necessary data to calculate TMF and standard error were not provided.
Assessment of metal and organic pollutants in combination with stable isotope analysis in tunas	NA	10.1016/j.marenvres.2024.106432	No PFAS.

from the Gulf of Cadiz (east Atlantic)			
Bioaccumulation and risk assessment of per- and polyfluoroalkyl substances in wild freshwater fish from rivers in the Pearl River Delta region, South China	2014	10.1016/j.ecoenv.2014.05.031	The necessary data to calculate TMF and standard error were not provided.
A survey of perfluorinated compounds in surface water and biota including dolphins from the Ganges River and in other waterbodies in India	NA	10.1016/j.chemosphere.2009.02.055	The necessary data to calculate TMF and standard error were not provided.
The relationship between perfluorinated chemical levels in the feathers and livers of birds from different trophic levels	NA	10.1016/j.scitotenv.2009.07.032	The necessary data to calculate TMF and standard error were not provided.
Tissue distribution and bioaccumulation of legacy and emerging per- and polyfluoroalkyl substances (PFASs) in edible fishes from Taihu Lake, China	2021	10.1016/j.envpol.2020.115887	The necessary data to calculate TMF and standard error were not provided.
Survey of legacy and emerging per- and polyfluorinated alkyl substances in Mediterranean seafood from a North African ecosystem	NA	10.1016/j.envpol.2021.118398	The necessary data to calculate TMF and standard error were not provided. PFAS concentrations pooled in major taxa and not provided at the species level.
Perfluorinated alkyl substances (PFAS) in terrestrial environments in Greenland and Faroe Islands	2015	10.1016/j.chemosphere.2014.11.044	The necessary data to calculate TMF and standard error were not provided.
STUDIO DELLA BIODISTRIBUZIONE DI SOSTANZE BIOLOGICAMENTE ATTIVE IN ORGANISMI ACQUATICI	2022	NA	The necessary data to calculate TMF and standard error were not provided.

Biomagnification and temporal trends (1990-2021) of perfluoroalkyl substances in striped dolphins (Stenella coeruleoalba) from the NW Mediterranean sea	NA	10.1016/j.envpol.2023.122738	The necessary data to calculate TMF and standard error were not provided.
Characterisation of perfluorooctane sulfonate (PFOS) in a terrestrial ecosystem near a fluorochemical plant in Flanders, Belgium	NA	10.1007/s11356-013-2449-4	The necessary data to calculate TMF and standard error were not provided.
The fate of poly- and perfluoroalkyl substances in a marine food web influenced by land-based sources in the Norwegian Arctic	NA	10.1039/d0em00510j	The necessary data to calculate TMF and standard error were not provided.
Enantiospecific perfluorooctane sulfonate (PFOS) analysis reveals evidence for the source contribution of PFOS-precursors to the Lake Ontario foodweb	NA	10.1021/es301160r	The necessary data to calculate TMF and standard error were not provided.
Fractionation of perfluoroalkyl acids (PFAAs) along the aquatic food chain promoted by competitive effects between longer and shorter chain PFAAs	NA	10.1016/j.chemosphere.2023.137931	The necessary data to calculate TMF and standard error were not provided.
Accumulation of per- and polyfluoroalkyl substances (PFAS) in a terrestrial food web	2023	10.1101/2023.12.12.571392	The necessary data to calculate TMF and standard error were not provided.
Transfer of perfluorinated compounds from sediment to benthic invertebrates and fish	2014	NA	The necessary data to calculate TMF and standard error were not provided.
Bioaccumulation of organohalogenated compounds in sharks and rays from the southeastern USA	NA	10.1016/j.envres.2014.12.022	no PFAS.
Dietary accumulation of perfluorinated acids in juvenile	2003	10.1002/etc.5620220125	The necessary data to calculate TMF and

rainbow trout (Oncorhynchus mykiss)			standard error were not provided.
Perfluorinated compounds in the aquatic food chains of two subtropical estuaries	NA	10.1016/j.scitotenv.2019.135047	The necessary data to calculate TMF and standard error were not provided.
Perfluorinated alkyl substances in water, sediment, plankton and fish from Korean rivers and lakes: A nationwide survey	2014	10.1016/j.scitotenv.2014.01.045	The necessary data to calculate TMF and standard error were not provided.
Detection of a Cyclic Perfluorinated Acid, Perfluoroethylcyclohexane Sulfonate, in the Great Lakes of North America	2011	10.1021/es200135c	The necessary data to calculate TMF and standard error were not provided.
Dietary exposure and accumulation of per- and polyfluoroalkyl substances alters growth and reduces body condition of post-metamorphic salamanders	NA	10.1016/j.scitotenv.2020.142730	The necessary data to calculate TMF and standard error were not provided.
Ecosystem specific accumulation of organohalogenated compounds: A comparison between adjacent freshwater and terrestrial avian predators	NA	10.1016/j.envres.2022.113455	The necessary data to calculate TMF and standard error were not provided.
Perfluorinated compounds in the Great Lakes	2006	10.1007/698_5_046	Review.
Identification of long-chain perfluorinated acids in biota from the Canadian Arctic	NA	10.1021/es034727+	The necessary data to calculate TMF and standard error were not provided.
Legacy and emerging organohalogenated contaminants in wild edible aquatic organisms: Implications for bioaccumulation and human exposure	NA	10.1016/j.scitotenv.2017.10.296	The necessary data to calculate TMF and standard error were not provided.
Trophic transfer of PFAS from tomato (Solanum lycopersicum)	2022	10.1016/j.envpol.2022.119814	The necessary data to calculate TMF and

to tobacco hornworm (Manduca sexta) caterpillars			standard error were not provided.
Accumulation of perfluorooctane sulfonate (PFOS) in the food chain of the Western Scheldt estuary: Comparing field measurements with kinetic modeling	NA	10.1016/j.chemosphere.2007.08.038	The necessary data to calculate TMF and standard error were not provided.
Perfluoroalkyl substances in freshwater and marine fish from northern Vietnam: Accumulation levels, profiles, and implications for human consumption	2022	10.1016/j.marpolbul.2022.113995	The necessary data to calculate TMF and standard error were not provided.
Perfluoroalkyl substances in the surface water and fishes in Chaohu Lake, China	NA	10.1007/s11356-022-20753-6	The necessary data to calculate TMF and standard error were not provided.
Elevated levels of per- and polyfluoroalkyl substances (PFAS) in freshwater benthic macroinvertebrates from the Hudson River Watershed	2022	10.1016/j.chemosphere.2021.132830	The necessary data to calculate TMF and standard error were not provided.
Spatial (bio)accumulation of pharmaceuticals, illicit drugs, plasticisers, perfluorinated compounds and metabolites in river sediment, aquatic plants and benthic organisms	NA	10.1016/j.envpol.2017.11.090	The necessary data to calculate TMF and standard error were not provided.
Perfluorinated compounds: levels, trophic web enrichments and human dietary intakes in transitional water ecosystems	NA	10.1016/j.marpolbul.2013.09.014	The necessary data to calculate TMF and standard error were not provided.
Targeted PFAS analyses and extractable organofluorine â€“ Enhancing our understanding of the presence of unknown PFAS in Norwegian wildlife	2023	10.1016/j.envint.2022.107640	The necessary data to calculate TMF and standard error were not provided.
Investigation of levels of perfluoroalkyl substances in freshwater fishes collected in a	2022	10.1007/s11356-021-17236-5	The necessary data to calculate TMF and

contaminated area of Veneto Region, Italy			standard error were not provided.
Point source characterization of per- And polyfluoroalkyl substances (PFASs) and extractable organofluorine (EOF) in freshwater and aquatic invertebrates	2019	10.1039/c9em00281b	The necessary data to calculate TMF and standard error were not provided.
Diet and metabolic state are the main factors determining concentrations of perfluoroalkyl substances in female polar bears from Svalbard	NA	10.1016/j.envpol.2017.04.100	Only one species investigated
Perfluoroalkyl acids in marine organisms from lake Shihwa, Korea	2009	10.1007/s00244-008-9282-7	The necessary data to calculate TMF and standard error were not provided.
Fate of perfluoroalkyl substances within a small stream food web affected by sewage effluent	NA	10.1016/j.watres.2018.01.066	The necessary data to calculate TMF and standard error were not provided.

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