‘Forever chemicals’ poisoning Europe’s waters and fish

The tip of the PFAS iceberg: contaminated fish, harmed ecosystems, and the urgent need for regulation

EEB
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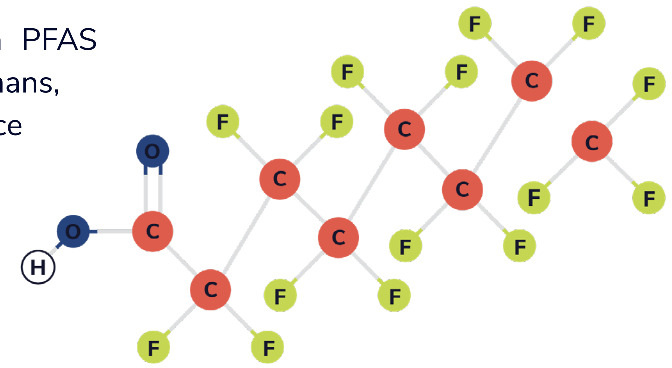
ACRONYMS

EEA	European Environment Agency
EFSA	European Food Safety Agency
EQS	Environmental Quality Standard
EQSD	Environmental Quality Standards Directive
LOQ	Limit of Quantification
MS	Member State
PFAS	Per- and Polyfluoroalkyl substance
PFAS-4	PFOA, PFOS, PFNA, PFHxS
PoM	Programme of Measures
RPF	Relative Potency Factor
UPBT	Ubiquitous, Persistent, Bioaccumulative, Toxic
UWWTD	Urban Wastewater Treatment Directive
WFD	Water Framework Directive
WW	Wet weight

SUMMARY

Healthy freshwater and coastal ecosystems are fundamental for life on our planet. But widespread chemical pollution threatens coastal and freshwater biodiversity and poses a severe risk for human health via fish and seafood consumption. PFAS (per- and polyfluoroalkyl substances), characterised by their persistence and mobility, are an emblematic example of the extent to which the natural environment has been contaminated by synthetic and harmful substances.

The European Environment Agency (EEA) reports that only 30% of EU surface waters are in good chemical status. However, that does not reveal the full extent of water pollution as chemical status is only assessed against a limited and outdated list of 45 so-called "priority substances", a small sub-set of the pollutants present in the environment.



Perfluoro-octanoic sulfonic acid (PFOS), a PFAS identified as possibly carcinogenic to humans, has been listed as a priority substance since 2013, with associated quality standards for water and biota (fish). However, Member States were granted until 2027 to comply with the new standards.

In 2022, the European Commission proposed to update the list of priority substances, including adding a group of 24 PFAS, with a health-based group threshold for surface and groundwater, as well as for biota. This would be a major step forward in the monitoring and regulation of PFAS in European waters. However, close to three years later, these new water quality standards have still not been adopted by the EU institutions, slowing down their implementation. Additionally, Member States again want to grant themselves decades more to act and comply with the new quality standards.

Meanwhile, new EEA data show that by now, more than half of European rivers, and up to 100% of coastal waters exceed the annual average water quality standard for PFOS. This policy briefing assesses the monitoring data of PFOS in fish, reported by Austria, France, Germany, Italy, Poland, Spain, and Sweden between 2009 and 2023. The reported data was compared to the existing and proposed new quality standards for biota (fish).

MAIN FINDINGS:

- The existing EU safety limit for PFOS in fish (9,1 µg/kg ww) was exceeded in 40% of cases in Sweden and Austria, 32% of cases in France, nearly 25% of cases in Spain, and 22% of cases in Germany;

- All reported PFOS concentrations (when a quantification was possible) surpassed the proposed new safety thresholds for fish (77 ng/kg ww, expressed as PFOA equivalents);
- 24% of reported values in Sweden, 19% in France, 17% in Austria and 15% in Spain exceed proposed new safety limits by 500 times or more.

These numbers are only based on the monitoring of PFOS. The results would likely be even more concerning if the 24 PFAS proposed by the Commission were assessed. An accurate comparison of the extent of PFOS pollution between the assessed countries is not possible due to significant disparities in monitoring, analytical and reporting approaches, yet the results reveal a tremendous extent of PFOS contamination of fish across the EU.

Swift action to limit further emissions of PFAS to the environment is urgently needed to protect aquatic life and human health from the adverse effects of chemical pollution. Therefore, the new quality standards for PFAS must be adopted swiftly and be accompanied by a requirement on Member States to include measures to curb pollution in the next River Basin Management Plans (RBMPs), covering the years 2028 to 2033.

RECOMMENDATIONS:

1. European Commission: Swiftly adopt a broad EU-wide PFAS restriction with as few exemptions as possible to close the tap of ongoing PFAS pollution.

2. EU institutions: Ensure that Member States are required to make public and report monitoring data of chemicals in freshwater to the EEA on a yearly basis to provide policymakers and the public with an up-to-date picture of water pollution in the EU.

3. European Environment Agency: Produce an EU-wide assessment of PFAS contamination of coastal and freshwater fish.

4. EU institutions: Ensure rapid adoption of updated Environmental Quality Standards for PFAS in coastal and freshwater, based on the latest scientific findings on their effect on human health and wildlife, and require that Member States start monitoring within 6 months of adoption.

5. EU institutions: Ensure that Member States are obliged to include measures to curb PFAS pollution of surface and groundwater in the 4th River Basin Management Plans (2028-2033), with aim to comply with the new quality standards by end of 2033. After that, exemptions from compliance should only be granted if justified under strict conditions.

6. EU institutions: Ensure that Member States make full use of the economic instruments provided by the WFD (and the revised UWWTD) to incentivize measures to curb pollution at source and to ensure polluters pay for the remediation, treatment and monitoring costs related to PFAS pollution.

1.1 Why is PFAS pollution of water and fish problematic?

PFAS are a wide family of chemicals, characterised by their carbon – fluorine bond, one of the strongest chemical bonds there is in organic chemistry. This chemical group could be as large as 10,000 substances. Due to the strength of the chemical bond, PFAS chemicals are persistent in the environment, and some can also be mobile. Additionally, several PFAS substances bioaccumulate, are transported over long distances and have (eco)toxicological effects. It is already suggested that **PFAS exceed the planetary boundary** as detected levels in the environment, including rain, exceed health advisories and have already contaminated the environment irreversibly.[1]

The large number of PFAS used for professional and consumer application results in high emissions into the environment during production, use and end-of-life. The Nordic Council of Ministers estimates that around 100,000 sites across Europe are potentially emitting PFAS chemicals[2] and a cross-European journalistic investigation identified more than 2,100 sites in Europe as PFAS hotspots – places where contamination reaches levels considered to be hazardous to the health of exposed people[3]. In 2020, the estimated production volumes of PFAS in the EU ranged between 120,000 and 400,000 tonnes per year. However, **almost 1 million tons of PFAS is estimated to be used and placed on the market yearly, with a growing trend.**[4]

People in Europe are already exposed to too much PFAS. An assessment by the European Food Safety Authority (EFSA), based on food sample analyses from 16 EU Member States, including drinking water, revealed that exposure levels for adults to four PFAS that accumulate in the body (PFOA, PFNA, PFHxS and PFOS; together referred to as PFAS-4), even when looking at conservative values, is up to **five times the recommended maximum weekly intake**.[5] For children and infants, the exposure is even higher.

PFAS exposure is linked to a range of negative impacts on human health, from development disabilities to cancer generation, liver damage, thyroid disease, obesity and reproduction impairments. Due to the endocrine-disrupting properties of some PFAS, it is not possible to establish safe limits at which harmful effects can be ruled out: any level can cause harm.

[1] Cousins et al. Environ. Sci. Technol. 2022, 56, 16, 11172–11179 https://doi.org/10.1021/acs.est.2c02765
[2] Nordic Council of Ministers (2019) The cost of inaction https://www.norden.org/en/publication/cost-inaction-0
[3] Le Monde, (2023): The Forever Pollution Project. Journalists tracking PFAS across Europe. https://foreverpollution.eu/ (18/08/2023)
[4] ECHA (2023): ANNEX XV RESTRICTION REPORT – Per- and polyfluoroalkyl substances (PFASs)
[5] EFSA, (2020), Risk to human health related to the presence of perfluoroalkyl substances in food https://doi.org/10.2903/j.efsa.2020.6223

The main human uptake route of PFAS is through food and drink consumption. Fish and seafood have proven to be a particularly important source. According to the German Federal Institute for Risk Assessment, **fish consumption can account for almost 90% of the total dietary PFOS exposure**, based on the most commonly detected PFAS[6].

Water resources are especially vulnerable to PFAS pollution as many chemicals of this group have high water solubility and high persistency combined. Therefore, limiting further PFAS pollution of water is key to limit human exposure via both fish and seafood intake, as well as via drinking water, while protecting biodiversity and economic sectors that rely on these resources.

METHODOLOGY

Monitoring data of PFOS in fish was assessed from seven EU Member States: Austria, France, Germany, Italy, Poland, Spain and Sweden.

Data was retrieved from the WISE 6 - 2023 database[7] for those countries where data was available (Italy, Poland, Austria). For the remaining countries, monitoring data was requested from the national authorities (Spain, Germany) or obtained from public national databases (France, Sweden).

Information about sources for the PFOS contamination was sought from national databases where available (Sweden), as well as from other sources, including the Forever Pollution Project[8].

More details on the methodologies are available in Annex 2. The full set of data is available via this link.

[6] https://www.bfr.bund.de/cm/349/pfas-in-food-bfr-confirms-critical-exposure-to-industrial-chemicals.pdf
[7] https://www.eea.europa.eu/en/datahub/datahubitem-view/fbf3717c-cd7b-4785-933a-d0cf510542e1
[8] https://foreverpollution.eu/

1.2 PFAS quality standards for fish in the EU

2013 / The main EU water protection law, the Water Framework Directive (2000/60/EC, WFD), has regulated PFOS as a priority substance for surface water since 2013. This means that Member States must monitor its presence in water and biota and make sure that the associated legal environmental quality standards, set in the Environmental Quality Standards Directive (2008/105/EC, EQSD), are not surpassed. **The current Environmental Quality Standard (EQS) for PFOS in biota is 9.1 µg/kg wet weight (ww)**. This EQS is based on the 2008 guidelines from the EFSA on the lowest no-observed-adverse-effect level for PFOS (0.03 mg/kg of body weight). However, since then, EU guidelines on PFAS exposure have been revised down several orders of magnitude.

2020 / In 2020, the EFSA presented updated guidelines on PFAS exposure, which sets a maximum quantity of four PFAS that accumulate in the body (PFOA, PFOS, PFNA, PFHxS) that people can ingest via food and drink without expected negative health impact. The threshold of the Tolerable Weekly Intake (TWI) was set to **4.4 ng per kilogram of body weight** and follows the EFSA's guidance for assessing combined exposure to multiple chemicals.

2022 / In October 2022, the European Commission proposed an update to the lists of priority substances and their associated quality standards, including an updated biota standard of **77 ng/kg ww** for the sum of 24 PFAS (including PFOS) expressed as PFOA-equivalents. This means that each of the 24 PFAS should be analysed separately and their concentration compared to the potency of PFOA. The Relative Potency Factor (RPF) of PFOS is established at 2, meaning PFOS is estimated to be twice as potent as PFOA when considering exposure for humans and wildlife. The proposed new biota EQS is based on the 2020 EFSA guidelines and the assumption that 20% of PFAS intake comes from fish consumption. It is more than 236 times lower than the existing biota EQS for PFOS.

'Acceptable' pollution levels in fish placed on the EU market for human consumption are regulated in the EU Foodstuff Regulation (Regulation 2023/915/EU). In 2022, this regulation was updated, setting a maximum level for the sum of PFOS, PFOA, PFNA and PFHxS in fish muscle at **2 µg/kg ww**. For some fish species, and when not intended for consumption by young children and infants, higher thresholds (**8**[9] and **45**[10] **µg/kg ww**) are allowed. Those higher values would allow the consumption of only 39g and 7g of fish per week respectively to not exceed the EFSA TWI guidelines.

[9] Baltic herring, bonito, burbot, European sprat, flounder, grey mullet, horse mackerel, pike, plaice, sardine and pilchard, seabass, sea catfish, sea lamprey, tench, vendace, silverly lightfish, wild salmon and trout and wolf fish
[10] Anchovy, babel, bream, char, eel, pike-perch, perch, roach, smelt and some species of whitefish

1.3 EU monitoring, reporting and compliance requirements

Following the adoption of PFOS as a priority substance in 2013, **Member States had to establish a monitoring programme and a preliminary Programme of Measures (PoM) by 22 December 2018**. A final Programme of Measures should have been established by 22 December 2021, then implemented and made fully operational as soon as possible after that date, and no later than 22 December 2024. That means that **Member States were granted more than ten years to implement measures to limit water pollution from PFOS**.

Member States are obliged to report chemical status to the EEA every six years. The European Commission has proposed (as part of the ongoing update of priority substances) that Member States should report monitoring data and the corresponding status every year, in order to provide a more up-to-date picture of chemical water pollution in the EU.

Member States have until December 2027 to **comply with the EQS** for the priority substances added in 2013. As a result, some Member States still only assess chemical status against the original list of priority substances dating from when the EQSD was adopted in 2008. Additionally, Member States can apply exemptions under certain conditions, including delaying compliance with the PFOS EQS for up to two RBMPs, i.e. until 2039.

Priority substances with a biota EQS must be monitored at least once a year. However, other intervals can be justified based on 'technical knowledge and expert judgment' (EQSD, Art. 3.4). PFOS is also among the substances that Member States may monitor **less intensely** as long as "the monitoring is representative and a statistically robust baseline is available" (EQSD, Art. 8a.2). The European Commission has proposed that substances behaving like ubiquitous PBTs, including the proposed new group of 24 PFAS, may be monitored less intensively (as a guidance, every three years).

As PFOS is among the substances that tend to accumulate in sediment and/or biota, Member States must also carry out **long-term trend analysis** (EQSD, Art. 3.6) and take measures to ensure that concentrations "do not significantly increase in sediment and/or relevant biota". Monitoring for long-term trend analysis should take place every three years, unless technical knowledge and expert judgment justify another interval.

RESULTS 2

PFOS contamination in European fish

2.1 Data availability and accessibility

Member States are currently only requested to report PFOS monitoring data to the EEA (WISE SoE database) on a voluntary basis. At the time of request (2024), no data or very few entries were found in the WISE database from France, Germany, Spain and Sweden. Data from those countries therefore had to be sought at national level. France and Sweden offer public databases from which data can be downloaded. Data from Spain and Germany was requested from the authorities who demonstrated very different willingness to make them available. In Spain the authorities readily provided the requested data, while **German authorities took five months to provide the data upon request**.

In the WISE 6 database, Member States report results using the "eu monitoring site code" nomenclature, a number that can be matched with precise locations. The file containing the correspondence between the code and the location name must be available publicly on the EEA platform, but some Member States, like Germany, it is not centralised in the same page and trickier to access them. Besides, some locations linked to the eu monitoring site codes are too wide (as in Poland) restraining the public ability to get the precise locations of contaminated sites.

2.2 Reported data

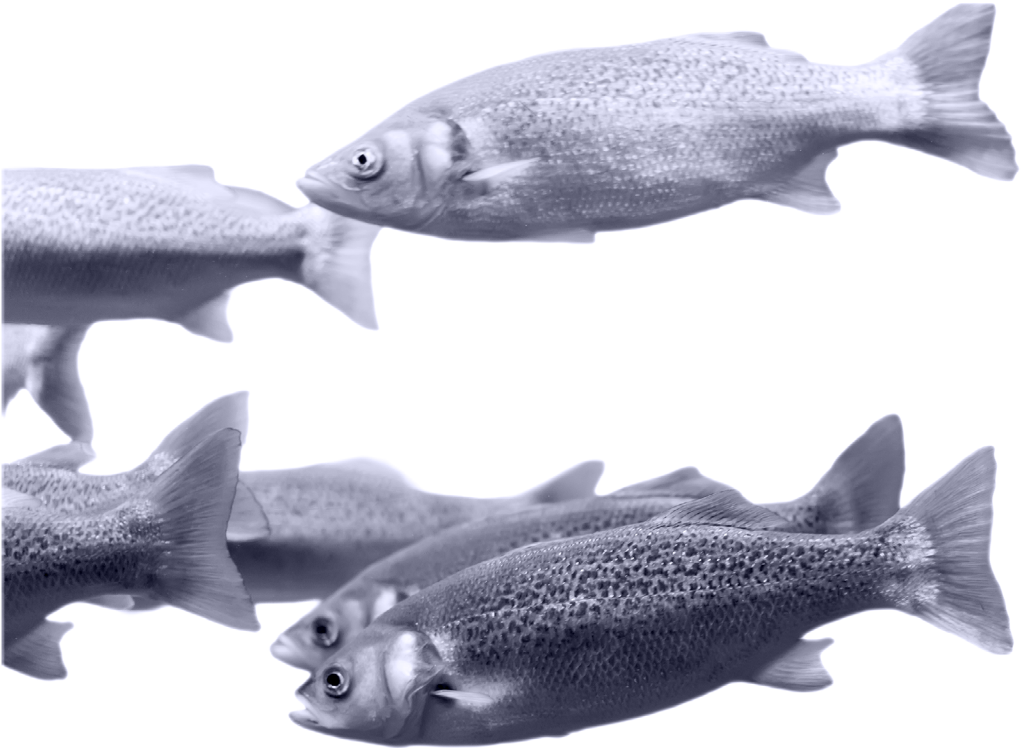
The sampling timeframe varies greatly among Member States. Some Member States reported PFOS data already before they were obliged to put in place a monitoring program in 2018. This includes Sweden that has reported PFOS biota monitoring from 2009 and Austria that has reported data on PFOS in biota since 2013. Other Member States, like Germany, Italy and Poland reported biota monitoring after they were required to put in place a (supplementary) monitoring program for PFOS.

The number of reported values range from 68 in France to 542 in Germany. However, what a reported value represents varies between countries. In Poland, each reported value represents a site, while in Germany and Italy for example, several results from different fish species are reported for some sites at the same date. In Sweden, for some locations, an average value is provided for a timeframe of several years. Additionally, the differences in number of reported values can be due to the number of years covered as well as the number of surface water bodies in each country but also indicate differences in monitoring efforts among Member States.

Some Member States report monitoring sites that aren't sampled and therefore no results are advertised. For instance, Poland reported a total of 296 monitoring sites for PFOS in fish, but only 216 sites actually display values, meaning that more than 27% of the entries are missing. On the other hand, it is very difficult to access information on the number of sites each MS committed to assess. This information should be available in the dataset to ensure that the monitoring is conducted and reported comprehensively.

Country	Sampling timeframe	Number of reported values	Samples exceeding 2013 EQS for PFOS (%)	Samples exceeding proposed new EQS for PFAS-24 (%)
Sweden[11]	2009 - 2020	134	40	100
Austria	2013 - 2022	135	38	100
France	2017 - 2020	68	32	100
Spain	2015 - 2023	379	25	60
Germany	2019 - 2023	542	22	92
Italy	2019 - 2022	248	9.3	100
Poland	2022	215	3.3	100

Table 1: Overview of the reported data and proportion of values exceeding existing and proposed new environmental quality standards for PFAS in biota (9.1 µg/kg ww and 77 ng/kg ww)



[11] Sweden has also reported samples taken in fish liver tissues, with a threshold of 140 µg/kg. Those data have been excluded from the analysis as they weren't converted to be compared to the biota EQS of 9.1 µg/kg.

2.3 Widespread PFOS contamination decades after its ban

The share of cases where the existing biota EQS for PFOS is exceeded varies greatly among Member States. **The 2013 EQS is exceeded in around 40% of the cases in Sweden and Austria, 32% of the cases in France, nearly 25% of cases in Spain, and 22% of the cases in Germany,** while it is exceeded in less than 10% of cases in Italy and Poland. This is broadly consistent with a recent EEA compilation that showed that between 2018 and 2022, over half of rivers, up to a third of lakes and up to 100% of transitional and coastal waters exceeded the annual average Environmental Quality Standards for PFOS (in the water matrix).[12]

However, the existing PFOS EQS is both outdated and too restrictive, as it only concerns one PFAS and is not based on the latest EFSA guidelines on adverse effects of PFAS, and so does not reflect the real extent of the risk.

To get a clearer and fuller sense of the situation, the reported PFOS levels in fish were compared to **the proposed new biota threshold of 77ng/kg (expressed as PFOA equivalents). This paints a very different picture, as in most of the assessed countries, 100% of the reported concentrations exceed this threshold that is based on the latest health advisories from the EFSA.**

These blank exceedances hide some disparities, as well as some extremely high exceedances of the threshold:

- All reported PFOS concentrations (when a quantification was possible) surpassed the proposed new safety thresholds for fish (77 ng/kg ww, expressed as PFOA equivalents);
- 24% of reported values in Sweden, 19% in France, 17% in Austria and 15% in Spain exceed proposed new safety limits by 500 times or more.
- The highest reported values of PFOS in fish from Sweden (Frommestabäcken, 750 µg/kg), Germany (Hitzelbach, Rheinland, 720 µg/kg) and Spain (Camargo 612 µg/kg and Amoroto 473 µg/kg) exceed the new standard between 12,300 and 19,500 times.

Similarly high exceedances have been identified in England, where reported levels of PFOS in freshwater fish are on average 322 times higher than the proposed new EQS for biota.[13]

While the numbers observed in this briefing are concerning, they are only based on reported values of PFOS and are therefore on the conservative end as the proposed new PFAS EQS should be assessed against 24 PFAS.

[12] EEA, 2024, PFAS pollution in European waters https://www.eea.europa.eu/en/analysis/publications/pfas-pollution-in-european-waters
[13] https://www.wcl.org.uk/action-on-forever-chemicals-to-prevent-a-forever-problem.asp

In FRANCE, three main sites have been identified: the Rhône Valley close to Lyon and its infamous “Valley of chemistry” with industries like Arkema and other PFAS producers; in Marignane, a city hosting Marseille airport as well as PFAS manufacturing facilities; and the River Le Touyre in the Pyrénées, a region with textile industries[16] and facilities for the treatment and disposal of hazardous waste.

In SPAIN, two main locations have been identified as greatly contaminated to PFOS: Cantabria and the Basque Country in the north, and Valencia on the east coast. A PFAS manufacturing facility is located in the Cantabria region.[14] Water, sediments and biota samples from the Jucar River, south of Valencia, taken by scientists in 2016[15] showed high PFAS (not only PFOS) concentrations, related to urban and industrial (car factories) discharges. Other hotspots of contamination are located in the National Park of the Ruidera Laguna, close by several waste management sites.

In ITALY, the reported hotspots are primarily located in a triangle delimited by Bolzano (Trentino-Alto Adige), Venice (Veneto) and Bologna (Emilia-Romagna). The industrial plant of the Miteni Company producing PFAS since 1968 released untreated water into the environment[17], a contamination for which 11 former executives of the company have been sentenced to jail and forced to pay financial compensation[18]. The Bolzano region is rich in electrometallurgical and engineering industries and manufacturers of vehicles and textiles. The Bologna region is known for its intensive agriculture and engineering industries.

In GERMANY, hotspots are located in the Rheinland. The Ruhr Valley is known as a hub for big industries and PFAS production facilities. In addition, contamination has been identified close to US Army bases (Hahn, Spangdahlem). Other states such as Niedersachsen show contamination close to airports (Ems, Nienburg). Samples taken close to Lake Constance (Bodensee), at the border with Switzerland and Austria, also display high level of PFOS, consistent with what has been reported from Austria.

HOTSPOTS OF PFOS CONCENTRATION IN FISH

Hotspots represent the highest 5% of reported PFOS concentration in fish per country. Values are expressed as exceedance relative to the proposed new EQS of 77ng/kg of fresh weight (expressed as PFOA equivalents). The data cover the sampling period from 2009 to 2023.

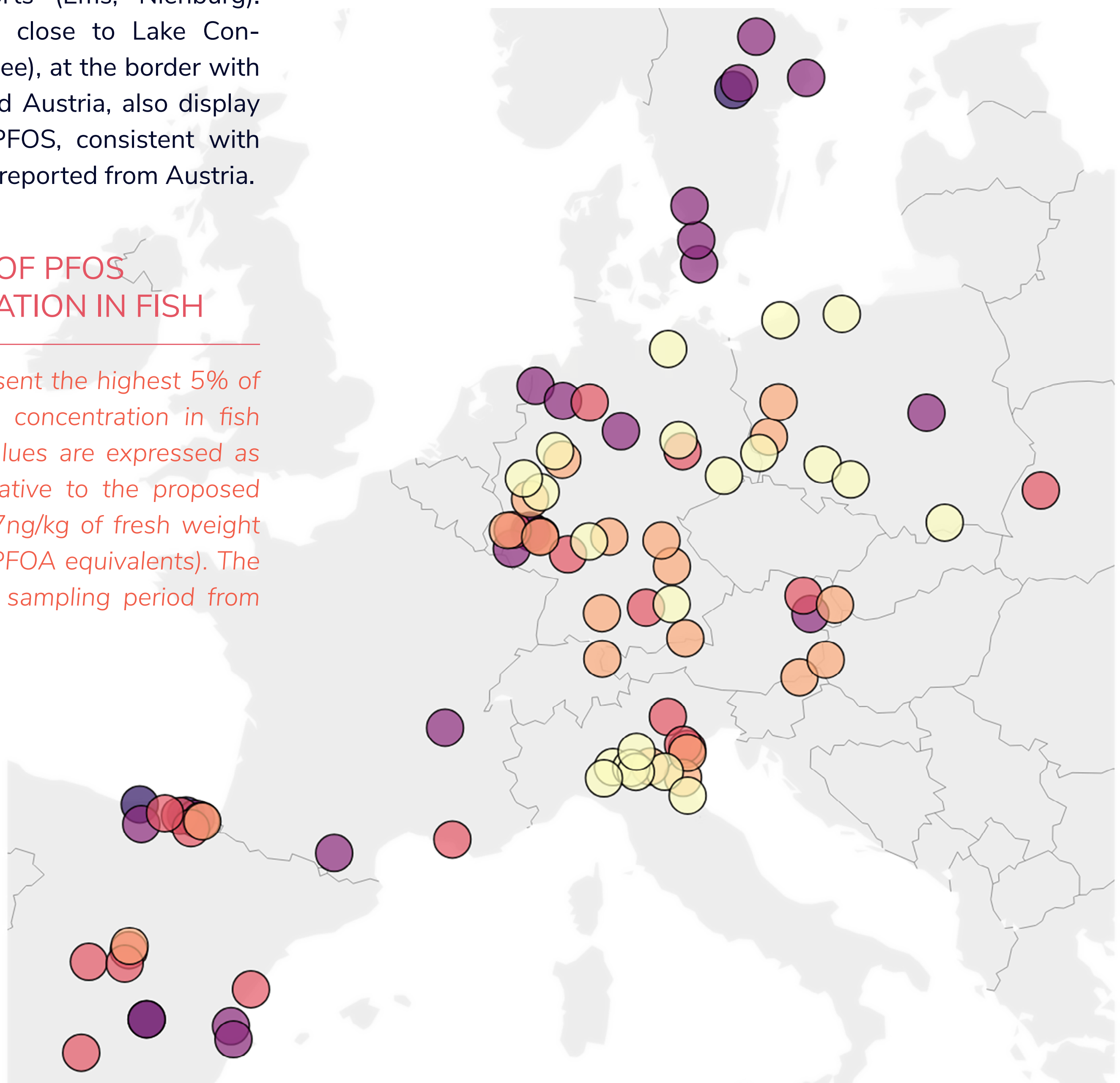
[16] https://www.eea.europa.eu/en/analysis/publications/pfas-in-textiles-in-europes-circular-economy
[14] https://foreverpollution.eu/maps-and-data/maps/
[15] https://pubmed.ncbi.nlm.nih.gov/26974364/
[17] https://www.mase.gov.it/sites/default/files/archivio/allegati/reach/progettoPFAS_ottobre2013.pdf
[18] https://www.renewablematter.eu/en/miteni-pfas-trial-historic-ruling-condemns-11-former-executives

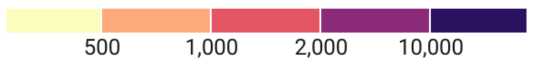
In SWEDEN, most of the hotspots are located in the south of the country, such as Frommestabäcken, but also Ybbarpsån (290 and 85 µg/kg), Fjällfotasjön (202 µg/kg), Hjälmaren (167 µg/kg) and Skärån (109 µg/kg). Some sites, like Skurup airport (fire training site) and Perstorp industrial area have contaminated several water bodies. What is particularly concerning is that several of the hotspots are in protected areas, including Natura 2000 sites like Herrevadkloster, Ålsjön and Söderåsen, but also fishing waters like Mellanfärden in lake Hjälmaren.

In POLAND, several locations show fish contamination by PFOS, but the highest value is observed in Jeziórka, close to the capital city Warsaw. The second highest value is observed at the border with Slovakia, close to Krakow, where a PFAS manufacturing facility is located.

In AUSTRIA, the city of Absdorf, not far from Vienna, on the east side of the country, is the most contaminated location. Other contaminated sites are observed in the eastern part of the country, namely on the Dornbirner Ach River (in Lauterach) directly upstream from Lake Constance (Bodensee). The town of Hainburg an der Donau, located on the Danube River close to the border with Slovakia also showed high levels of fish contamination by PFOS.

To summarise, the main hotspots of contamination are typically located close to airports, army bases, industrial hubs, waste management sites (both non-hazardous and hazardous) and PFAS manufacturing facilities. However, some of the highest reported values are sampled in protected areas. This is of particular concern as Natura 2000 sites are designated for the protection of Europe’s most precious and threatened species and ecosystems. Such contamination not only risks Europe’s conservation objectives and credentials but also poses a direct threat to the ecological integrity of protected habitats.





Map 1: Concentrations hotspots of PFOS in fish in the 7 analysed Member States - Link

3 DISCUSSION

3.1 What does the data say?

Due to the different methodologies and monitoring approached between Member States, it is difficult to compare the results between countries.

Discrepancies include:

- **Design of monitoring programs:** Some countries might have concentrated monitoring around known contaminated sites. As an example, in the case of Sweden, several of the highest reported values were around the same contaminated site (see Annex 4). However, it was outside of the scope of this report to assess how the monitoring programs are designed.
- **Fish matrix and species:** PFOS accumulate differently depending on the tissue, the size and type of fish. Liver samples, that for example have been taken in Germany, might generate higher values. In addition, an adequate assessment should cover different trophic levels in the food web and therefore samples should be taken in different fish, which was hard to assess granted the limited information.
- **Water bodies:** Most countries report samples from a range of different water bodies (coastal, rivers, lakes and/or transitional waters). But for example, France sampled biota only in rivers, which significantly restricts the scope of assessment of contamination.
- **Analytical methods and Limit of Quantification (LOQ)[19]:** Some countries have only reported values that can be quantified (i.e. above the LOQ). Other countries have reported values below LOQ, but with different approaches. Spain has reported values below LOQ as zero, and Germany has reported them as "< LOQ value". This impacts the rate of exceedance of the new threshold: Spain and Germany show lower rates of exceedance as the calculation was made on all entries, even those advertising values under the LOQ (= full dataset).

  The choice of analytical method, and hence the LOQ also impacts the reported values. A more sensitive analytical method (thus lower LOQ) results in more samples being quantified. On the contrary, in Spain, the LOQ is sometimes 10 µg/kg, which is higher than the EQS of 9.1 µg/kg meaning that some exceedances will not be reported.

  Additionally, considering the fact that the new proposed EQS is much lower than the existing one (in the order of ng/kg instead of µg/kg) means that a value reported as zero or under LOQ could have been above the new EQS[20].

[19] The limit of quantification (LOQ) is the lowest analyte concentration that can be quantitatively detected with a stated accuracy and precision.
[20] As an example, a concentration of 1 µg PFOS/kg equals 2,000 ng/kg expressed as PFOA-equivalents, which is much above 77ng/kg.

Not all Member States reported which species or fish tissue they sampled, which analytical method was used or if some concentrations couldn't be assessed because being under the LOQ.

Nonetheless, and despite those inconsistencies and discrepancies, we can still see the tremendous extent of PFOS contamination of fish across Member States, despite PFOS having been banned since 2009.

In fact, the results are likely underestimated as they are only based on the monitoring of one PFAS. This points to the urgent need to expand the number of PFAS regulated under EU water law. The Commission's proposal includes the four PFAS identified by the EFSA to be among the most problematic if it's present in food for human consumption, including PFNA, a PBT substance recognised as being chronically toxic for several organs, suspected of being carcinogenic, probably reprotoxic and transmissible via maternal milk.[21]

3.2 What are the risks if we don't act?

IMPACTS ON BIODIVERSITY

Freshwater species are among the most threatened by biodiversity loss. The decades since 1970 have seen an 84% collapse in freshwater species populations due to habitat loss and pollution.[22] Scientists and conservation organisations list pollution reduction among the key priorities to halt freshwater biodiversity loss.[23]

PFAS is linked to a wide range of negative impacts on aquatic organisms, including reproduction, metabolism, development impairments and even death.[24 25] As some fish species migrate widely, between seas, oceans and rivers and over thousands of kilometres, they can transmit genetic impairments and accumulated PFAS to semi-aquatic and terrestrial species that feed on them over large distances.

Long-chain PFAS, such as PFOS, can bioaccumulate and biomagnify in aquatic organisms, and spread further in the food web. Analysis of **otters in Sweden detected PFOS levels between 15 and 13,400 ng/g ww** between 2010 and 2020, with no decreasing trend over the last decade.[26] The effects on the otters are unclear but the results indicate the high and persistent presence of PFAS in the environment.

[21] https://pfaswaterexperts.org/pfna-perfluorononanoic-acid-health-risks-legal-response/
[22] WWF, (2020), 84% collapse in Freshwater species populations since 1970
[23] Tickner et al., (2020) Bending the Curve of Global Freshwater Biodiversity Loss: An Emergency Recovery Plan, BioScience, Vol. 70:4, pp. 330–342, https://doi.org/10.1093/biosci/biaa002
[24] https://pubmed.ncbi.nlm.nih.gov/37368643
[25] https://www.frontiersin.org/journals/environmental-science/articles/10.3389/fenvs.2023.1101100/full
[26] Roos et a. Miljögifter i utter från Sverige, https://www.diva-portal.org/smash/get/diva2:1825146/FULLTEXT01.pdf

IMPACTS ON HUMAN HEALTH

Many countries have established recommendations for fish consumption as part of their national dietary recommendations, based on its content of omega-3 fatty acids that are crucial for brain activity and development and cardiovascular protection (although these are of course also available in many plant-based foods), as well as being a source of protein and micronutrients.

However, PFAS pollution risks the attainment of these recommendations. **For example, a person of 70kg consuming 154g of fish (roughly one portion) per week containing 2 µg/kg ww of PFOS, PFOA, PFNA and PFHxS, limit set by the EU foodstuff regulation, exceed the EFSA recommendations on PFAS intake.**[27] Many countries, including France, Italy, Poland, Spain and Sweden, recommend eating one serving of fish at least twice per week (see Annex 5).

Unfortunately, there are already instances where PFAS concentrations greatly restrict intake.

- A recent study showed that **consuming just 16g of fish from the lower Elbe per week** would reach recommended maximum intake of PFAS-4.[28]
- The massive contamination from the 3M factory in Antwerp, Belgium, has resulted in high levels of PFAS in fish from the **Western Scheldt**. The Dutch authorities have issued recommendations to limit intake of fish and seafood from the area,[29] for example: **flounder can be eaten at most twice a year, sea bass one to six times a year, while a portion of shrimp can be eaten five to six times in a year.**
- An assessment of foodstuffs in Denmark, France, Germany and the Netherlands found that **69% of fish sampled contained at least one of the PFAS-4** from the EFSA opinion and **some samples had up to 35.78 µg/kg of PFAS-4**.[30]

Some regions rely particularly heavily on fish consumption and will therefore be more vulnerable to contamination. Spain is the second-largest consumer of fish and seafood per capita in Europe, after Portugal, with 43kg consumer per capita each year. However, contamination poses a threat to all individuals and communities relying on fish for their livelihood in terms of physical and economic health, including indigenous communities. The Sámi, Europe's last remaining and increasingly threatened indigenous community, ancestrally and culturally rely on fish to sustain their livelihoods.

[27] https://www.sciencedirect.com/science/article/pii/S0160412024004306#b0310
[28] Semerád et al., (2022), The driving factors of per- and polyfluorinated alkyl substance (PFAS) accumulation in selected fish species, Sci Total Environ. 816:151662. DOI: 10.1016/j.scitotenv.2021.151662
[29] RIVM, 2022, Consumption of products contaminated with PFAS from the Western Scheldt, https://www.rivm.nl/publicaties/consumptie-van-producten-verontreinigd-met-pfas-uit-westerschelde
[30] https://www.generations-futures.fr/publications/pfas-alimentation/

3.DISCUSSION

ECONOMIC IMPACTS

PFAS pollution has also started harming fisherfolk. Following the serious pollution of the Western Scheldt from the 3M factory in Antwerp, concentrations in fish and seafood have been found to exceed standards set by the Dutch National Institute for Public Health and the Environment by 800 times.[31] Following this, the Dutch Fishermen's Association called on its members to stop fishing in the eastern part of the Western Scheldt, which has caused the sector economic damage. The Dutch Fishermen's Association is now taking 3M to court in hope to get financial compensation.[32]

Fish exports within and outside the EU is an important economic sector. Intra-EU exchanges amounted to 6 million tonnes and EUR 31,5 billion in 2022, growing by 17% in value; while extra-EU exports reached EUR 8 billion, a 19% increase from 2021.[33] Water pollution, and further contamination of fish, has already led to impacts on fish exports in Europe. One example being the severe contamination of dioxins in the Baltic Sea, resulting e.g. from wood treatment, which prohibits fish from the Baltic to be put on the EU internal market, as it surpasses the limits set in the EU Foodstuff Regulation. PFAS pollution, if not restricted, could result in further such restrictions.

3.3 What can be done to limit further pollution?

PFAS has already contaminated freshwater and biota across Europe, often exceeding existing legal thresholds set to protect human health and the environment.[34] A broad restriction is urgently needed to prevent further pollution and to ensure we can continue drinking water, eating fish and swimming in seas, lakes and rivers without risking exposure to harmful chemicals.

However, as a ban is not expected in the near future, and is expected to include exemptions for certain sectors, emissions to the environment must be limited as much as possible, and as soon as possible. There are a number of actions Member States can take, including:

- national bans on the production of PFAS-containing products
  - **Denmark** has adopted legislation to prohibit PFAS in paper and board food packaging, as well as, from 2026, in clothing, shoes and waterproofing products.

[31] De Standaard, 6 December 2021, Milieuchemicus waarschuwt: 'Eet geen vis uit de Westerschelde' https://www.standaard.be/cnt/dmf20211206_97149428
[32] De Standaard, 30 December 2024, Nederlandse Vissersbond start rechtszaak tegen 3M wegens PFOS-vervuiling: "Economische schade is groot" https://www.standaard.be/cnt/dmf20241230_94568221
[33] European Commission, the EU Fish market - 2023 Report
[34] EEA, 2024, PFAS pollution in European Waters, https://www.eea.europa.eu/en/analysis/publications/pfas-pollution-in-european-waters

- **France** will ban the manufacture, import and sale of cosmetics, clothing textiles (excluding protective clothing for security and civil protection workers) and waxes containing PFAS from 1 January, 2026. All textiles, except for essential uses, will be covered from January 1, 2030.

- regulate companies' emissions of PFAS **to the environment**
  - **The Netherlands** recently listed all PFAS as 'substances of very high concern' meaning companies must prevent PFAS emissions to air and water.[35]
- regulate diffuse sources of pollution, such as banning the use of PFAS-containing pesticides
- impose discharge fees for PFAS **to create economic incentives to reduce emissions, and to shift the economic burden from the public to polluters**
  - **France** has introduced a penalty of €100 per gram per year of PFAS discharged into water.

In fact, the WFD already requires Member States to limit pollution from both point and diffuse sources by regularly updating discharge permits and authorisations for substances to ensure environmental quality standards are not breached. However, the legal pressure to do so is limited as long as the list of priority substances is outdated.

Additionally, due to the mobile nature of both water and PFAS and considering that 60% of EU river basins are transboundary, the lack of a unified ambitious regulatory framework limits the effectiveness of national initiatives as well as creates justice issues for people in terms of health and financial impacts, both because of different levels of commitment to tackle pollution but also inheriting pollution from neighbouring countries. As an example, every year, hundreds of kilos of PFAS flow into the Netherlands through the Rhine, the Meuse and the Scheldt rivers across the border. Water in the Rhine is estimated to contain three to four times more PFAS than is considered safe by the Dutch authorities.

[35] Dutch Ministry of Infrastructure and Water Management, 14 November 2024, All PFAS classified as Substances of Very High Concern https://www.rijksoverheid.nl/ministeries/ministerie-van-infrastructuur-en-waterstaat/nieuws/2024/11/14/alle-pfas-geclassificeerd-als-zeer-zorgwekkende-stof

4 CONCLUSIONS & RECOMMENDATIONS

Healthy freshwater ecosystems are indispensable allies in providing us with essential benefits such as drinking water, recreation and sustaining economic activities such as fishing and mollusc production. Action to prevent further pollution of coastal and surface waters, and by extension of the fish that should thrive in them, is also crucial to preserving fish stocks. Sustainable fish consumption is deeply ingrained in cultural traditions across the EU and a recognised source of healthy fats, minerals and proteins and should not be conflicting with the health recommendations on maximum intake of PFAS.

The inclusion of a 'sum of PFAS' parameter under the WFD regulating 24 PFAS, including PFOS, and a science-based legal EQS in surface water and biota is a positive and much-needed step in delivering on the EU's zero pollution ambition, freshwater and biodiversity objectives, while also safeguarding the livelihoods of communities that depend on clean water.

However, if timelines for when Member States are required to act to curb emissions are set without ambition, the new quality standards risk falling short of their potential to reduce pollution as it would leave Member States without legal pressure to act to prevent pollution at source. The current extent of PFOS pollution, more than 10 years on from its listing as a priority hazardous substance, and more than 15 years since its ban, is highly concerning. This, combined with Member States asking to delay requirements to take action to curb further water pollution by more PFAS, reveals a troubling pattern of delay, resulting in incoherent implementation. While the WFD and its daughter directives provide a solid framework, their effectiveness is being undermined by excessive time for Member States to act.

There is now a risk that – instead of building on the 20+ years of improving chemical regulation of EU water – Member States will again get a free pass to sit back and watch pollution levels rise over the next 10 years, waiting for a broad PFAS restriction to materialise. This would be contrary to the fact that guidelines on maximum safe intake of PFAS has been consistently revised down, following new information about the risk of PFAS exposure for humans and wildlife, as well as rising concerns about the societal costs of PFAS.

A swift broad restriction of PFAS is necessary to limit further pollution, but as that might still be years away, and is likely to contain exemptions for certain sectors, it is crucial to limit emissions to the environment as much as possible. There is much that Member States can, and are obliged to do, to limit pollution under EU water legislation. This includes tightening discharge permits and banning substances that result in diffuse pollution, such as pesticides. However, only with up-to-date pollution standards and without unnecessarily long timelines for Member States to act, will these be effective in improving monitoring that guides measures, as well as timely reporting to provide a closer-to-reality picture of PFAS pollution.

It is therefore crucial that the Commission's proposal to update the EU's water quality standards and regulate a group of PFAS with an up-to-date legal threshold representing the latest findings on the dangers of PFAS exposure is adopted as soon as possible. The process has already suffered severe delays by the EU institutions, which put at risk Member States' willingness to include measures on the new quality standards in the next River Basin Management Plans (covering the period 2028-2033). If this is not done, we risk missing another decade of action on curbing the ongoing contamination of our freshwater, putting even further away the attainment of the objective of the Water Framework Directive of healthy waters.

RECOMMENDATIONS

1. **European Commission:** Swiftly adopt a broad EU-wide PFAS restriction with as few exemptions as possible to close the tap of ongoing PFAS pollution.
2. **EU institutions:** Ensure that Member States are required to make public and report monitoring data of chemicals in freshwater to the EEA on a yearly basis to provide policymakers and the public with an up-to-date picture of water pollution in the EU.
3. **European Environment Agency:** Produce an EU-wide assessment of PFAS contamination of coastal and freshwater fish.
4. **EU institutions:** Ensure rapid adoption of updated Environmental Quality Standards for PFAS in coastal and freshwater, based on the latest scientific findings on their effect on human health and wildlife, and require that Member States start monitoring within 6 months of adoption.
5. **EU institutions:** Ensure that Member States are obliged to include measures to curb PFAS pollution of surface and groundwater in the 4th River Basin Management Plans (2028-2033), with aim to comply with the new quality standards by end of 2033. After that, exemptions from compliance should only be granted if justified under strict conditions.
6. **EU institutions:** Ensure that Member States make full use of the economic instruments provided by the WFD (and the revised UWWTD) to incentivize measures to curb pollution at source and to ensure polluters pay for the remediation, treatment and monitoring costs related to PFAS pollution.

ANNEXES

ANNEX 1

REPORTED DATA FROM THE SELECTED MEMBER STATES

The obtained datasets are available via this link

ANNEX 2 - METHODOLOGY

Country	Source of data	Date of acquisition
Austria	WISE 6 - 2023	September 2024
Germany	National authorities at the Federal States	December 2024
France	National platform: Naïades	July 2024
Italy	WISE 6 - 2023	September 2024
Poland	WISE 6 - 2023	September 2024
Spain	Environment Spanish Ministry and URA (Basque Country Water Agency)	April 2024
Sweden	National platform Vatteninformationsystem Sverige	December 2024

CALCULATIONS

Rate of exceedance of the existing biota EQS for PFOS

Formula: Value X /9.1 = rate of exceedance

Value X = PFOS in biota concentration expressed in µg/kg

9.1 = existing EQS expressed in µg/kg of fish wet weight

Rate of exceedance of the new proposed biota threshold for 'sum of PFAS'

Formula: (Value X * 2 * 1000) / 77 = rate of exceedance

Value X= PFOS in biota concentration expressed in µg/kg

2= PFOS RPF

77 = proposed new biota EQS, expressed as ng/kg of fish wet weight (expressed as PFOA equivalents)

Creation of the map

The map was produced with Datawrapper. The highest 5% of values were plotted (choosing the most recent sample when a place was sampled multiple times). Locations of EU monitoring sites were found on the EIONET website: https://cdr.eionet.europa.eu/ (CDR > MS > EU obligations > WFD – RBMP 2022 reporting > National spatial data > last updated file > Monitoring sites . gml > HTML preview).

The locations are as exact as were the monitoring sites indications. This might vary from Member State to Member State, depending on if the data were acquired in WISE 6 or from national authorities.

ANNEX 3 - THE 24 PFAS PROPOSED BY THE COMMISSION FOR THE NEW BIOTA EQS

Acronym	**RPF**	**CAS number**	**Full name**
PFOA	1	335-67-1	Perfluorooctanoic acid
PFOS	2	1763-23-1	Perfluorooctane sulfonic acid
PFHxS	0.6	355-46-4	Perfluorohexane sulfonic acid
PFNA	10	375-95-1	Perfluorononanoic acid
PFBS	0.001	375-73-5	Perfluorobutane sulfonic acid
PFHxA	0.01	307-24-4	Perfluorohexanoic acid
PFBA	0.05	375-22-4	Perfluorobutanoic acid
PFPeA	0.03	2706-90-3	Perfluoropentanoic acid
PFPeS	0.3005	2706-91-4	Perfluoropentane sulfonic acid
PFDA	7	335-76-2	Perfluorodecanoic acid
PFDoDA or PFDoA	3	307-55-1	Perfluorododecanoic acid
PFUnDA or PFUnA	4	2058-94-8	Perfluoroundecanoic acid
PFHpA	0.505	375-85-9	Perfluoroheptanoic acid
PFTrDA	1.65	72629-94-8	Perfluorotridecanoic acid
PFHpS		375-92-8	Perfluoroheptane sulfonic acid
PFDS	2	335-77-3	Perfluorodecane sulfonic acid
PFTeDA	0.3	376-06-7	Perfluorotetradecanoic acid
PFHxDA	0.02	67905-19-5	Perfluorohexadecanoic acid
PFODA	0.02	16517-11-6	Perfluorooctadecanoic acid
HFPO-DA or Gen X	0.06	62037-80-3	Ammonium perfluoro (2-methyl-3-oxahexanoate)
ADONA	0.03	958445-44-8	Propanoic Acid / Ammonium 2,2,3-triflu ro-3- (1,1,2,2,3,3-hexafluoro3-(trifluoromethoxy)propoxy) propanoate
6:2 FTOH	0.02	647-42-7	2- (Perfluorohexyl)ethyl alcohol (6:2 FTOH)
8:2 FTOH	0.04	678-39-7	2-(Perfluorooctyl)ethanol
C6O4	0.06	1190931-41-9	Acetic acid / 2,2-difluoro-2-((2,2,4,5-tetrafluoro-5-(trifluoromethoxy)-1,3-dioxolan-4yl) oxy)-

ANNEX 4 - TOP REPORTED CONCENTRATIONS OF PFOS IN FISH (BETWEEN 2009 AND 2024)

AUSTRIA		**Danube, Absdorf** **River 47 µg/kg** Close to Vienna Waste management site in Stockerau (25km away)	**Mur-Straenbrücke, Spielfeld** **River 38 µg/kg** Waste management site
Dornbirner Ach, Lauterach **River 37 µg/kg** 3 waste management sites around	**Ehbach, Meiningen** **River 37 µg/kg** Waste management site	**Unknown (prob. Inn), Erl** **River 36 µg/kg** Industrial site and waste management sites in the surroundings of 30km	**Unknown** (prob Danube), **Hainburg** **River 30 µg/kg** Known contamination
Unknown, Strem/ Luising **River 27 µg/kg** Waste management site (at 20km)	**Unknown** (prob. Mur), **Bruck an der Mur** **River 24 µg/kg** Manufacture of pulp, paper and paperboard	**Unknown** (prob. Piesting), **Markt Piesting** **River 19 µg/kg** Waste management site (at 20km)	**Mur, Lebring** **River 14.9 µg/kg** Known contamination

GERMANY		**Hitzelbach, Zell/ Rheinland** **River 720 µg/kg** Airport, US army base	**Elbe, Schnackenburg/ Niedersachsen** **River 149µg/kg** Airport
Sohren/Rheinland **River 130 µg/kg** Airport, US army base	**Ems, Herbrum/ Niedersachsen** **River 106 µg/kg** Airport	**Vechte, Laar/ Niedersachsen** **River 97.7 µg/kg** Waste management site + Industrial site in NL beside	**Unknown** (probably Rhein), **Karlsruhe/ Baden-Württemberg** **River 91 µg/kg** Known contamination, several industrial sites and waste management sites (Ruhr Valley)
Grossbach, Zerf/ Rheinland **River 83 µg/kg** Airport, US army base	**Ellerbach, Sobernheim/ Rheinland** **River 70 µg/kg** Industrie- und Gewerbegebiet Pferdsfeld	**Unknown** (Neckar or Rhein), **Mannheim/ Baden-Württemberg** **River 65 µg/kg** BASF, airport	**Weser, Drakenburg/ Niedersachsen** **River 47.5 µg/kg** Airport

FRANCE		**Le Touyre, Lagarde River 100 µg/kg** Textile industry, treatment and disposal of hazardous waste	**La Saône, Lyon River 87.2 µg/kg** Valley of the Chemistry and PFAS manufactures (Arkema, etc.)
La Cadière, Marignane River 72.1 µg/kg Airport, PFAS manufactures	**La Saône, Saint-Symphorien-d'Ancelles River 70.1 µg/kg** Waster management site, airport	**Le Doubs, Thoraise River 33 µg/kg** Manufacture of pulp and paper	**La Valserine, Montanges River 21.2 µg/kg** Treatment and disposal of non-hazardous waste
Druelle River 19 µg/kg Airport, wastewater treatment plant, waste management plant	**Pond of Lacanau, Lacanau Lake / pond 15 µg/kg** Close to Bordeaux (industrial sites, waste management sites and airport)	**Le Dourdou, Grand Vabre River 14µg/kg** Treatment and coating of metals	**La Cère, Sansac-de-Marmiesse River 11µg/kg** Close to Aurillac (airport, treatment and coating of metals)

ITALY		**Fossa Monselesana, Tribano, Padua River 69.1 µg/kg** Know contamination	**Fiumazzo, Campagna Lupia River 68.5 µg/kg** Known contamination of surface waters
Tergola, Vigonza River 41.6 µg/kg Several waste management facilities	**Burana, Ostellato River 30.82 µg/kg** Manufacture of refined petroleum products	**Codevigo, Padua River 27.8 µg/kg** Known contamination of surface waters (FPP)	**Secchia, Quistello/ Mantua River 25 µg/kg** Known contamination of surface waters in the village beside
Panaro, Bondeno River 17.1 µg/kg Known contamination of surface waters	**Chiavenna, Chiavenna Landi River 15.4 µg/kg** Manufactures close by	**Pô, Casalmaggiore River 15 µg/kg** Manufactures around (paper, petroleum prod.)	**Pô, Boretto River 13.6 µg/kg** Close to Parma (industrial sites, waste management sites and airport) + Know contamination

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POLAND		**Jeziórka, Wólka Kozodawska River 108 µg/kg** Manufactures close by	**Biała, Kąclowa River 54.6 µg/kg** Waste management site beside
Jezioro Mały Szarcz, Szarcz Lake 32.2 µg/kg Unknown	**Nysa Łużycka, Sobolice River 21.9 µg/kg** German airport	**Kasina, Ślęza River 12.9 µg/kg** Military base, waste management site, industrial site	**Wkra - uj do Molstowej River 11.9 µg/kg**
Kamienica, Frycowa River 11.7 µg/kg Waste management site (less than 20km away)	**Mala Panew, Czarnowasy River 8.4 µg/kg** Waste management site	**Lake Jamno, Dobiesławiec River 7.6 µg/kg** Waste management sites	**Biala, Tarnow River 7.54 µg/kg** PFAS manufacturing facility, industries, waste management site

SPAIN		**Pozón de la Dolores, Station: Camargo, State: COCC CANTABRICO Laguna 612 µg/kg** Industrial sites, waste management sites and aiport all around	**Léa-A, Oleta (lea) Amoroto, COR-CANTABRICO ORIENTAL INTRA River 473 µg/kg** Know contamination
Lagunas Bajas de Ruidera, LAGUNA DE CUEVA MORENILLA, GUADIANA Laguna 427µg/kg Know contamination	**Laguna Tomilla, Laguna Tomilla, Guadiana Laguna 262µg/kg** Know contamination	**Río Albaida: Río Barcheta - Río Júcar, Azud Río Albaida, Senyera, JUCAR River 182µg/kg** Know contamination	**Barbadun-B, Santelices (Barbadun) (MUSKIZ), COR-CANTABRICO ORIENTAL INTRA River 176µg/kg** Unknown
Río Serpis: EDAR Alcoy - E. Beniarrés, Alcocer de Planes (COCA), JUCAR River 91µg/kg Textile Industry beside	**Deba-B, San Prudentzio (Deba Alto) (BERGARA), COR-CANTABRICO ORIENTAL INTRA River 90µg/kg** Industrial site and waste management site at less than 10km	**Oka-A, Gernika (Oka-o) (AJANGIZ), COR-CANTABRICO ORIENTAL INTRA River 72.9 µg/kg** Known contamination + industrial site and waste management site	**Urola-F, Oikina (Urola Bajo) (AIZARNAZABAL), COR-CANTABRICO ORIENTAL INTRA River 69µg/kg** Treatment and coating of metals facility close by

SWEDEN		**Frommestabäcken, Hallsberg/Kumla River 750 µg/kg** Waste facility: leaching and use of fire-fighting foam	**Ybbarpsån: Rönne å-Östra Sorrödssjön in, Klippan/Svalöv Natura 2000 site: Herrevadskloster River 290 µg/kg** Fire training site by Herrevad kloster and Perstorp industrial area
Fjällfotasjön, Svedala Lake 202 µg/kg Skurup airport (fire training site)	**Hjälmaren-Mellanfjärden, Örebro Fishingwater Lake 167 µg/kg** Wastewater treatment plant Skebäck	**Ålsjön, Söderhamn Lake 160 µg/kg** Helsinge airport	**Skärån, Klippan/Svalöv Natura 2000 site (Söderåsen) River 109 µg/kg** Ljungbyhed airport (fire training site)
Ybbarpsån Östra Sorrödssjön in -Storarydsdammen U, Klippan River 85 µg/kg Perstorp industrial area	**Börringesjön, Svedala/ Trelleborg Lake 81 µg/kg** Skurup airport (fire training site)	**Skavebäck, Helsingborg River 56 µg/kg** Berga fire training centre and Dafo Fomec (fire foam producer)	**Rannåsbäcken, Östersund River 49 µg/kg** Fire training site Furulund

ANNEX 5 - OVERVIEW OF NATIONAL SEAFOOD CONSUMPTION RECOMMENDATIONS

Country	Quantitative recommendation	Qualitative recommendation	Portion size
AUSTRIA	-1-2 portions/week	Prefer high-fat fish such as mackerel, salmon, tuna and herring or domestic coldwater fish such as char	1 portion corresponds to approximately 150 g
GERMANY	- Fish once or twice a week. - Eat weekly 1 portion (80-150 g) low-fat seafish (prepared) AND 1 serving (70 g) of fatty fish (prepared)	-Choose from recognised sustainable sources	80-150 g low-fat seafish (prepared) and 70 g of fatty fish (prepared)
FRANCE	-Fish and seafood 2 times per week, of which one time should be fatty fish	-Vary species and locations (especially for large consumers), to limit exposure to contaminants	100g
ITALY	-At least 2-3 times fresh fish a week and up to 1 time per week preserved fish	- Prefer either fresh or frozen and prefer local blue fish. - Choose small fish that you can eat with the fishbone.	150 g fresh (one small fish, one medium fillet, 3 large shrimps, 20 small shrimps, 25 mussels); 50 g canned or preserved (1 small can of tune or mackerel, 4-5 slices of smoked salmon, 0.5 cod fillet)
POLAND	-At least 2 times a week	-Not fried fish, but baked or boiled	
SPAIN	-At least 3 servings weekly	- Prioritise blue fish (blue: sardines, anchovies, mackerel, scad etc.; white: haddock, blue whiting, cod etc.; shellfish: mussels, etc.). - Frozen and canned fish have similar nutritional value to fresh. - If you eat canned fish, choose low-salt varieties.	One serving= 125-150 g Example: 1 individual fillet, or several units of seafood
SWEDEN	-Eat fish and shellfish 2-3 times a week	-Vary your intake of fatty and low-fat varieties Note: Specific recommendations for risk groups to limit fish from Baltic Sea and certain lakes	

Source: EC Knowledge For Policy