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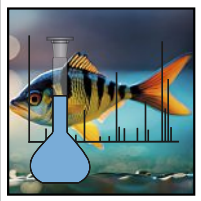

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Per- and Polyfluoroalkyl Substances in Swiss Fish – a Health Problem?

Fiorella Lucarini[a]* and Davide Staedler[b,c]

*Correspondence: Prof. Dr. F. Lucarini, E-mail: Fiorella.lucarini@hefr.ch
[a]School of Engineering and Architecture of Fribourg, Institute of Chemical Technology, HES-SO University of Applied Sciences and Arts of Western Switzerland, Boulevard de Pérolles 80, CH-1700 Fribourg; [b]TIBIO Suisse romande, Chemin de Bérée 4C, CH-1010 Lausanne; [c]Department of Biomedical Sciences, University of Lausanne, Rue du Bugnon 27, CH-1011 Lausanne

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Per- and polyfluoroalkyl substances (PFAS) are anthropogenic chemicals widely utilized in various industrial and consumer products due to their exceptional water and oil repellent properties. Their persistence and bioaccumulation in the environment, particularly in aquatic ecosystems, have made PFAS global contaminants. Fish, due to their position in the food chain and direct exposure to aquatic contaminants, are vulnerable to PFAS accumulation, making them effective bioindicators of environmental contamination and potential sources of human exposure.

We recently investigated the presence and levels of PFAS in freshwater fish from Swiss lakes, addressing concerns about widespread environmental contamination and potential health risks associated with fish consumption (Fig. 1).

Fig. 1. PFAS analysed in 218 fish samples. Fish species analysed: *Coregonus wartmanni* (whitefish) (N = 20), *Cyprinus carpio* (common carp) (N = 11), *Oncorhynchus mykiss* (rainbow trout) (N = 11), *Perca fluviatilis* (perch) (N = 38), *Salmo trutta* (brown trout) (N = 131), and *Squalius cephalus* (common chub) (N = 7).

We analyzed 15 PFAS in 218 fish fillet samples from six species commonly found in Switzerland. An optimized QuEChERs (Quick, Easy, Cheap, Effective, Rugged, and Safe) extraction method was employed, followed by LC-MS/MS analysis. The results were compared to EU regulations (Commission Regulation (EU) 2022/2388) and EFSA guidelines for tolerable weekly intake (TWI) to evaluate potential risks to human health. The optimized QuEChERS method offered a simplified and cost-effective approach for extracting PFAS from complex matrices like fish tissues, reducing interferences and improving analyte recovery.

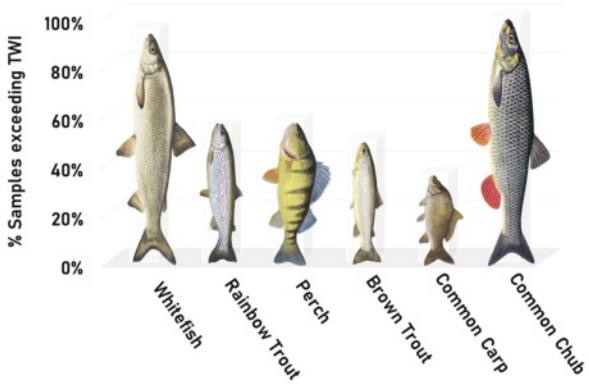

Fig. 2. Percentage of fish exceeding the TWI set by EFSA here calculated for a person of 70 kg body weight and an intake of 200 g of fish fillets.

The analysis revealed significant PFAS contamination across all species. Perch exhibited the highest levels of PFOS and PFHxS, with concentrations frequently exceeding EU safety limits. TWI calculations, based on a 70 kg person consuming 200 g of fish fillet per week, were exceeded in a significant percentage of fish (Fig. 2).

Analysis of 121 brown trout specimens revealed positive correlations between fish size and PFBS, PFDA, and PFHxS levels, suggesting bioaccumulation increases with age and size. In contrast, PFPeA – a short chain C5 PFAS – showed a negative correlation, likely reflecting the lower bioaccumulation potential and short half-life typical of short-chain PFAS in animals.

These findings highlight the need for ongoing monitoring, further research into PFAS sources and pathways, and stronger regulations to protect aquatic ecosystems and human health from PFAS exposure *via* fish consumption.

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Please contact: Dr. Veronika R. Meyer, Unterstrasse 58, CH-9000 St. Gallen
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