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Environmental monitoring of organic micropollutants, PFAS and pesticides in Swedish river outlets 2023

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1. Introduction

The Swedish Agency for Marine and Water Management (Havs- och vattenmyndigheten) recognizes the imperative to enhance understanding of organic micropollutants (OMPs) within aquatic environments [1, 2]. This necessity for monitoring is particularly pronounced concerning per- and polyfluoroalkyl substances (PFAS), as well as other persistent substances like pharmaceutical residues, pesticides, industrial chemicals and personal care products. Their presence in surface waters poses diverse concerns for both human health and ecosystem vitality [2-4]. The objective of the present project was to conduct comprehensive chemical analyses in rivers, with the aim to enhance comprehension of OMP presence in aquatic environments.

2. Material and methods

2.1 Target analytes and chemicals

2.1.1 OMPs

In total 86 OMPs (pharmaceuticals, personal care products and industrial chemicals) were included in this study. All analytical standards used for analysis were of high purity grade (>95%). Native standards were acquired from Sigma-Aldrich (Sweden). Isotopically labeled standards (IS) for the target compounds were obtained from Wellington Laboratories (Canada), Teknolab AB (Kungsbacka, Sweden), Sigma-Aldrich, and Toronto Research Chemicals (Toronto, Canada). Detailed information about internal standards (IS) and native standards can be found elsewhere [5]. A list of the OMPs included in the study, is given in Appendix Table A1.

2.1.2 PFAS

In total 28 PFAS were included in this study plus branched (B)-PFHxS and B-PFOS. All analytical standards used for analysis were of high purity grade (>98%). Native and IS were acquired from Wellington Laboratories (Canada) (for details see elsewhere [6]). A list of the PFAS included in the study, is given in Appendix Table A2.

2.1.3 Pesticides

In total 132 pesticides were included in this study. All standards used were of high analytical purity (>97%) and compared versus reference mix of known concentration before first use. Native standards and isotopically labeled standards were acquired from Teknolab AB (Kungsbacka, Sweden) or from LGC Standards GmbH (Wesel, Germany). A list of the pesticides included in the study is given in Appendix Table A3

2.1.4 Other chemicals

Ultrapure water was generated by a Milli-Q (MQ) Advantage Ultrapure Water purification system and filtered through a 0.22 µm Millipak Express membrane and an LC-Pak polishing unit (Merk

Millipore, Billercia, MA). Methanol, acetonitrile, formic acid and ammonia of high analytical grade were acquired from Sigma-Aldrich (Sweden).

The 1,4-dioxane analysis was conducted by a commercial lab in Karlsruhe, Germany (https://tzw.de/) whereby headspace-GC-MS (standard method DIN 38407-43:2014) was used.

2.2 Sampling

Surface water samples at river outlets sites in Sweden were sampled (Table A4). The sampling campaign was carried out in May, September, October and November 2023. Samples collected in September, October and November 2023 are collectively called Autumn samples and are marked with symbol **S** in figures. In total, 34 locations and 63 samples were collected, of which 29 were collected in May 2023, 21 in September 2023, 11 in October 2023 and 2 in November 2023, excluding duplicates and field blanks (see Table A4 for details). The monitoring program River Outlet is part of the freshwater program of the Swedish Agency for Marine and Water Management (Havs- och vattenmyndigheten) within the national environmental monitoring, and includes the outlets of Sweden's major rivers to the sea. The sampling for the current study was an extension of the regular sampling and was conducted by contracted sampling staff. Pre-cleaned high-density polyethylene bottles, disposable gloves and ethanol/water cleaning liquid to rinse any sample equipment needed was sent to the contracted staff. The grab samples, 1 L each, were collected in polypropylene (PP) bottles and were sent to SLU right after the sampling. Samples were stored frozen (− 20 ◦C) in darkness until extraction. For quality control, two duplicates were taken for evaluation the repeatability of the study. In addition, three field blanks were collected using empty high-density polyethylene bottles, which were opened but not filled during sampling and thereafter handled in the same way as the real samples.

2.3 Sample preparation

2.3.1 OMPs

Procedures for preparation of water samples for instrument analysis were done as described previously [7, 8]. Filtered samples (500 mL) were spiked with the IS mixture [9-12]. The water samples and laboratory method blanks (n = 3) were extracted by solid-phase extraction (SPE) using Oasis HLB-cartridges (6 mL, 200 mg, 30 µm). The results show OMPs concentrations in water, since only liquid phase was analyzed. Previous studies have shown that most of studied OMPs are predominantly in the dissolved phase in surface water samples (river and lake samples) [8, 13-15] and therefore particulate phase is typically not analysed.

2.3.2 PFAS

Procedures for preparation of water samples for instrument analysis were done as described previously [16]. Briefly, filtered water samples (500 mL) and laboratory method blanks (n = 3) were extracted by solid-phase extraction (SPE) using Oasis WAX-cartridges (6 mL, 150 mg, 30 µm). Reported concentrations reflect the apparently dissolved concentrations since the internal

standards were added after the filtration. Previous studies have shown that PFAS are predominantly in the dissolved phase in river and sea samples (>99%) [17] and therefore particulate phase is typically not analysed. Thus, the PFAS measured is conservative when it comes to estimating the risks.

2.3.3 Pesticides

Procedures for preparation of water samples for instrument analysis were done as described previously [18]. Briefly, water samples (5 mL) were pH-adjusted, spiked with internal standards solution and filtered with 0.2 µm RC-filters. Reported concentrations reflect the total concentrations since the internal standards are added before the filtration and continuous validation samples, to determine relative recoveries and precisions, are prepared by adding native pesticide solution to whole water samples.

2.4 Instrumental analysis and quality control

2.4.1 OMPs

The water samples were analyzed by a DIONEX UltiMate 3000 ultra-high pressure liquid chromatography (UPLC) system (Thermo Scientific, Waltham, MA, USA) coupled to a triple quadrupole mass spectrometer (MS/MS) (TSQ QUANTIVA, Thermo Scientific, Waltham, MA, USA). The data obtained were evaluated using TraceFinder^{TM} 4.1 software (Thermo Fisher). Quality assurance and quality controls for the water samples included analysis of method blanks, two duplicates and calculation of limit of quantification (LOQ). The concentration ranges of the calibration curves for the target analytes were 0.01-1000 ng/L. The method blanks were prepared and extracted in the same way as the samples. For calculating the sum of the concentration, the concentrations below LOQ were taken as 0.

2.4.2 PFAS

Chemical analysis was performed using a Sciex Triple Quad 3500 UPLC−MS/MS system (Sciex, USA). The data obtained were evaluated using the SCIEX OS-MQ software 3.0 software (Sciex, USA). Quality assurance and quality controls for the water samples included analysis of method blanks, two duplicates and calculation of LOQ. The concentration ranges of the calibration curves for the target analytes were 0.01-100 ng/L. The method blanks were prepared and extracted in the same way as the samples. Linear and branched PFHxS (LPFHxS, BPFHxS) and PFOS (LPFOS, BPFOS) were quantified separately. For calculating the sum of the concentration, the concentrations below LOQ were taken as 0.

2.4.3 Pesticides

Chemical analysis was performed using an Agilent 1260/1290 HPLC-system coupled to a triple quadrupole 6470-system (Agilent Technologies, USA). The data obtained was evaluated with Masshunter Quant 10.0 (Agilent Technologies, USA). The method is accredited by SWEDAC and follows ISO/IEC 17025:2018. The concentration range of the calibration curve of the analytes

depends on the sensitivity for the compounds and are bracketed into three ranges; 0.001 – 0.26 µg/L, 0.005-1.28 µg/L, 0.025-6.40 µg/L. For calculating the sum of the concentration, the concentrations between LOQ and LOD were used as reported.

3. Results and discussion

3.1 OMPs

Among the 86 OMPs analyzed (including EU Watch List compounds), 31 compounds were found to be below the LOQ (not detected). Compound composition and concentration ranges varied largely between sampling locations and seasons (Figure 1, 2 and 3). The compounds which were detected above LOQ levels are presented in Figure 1, 2 and 3. Most compounds showed higher concentrations in Autumn sampling campaign compare to the sampling in May (Figure 1). Seasonal comparisons were not possible for five locations sampled only in Autumn (Gothemsån Hörsne, Mörrumsån Mörrum, Viskan Åsbro, Smedjeån V. Mellby, Ljusnan Funäsdalen) (Figure 2).

The most frequently detected compounds were nicotine, caffeine, diethyltoluamide (DEET) and salicylic acid (Figures 1 and 2). Caffeine was detected in every sample with a concentration range 4 – 150 ng/L. For individual OMPs, the highest concentration was found for DEET (range 1.9 – 680 ng/L) and it showed the highest concentration levels in the water samples collected in Autumn (Figure 3). Most of the studied OMPs were found in the samples from Kävlingeån Högsmölla and Ljungbyån Ljungbyholm, with a wide range of concentrations (Figure 1).

EU Watch List compounds which include amoxicillin, ciprofloxacin sulfamethoxazole, trimethoprim, venlafaxine, O-desmethylvenlafaxine, azithromycin, clarithromycin and pesticides (fluconazole, clotrimazole, imazalil, ipconazole, metconazole, miconazole, procloraz, penconazole, tebuconazole and tetraconazole) were studied as well. Out of 18 Watch List compounds, 8 were below the limit of quantification (amoxicillin, ciprofloxacin, fluconazole, imazalil, ipconazole, metconazole, penconazole, and tetraconazole). The most frequently detected compounds were venlafaxine and its metabolite O-desmethylvenlafaxine with concentration range 1.6 – 43 ng/L and 2.1 – 46 ng/L and detection frequency of 38% and 21%, respectively. Sulfamethoxazole, trimethoprim, tebuconazole, procloraz, clotrimazole and miconazole were found at the concentration levels below 10 ng/L and the detection frequency of these compounds was below 20%.

In this study 6PPD and its transformation product 6PPD-quinone were analyzed. 6PPD is extensively used in the rubber industry and it is well known contaminant which can be found in different environmental samples including surface water [19]. The concentration of 6PPD was below the LOQ (not detected) in all studied locations. 6 PPD-quinone was found in 35 samples with a concentration range 3.4 – 48 ng/L. It was shown that 6 PPD-quinone could induce species-

specific toxicity in aquatic organisms and it is important to keep monitoring occurrence and concentration levels of this contaminant in the aquatic environment [19].

1,4-Dioxane is a very persistent organic contaminant and it was analyzed in 34 water samples which were collected in Autumn 2023 (September, October and November). It was found in all studied locations at concentration levels 0.031 – 0.36 µg/L (31 – 360 ng/L). It is important to keep monitoring the occurrence of 1,4-dioxane in water because in recent years, international concern has risen about the ubiquitous presence of 1,4-dioxane in the environment and the adverse health effects to its exposure.

The current EQSs (HVMFS 2019:25) for diclofenac (0.1 µg/L expressed as annual average) were exceeded at sites Nordre älv, Gullö (180 ng/L) and Indalsälven Bergeforsen (140 ng/L), in water samples collected in May 2023 [20].

In the proposal for a revised Environmental Quality Standards Directive (EQSD), there are annual average (AA) EQSs for inland surface waters for azithromycin (0.019 µg/L), carbamazepine (2.5 µg/L), clarithromycin (0.13 µg/L), diclofenac (0.04 µg/L) and erythromycin (0.5 µg/L). The occurrence of these substances were as follows:

- azithromycin (an antibiotic) was detected in five studied locations (water samples collected in September 2023) at concentrations ranging from 5.5 to 12 ng/L,
- carbamazepine (antiepileptic) was detected in 15 locations, at concentrations ranging from 2.2 to 81 ng/L, the highest concentration observed in the studied location was 81 ng/L (location Ljungbyån, Ljungbyholm, in water sample collected in Autumn 2023),
- clarithromycin (an antibiotic) was below the limit of quantification (< 1.1 ng/L),
- diclofenac (nonsteroidal anti-inflammatory drug) was detected in 27 locations, concentrations ranged from a 5.9 ng/L to 180 ng/L,
- erythromycin (an antibiotic) was below the limit of quantification (< 49 ng/L).

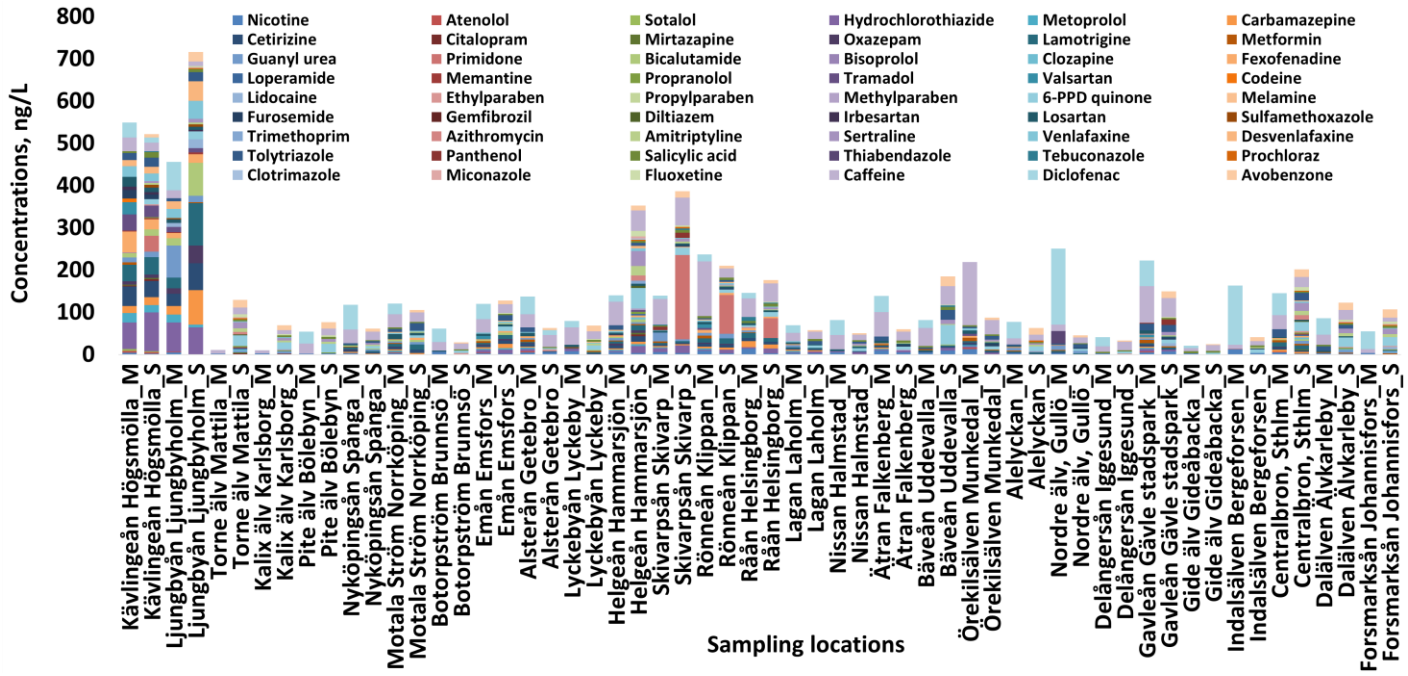

Figure 1. Cumulative concentrations of detected OMPs in water samples collected during May (M) and Autumn (S) 2023. Autumn samples were collected in September (*n*=21), October (*n*=11) and November (*n*=2). The sampling dates are given in Table A4.

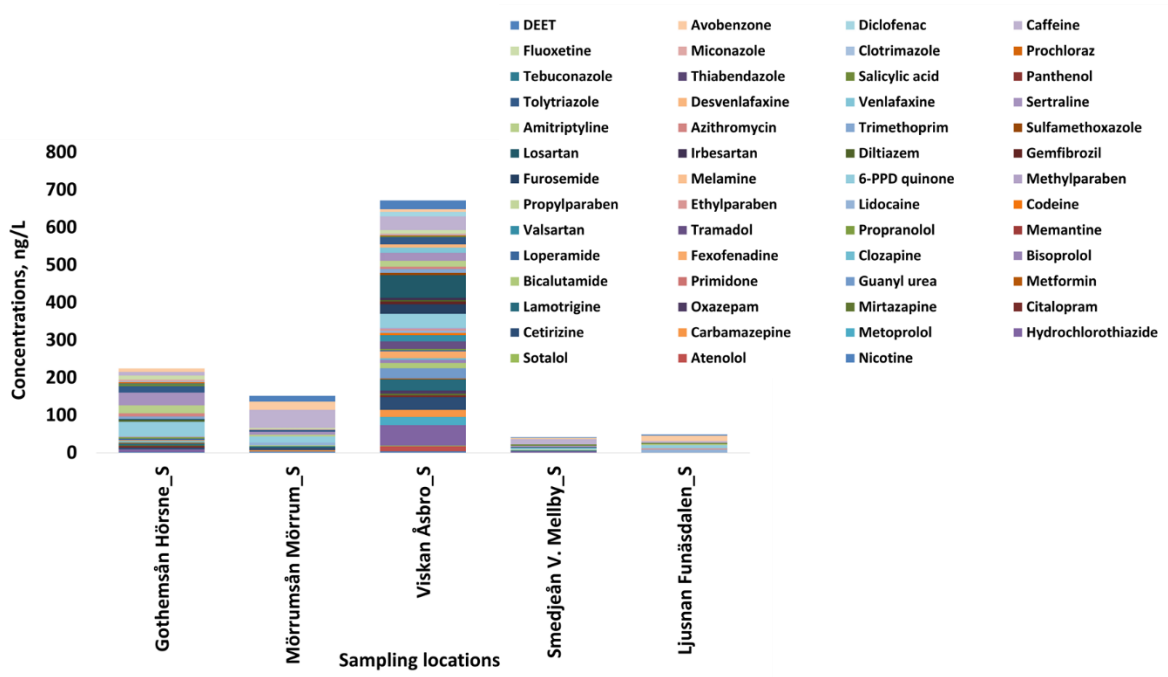

Figure 2. Cumulative concentrations of detected OMPs in water samples collected during Autumn (S) 2023. Gothemsån, Mörrumsån and Viskan were sampled in September, Smedjeån in October and Ljusnan in November (sampling dates in Table A4).

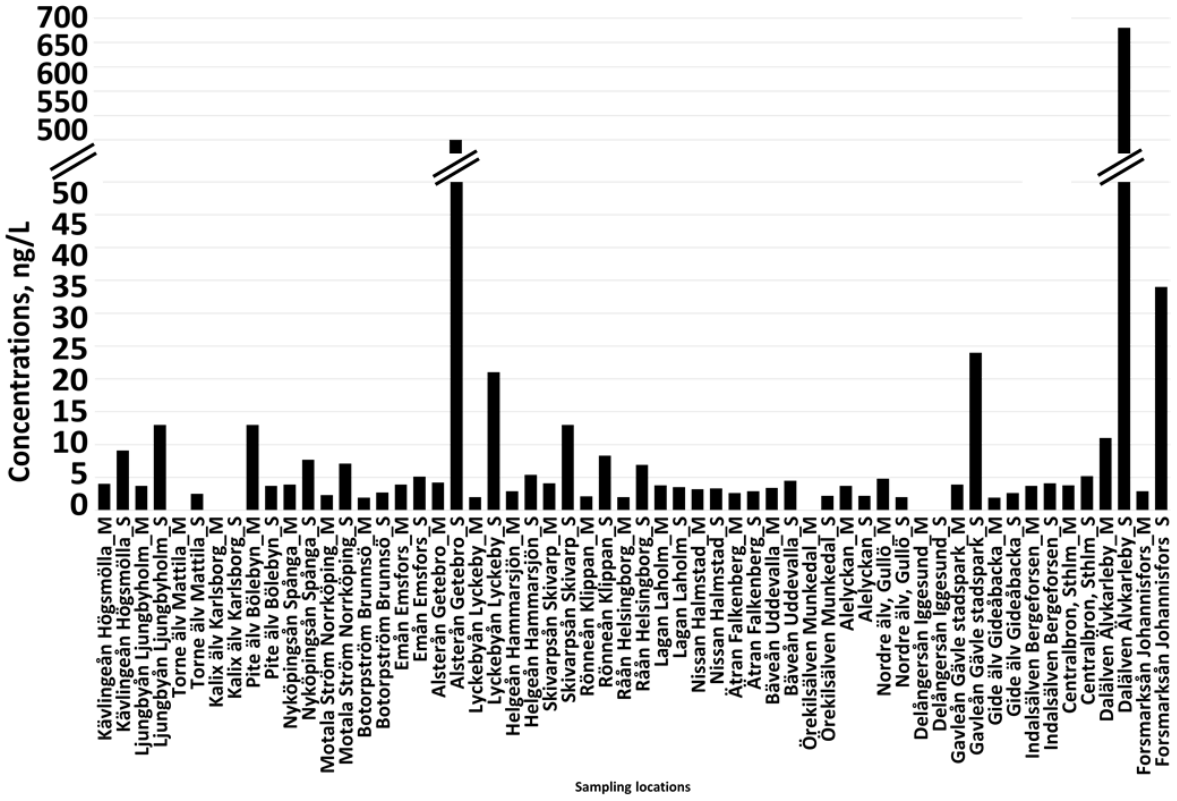

Figure 3. Concentrations of DEET in water samples collected during May (M) and Autumn (S) 2023. **Autumn samples were collected in September (*n*=21), October (*n*=11) and November (*n*=2). Sampling dates are given in Table A4.**

3. 2 PFAS

In total, 21 out of 30 different PFAS were detected in the water samples including both linear and branched PFHxS and PFOS, respectively (Figure 4). The ∑PFAS concentrations showed highest variations between the sampling locations ranging from 0.4 to 28 ng/L (Figure 5). The composition of PFAS was dominated on average by PFBA (44%), followed by PFPeA (16%), PFHxA (8.9%), and PFOA (8.2%) (Figure 4). Most locations showed high PFAS concentrations in May compared to autumn samples with on average a factor of 1.5 higher ∑PFAS concentrations in May. Highest ∑PFAS concentrations were found at Torne älv Mattila in May (28 ng/L), followed by Rönneån Klippan in May (27 ng/L), Rönneån Klippan in September (23 ng/L), Nyköpingsån Spånga in May (23 ng/L), and Ljungbyån Ljungbyholm in May (21 ng/L).

The most abundant PFAS with the highest detection frequency were PFOA (98%), followed by PFPeA (97%), BPFOS (95%), PFBA, PFHpA (94%), PFHxA (89%) and PFNA (95%). Highest individual PFAS concentrations were detected for PFBA (mean = 4.4 ng/L, median = 3.5 ng/L), followed by PFPeA (mean = 1.6 ng/L, median = 1.2 ng/L), PFHxA (mean = 0.87 ng/L, median =

0.74 ng/L), PFOA (mean = 0.73 ng/L, median = 0.72 ng/L), PFHpA (mean = 0.71 ng/L, median = 0.65 ng/L), and LPFOS (mean = 0.38 ng/L, median = 0.22 ng/L).

The EU WFD AA-EQSs for PFOS is currently 0.00065 µg/L (0.65 ng/L) for inland surface waters. The EQS for PFOS was exceeded at almost half of the sites (14 out of 34 locations) and in around one third of the samples (19 out of the 66 samples) (29%).

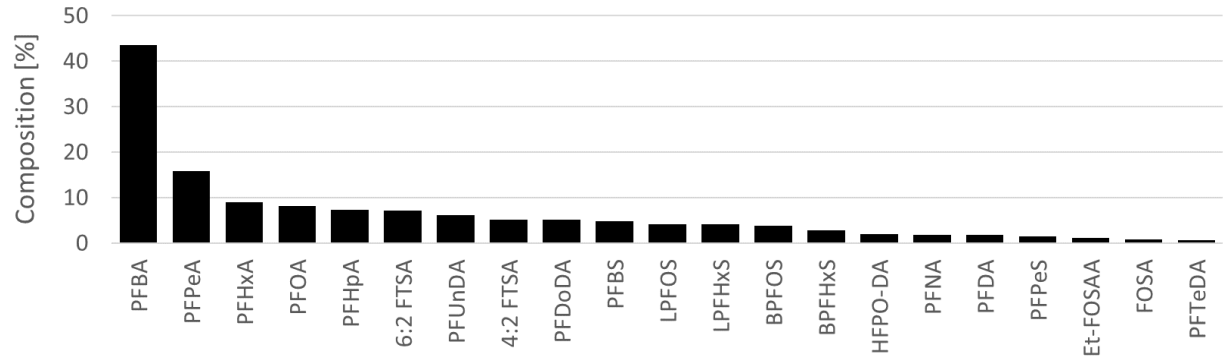

Figure 4. Average PFAS composition [% of ∑PFAS] in water sampled during May and Autumn 2023 (sampling dates in Table A4).

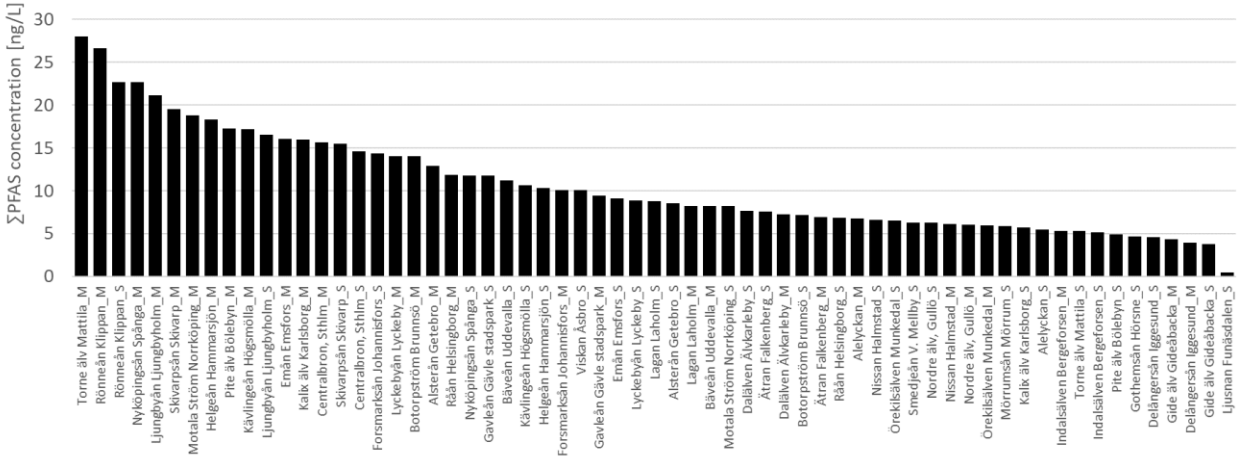

Figure 5. Concentrations of detected ∑PFAS in water sampled during May (M) and Autumn (S) 2023. Autumn samples were collected in September, October or November (sampling dates in Table A4).

3. 3 Pesticides

In total, 21 out of 132 different pesticides were detected in the water samples. Samples were taken at 29 different sampling locations in May. Pesticides were detected at 15 of these sampling locations. Out of these 15 locations, 10 locations had two or more pesticides detected in the sample (Figure 6).

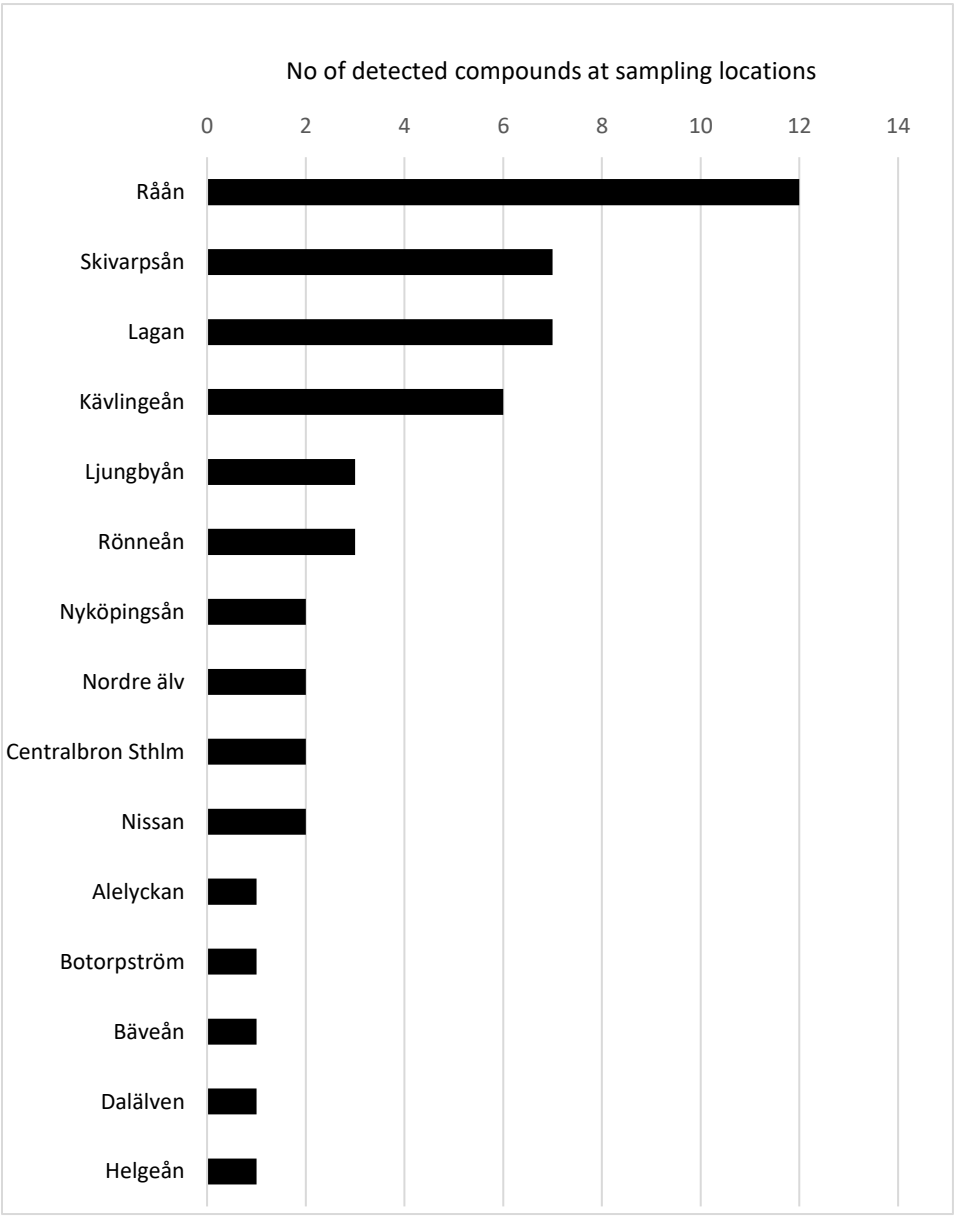

Figure 6. Number of detected pesticides in water samples collected during May 2023.

In general, the sampling locations situated in the southern part of Sweden are the ones with a higher number of pesticides detected, which is in line with the increased use of pesticides in the south of Sweden. The composition and concentrations of the detected compounds varied in the different sampling locations, but the concentrations were in general in the range 0.001 – 0.011 µg/L; only six detected compounds were in the range 0.012 – 0.037 µg/L.

Propiconazole was found at 0.037 µg/L, followed by BAM (0.024 µg/L), bentazone (0.020 µg/L), fluroxypyr (0.018 µg/L), quizalofop (0.013 µg/L) and clopyralid (0.012 µg/L).

The most commonly detected compounds were fluopyram (24%) and terbuthylazindesethyl (24%), which were found in seven of the sampling locations, followed by imidacloprid (21%), which was detected in six of the sampling locations (Figure 7).

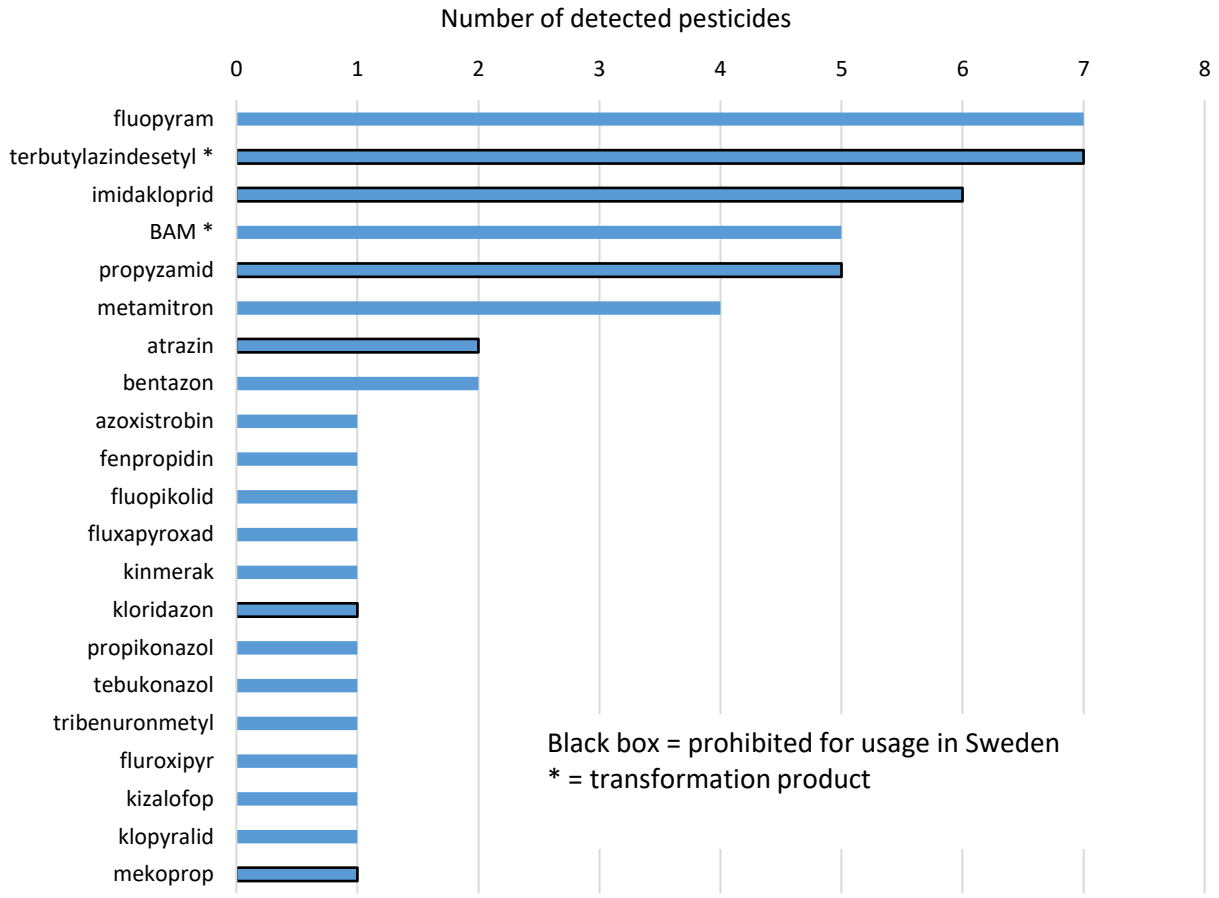

Figure 7. Number of detections of specific pesticides in water samples collected during May 2023.

Fluopyram is approved as fungicide in Sweden since 2016. Imidacloprid is not approved as a plant protection product since 2018 but is still used as an insect controlling biocide. Two of the most commonly detected compounds were transformation products, i.e., terbuthylazine-desethyl deriving from the parent compound terbuthylazine (not approved in Sweden since 2003), and

BAM, which can derive from two different parent compounds, dichlobenil (not approved in Sweden since 1990) and fluopicolide (approved for use as a potato fungicide since 2012).
The highest concentration found for an individual compound was 0.037 µg/L for propiconazole (approved as a wood preservative but not as a plant protection product since 2019) that was only detected at Nordre älv. The total concentration of substances quantified per sampling location are presented in Figure 8. For an overview of detected substances and concentrations, see table B1.

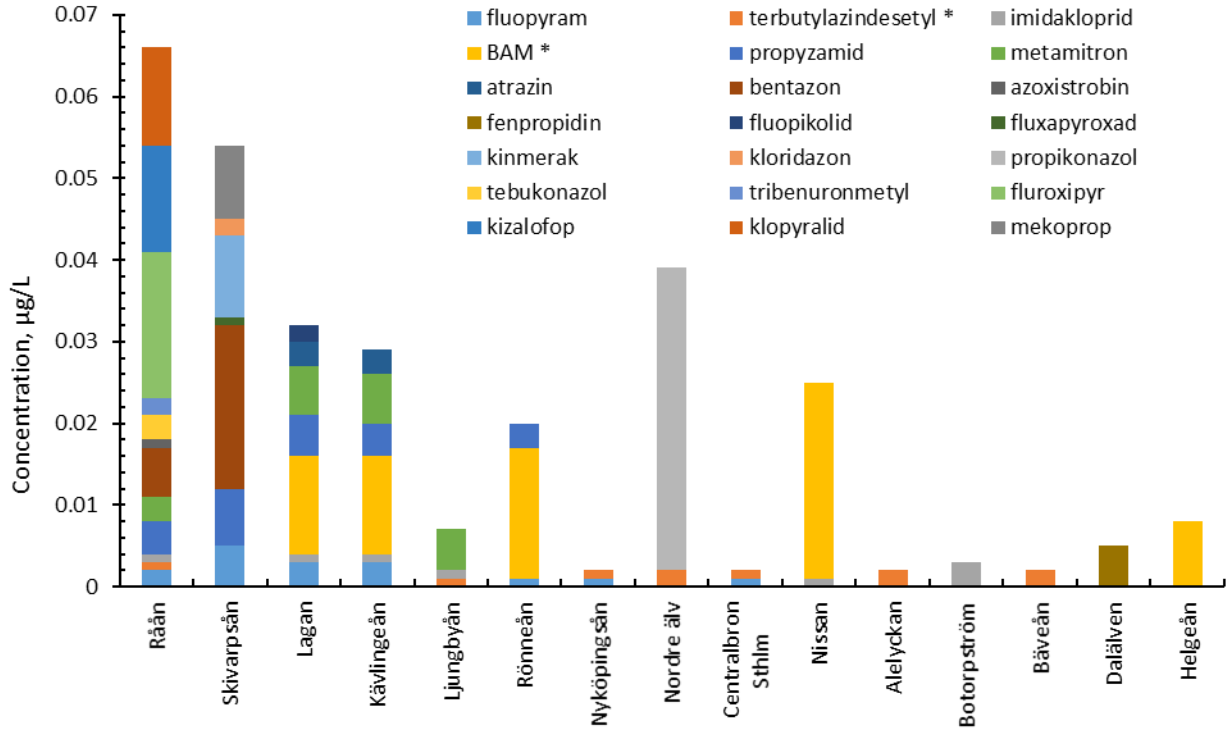

Figure 8. Total concentration of detected pesticides in water samples collected in May 2023.

One of the detected pesticides (atrazine) is a priority substance. The EU WFD AA-EQS is 0.6 µg/L for inland surface waters. The highest concentration found was 0.003 µg/L. Four of the detected substances are on the list for River Basin Specific Substances in Sweden (HVMFS 2019:25), bentazone (AA-EQS 27 µg/L, highest concentration 0.02 µg/L), chloridazon (AA-EQS 10 µg/L, highest concentration 0.002 µg/L), mecoprop (AA-EQS 20 µg/L, highest concentration 0.009 µg/L) and imidacloprid (AA-EQS 0.005 µg/L, highest concentration 0.003 µg/L). Imidacloprid is also proposed as a new priority substance with a suggested AA-EQS of 0.0068 µg/L. Two of the detected substances are on the Watch List, azoxystrobin (maximum acceptable LOQ 0.2 µg/L, highest concentration 0.001 µg/L) and tebuconazole (maximum acceptable LOD 0.24 µg/L, highest concentration 0.003 µg/L).

None of the 21 substances detected exceeded any of the EQSs or the Swedish Water Quality Objective [21].

4. Summary

In total 98 out of 249 different chemicals were found in water samples above LOQs. The most abundant OMPs with the highest detection frequency were caffeine (100%), 1,4-dioxane (100%), diethyltoluamide (DEET) (89%), nicotine (75%) and salicylic acid (68%). The most abundant PFAS with the highest detection frequency were PFOA (98%), followed by PFPeA (97%), BPFOS (95%), PFBA, PFHpA (94%), PFHxA (89%) and PFNA (95%). The most commonly detected pesticides were fluopyram (24%), terbutylazindesetyl (24%) and imidakloprid (21%).

The current annual average (AA) Environmental Quality Standard (EQS) for inland surface waters for diclofenac (0.1 µg/L) was exceeded at 2 out of 34 sites. The current EQS for PFOS (0.00065 µg/L) was exceeded at almost half of the sites (14 out of 34 sites). The proposed AA EQSs for azithromycin (0.019 µg/L), carbamazepine (2.5 µg/L), clarithromycin (0.13 µg/L), and erythromycin were not exceeded at any site. The proposed AA EQSs for diclofenac (0.04 µg/L) was exceeded at 2 sampling locations.

A number of Watch list compounds were detected including sulfamethoxazole, trimethoprim, azithromycin, tebuconazole, procloraz, clotrimazole, miconazole, venlafaxine and its metabolite desvenlafaxine. Some of the compounds under study are known as endocrine disruptors, capable of inducing changes in behavior, cellular toxicity and disrupting sex ratios in organisms.

To enhance the management and sustainability of future water resources, it is imperative to advance scientific knowledge that can aid environmental authorities in their decision-making and guidance processes.

Recommendations:

- Continued monitoring and research on OMPs are essential for gaining deeper insights into their origins, environmental levels and ecological impact.
- Further experimental data is necessary to evaluate the fate of OMPs in both water and sediment, enhancing our understanding of their natural degradation mechanisms and pathways in aquatic ecosystems.
- Future studies should conduct comprehensive assessments of the associated health risks to provide a more accurate understanding of the potential hazards posed by OMPs to aquatic ecosystems.
- A critical future focus in managing OMP pollution is regulating their release at the source to prevent their introduction into aquatic environments.

Acknowledgements

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CRediT authorship contribution statement

Oksana Golovko: Methodology, formal analysis and data handling for OMPs; Writing – original draft, Project administration, **Aleksandra Skrobonja**: Methodology, formal analysis and data handling for PFAS, **Lutz Ahrens**: Writing – review & editing, formal analysis and data handling for PFAS, **Henrik Jernstedt**: Methodology, formal analysis and data handling for pesticides, writing – original draft, **Karin Wiberg**: Writing – review & editing

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Appendix

Table A1. List of organic micropollutants (OMPs) included in the study

Compound	Category	Type	CAS number	Molecular formula	Monoisotopic mass (Da)	Log K_{owc}
1,4-dioxane		Ether	123-91-1	$C_4H_8O_2$	88.11	-0.27
6PPD	Rubber antiozonant		793-24-8	$C_{18}H_{24}N_2$	268.4	4.68
6PPD quinone	Rubber antiozonant	Transformation product of 6PPD	2754428-18-5	$C_{18}H_{22}N_2O_2$	298.4	
Albuterol (Salbutamol)	Pharmaceutical	Beta blocker	18559-94-9	$C_{13}H_{21}NO_3$	239.1	0.64
Amitriptyline	Pharmaceutical	Antidepressant	50-48-6	$C_{20}H_{23}N$	277.1	4.95
Amoxicillin	Pharmaceutical	Antibiotic	26787-78-0	$C_{16}H_{19}N_3O_5S$	365.104542	0.87
Atenolol	Pharmaceutical	Beta blocker	29122-68-7	$C_{14}H_{22}N_2O_3$	266	0.16
Atorvastatin	Pharmaceutical	Antilipidemic agents	134523-00-5	$C_{33}H_{35}FN_2O_5$	558.2	-
Azithromycin	Pharmaceutical	Antibiotic	83905-01-5	$C_{38}H_{72}N_2O_{12}$	748.5	4.02
BAM (Dichlorobenzamide)	Pesticide	Metabolite of dichlobenil	2008-58-4	$C_7H_5Cl_2NO$	189	1.29
Bezafibrate	Pharmaceutical	Antilipemic drug	41859-67-0	$C_{19}H_{20}ClNO_4$	361.1	4.25
Bicalutamide	Pharmaceutical	Antineoplastic agent	90357-06-5	$C_{18}H_{14}F4N_2O_4S$	430.373	2.3
Bisoprolol	Pharmaceutical	Antihypertensive	6722-44-9	$C_{18}H_{31}NO_4$	325.225308	1.87
Caffeine	Stimulant		58-08-02	$C_8H_{10}N_4O_2$	194.1	-0.07
Carbamazepine	Pharmaceutical	Antiepileptic	298-46-4	$C_{15}H_{12}N_2O$	236	2.25
Cetirizine	Pharmaceutical	Antihistamine	83881-51-0	C21H25ClN2O3	388.89	**1.7**
Chloramphenicol	Pharmaceutical	Antibiotic	56-75-7	$C_{11}H_{12}Cl_2N_2O_5$	322	1.14
Chlorzoxazone	Pharmaceutical	Muscle relaxant	95-25-0	$C_7H_4ClNO_2$	168.993056	1.31
Ciprofloxacin	Pharmaceutical	Antibiotic (quinolone)	85721-33-1	$C_{17}H_{18}FN_3O_3$	331.13322	0.28
Citalopram	Pharmaceutical	Antidepressant	59729-33-8	$C_{20}H_{21}FN_2O$	324.1	3.74
Clarithromycin	Pharmaceutical	Antibiotic	81103-11-9	$C_{38}H_{69}NO_{13}$	747.4	3.16
Climbazole	Pharmaceutical	Antifungal	38083-17-9	$C_{15}H_{17}ClN_2O_2$	292	3.76
Clindamycin	Pharmaceutical	Antibiotic	21462-39-5	$C_{18}H_{33}ClN_2O_5S$	424.981	2.16
Clotrimazole	Pesticide	Antifungal agent	23593-75-1	$C_{22}H_{17}ClN_2$	344.1	6.26
Clozapine	Pharmaceutical	Antipsychotic	5786-21-0	$C_{18}H_{19}ClN_4$	326.1	3.35
Codeine	Pharmaceutical	Opiates, opioids and metabolites	76-57-3	$C_{18}H_{21}NO_3$	299.1	1.28
DEET (diethyltoluamide)	Pesticide	Insect repellent	134-62-3	$C_{12}H_{17}NO$	191.1	2.26
Desvenlafaxine (O-desmethylvenlafaxine)	Pharmaceutical	Antidepressant	93413-62-8	$C_{16}H_{25}NO_2$	263.1	2.72
Diazepam	Pharmaceutical	Sedative	439-14-5	$C_{16}H_{13}ClN_2O$	284	2.70
Diclofenac	Pharmaceutical	NSAID (nonsteroidal anti-inflammatory drug)	15307-86-5	$C_{14}H_{11}Cl_2NO_2$	295	4.02
Diltiazem	Pharmaceutical	Antihypertensive	42399-41-7	$C_{22}H_{26}N_2O_4S$	414.1	2.79
Erytromycin	Pharmaceutical	Antibiotic	114-07-8	$C_{37}H_{67}NO_{13}$	733.4	-
Ethylparaben	Paraben	Antifungal preservative	120-47-8	$C_9H_{10}O_3$	166	2.49
Fexofenadine	Pharmaceutical	Antihistamine	153439-40-8	$C_{32}H_{39}NO_4$	501.656	2.81
Fluconazole	Pharmaceutical	Antifungal	86386-73-4	$C_{13}H_{12}F_2N_6O$	306.1	0.25
Fluoxetine	Pharmaceutical	Antidepressant	54910-89-3	$C_{17}H_{18}F_3NO$	309.134049	4.09
Furosemide	Pharmaceutical	Diuretics	54-31-9	$C_{12}H_{11}ClN_2O_5S$	330	2.32
Gemfibrozil	Pharmaceutical	Antilipidemic agents	25812-30-0	$C_{15}H_{22}O_3$	250.1	4.77
Hydrochlorothiazide	Pharmaceutical	Diuretics	58-93-5	$C_7H_8ClN_3O_4S_2$	296.9	-0.10

Ifosfamide	Pharmaceutical	Anticancer	3778-73-2	$C_7H_{15}Cl_2N_2O_2P$	260.02482	0.86
Enilconazole (Imazalil)	Pesticide	Fungicide	35554-44-0	$C_{14}H_{14}Cl_2N_2O$	296.18	4.10
Ipconazole	Pesticide	Fungicide	125225-28-7	$C_{18}H_{24}ClN_3O$	333.16	4.65
Irbesartan	Pharmaceutical	Antihypertensive	138402-11-6	$C_{25}H_{28}N_6O$	428.2	5.31
Lamotrigine	Pharmaceutical	Antiepileptic	84057-84-1	$C_9H_7Cl_2N_5$	255	0.99
Lidocaine	Pharmaceutical	Anesthetic	137-58-6	$C_{14}H_{22}N_2O$	234.1	1.66
Loperamide	Pharmaceutical	Antidiarrhoeal	53179-11-6	$C_{29}H_{33}ClN_2O_2$	476.223056	5.5
Losartan	Pharmaceutical	Antihypertensive	114798-26-4	$C_{22}H_{23}ClN_6O$	422.1	4.01
Memantine	Pharmaceutical	Alzheimer	41100-52-1	$C_{21}H_{21}N$	179.307	3.28
Metconazole	Pesticide	Fungicide	125116-23-6	$C_{17}H_{22}ClN_3O$	319.829	4.19
Metformin	Pharmaceutical	Biguanide hypoglycemic agent (non-insulin-dependent diabetes mellitus)	657-24-9	$C_4H_{11}N_5$	129.101445	-2.64
Methylparaben	Paraben	Antifungal preservative	99-76-3	$C_8H_8O_3$	152	2.00
Metoprolol	Pharmaceutical	Beta blocker	51384-51-1	$C_{15}H_{25}NO_3$	267.1	1.69
Metronidazole	Pharmaceutical	Antibiotic	443-48-1	$C_6H_9N_3O_3$	171	0.00
Miconazole	Pesticide	Antifungal agent	22916-47-8	$C_{18}H_{14}Cl4N2O$	413.986	6.25
Mirtazapine	Pharmaceutical	Antidepressant	85650-52-8	$C_{17}H_{19}N_3$	265.1	3.03
Nicotine	Stimulant		54-11,5	$C_{10}H_{14}N_2$	162.1	1.00
Oxazepam	Pharmaceutical	Sedative	604-75-1	$C_{15}H_{11}ClN_2O_2$	286	3.34
Oxycodone	Pharmaceutical	Opiates, opioids and metabolites	76-42-6	$C_{18}H_{21}NO_4$	315.1	0.66
Panthenol	Pharmaceutical	Moisturizer	16485-10-2	$C_9H_{19}NO_4$	205.131408	-1.92
Penconazole	Pesticide	Fungicide	66246-88-6	$C13H_{15}Cl_2N3$	283.064	4.67
Primidone	Pharmaceutical	Antiepileptic	125-33-7	$C_{12}H_{14}N_2O_2$	218.1	0.73
Prochloraz	Pesticide	Fungicide	67747-09-05	$C_{15}H_{16}Cl3N_3O_2$	375.665	4.13
Propranolol	Pharmaceutical	Beta blocker	525-66-6	$C_{16}H_{21}NO_2$	259.1	2.60
Propylparaben	Paraben	Antifungal preservative	94-13-3	$C_{10}H_{12}O_3$	180	2.98
Ramipril	Pharmaceutical	Antihypertensive	87333-19-5	$C_{23}H_{32}N_2O_5$	416.231122	3.32
Ranitidine	Pharmaceutical	Antisecretory agent	66357-35-5	$C_{13}H_{22}N_4O_3S$	314.1	0.29
Roxithromycin	Pharmaceutical	Antibiotic	80214-83-1	$C_{41}H_{76}N_2O_{15}$	836.5	-
Salicylic acid	Pharmaceutical	NSAID (nonsteroidal anti-inflammatory drug)	69-72-7	$C_7H_6O_3$	138	2.24
Sertraline	Pharmaceutical	Antidepressant	79617-96-2	$C_{17}H_{17}Cl_2N$	305	5.29
Simvastatin	Pharmaceutical	Statins (HMG CoA reductase inhibitors)	79902-63-9	$C_{25}H_{38}O_5$	418.271924	4.68
Sotalol	Pharmaceutical	Beta blocker	3930-20-9	$C_{12}H_{20}N_2O_3S$	272.1	0.37
Sulfamethoxazole	Pharmaceutical	Antibiotic	723-46-6	$C_{10}H_{11}N_3O_3S$	253	0.48
Tebuconazole	Pesticide	Fungicide	107534-96-3	$C_{16}H_{22}ClN_3O$	307.818	3.89
Terbutaline	Pharmaceutical	Beta adrenergic receptor agonists	23031-25-6	$C_{12}H_{19}NO_3$	225.136493	0.9
Tetraconazole	Pesticide	Fungicide	112281-77-3	$C_{13}H_{11}Cl_{2F4}N_3O$	372.146	4.25
Thiabendazole	Pharmaceutical	Antihelminthic	148-79-8	$C_{10}H_7N_3S$	201.036068	2.47
Tolyltriazole	Industrial chemical		13351-73-0	$C_7H_7N_3$	133.063997	-
Tramadol	Pharmaceutical	Analgesics (painkiller)	27203-92-5	$C_{16}H_{25}NO_2$	263.1	3.01
Trimethoprim	Pharmaceutical	Antibiotic	738-70-5	$C_{14}H_{18}N_4O_3$	290.1	0.73
Valsartan	Pharmaceutical	Antihypertensive	137862-53-4	$C_{24}H_{29}N_5O_3$	435.2	3.65
Venlafaxine	Pharmaceutical	Antidepressant	93413-69-5	$C_{17}H_{27}NO_2$	277.2	3.28

Guanylurea	Pharmaceutical	Metabolite of metformin		$C_2H_6N_4O$	102.1	-3.57
Butyl methoxy-dibenzoyl-methane	Ultraviolet filter			$C_{37}H_{40}O_4$	548.7	4.51
Octocrylene	Ultraviolet filter			$C_{24H27}NO_2$	361.5	6.88
Benzophenone-3	Ultraviolet filter			C14H12O3	228.24	3.79
Fipronil	Pesticide	insecticide		C12H4Cl2F6N4OS	437.1	4.00

Table A2. List of PFAS included in the study

Name	Abbreviation	Group
Perfluorobutanoic acid	PFBA	PFCAs
Perfluoropentanoic acid	PFPeA	
Perfluorohexanoic acid	PFHxA	
Perfluoroheptanoic acid	PFHpA	
Perfluorooctanoic acid	PFOA	
Perfluorononanoic acid	PFNA	
Perfluorodecanoic acid	PFDA	
Perfluoroundecanoic acid	PFUnDA	
Perfluorododecanoic acid	PFDoDA	
Perfluorotridecanoic acid	PFTriDA	
Perfluorotetradecanoic acid	PFTeDA	
Perfluorobutane sulfonic acid	PFBS	PFSAs
Perfluoropentane sulfonic acid	PFPeS	
Perfluorohexane sulfonic acid (linear)	L-PFHxS	
Perfluorohexane sulfonic acid (branched)	B-PFHxS	
Perfluoroheptane sulfonic acid	PFHpS	
Perfluorooctane sulfonic acid (linear)	L-PFOS	
Perfluorooctane sulfonic acid (branched)	B-PFOS	
Perfluorononane sulfonic acid	PFNS	
Perfluorodecane sulfonic acid	PFDS	
Perfluorooctane sulfonamide	FOSA	FOSAs
Methylperfluorooctanesulfonamidoacetic acid	MeFOSAA	FOSAAs
Ethylperfluorooctanesulfonamidoacetic acid	EtFOSAA	
4:2 Fluorotelomer sulfonat	4:2 FTSA	FTSAs
6:2 Fluorotelomer sulfonat	6:2 FTSA	
8:2 Fluorotelomer sulfonat	8:2 FTSA	
Ammonium perfluoro (2-methyl-3-oxahexanoate)	HFPO-DA (GenX)	
Propanoic Acid / Ammonium 2,2,3-trifluoro-3-(1,1,2,2,3,3-hexafluoro-3-(trifluoromethoxy)propoxy)propanoate	NaDONA (ADONA)	
6:2 chlorinated polyfluorinated ether sulfonate	6:2 Cl-PFESA (9Cl-PF3ONS) (F-53B)	
8:2 chlorinated polyfluorinated ether sulfonate	8:2 Cl-PFESA (11Cl-PF3OUdS)	

Table A3. List of pesticides included in the study

Compound	LOD (µg/L)	LOQ (µg/L)	CAS	Compound	LOD (µg/L)	LOQ (µg/L)	CAS
2,4-D	0,01	0,05	94-75-7	fluopyram	0,001	0,002	658066-35-4
acetamiprid	0,001	0,002	135410-20-7	fluoxastrobin	0,001	0,002	361377-29-9
alaklor	0,005	0,01	15972-60-8	flupyrsulfuronmetyl	0,002	0,01	144740-54-5
amidosulfuron	0,001	0,002	120923-37-7	fluroxipyr	0,01	0,05	69377-81-7
amisulbrom	0,05	0,25	348635-87-0	flurtamon	0,001	0,002	96525-23-4
atrazin	0,001	0,002	1912-24-9	fluxapyroxad	0,001	0,002	907204-31-3
atrazindesetyl	0,001	0,002	6190-65-4	foramsulfuron	0,001	0,002	173159-57-4
atrazindesisopropyl	0,005	0,01	1007-28-9	halauxifen-metyl	0,002	0,01	943831-98-9
azoxistrobin	0,001	0,002	131860-33-8	hexazinon	0,001	0,002	51235-04-2
BAM	0,005	0,01	2008-58-4	hexytiazox	0,01	0,05	78587-05-0
bensovindiflupyr	0,002	0,01	1072957-71-1	imazalil	0,005	0,01	35554-44-0
bentazon	0,005	0,01	25057-89-0	imidakloprid	0,001	0,002	138261-41-3
bifenox-syra	0,01	0,05	53774-07-5	indoxakarb	0,01	0,05	173584-44-6
bitertanol	0,01	0,05	55179-31-2	ipkonazol	0,001	0,002	125225-28-7
bixafen	0,002	0,01	581809-46-3	isofetamid	0,002	0,01	875915-78-9
boskalid	0,005	0,01	188425-85-6	isoproturon	0,001	0,002	34123-59-6
cyantraniliprol	0,05	0,25	736994-63-1	isopyrazam	0,001	0,002	881685-58-1
cyazofamid	0,002	0,005	120116-88-3	jodsulfuronmetyl	0,005	0,01	144550-36-7
cyflufenamid	0,002	0,01	180409-60-3	karbendazim	0,002	0,005	10605-21-7
cykloxidim	0,01	0,05	101205-02-1	karfentrazonetyl	0,005	0,01	128639-02-1
cymoxanil	0,01	0,05	57996-95-7	karfentrazonsyra	0,025	0,05	128621-72-7
cyprodinil	0,002	0,01	121552-61-2	kinmerak	0,005	0,01	90717-03-6
difenokonazol	0,005	0,01	119446-68-3	kizalofop	0,01	0,01	76578-12-6
diflufenikan	0,002	0,01	83164-33-4	kletodim	0,01	0,05	99129-21-2
diklorprop	0,005	0,01	120-36-5	klomazon	0,001	0,002	81777-89-1
dimetenamid-p	0,002	0,01	87674-68-8	klopyralid	0,01	0,05	1702-17-6
dimetoat	0,001	0,002	60-51-5	kloridazon	0,002	0,002	1698-60-8
dimetomorf	0,002	0,01	110488-70-5	klotianidin	0,005	0,01	210880-92-5
diuron	0,003	0,01	330-54-1	linuron	0,003	0,01	330-55-2
epoxikonazol	0,005	0,01	135319-73-2	mandipropamid	0,001	0,002	374726-62-2
etofumesat	0,003	0,01	26225-79-6	MCPA	0,005	0,01	94-74-6
fenmedifam	0,001	0,002	13684-63-4	mefentriflukonazol	0,002	0,01	1417782-03-6
fenpropidin	0,005	0,01	67306-00-7	mekoprop	0,005	0,01	93-65-2
fenpropimorf	0,005	0,01	67564-91-4	mesosulfuronmetyl	0,005	0,01	208465-21-8
florasulam	0,005	0,01	145701-23-1	mesotrion	0,01	0,05	104206-82-8
fluazinam	0,002	0,01	79622-59-6	metabenstiazuron	0,001	0,002	18691-97-9
fludioxonil	0,002	0,01	131341-86-1	metalaxyl	0,001	0,002	57837-19-1
flufenacet	0,001	0,002	142459-58-3	metamitron	0,003	0,01	41394-05-2
fluopikolid	0,002	0,005	239110-15-7	metazaklor	0,001	0,002	67129-08-2

Compound	LOD (µg/L)	LOQ (µg/L)	CAS	Compound	LOD (µg/L)	LOQ (µg/L)	CAS
metiokarb	0,001	0,002	2032-65-7	sedaxan	0,001	0,002	874967-67-6
metkonazol	0,002	0,002	125116-23-6	siltiofam	0,001	0,002	175217-20-6
metobromuron	0,002	0,01	3060-89-7	simazin	0,001	0,002	122-34-9
metolaklor	0,002	0,002	51218-45-2	spiroxamin	0,002	0,01	118134-30-8
metrafenon	0,003	0,01	220899-03-6	sulfosulfuron	0,001	0,002	141776-32-1
metribuzin	0,005	0,01	21087-64-9	tebukonazol	0,002	0,01	107534-96-3
metsulfuronmetyl	0,002	0,005	74223-64-6	terbutryn	0,005	0,01	886-50-0
napropamid	0,001	0,002	15299-99-7	terbutylazin	0,001	0,002	5915-41-3
oxatiapiprolin	0,001	0,002	1003318-67-9	terbutylazindesetyl	0,001	0,002	30125-63-4
pendimetalin	0,01	0,02	40487-42-1	tiakloprid	0,001	0,002	111988-49-9
penkonazol	0,003	0,01	66246-88-6	tiametoxam	0,002	0,002	153719-23-4
pikloram	0,05	0,25	1918-02-01	tienkarbazon-metyl	0,1	0,25	317815-83-1
pikolinafen	0,05	0,15	137641-05-5	tifensulfuronmetyl	0,002	0,002	79277-27-3
pikoxystrobin	0,001	0,002	117428-22-5	tiofanatmetyl	0,001	0,002	23564-05-8
pinoxaden	0,002	0,01	243973-20-8	triallat	0,005	0,01	2303-17-5
pirimikarb	0,001	0,002	23103-98-2	tribenuronmetyl	0,002	0,002	101200-48-0
prokinazid	0,002	0,01	189278-12-4	trifloxystrobin	0,002	0,01	141517-21-7
prokloraz	0,005	0,01	67747-09-5	trifloxystrobin-syra	0,005	0,01	252913-85-2
propakizafop	0,005	0,01	111479-05-1	triflusulfuronmetyl	0,001	0,002	126535-15-7
propamokarb	0,002	0,01	24579-73-5	trinexapak-etyl	0,005	0,01	95266-40-3
propikonazol	0,005	0,01	60207-90-1	trinexapak-syra	0,05	0,25	104273-73-6
propoxikarbazon-Na	0,005	0,01	181274-15-7	tritikonazol	0,005	0,01	131983-72-7
propyzamid	0,001	0,002	23950-58-5	tritosulfuron	0,01	0,05	142469-14-5
prosulfokarb	0,005	0,01	52888-80-9				
protiokonazol-destio	0,003	0,01	120983-64-4				
pymetrozin	0,01	0,05	123312-89-0				
pyraflufenetyl	0,002	0,01	129630-19-9				
pyraklostrobin	0,002	0,01	175013-18-0				
pyriofenon	0,001	0,002	688046-61-9				
pyroxsulam	0,002	0,01	422556-08-9				
rimsulfuron	0,002	0,01	122931-48-0				

Table A4. List of locations included in the study

Station name	SWEREF_N	SWEREF_E	X_Id	Y_Id	Län	Läns-bokstav	Nivå (m)	Sampled (Spring, May 2023)*	Sampled (Autumn 2023)*
Botorpström, Brunnsö	6392208	589249	6393390	1541220	8	H	0.5	5/22/2023	9/11/2023
Centralbron, Sthlm	6580488	674315	6580650	1628410	1	AB	0.5	5/15/2023	9/12/2023
Gide älv, Gideåbacka	7031457	705271	7030550	1665720	22	Y	0.5	5/15/2023	9/11/2023
Kalix älv, Karlsborg	7326323	872437	7324070	1836040	25	BD	0.5	5/24/2023	9/19/2023
Kävlingeån, Högsmölla	6183240	379372	6186780	1328810	12	M	0.5	5/15/2023	
Lagan, Laholm	6265128	380076	6268750	1330510	13	N	0.1	5/15/2023	10/12/2023
Lyckebyån, Lyckeby	6228238	540991	6230060	1491190	10	K	0.5	5/15/2023	9/11/2023
Motala Ström, Norrköping	6495264	565175	6496730	1518380	5	E	0.5	5/15/2023	10/16/2023
Mörrumsån, Mörrum	6227369	484539	6229500	1434500	10	K	0.5	5/15/2023	9/18/2023
Råån, Helsingborg	6208257	361524	6212050	1311220	12	M	0.5	5/15/2023	10/16/2023
Skivarpsån, Skivarp	6145730	411067	6148860	1360020	12	M	0.5	5/15/2023	10/16/2023
Smedjeån, V. Mellby	6264652	375369	6268270	1325770	13	N	0.1	5/15/2023	10/12/2023
Alsterån, Getebro	6318968	570581	6320330	1521670	8	H	0.5	5/15/2023	9/13/2023
Bäveån, Uddevalla	6471414	321035	6475820	1273690	14	O	0.3	5/22/2023	9/11/2023
Dalälven, Älvkarleby	6716428	633862	6717420	1589740	3	C	0.5	5/22/2023	9/13/2023
Forsmarksån, Johannisfors	6694697	676984	6695000	1632460	3	C	0.1	5/22/2023	9/13/2023
Gavleån, Gävle stadspark	6728334	616191	6729240	1572240	21	X	0.5	5/15/2023	10/17/2023
Göta Älv, Trollhättan	6463558	340767	6467710	1293300	14	O	0.5	5/16/2023	9/19/2023
Helgeån, Hammarsjön	6199820	451131	6202770	1400910	12	M	0.5	5/16/2023	9/14/2023
Nissan, Halmstad	6285017	369787	6288770	1320400	13	N	0.1	5/15/2023	10/12/2023
Nordre älv, Gullö	6415408	317213	6419809	1269355	14	O	0.5	5/16/2023	10/18/2023
Nyköpingsån, Spånga	6520892	611899	6523700	1564420	4	D	0.3	5/16/2023	9/12/2023
Pite älv, Bölebyn	7265405	792380	7264100	1755250	25	BD	0.5	5/10/2023	9/13/2023
Rönneån, Klippan	6221174	384636	6224670	1334580	12	M	0.5	5/16/2023	9/14/2023
Viskan, Åsbro	6347240	337607	6351360	1288950	13	N	0.5	5/23/2023	9/18/2023
Ätran, Falkenberg	6309352	347407	6313380	1298330	13	N	0.1	5/15/2023	10/12/2023
Örekilsälven, Munkedal	6484891	306641	6489300	1259640	14	O	0.5	5/30/2023	10/17/2023
Emån, Emsfors	6334282	587847	6335200	1539200	8	H	0.4	5/16/2023	10/17/2023
Indalsälven, Bergeforsen	6934501	623040	6935870	1582050	22	Y	0.3	5/15/2023	11/14/2023
Delångersån, Iggesund	6835609	610559	6836610	1567930	21	X	0.5	5/22/2023	9/14/2023
Gothemsån, Hörsne	6385253	715277	6384910	1667210	9	I	0.01	5/22/2023	9/17/2023
Ljungbyån, Ljungbyholm	6277028	571895	6278310	1522550	8	H	0.5	5/17/2023	9/21/2023
Torne älv Mattila	7337523	915069	7333510	1879000	25	BD	0.2	5/15/2023	9/19/2023
Alelyckan	6406625	321848	6410710	1273720	14	O		5/16/2023	9/19/2023
Ljusnan Funäsdalen	6938340	374935	6942310	1333500	23	Z	0.5	5/20/2023	11/9/2023

Table B1: Summary table of detected pesticides and their concentrations in the different sample locations

		Provplats	Nyköpings-ån	Ljungby-ån	Helgeån	Skivarpsån	Rönneån	Råån	Kävlingeån	Lagan
		Provdatum	23-05-16	23-05-17	23-05-16	23-05-15	23-05-16	23-05-16	23-05-15	23-05-15
		StKod	D0040	H0045	M0048	M0050	M0053	M0066	M0073	N0054
	LOD	LOQ	Halt	Halt	Halt	Halt	Halt	Halt	Halt	Halt
	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
atrazin	0,001	0,002	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	0,003	0,003
azoxistrobin	0,001	0,002	<LOD	<LOD	<LOD	<LOD	<LOD	*0,001*	<LOD	<LOD
BAM	0,005	0,01	<LOD	<LOD	*0,008*	<LOD	0,016	<LOD	0,012	0,012
bentazon	0,005	0,01	<LOD	<LOD	<LOD	0,02	<LOD	*0,006*	<LOD	<LOD
fenpropidin	0,005	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
fluopikolid	0,002	0,005	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	*0,002*
fluopyram	0,001	0,002	*0,001*	<LOD	<LOD	0,005	*0,001*	0,002	0,003	0,003
fluroxipyr	0,01	0,05	<LOD	<LOD	<LOD	<LOD	<LOD	*0,018*	<LOD	<LOD
fluxapyroxad	0,001	0,002	<LOD	<LOD	<LOD	*0,001*	<LOD	<LOD	<LOD	<LOD
imidakloprid	0,001	0,002	<LOD	<LOD	<LOD	<LOD	<LOD	*0,001*	*0,001*	*0,001*
kinmerak	0,005	0,01	<LOD	<LOD	<LOD	0,01	<LOD	<LOD	<LOD	<LOD
kizalofop	0,01	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	0,013	<LOD	<LOD
klopyralid	0,01	0,05	<LOD	<LOD	<LOD	<LOD	<LOD	*0,012*	<LOD	<LOD
kloridazon	0,002	0,002	<LOD	<LOD	<LOD	0,002	<LOD	<LOD	<LOD	<LOD
mekoprop	0,005	0,01	<LOD	<LOD	<LOD	*0,009*	<LOD	<LOD	<LOD	<LOD
metamitron	0,003	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	*0,003*	*0,006*	*0,006*
propikonazol	0,005	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
propyzamid	0,001	0,002	<LOD	<LOD	<LOD	0,007	0,003	0,004	0,004	0,005
tebukonazol	0,002	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	*0,003*	<LOD	<LOD
terbutylazindesetyl	0,001	0,002	*0,001*	*0,001*	<LOD	<LOD	<LOD	*0,001*	<LOD	<LOD
tribenuronmetyl	0,002	0,002	<LOD	<LOD	<LOD	<LOD	<LOD	0,002	<LOD	<LOD

		Provplats	Bäveån	Alelyckan	Nordre älv	Ljungbyån	Centralbron	Dalälven	Botorpström	Nissan
		Provdatum	23-05-22	23-05-16	23-05-16	23-05-17	23-05-15	23-05-22	23-05-22	23-05-15
		StKod	O0062	O0069	O1909	H0045	AB0037	C0031	H0043	N0056
	LOD	LOQ	Halt	Halt	Halt	Halt	Halt	Halt	Halt	Halt
	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
atrazin	0,001	0,002	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
azoxistrobin	0,001	0,002	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
BAM	0,005	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	0,024
bentazon	0,005	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
fenpropidin	0,005	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	*0,005*	<LOD	<LOD
fluopikolid	0,002	0,005	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
fluopyram	0,001	0,002	<LOD	<LOD	<LOD	<LOD	*0,001*	<LOD	<LOD	<LOD

fluroxipyr	0,01	0,05	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
fluxapyroxad	0,001	0,002	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
imidakloprid	0,001	0,002	<LOD	<LOD	<LOD	*0,001*	<LOD	<LOD	0,003	*0,001*
kinmerak	0,005	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
kizalofop	0,01	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
klopyralid	0,01	0,05	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
kloridazon	0,002	0,002	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
mekoprop	0,005	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
metamitron	0,003	0,01	<LOD	<LOD	<LOD	*0,005*	<LOD	<LOD	<LOD	<LOD
propikonazol	0,005	0,01	<LOD	<LOD	0,037	<LOD	<LOD	<LOD	<LOD	<LOD
propyzamid	0,001	0,002	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
tebukonazol	0,002	0,01	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
terbutylazindesetyl	0,001	0,002	0,002	0,002	0,002	<LOD	*0,001*	<LOD	<LOD	<LOD
tribenuronmetyl	0,002	0,002	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD

Kursiv = spårhalt
(trace amount)