MONITORING PROGRAM FOR PHARMACEUTICALS, ILLEGAL SUBSTANCES, AND CONTAMINANTS IN FARMED FISH

Annual report for 2024

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Summary (English):

This report summarizes the results of the monitoring of illegal substances, pharmaceuticals, and contaminants in Norwegian farmed fish in 2024. In 2024, a total of 1015 samples of both fresh fish fillet and liver were examined, in addition to 13 samples of smoked farmed fish fillet. All samples were collected by the Norwegian Food Safety Authority as part of the official monitoring plan and were analyzed by IMR. Samples for illegal substances were collected at all stages of farming and are representative of farmed fish under production. The samples were analyzed for substances with anabolic effect or unauthorized substances. Samples tested for approved veterinary drugs and contaminants were collected at slaughterhouses and are representative of Norwegian farmed fish ready for human consumption. Residues of the authorized anti-sea lice agents emamectin, diflubenzuron, cypermethrin, and deltamethrin were found at concentrations below the respective Maximum Residue Limits (MRLs) in fish meat. Residues of other authorized veterinary drugs, such as antibiotics, drugs against internal parasites, or sedatives, were not detected. The concentrations of environmental contaminants were found below the EU Maximum Levels (MLs), where those are established for fish. Further analyses were performed to monitor the occurrence of compounds of emerging concern in fillet of farmed fish. These compounds were selected based on their relevance to aquaculture, and included chemical elements, a broad spectrum of pesticides, mycotoxins, persistent organic pollutants, processing contaminants, technological feed additives, nitrate and nitrite, and aromatic hydrocarbons, including PAHs in samples of smoked fish fillet.

Summary (Norwegian):

Denne rapporten oppsummerer resultatene fra overvåkningen av ulovlige stoffer, legemidler og kontaminanter i norsk oppdrettsfisk i 2024. Totalt 1015 prøver av både fersk fiskefillet og lever ble analysert i 2024, i tillegg til 13 prøver av røykt fillet av oppdrettsfisk. Prøvene ble samlet inn av Mattilsynet som en del av det offisielle overvåkingsprogrammet og ble analysert av Havforskningsinstituttet. Prøver for ulovlige stoffer ble samlet inn på alle stadier av oppdrett og er representative for oppdrettsfisk under produksjon. Prøver som ble analysert for godkjente veterinærlegemidler og kontaminanter, ble samlet inn ved slakterier og er representative for norsk oppdrettsfisk klar for konsum. Rester av de godkjente avlusingsmidlene emamektin, diflubenzuron, cypermetrin og deltametrin ble funnet i konsentrasjoner under respektive maksimumsgrenseverdier (MRL) i fiskekjøtt. Rester av andre godkjente veterinærlegemidler, som antibiotika, midler mot innvollsparasitter eller sedativer, ble ikke påvist. Konsentrasjonene av miljøkontaminanter ble funnet å være under EUs maksimumsgrenser (ML) der slike er etablert for fisk. Videre analyser ble utført for å overvåke forekomsten av nye kontaminanter. Disse forbindelsene ble valgt basert på deres relevans for akvakultur, og inkluderte grunnstoffer, et bredt spekter av plantevernmidler, mykotoksiner, persistente organiske miljøgifter, prosesseringskontaminanter, teknologiske fôrtilsetningsstoffer, nitrat og nitritt, og aromatiske hydrokarboner samt PAH i de prøvene av røykt fillet.

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1 - Introduction

Official control rules enable the enforcement of EU regulations and standards governing food safety and animal health. This ensures that businesses and operators comply with legal requirements, thereby preventing fraudulent practices and maintaining the integrity of food products. The rules are also designed to uphold standards of food safety and quality throughout the agri-food chain. Authorities can identify and address risks associated with food production, processing, and distribution by conducting official controls. Such controls increase consumer safety and confidence in food products marketed in EU and European Economic Area (EEA) countries.

As part of the EEA, Norway aligns its control framework with EU standards, supporting harmonized practices and regulatory cooperation across the internal market. Norway carries out official controls in accordance with Regulation (EU) 2017/625[1] on official controls, which has been incorporated into Norwegian law through the EEA Agreement and implemented nationally by the Norwegian Food Act (Matloven) and related regulations. The Norwegian Food Safety Authority (Mattilsynet) is responsible for performing these controls in Norway and ensures compliance with legislation governing food and feed safety, animal health and welfare.

Considering relevance in aquaculture production, residues and substance groups were included into the national control plan for pharmacologically active substances in Norwegian farmed fish in line with Annexes I and II of Commission Delegated Regulation (EU) 2022/1644.[2] Contaminants groups were included in the control plan in line with Commission Delegated Regulation (EU) 2022/931.[3] In addition to contaminants that are regulated with legal limits, in 2024 the occurrence of several emerging contaminants was surveyed in farmed fish. These contaminants were identified by the European Food Safety Authority (EFSA), the Norwegian Scientific Committee for Food and the Environment (VKM) or the Institute of Marine Research (IMR) as emerging chemical risks in food and feed and selected for surveying according to their relevance for farmed fish food production. All samples in this report were collected by the Norwegian Food Safety Authority (NSFA) as part of the official monitoring plan and were analyzed by the IMR.

1.1 - Prohibited or unauthorized pharmacologically active substances in food-producing animals (Group A substances)

Fish tested for illegal compounds were collected without prior notification to the farmers. Official inspectors from the NSFA collected the samples at all stages of farming in order to represent farmed fish during production. Substances monitored in Group A include growth promoters like steroids, stilbenes and beta-agonists, unauthorized pharmacologically active feed additives, such as resorcylic acid lactones, and unauthorized drugs. Unauthorized drugs considered most relevant for aquaculture are chloramphenicol, nitrofurans, metronidazole and dyes.

Analytical methods for Group A compounds should meet minimum method performance requirements (MMPRs) set by the European Union[4], and European reference laboratories (EU-RLs)[5] to ensure harmonized control of unauthorized substances. No maximum residue level (MRL) is established for Group A compounds. Instead, any residue detected is considered a hazard to human health.

1.2 - Pharmacologically active substances authorized for use in food-producing animals (Group B substances)

Current EU legislation (Commission Regulation (EU) 37/2010)[6] provisions the assignment of limits for all legally applied pharmacologically active substances in products intended for human consumption, where required, in

order to protect public health. A maximum residue limit (MRL) denotes the highest permitted residual concentration of a legally applied veterinary drug and is evaluated for each substance and each food product individually. For fish, the MRLs are set for muscle and skin in natural proportions. Consuming food with drug residues below the MRL should not pose a health risk to the consumer. Samples examined for authorized veterinary drugs were collected from fish at processing plants and the samples are representative of fish ready to be placed on the market for human consumption.

1.3 - Regulated contaminants in food

Samples examined for contaminants were collected from fish at processing plants and are representative of fish ready for human consumption. In the EU, maximum levels (ML) have been established for certain contaminants in food, per Commission Regulation (EU) 2023/915.[6] For fish, MLs are established for certain groups of halogenated persistent organic pollutants, namely dioxins, dioxins and dioxin-like PCBs, PCB-6 (the sum of 6 non-dioxin-like PCBs), and per- and polyfluoroalkyl substances (PFAS). The heavy metals mercury, cadmium, and lead are also mandated and have MLs. These compounds are therefore mandated within the official control plan for contaminants as part of the 2024 monitoring plan.

1.4 - Other, non-regulated contaminants

A diverse range of contaminants are also included in monitoring in 2024 despite not having established MLs. The various chemical classes were selected as emerging contaminants, or because of their relevance to aquaculture. The data herein provide information about their occurrence in farmed fish fillet. Levels of several non-regulated chemical elements, as well as the occurrence of arsenic and mercury species are included. A range of brominated flame retardants (BFRs) were measured, including “legacy” BFRs such as polybrominated diphenyl esters (PBDEs), but also novel halogenated flame retardants were surveyed. Moreover, a broad screening of chlorinated and organophosphorus pesticides and mycotoxins was performed in 2024, in addition to monitoring of residues of individual processing contaminants from feed production, or residues of environmental pollutants.

2 - Materials and methods

2.1 - Sampling

Samples were taken on fish farms or slaughterhouses, by official inspectors from the NFSA, in all fish-producing regions in Norway. The sampling plan was randomized according to season and region. In 2024, analyses were conducted on 888 fillet samples and 127 liver samples of Atlantic salmon *(Salmo salar*), rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), Atlantic halibut (*Hippoglossus hippoglossus*), and Atlantic cod (*Gadus morhua*).

Samples were transported to the Institute of Marine Research (IMR) in a frozen state. Analyses of substances with anabolic effects or unauthorized substances were performed on individual fish samples, whereas authorized pharmacologically active substances and contaminants were analyzed as pooled samples comprising three fish from the same cage/farm.

In addition, thirteen samples of smoked fish fillet were randomly collected by official inspectors from the NSFA at the production sites. The samples were taken as composite samples consisting of three, five or ten processed fish depending on the size of the production batch. Both packaged and unpackaged samples were taken. Unpackaged samples were packed into aluminum foil before transport. Samples were transported chilled to the IMR and immediately processed.

2.2 - Pre-treatment

Sample identifications were anonymized for the analysts upon arrival at IMR. A back-up sample was stored for all samples. For analyses of Group B substances and regulated contaminants, pooled samples of muscle from three fish from the same cage/farm were homogenized together. The Norwegian Quality Cut (NQC) of the was used for all fillet samples.[7,8] Samples for analyses of Group A substances also included small fish from early life stages taken at the farm, and in these cases, the whole fish except head, tail and gut were used. Composite samples of smoked fish fillets were homogenized before analysis.

For analysis of selected antibiotics in Group B1a, individual liver samples were collected in addition to the NQC fillet. These liver samples were excised from the fish for screening of antimicrobial agent residues with microbiological inhibition zone assay. If residues were to be detected, the back-up sample of muscle would be analyzed by chemical methods. The maximum residue limits for veterinary drugs are set for muscle and skin in natural proportions.[9] Therefore, according to the analytical protocol, any detection of drug residues in the muscle or liver was followed by a re-analysis of the back-up sample, consisting of muscle and skin in natural proportions, in duplicate.

2.3 - Analytical methods

The laboratory routines and most of the analytical methods are accredited in accordance with the standard ISO 17025. A summary of the analytical methods and their limit of quantification (LOQ) and/or limit of detection (LOD) is provided in Table A 1. The LOQ is the lowest level for a reliable quantitative measurement, while the LOD is the lowest level at which the method is able to detect the substance. For all methods, a sample blank, and a quality control sample with a known composition and concentration of target analyte are included in each series. The methods are regularly verified by participation in inter laboratory proficiency tests, and by analyzing certified reference material, where such exist.

3 - Results

3.1 - Prohibited or unauthorized pharmacologically active substances in food-producing animals (Group A)

In 2024, a total of 394 individual fillet samples were tested for residues of illegal substances, including stilbenes (194 samples), steroids (102 samples), resorcylic acid lactones (zeranol & beta-zearalanol; 194 samples), beta agonists (98 samples), and unauthorized veterinary drugs including chloramphenicol (97 samples), nitrofurans (98 samples), metronidazole (104 samples), dapsone (93 samples) and dyes (201 samples). The samples were mainly taken from Atlantic salmon, but also samples from rainbow trout, Atlantic cod, and Atlantic halibut were analyzed. The evaluation criterion for samples for official controls of illegal substances is presence.

No residues of any unauthorized compounds were detected in any of the samples. The individual substances included in the monitoring of these substance groups, analytical methods, and reference limits are listed in Table A 1.

Table 1 . Substances with anabolic effect and unauthorized substances in fillets of farmed fish. The table shows the total number of samples analyzed in 2024, number of samples per fish species. No residues of any unauthorized compounds were detected in any of the samples. Samples are fillet from individual fish per sample taken at the production site.

		Number of samples analyzed per species			
Antibacterial agents	**total n**	**Atlantic salmon**	**Rainbow trout**	**Atlantic cod**	**Atlantic halibut**
A1a Stilbenes*	**194**	175	17	0	2
A1c Steroids*	**102**	96	4	1	1
A1d Resorcylic acid lactones, incl. Zeranol*	**194**	175	17	0	2
A1e Beta-agonists*	**98**	86	11	0	1
A2a Chloramphenicol	**97**	86	10	0	1
A2b Nitrofurans (AHD, AOZ, AMOZ, SEM)	**98**	86	11	0	1
A2c Metronidazole, Metronidazole hydroxide	**104**	98	4	1	1
A2d Dapsone	**95**	87	7	0	1
A3a Dyes*	**201**	184	14	1	2

* *A list of summed individual substances and their limits of detection and reference limits is provided in Table A 1.*

3.2 - Pharmacologically active substances authorized for use in food-producing animals (Group B)

Samples analyzed for veterinary drugs were collected from fish at processing plants, representing fish ready for human consumption. The maximum residue limit (MRL) for veterinary drugs is defined for muscle and skin in natural proportions.[9] Therefore, according to the analytical protocol, any detection of drug residues in a sample of muscle or liver would be followed by a re-analysis of the backup sample, consisting of muscle and skin in natural proportions, in duplicate.

3.2.1 - Group B1a, Antimicrobial substances

Antibacterial agents were monitored with two analytical methods. No antibacterial agent residues were detected above LOQ in any of the samples analyzed. The broad groups quinolones, sulfonamides, tetracyclines, and amphenicols were screened using a three-plate bioassay in livers of 127 fish (Table 2). In addition, 120 pooled

fillet samples representing 360 fish taken at processing sites (Group B-samples) were tested for residues of antibacterial substances using chemical analysis methods (Table 3). Furthermore, 95 individual fish samples were taken at the farm (Group A-samples) and analyzed for sulfonamides, ormethoprim and trimethoprim using a chemical analysis method (Table 3). None of the substances included in the measurement were detected above LOQ.

Table 2 . Antibacterial agents in liver of farmed fish. The table shows total number of pooled samples analyzed in 2024, number of samples analyzed per fish species, number of samples above LOQ (n >LOQ), and method LOQs for the screening for residues of four groups of broad-spectrum antibiotics in liver tissue.

		Species				
Antibiotics in liver		**Atlantic salmon**	**Rainbow trout**	**Atlantic halibut**	**LOQ (µg/kg w.w.)**	**MRL (µg/kg w.w.)**
n	**127**	122	1	4		
Quinolones	n>LOQ	0	0	0	100	*
Sulfonamides	n>LOQ	0	0	0	400	*
Tetracyclines	n>LOQ	0	0	0	200	*
Amphenicols	n>LOQ	0	0	0	200	*

** No MRL established for liver.*

Table 3 . Antibacterial agents in fillets of farmed fish. The table shows the total number of pooled samples analyzed in 2024, number of samples analyzed per fish species, number of samples above the LOQ (n >LOQ), method LOQs, and legal maximum residue limits (MRLs) for residues of different antibacterial substances included in the monitoring.

		Species						
Antibiotics in fillet		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (µg/kg w.w.)**	**MRL[9] (µg/kg w.w.)**
n	**100**	82	8	2	6	2		
Ciprofloxacin	n>LOQ	0	0	0	0	0	10	100 (Sum)
Enrofloxacin	n>LOQ	0	0	0	0	0	10	
Florfenicol	n>LOQ	0	0	0	0	0	4	1000
Flumequine	n>LOQ	0	0	0	0	0	40	600
Oxolinic acid	n>LOQ	0	0	0	0	0	40	100
Trimethoprim	n>LOQ	0	0	0	0	0	2	50
n	**20**	17	1	1	1	0		
Tetracycline	n>LOQ	0	0	0	0	0	30	100
Doxycycline	n>LOQ	0	0	0	0	0	30	100
Chlortetracycline	n>LOQ	0	0	0	0	0	30	100
Oxytetracycline	n>LOQ	0	0	0	0	0	30	100
n	**95**	87	7	0	0	1		
Sulfonamides*†	n>LOQ	0	0	0	0	0	30	100
Ormethoprim*	n>LOQ	0	0	0	0	0	30	‡
Trimethoprim*	n>LOQ	0	0	0	0	0	30	50

** Analyzed in 95 individual fillet samples taken at the farm. † Sum of 22 individual sulfonamides. See Table A 1 for list. ‡ No MRL established.*

3.2.2 - Group B1b, Insecticides, fungicides, anthelmintics and other antiparasitic agents

Residues anti-sea-lice agents (Table 4) and agents for treatment of endoparasites (Table 5) were monitored in a total of 494 pooled fillet samples, representing 1482 fish. Data for all measured anthelmintics are reported in this section, although some do not have assigned MRL values. Residues of the anti-sea lice agent emamectin (9.3 µg/kg) were detected in one sample, and the level was below the MRL of 100 µg/kg.[9] Residues of diflubenzuron (1.2 µg/kg) were detected in one sample of Atlantic salmon and were below the MRL established at 10 µg/kg for fish fillet.[9]

Cypermethrin and deltamethrin were monitored in 111 samples in 2024 (Table 4). Cypermethrin was detected in 5 out of 94 pooled fillet samples of Atlantic salmon. The maximum value of cypermethrin measured was 1.8 µg/kg, which is below the veterinary use MRL of 50 µg/kg[9] established for cypermethrin residues from use as veterinary drugs. The median value of the five cypermethrin detections in Atlantic salmon was 1.2 µg/kg. The MRL for deltamethrin used as veterinary drug is established at 10 µg/kg for fin fish.[9] The only value of deltamethrin detected (1.1 µg/kg in Atlantic halibut) was below this MRL.

Both cypermethrin and deltamethrin are synthetic pyrethroid substances, authorized for use as pharmaceutical delousing agent applied as bath treatment in aquaculture farm cages. These compounds are also used as insecticide in large-scale commercial agricultural applications. Residues of cypermethrin and deltamethrin in fish may therefore originate from their use in pharmaceutical applications, or from plant-based ingredients that are used in current fish feed from which residue levels are transferred to fish muscle. There are defined MRLs for their use as veterinary drugs in muscle and skin in natural proportions, however there are no MRLs for cypermethrin or deltamethrin as pesticide residues in fish muscle, yet.[9-11]

Results are provided in Section 3.4.3.2 for other pyrethroid compounds that are not regulated, neither as pharmaceuticals nor as pesticides. These include bifenthrin, cyfluthrin, fenvalerate, lambda-cyhalothrin, and permethrin. No samples had levels above LOQ.

No residues of other anti-sea lice agents or antiparasitic agents were detected in any of the samples in 2024.

Table 4 . Anti-sea lice agents in fillet of farmed fish. The table shows the total number of pooled samples analyzed in 2024, number of samples analyzed per fish species, number of samples with residues above LOQ (n >LOQ), method LOQs, and legal maximum residue limits (MRL). Where residues above LOQ were detected, the maximum value measured (µg/kg w.w.) is given in the row underneath.

		Species						
Anti-sealice agents		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (µg/kg w.w.)**	**MRL[9] (µg/kg w.w.)**
n	**152**	136	2	1	9	4		
Emamectin	n>LOQ	1	0	0	0	0	2	100
	Maximum	9.3	LOQ	LOQ	LOQ	LOQ		
n	**11**	10	1	0	0	0		
Ivermectin	n>LOQ	0	0	-	-	-	2	*
Abamectin	n>LOQ	0	0	-	-	-	2	*
Doramectin	n>LOQ	0	0	-	-	-	2	*
Eprinomectin	n>LOQ	0	0	-	-	-	2	50
Moxidectin	n>LOQ	0	0	-	-	-	2	*
n	**126**	105	9	3	7	2		
Diflubenzuron	n>LOQ	1	0	0	0	0	1	10
	Maximum	1.2	LOQ	LOQ	LOQ	LOQ		
Teflubenzuron	n>LOQ	0	0	0	0	0	1	500
Lufenuron	n>LOQ	0	0	0	0	0	1	1350
Hexaflumeron	n>LOQ	0	0	0	0	0	1	500
Fluazuron	n>LOQ	0	0	0	0	0	1	200
n	**108**	92	7	0	6	3		
Imidacloprid	n>LOQ	0	0	-	0	0	2	600
n	**111**	94	7	0	7	3		
Cypermethrin	n>LOQ	5	0	-	0	0	0.49-1.0	50**
	Maximum	1.8	LOQ	-	LOQ	LOQ		
Deltamethrin	n>LOQ	0	0	-	0	1	0.49-1.0	10
	Maximum	LOQ	LOQ	-	LOQ	1.1		

** No MRL established. ** MRL established for* Salmonidae *only (muscle and skin in natural proportions).*

Table 5 . Agents against endoparasites in fillet of farmed fish. The table shows the total number of pooled samples analyzed in 2024, number of samples analyzed per fish species, number of samples above LOQ (n >LOQ), and method LOQs and maximum residue limits (MRLs).

		Species						
Agents against endoparasites		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (µg/kg w.w.)**	**MRL[9] (µg/kg w.w.)**
n	**125**	105	9	3	6	2		
Praziquantel	n>LOQ	0	0	0	0	0	2	20*
Fenbendazole	n>LOQ	0	0	0	0	0	3	**

** MRL established for fin fish (muscle and skin in natural proportions). ** No MRL established .*

3.2.3 - Group B1c, Sedatives

No residues of isoeugenol were found in any of the 117 samples analyzed (Table 6).

Table 6 . Sedatives in fillet of farmed fish. The table shows the total number of pooled samples analyzed in 2024, number of samples analyzed per farmed fish species, and number of samples above LOQ (n >LOQ), method LOQ and legal maximum limits (MRL) for isoeugenol measured in fish fillets (µg/kg w.w.).

		Species						
Sedatives		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (µg/kg w.w.)**	**MRL[9] (µg/kg w.w.)**
n	**117**	106	1	1	5	4		
Isoeugenol	n>LOQ	0	0	0	0	0	50	6000

3.3 - Regulated contaminants in fish fillet

3.3.1 - Dioxins, dl-PCBs and PCB-6

Levels of dioxin (PCDD+PCDF), dioxin-like PCBs (dl-PCBs) and non-dioxin-like PCBs (PCB-6) in farmed fish were measured in a total of 116 samples, representing 348 fish. The sums of dioxins, dioxins + dl-PCBs and PCB-6 are calculated as upper bound.[6] Accordingly, the numerical LOQ values were used for calculating the sums for congeners with levels below LOQ. PCB-6 is the sum of the following 6 non-dioxin-like PCB congeners: 28, 52, 101, 138, 153, and 180.

The levels of dioxins and dl-PCBs are reported as ng toxic equivalents 2005 (TEQ05)/kg and represent the sum of 17 different PCDD/F and 12 dl-PCBs where each congener was multiplied by a Toxic Equivalency Factor (TEF). TEF values are determined by the World Health Organization (WHO), and the toxicity of each congener is expressed relative to the most toxic form of dioxin, which has a TEF value of 1.[6,12] TEF values have recently been reevaluated and updated.[13] However, the new values have not yet been incorporated into the legal framework, and the 2005 TEF is currently still applied for calculation of the TEQ.

Dioxin levels measured in different species of farmed fish in 2024 were similar to the levels found in the previous years. For salmon, the median of the sum of dioxins was 0.12 ng TEQ/kg w.w. The maximum value found in salmon (0.46 ng TEQ/kg w.w.) was below the EU maximum level (ML) of 3.5 ng TEQ/kg w.w.[6]

The median of the sum of all 29 PCDD/F and dl-PCBs was 0.31 ng TEQ/kg w.w. for salmon, which is nearly the same as in 2022 (0.32 ng TEQ/kg w.w.). The highest result for sum dioxin and dl-like PCBs was 1.1 ng TEQ/kg w.w., measured in Atlantic halibut. All measured values were below the EU maximum level of 6.5 ng TEQ/kg w.w.[6] The median of PCB-6 for salmon was 2.4 µg/kg w.w. The highest level of PCB-6 in any sample was

measured in Atlantic halibut, at 9.1 µg/kg. For PCB-6, a maximum level is set at 75 µg/kg w.w. in the EU.[6]

Table 7 . Median and maximum concentrations of the sum of dioxins, sum of dioxin and dioxin-like PCBs and PCB-6 in fillets of different farmed fish species in 2024. All concentrations are calculated as upper bound (UB). The EU maximum levels (ML) established for fish muscle are given in the last column.

		Species					
Dioxins and PCBs		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**ML[6]**
n	**116**	105	1	1	5	4	
Sum dioxins (ng TEQ/kg w.w.)	Median	0.12	-	-	0.019	0.13	3.5
	Maximum	0.46	0.067	0.25	0.047	0.29	
Sum dioxin + dl-PCBs (ng TEQ/kg w.w.)	Median	0.31	-	-	0.022	0.46	6.5
	Maximum	0.79	0.25	0.61	0.059	1.1	
PCB-6 (µg/kg w.w.)	Median	2.4	-	-	0.10	2.1	75
	Maximum	6.6	2.3	4.7	0.13	9.1	

3.3.2 - Perfluorinated compounds

Per- and polyfluoroalkyl substances (PFAS) are a large class of synthetic chemicals. They have a wide range of different physical and chemical properties and have been used in various applications for more than 50 years. PFAS are increasingly detected as environmental pollutants and some of the substances have been linked to negative health effects. Since 2023, MLs have been established for fish fillet for four PFAS (PFOS, PFOA, PFNA, PFHxS) individually and their sum (PFAS-4).[6] PFAS are thus included into the control plan for farmed fish and have been analyzed in a total of 313 pooled fillet samples in 2024. The results on PFAS measurements are presented in Table 8, and full names of the PFAS compounds are provided in Table A 1, Appendix.

Most of the analyzed PFAS compounds were not found at levels above the respective LOQs in any sample. None of the samples exceeded the MLs established by EU.[6] PFHxA was detected above LOQ in one salmon sample. PFOS was detected above LOQ in one salmon sample, seven samples of Atlantic cod samples, and half of the 8 Atlantic halibut samples. PFOS has a MLs established at 7 and 2 µg/kg w.w. in fish fillet. The maximum measured concentration was 0.22 µg/kg w.w. in Atlantic halibut. PFOS was not detected in any of the brown or rainbow trout samples.

Table 8 . Perfluorinated compounds in fillets of different farmed fish species. The table shows the number of samples analyzed per species, number of samples with values above LOQ (n > LOQ), and the maximum concentration measured of different perfluorinated compounds. A "-" is given as the maximum when no samples had levels above LOQ. LOQs and maximum levels (ML) are given in the last columns.

		Species						
Perfluorinated compounds		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (µg/kg w.w.)**	**ML (µg/kg w.w.)**
n	**313**	264	21	1	19	8		
PFBA*	n>LOQ	0	0	0	0	0	1.0	‡
PFBS	n>LOQ	0	0	0	0	0	0.1	‡
PFDA	n>LOQ	0	0	0	0	0	0.1	‡
PFDoDA	n>LOQ	0	0	0	0	0	0.1-0.5	‡
PFDoDS	n>LOQ	0	0	0	0	0	0.1-0.5	‡
PFDS	n>LOQ	0	0	0	0	0	0.1	‡
PFHpA	n>LOQ	0	0	0	0	0	0.2	‡
PFHpS	n>LOQ	0	0	0	0	0	0.1-1.0	‡
PFHxA	n>LOQ	1	0	0	0	0	0.5- 1.0	‡
	Maximum	1.0	-	-	-	-		
PFHxDA†	n>LOQ	0	0	0	0	0	0.1-1.0	‡
PFHxS	n>LOQ	0	0	0	0	0	0.1	0.2 (0.2)§
PFNA	n>LOQ	0	0	0	0	0	0.1-0.5	2.5 (0.5)§
PFNS	n>LOQ	0	0	0	0	0	0.1	‡
PFOA	n>LOQ	0	0	0	0	0	0.1-0.2	1 (0.2)§
PFOS	n>LOQ	1	0	0	7	4	0.1-0.2	7 (2)§
	Maximum	0.10	-	-	0.15	0.22		
FOSA	n>LOQ	0	0	0	0	0	0.1-0.5	‡
PFPeA	n>LOQ	0	0	0	0	0	0.2-0.5	‡
PFPeS	n>LOQ	0	0	0	0	0	0.1	‡
PFTeDA	n>LOQ	0	0	0	0	0	0.1-0.5	‡
PFTrDA	n>LOQ	0	0	0	0	0	0.5-1.0	‡
PFUnDA	n>LOQ	0	0	0	0	0	0.2-1.0	‡
PFUnDS	n>LOQ	0	0	0	0	0	0.1-0.2	‡
Sum PFAS-4 (LB)§	Mean	0	0	0	0.05	0.08	0	8 (2)¶
	Median	0	0	0	0	0.05		
	Maximum	0.10	0	0	0.15	0.22		

**Measured in 61 samples in total; n(Atlantic salmon)= 40, n(Rainbow trout)= 10, n(Atlantic cod)= 9, n(Brown trout)= 1; n(Atlantic halibut)= 1. † Measured in 260 samples in total; n(Atlantic salmon)= 219, n(Rainbow trout)= 18, n(Atlantic cod)= 15, n(Brown trout)= 1; n(Atlantic halibut)= 7. ‡ No MRL assigned. § LB = lower bound ¶ The Maximum Levels established for four individual PFAS compounds, and their sum depends on both the fish species and the intended use; the given values denote MLs for fillet not intended to be used for the production of food for infants and children, and for fillet that is intended to be used in the production of food for infants and children*

in brackets. [6]

3.3.3 - Heavy metals

Three heavy metals are regulated as contaminants in fin fish under Commission Regulation (EU) 2023/915, including mercury, cadmium, and lead.[6] In 2024, monitoring of the levels of these regulated heavy metals included 311 samples of Atlantic salmon, 21 samples of rainbow trout, one sample of brown trout, 20 samples of Atlantic cod and 8 samples of Atlantic halibut (Table 9).

No fish fillet sample had total mercury levels above the MLs,[6] which is 0.3 mg/kg for Atlantic salmon, rainbow trout, and Atlantic cod, 0.5 mg/kg for brown trout, and 1 mg/kg for Atlantic halibut. The highest concentrations of total mercury were 0.061 mg/kg w.w. in samples of Atlantic cod and halibut. Median and maximum levels were similar to results from 2023. Mercury can be present in multiple chemical forms; see Section 3.4.2.2 for mercury speciation analysis.

Cadmium was found in one sample of Atlantic cod at a level of 0.001 mg/kg w.w. This value is below the ML of 0.05 mg/kg w.w.[6] None of the samples of the other fish species had cadmium levels above LOQ. The frequency of detections above LOQ in 2024 was somewhat less than in 2023, when 4 of 377 total samples had cadmium levels above LOQ (maximum in 2023 was 0.002 mg/kg w.w.).

Lead was found in one sample of Atlantic salmon, at 0.009 mg/kg w.w. This level is below the EU ML, which is set at 0.30 mg/kg w.w. in muscle meat of fish.[6] All remaining samples of Atlantic salmon and the other species had lead concentrations below the LOQ. The number of detections and levels of lead are similar to the 2023 monitoring.

Table 9 . Heavy metals in fillets of different farmed fish species. The table shows the number of samples analyzed, number of samples with values above LOQ (n>LOQ), the median, and the maximum concentration measured. Median is not calculated when 1 or fewer samples are above LOQ. LOQs and maximum levels (ML) are given in the last columns.

		Species						
Elements		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (mg/kg w.w.)**	**ML[6] (mg/kg w.w.)**
n	**361**	311	21	1	20	8		
Total Mercury	n >LOQ	311	21	1	20	8	0.0008-0.002	0.3/0.5/1*
	Median	0.014	0.019	0.032	0.053	0.057		
	Maximum	0.048	0.037	0.032	0.061	0.061		
Cadmium	n >LOQ	0	0	0	1	0	0.0008-0.002	0.05**
	Maximum	LOQ	LOQ	LOQ	0.001	LOQ		
Lead	n >LOQ	1	0	0	0	0	0.0008-0.01	0.3
	Maximum	0.009	LOQ	LOQ	LOQ	LOQ		

** Maximum levels for mercury are dependent on fish species, and are 0.3 mg/kg for Atlantic salmon, rainbow trout, and Atlantic cod; 0.5 mg/kg for brown trout; and 1 mg/kg for Atlantic halibut. ** Maximum levels for cadmium are dependent on the fish species, and it is 0.05 mg/kg for all included species.*

3.4 - Other, non-regulated contaminants

National authorities are required to carry out official controls not only on contaminants that are subject to EU maximum levels, but also on other substances that may pose a risk to public health. As specified in Regulation (EU) 2017/625[1], along with Delegated Regulation (EU) 2022/931[3] and Implementing Regulation (EU)

2022/1646[14], the selection of such substances should take into account factors including occurrence data, toxicological relevance, consumer exposure, and the availability of suitable analytical methods. This risk-based approach ensures that national control plans remain targeted, proportionate, and capable of addressing both established and emerging food safety concerns.

In the case of fish and fishery products, this enables the inclusion of non-regulated contaminants in national monitoring programs, where their relevance is supported by a risk-based assessment.

3.4.1 - Chemical elements

Beyond the three regulated heavy metals reported in Section 3.3.3, several non-regulated chemical elements were also analyzed in 2024, including both essential and non-essential elements (Table 10). There are currently no EU limits established for any of these elements. Arsenic (as total arsenic) was present in every sample analyzed. See section 3.4.2.1 for results of organic arsenic analysis. Zinc and copper concentrations in fish fillet were found in all analysed samples, and at similar levels to previous years. The maximum concentrations found were 5.8 zinc mg/kg ww and 0.75 mg copper/kg ww, both in Atlantic salmon. Molybdenum was not found in any sample, cobalt was found in one sample of rainbow trout (0.008 mg/kg ww), nickel was found in one sample of Atlantic salmon (0.13 mg/kg ww) and one sample of rainbow trout (0.15 mg/kg ww), and silver was found in two samples of Atlantic salmon (maximum value: 0.008 mg/kg ww) and one sample of rainbow trout (0.005 mg/kg ww). Iron, manganese, selenium and zinc are essential nutrients for humans. The levels of iron, manganese and selenium were found to be similar to the previous years.

Table 10 . Chemical elements in fillets of different farmed fish species. The table shows the number of samples analyzed, number of samples with values above LOQ (n>LOQ), the median, and the maximum concentration measured. Where none of the samples had values above LOQ, "-" is given as the median, and the maximum value was set at LOQ. When more than 50% of samples are above LOQ, the median is calculated using upper bound method.

		Species					
Elements		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (mg/kg w.w.)**
n	**361**	311	21	1	20	8	
Total Arsenic	n >LOQ	311	21	1	20	8	0.002-0.004
	Median	0.57	0.79	0.97	1.2	1.4	
	Maximum	2.0	1.2	0.97	1.8	2.3	
Cobalt	n >LOQ	0	1	0	0	0	0.004-0.01
	Median	-	0.008	-	-	-	
	Maximum	LOQ	0.008	LOQ	LOQ	LOQ	
Chromium	n >LOQ	49	6	0	5	2	0.004-0.01
	Median	LOQ	LOQ	-	LOQ	LOQ	
	Maximum	0.053	0.32	LOQ	0.061	0.019	
Copper	n >LOQ	311	21	1	20	8	0.02-0.04
	Median	0.41	0.42	0.45	0.24	0.22	
	Maximum	0.75	0.6	0.45	0.36	0.23	
Iron	n >LOQ	311	21	1	20	8	0.02-0.04
	Median	2.7	2.8	2.7	0.97	0.98	
	Maximum	5.0	4.2	2.7	1.3	1.2	

		Species					
Elements		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (mg/kg w.w.)**
Manganese	n >LOQ	311	21	1	20	8	0.004-0.01
	Median	0.076	0.074	0.08	0.13	0.11	
	Maximum	0.53	0.15	0.08	0.42	0.58	
Molybdenum	n >LOQ	0	0	0	0	0	0.02-0.04
	Median	-	-	-	-	-	
	Maximum	LOQ	LOQ	LOQ	LOQ	LOQ	
Nickel	n >LOQ	1	1	0	0	0	0.05-0.1
	Median	0.13	0.15	-	-	-	
	Maximum	0.13	0.15	LOQ	LOQ	LOQ	
Selenium	n >LOQ	311	21	1	20	8	0.002-0.004
	Median	0.18	0.23	0.24	0.23	0.26	
	Maximum	0.48	0.35	0.24	0.26	0.30	
Silver	n >LOQ	1	2	0	0	0	0.002-0.004
	Median	0.008	LOQ	-	-	-	
	Maximum	0.008	0.005	LOQ	LOQ	LOQ	
Vanadium	n >LOQ	76	1	0	1	1	0.0008-0.002
	Median	LOQ	0.002	-	0.001	0.002	
	Maximum	0.01	0.002	LOQ	0.001	0.002	
Zinc	n >LOQ	311	21	1	20	8	0.08-0.2
	Median	3.9	3.8	4.2	4.1	3.8	
	Maximum	5.8	4.4	4.2	4.8	4.3	

3.4.2 - Metal species

Chemical elements can be present in more than one chemical form, or so-called species. Arsenic and mercury, for example, can be incorporated into organic molecules. In the context of chemical monitoring of farmed fish, it is relevant to distinguish between different arsenic and mercury species, because they vary greatly in terms of their rates of transfer, toxicity and potential health risks. Different metal species can have unique toxicity and rates of feed-to-fillet transfer in farmed fish.

3.4.2.1 - Arsenic speciation

The proportion of inorganic arsenic and occurrence of several organic arsenic species was investigated in 35 samples in 2024 (Table 11). Fish and seafood often contain relatively high levels of total arsenic compared to terrestrial food products, but the major form of As in seafood is typically present as organic arsenic compounds. Arsenobetaine, the dominant organic arsenic form, is considered non-toxic to humans. Arsenobetaine is not found in terrestrial food products. In contrast, inorganic arsenic (e.g. arsenite and arsenate) are classified as carcinogenic and toxic to humans. Therefore, assessing only the total arsenic content in seafood may lead to an overestimation of health risk if speciation is not considered. There is no established ML for total arsenic in fish, nor its various chemical forms. Results from 2024 demonstrate that, in salmon, median arsenobetaine levels (0.55 mg/kg w.w., Table 11) are close to levels of total arsenic (0.57 mg/kg w.w. Table 9), while inorganic arsenic

was not found above LOQ in any of the samples. Therefore, the majority of arsenic in sampled fish is found in the nontoxic, organic form.

Table 11 . Organic and inorganic arsenic (mg/kg w.w.) in fillets of different farmed fish species. The table shows the number of samples analyzed, number of samples with values above LOQ (n>LOQ), the median, and the maximum concentration measured. Where none of the samples had values above LOQ, "-" is given as the median, and the maximum value was set at LOQ. When more than 50% of samples are above LOQ, the median is calculated using upper bound method.

		Species				
Arsenic species		**Atlantic salmon**	**Rainbow trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (mg/kg w.w.)**
n	**35**	30	2	2	1	
Arsenobetaine	n >LOQ	30	2	2	1	0.004
	Median	0.55	0.40	0.80	0.90	
	Maximum	1.3	0.50	1.1	0.90	
Arsenocholine	n >LOQ	0	0	0	0	0.003-0.02
	Median	-	-	-	-	
	Maximum	LOQ	LOQ	LOQ	LOQ	
Dimethylarsinate	n >LOQ	28	2	0	0	0.002-0.004
	Median	0.0065	0.006	-	-	
	Maximum	0.01	0.008	LOQ	LOQ	
Tetramethyl arsonium ion	n >LOQ	0	0	0	0	0.003-0.02
	Median	-	-	-	-	
	Maximum	LOQ	LOQ	LOQ	LOQ	
Trimethylarsine oxide	n >LOQ	0	0	0	0	0.001-0.008
	Median	-	-	-	-	
	Maximum	LOQ	LOQ	LOQ	LOQ	
Inorganic arsenic	n >LOQ	0	0	0	0	1.4-2.8
	Median	-	-	-	-	
	Maximum	LOQ	LOQ	LOQ	LOQ	

3.4.2.2 - Mercury speciation

Total and methyl mercury were evaluated in 35 samples in 2024 (Table 12). While total mercury analysis gives an overall estimate of mercury contamination, it does not distinguish between its chemical forms, which differ significantly in potential toxicity to consumers and feed-to-fish muscle transfer. In fish muscle, methyl mercury typically accounts for more than 90% of the total mercury, and it is the form that is readily absorbed by the human body and known for its neurotoxic effects, particularly harmful to developing nervous systems in fetuses and young children. As opposed to arsenic, the inorganic form of mercury is considered to be less potentially toxic than the organic mercury forms. As expected, the majority of mercury was present in its organic methylated form. While there is currently no specific ML established for methyl mercury in fish, none of the samples exceeded the ML for total mercury in fish.

Table 12 . Total mercury and methyl mercury (mg/kg w.w.) in fillets of different farmed fish species. The table shows the number of samples analyzed, number of samples with values above LOQ (n>LOQ), the median, and the maximum concentration measured.

		Species				
Mercury speciation		**Atlantic salmon**	**Rainbow trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (mg/kg w.w.)**
n	**35**	28	4	2	1	
Total mercury	n >LOQ	28	4	2	1	0.002
	Median	0.015	0.016	0.066	0.071	
	Maximum	0.029	0.039	0.075	0.071	
Methyl mercury	n >LOQ	28	4	2	1	0.001
	Median	0.015	0.016	0.066	0.068	
	Maximum	0.028	0.037	0.075	0.068	

3.4.3 - Pesticides

3.4.3.1 - Organochlorine and organophosphorus pesticides

A suite of organochlorine and organophosphorus pesticides were determined in 111 pooled fillet samples, representing fillet of 333 fish (Table 13).

Among the organochlorine pesticides, the following were found in at least one sample: *α*-hexachlorocyclohexane, *β*-hexachlorocyclohexane, *γ*-hexachlorocyclohexane (Lindane), hexachlorobenzene, *cis*-nonachlor, *trans*-nonachlor, and mirex. The organochlorine pesticides are mostly banned for use in the EU. They are present in the environment as persistent, legacy contaminants. There is currently no MRL established for any of these compounds in fish fillet, yet as opposed to various terrestrial food products.

The analysis included three organophosphorus pesticide residues (chlorpyrifos, chlorpyrifos-methyl and pirimiphos-methyl). Of several organophosphorus pesticides that are used on crop used as feed ingredients in aquafeeds, these three pesticides are known to be most dominantly present in salmon feed. No residues of chlorpyrifos-methyl were detected in any of the samples, and chlorpyrifos was detected above limit of quantitation in one rainbow trout sample. There is currently no MRL established for chlorpyrifos or chlorpyrifos-methyl in fish fillet, however the use of these pesticides have recently been banned in the EU.[15] Pirimiphos-methyl was detected in six of 94 samples of Atlantic salmon, with a maximum concentration of 0.66 µg pirimiphos-methyl/kg fillet w.w. No residues of pirimiphos-methyl were detected in samples of rainbow trout, Atlantic cod or Atlantic halibut. There is currently no MRL established for pirimiphos-methyl in fish fillet, yet. However MRLs are established for this pesticide in various terrestrial animal food products.

Table 13 . Organochlorine and organophosphorus pesticides in fillets of farmed fish (µg/kg w.w.). The table shows the number of samples analyzed in 2024 per species, number of samples above LOQ (n>LOQ), median, and maximum measured value. Where none of the samples had values above LOQ, "-" is given as the median, and the maximum value was set at LOQ. Method LOQs for the different compounds are given in the last column. When more than 50% of samples are above LOQ, the median is calculated using upper bound method.

		Species				
Pesticides		**Atlantic salmon**	**Rainbow trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (µg/kg w.w.)**
n	**111**	94	7	7	3	
α-Hexachlorocyclohexane	n>LOQ	91	6	0	1	0.02-0.04
	Median*	0.069	0.065	-	LOQ	
	Maximum	0.11	0.12	LOQ	0.042	
β-Hexachlorocyclohexane	n>LOQ	94	7	0	2	0.02-0.04
	Median*	0.088	0.099	-	0.056	
	Maximum	0.18	0.15	LOQ	0.074	
γ-Hexachlorocyclohexane (Lindane)	n>LOQ	21	2	0	0	0.02-0.04
	Median	LOQ	LOQ	-	-	
	Maximum	0.092	0.073	LOQ	LOQ	
Hexachlorobenzene	n>LOQ	94	7	0	3	0.098-0.1
	Median*	0.74	0.66	-	0.69	
	Maximum	1.6	0.81	LOQ	1.2	
Pentachlorobenzene	n>LOQ	0	0	0	0	0.49-1.0
Toxaphene Parlar 32	n>LOQ	0	0	0	0	0.49-1.0
Toxaphene Parlar 40+41	n>LOQ	0	0	0	0	0.98-2.0
cis-Nonachlor	n>LOQ	2	0	0	0	0.20-0.40
	Median	LOQ	-	-	-	
	Maximum	0.63	LOQ	LOQ	LOQ	
trans-Nonachlor	n>LOQ	94	7	0	3	0.049-0.050
	Median*	0.46	0.40	-	0.59	
	Maximum	1.4	0.56	LOQ	0.86	
Endrin	n>LOQ	0	0	0	0	0.49-1.0
Endrin-ketone	n>LOQ	0	0	0	0	0.49-1.0
Mirex	n>LOQ	8	0	0	1	0.02-0.04
	Median	LOQ	-	-	LOQ	
	Maximum	0.086	LOQ	LOQ	0.051	
Isodrin	n>LOQ	0	0	0	0	0.49-1.0
Chlorpyrifos	n>LOQ	0	1	0	0	0.02-0.04
	Median	-	LOQ	-	-	
	Maximum	LOQ	0.091	LOQ	LOQ	

		Species				
Pesticides		**Atlantic salmon**	**Rainbow trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (µg/kg w.w.)**
Chlorpyrifos-methyl	n>LOQ	0	0	0	0	0.098-0.2
Pirimiphos-methyl	n>LOQ	6	0	0	0	0-098-0.2
	Median	LOQ	-	-	-	
	Maximum	0.66	LOQ	LOQ	LOQ	

[*] *When more than 50% of samples are above LOQ, the median is calculated using upper bound method.*

For other organochlorine pesticides, the amount present is calculated as a sum including metabolites or transformation products.[16] The results for these groups of pesticides are presented in Table 14. To calculate the sum of the components, conversion factors (Table A 3, Appendix) are used to adjust for different molecular weights. The sums in Table 14 were calculated according to the upper bound (UB) formula.[16]

For DDT and chlordane, levels were calculated for both all measured metabolites, as well as the sums of metabolites according to the legal residue definitions established through Regulation (EC) No 149/2008.[17] When using UB calculations, the numerical value of LOQ is used as a concentration value for each non-quantified analyte. UB thus represents a “worst case scenario.” As an example, all measurements of endosulfan are below LOQ, however, a sum is generated based on the LOQ-values. The results for individual organochlorine pesticides that are not summed are presented in Table 14. There are currently no MRLs established in fish fillet for any of the listed pesticides, as opposed to several terrestrial food products.[15]

Table 14 . Median and maximum concentrations of the sum of certain organochlorine pesticides and their metabolites in fillet of farmed fish (µg/kg w.w.). The values are calculated as upper bound and adjusted for molecular weights. A “-“ is given as the median when no samples had levels above LOQ.

		Species			
Pesticide sums		**Atlantic salmon**	**Rainbow trout**	**Atlantic cod**	**Atlantic halibut**
n	***111***	*94*	*7*	*7*	*3*
DDT	Median	3.3[*] (3.2)[†]	3.6[*] (3.5)[†]	0.38[*] (0.33)[†]	3.9[*] (3.7)[†]
	Maximum	10[*] (10)[†]	4.9[*] (4.7)[†]	0.38[*] (0.33)[†]	7.8[*] (7.7)[†]
Endosulfan	Median	2.2	2.2	1.1	2.2
	Maximum	2.2	2.2	1.1	2.2
Dieldrin	Median	1.2	1.1	0.41	0.96
	Maximum	2.3	1.5	0.41	1.8
Chlordane	Median	0.59[‡] (0.40)[§]	0.54[‡] (0.34)[§]	0.24[‡] (0.15)[§]	0.64[‡] (0.45)[§]
	Maximum	1.4[‡] (1.2)[§]	0.65[‡] (0.46)[§]	0.25[‡] (0.15)[§]	0.86[‡] (0.67)[§]
Heptachlor	Median	1.2	1.2	0.59	1.2
	Maximum	1.2	1.2	0.60	1.2
Toxaphene	Median	1.8	1.8	0.90	2.0
	Maximum	2.8	1.9	0.90	2.3

[*] DDT (sum of p,p-DDT, o,p-DDT, p,p-DDD, o,p-DDD, p,p-DDE,and o,p-DDE) expressed as DDT [†] Legal residue definition according to Reg. (EC) No 149/2008 [17] : DDT (sum of p,p´-DDT, o,p´-DDT, p-p´-DDE and p,p´-TDE (DDD), expressed as DDT). [‡] Chlordane (sum of

cis - and *trans* -isomers and oxychlordane expressed as chlordane). § Legal residue definition according to Reg. (EC) No 149/2008 [17] : Chlordane (sum of cis- and trans-chlordane).

3.4.3.2 - Pyrethroid pesticides

None of the following pyrethroid substances were detected in any of the samples: bifenthrin, cyfluthrin, fenvalerate, lambda-cyhalothrin, and permethrin. A total of 111 samples were included in the monitoring in 2024, that included samples of 94 Atlantic salmon, 7 rainbow trout, 7 Atlantic cod, and 3 Atlantic halibut. The LOQs ranged between 0.49 and 2.0 µg/kg w.w.

Cypermethrin and deltamethrin are pyrethroid pesticides that also have pharmacological uses and have regulated MRLs. Results for these compounds are provided in section 3.2.2.

3.4.3.3 - Glyphosate, AMPA, and glufosinate

Glyphosate and glufosinate are widely used broad-spectrum pesticides, and aminomethylphosphonic acid (AMPA) is a metabolite of glyphosate. These compounds are of interest to aquaculture as more land-based feed ingredients are used in fish feeds and are also some of the dominant pesticides found in aquafeeds. Twenty samples were included in the 2024 monitoring plan, and none had levels of glyphosate, AMPA, or glufosinate over LOQ. The 20 samples include 16 Atlantic salmon, and one of each rainbow trout, brown trout, Atlantic cod, and Atlantic cod.

3.4.3.4 - Widescope pesticide screen

Thirty samples were analyzed on a widescope screen that included 542 pesticides with LOQs ranging from 0.05-0.1 mg/kg w.w. None were above detection limit in any samples. The complete list of pesticide analytes and their LOQs are given in List A 1.

3.4.4 - Mycotoxins

Mycotoxins are secondary metabolites of fungi that can form during crop production or in storage. As for pesticides currently used on crop, mycotoxins are of emerging interest in aquaculture as fish feed ingredients have shifted more toward plant-based ingredients. The monitoring program for farmed fish in 2024 included measurements of several mycotoxins, including aflatoxins (aflatoxins B1, B2, G1, G2), deoxynivalenol, fumonisins (B1 and B2), T2 and HT2 toxin, nivalenol, ochratoxin A and zearalenone in 28 samples of Atlantic salmon and two samples for Atlantic halibut. No mycotoxins were present above LOQs, which ranged from 0.1 to 20 µg/kg ww. See Table A 1 for a list of the measured mycotoxins and their specific LOQs.

3.4.5 - Persistent organic pollutants

3.4.5.1 - Brominated flame retardants

Brominated flame retardants (BFRs) are a group of synthetic chemicals used in a wide range of consumer products to reduce their flammability. Due to their persistence, bioaccumulation and potential toxicity, the production and use of several BFRs including polybrominated diphenyl ethers (PBDEs) and hexabromocyclododecane (HBCD) has been prohibited or restricted through the Stockholm Convention on Persistent Organic Pollutants. However, these persistent chemicals are widely present and can bioaccumulate through the food web, including marine fish used as feed-ingredients. In 2024, levels of several “legacy” BFRs, such as PBDEs (Table 15) and HBCD (Table 16) were monitored in farmed fish. In addition, due to growing concerns about health risks, levels of BFRs still currently used (tetrabromobisphenol A (TBBP-A; Table 16)) and novel flame retardants (Table 17), including dechloranes were measured. There are currently no EU maximum levels for any BFR substances in food products.

Table 15 . Polybrominated biphenyl ethers (PBDEs, ng/g w.w.) in fillets of different farmed fish species. The table shows the number of samples analyzed per species, number of samples with values above LOQ (n > LOQ), and the maximum concentration measured of different perfluorinated compounds. Where none of the samples had values above LOQ, “-“ is given as the median, and the maximum

value was set at LOQ. LOQs are given in the last column . When more than 50% of samples are above LOQ, the median is calculated using upper bound method.

		Species					
PBDEs		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (ng/g w.w.)**
n	**106**	95	1	1	5	4	
PBDE 28	n>LOQ	95	1	1	2	4	0.00026-0.0011
	Median	0.0063	0.0046	0.0078	LOQ	0.0075	
	Maximum	0.060	0.0046	0.0078	0.0004	0.021	
PBDE 35	n>LOQ	1	0	0	0	0	0.00024-0.0011
	Median	LOQ	-	-	-	-	
	Maximum	0.0014	LOQ	LOQ	LOQ	LOQ	
PBDE 47	n>LOQ	95	1	1	5	4	0.00095-0.0043
	Median	0.11	0.092	0.15	0.0042	0.16	
	Maximum	1.1	0.092	0.15	0.0054	0.42	
PBDE 49	n>LOQ	95	1	1	5	4	0.00024-0.0011
	Median	0.041	0.049	0.052	0.0023	0.090	
	Maximum	0.36	0.049	0.052	0.0040	0.17	
PBDE 66	n>LOQ	95	1	1	2	4	0.00024-0.0011
	Median	0.0059	0.0064	0.0067	LOQ	0.011	
	Maximum	0.055	0.0064	0.0067	0.00043	0.021	
PBDE 71	n>LOQ	1	0	0	0	0	0.00024-0.0011
	Median	LOQ	-	-	-	-	
	Maximum	0.0012	LOQ	LOQ	LOQ	LOQ	
PBDE 75	n>LOQ	5	0	0	0	0	0.00024-0.0011
	Median	LOQ	-	-	-	-	
	Maximum	0.0066	LOQ	LOQ	LOQ	LOQ	
PBDE 77	n>LOQ	4	0	0	0	2	0.00024-0.0011
	Median	LOQ	-	-	-	0.0011	
	Maximum	0.0028	LOQ	LOQ	LOQ	0.0018	
PBDE 85	n>LOQ	1	0	0	0	0	0.00024-0.0011
	Median	LOQ	-	-	-	-	
	Maximum	0.0017	LOQ	LOQ	LOQ	LOQ	
PBDE 99	n>LOQ	95	1	1	1	4	0.00072-0.0032
	Median	0.019	0.016	0.026	LOQ	0.023	
	Maximum	0.19	0.016	0.026	0.0011	0.058	
PBDE 100	n>LOQ	95	1	1	5	4	0.00024-0.0011
	Median	0.030	0.021	0.045	0.00097	0.035	
	Maximum	0.22	0.021	0.045	0.0012	0.11	

		Species					
PBDEs		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (ng/g w.w.)**
PBDE 118	n>LOQ	39	1	1	0	4	0.00024-0.0011
	Median	LOQ	0.0011	0.0018	-	0.0017	
	Maximum	0.011	0.0011	0.0018	LOQ	0.0040	
PBDE 119	n>LOQ	95	1	1	0	4	0.00024-0.0011
	Median	0.0045	0.0056	0.0046	-	0.0094	
	Maximum	0.057	0.0056	0.0046	LOQ	0.026	
PBDE 138	n>LOQ	0	0	0	0	0	0.00095-0.0043
	Median	-	-	-	-	-	
	Maximum	LOQ	LOQ	LOQ	LOQ	LOQ	
PBDE 153	n>LOQ	95	1	1	0	4	0.00024-0.0011
	Median	0.0050	0.0040	0.0079	-	0.0069	
	Maximum	0.044	0.0040	0.0079	LOQ	0.015	
PBDE 154	n>LOQ	95	1	1	5	4	0.00024-0.0011
	Median	0.027	0.023	0.043	0.00094	0.035	
	Maximum	0.30	0.023	0.043	0.0010	0.085	
PBDE 183	n>LOQ	7	0	1	0	1	0.00024-0.0011
	Median	LOQ	-	0.00073	-	LOQ	
	Maximum	0.0058	LOQ	0.00073	LOQ	0.0012	
PBDE 196	n>LOQ	2	0	0	0	0	0.00024-0.0011
	Median	LOQ	-	-	-	-	
	Maximum	0.0020	LOQ	LOQ	LOQ	LOQ	
PBDE 197	n>LOQ	1	0	0	0	0	0.00024-0.0011
	Median	LOQ	-	-	-	-	
	Maximum	0.0037	LOQ	LOQ	LOQ	LOQ	
PBDE 206	n>LOQ	23	0	1	0	1	0.00072-0.0032
	Median	LOQ	-	0.0031	-	LOQ	
	Maximum	0.013	LOQ	0.0031	LOQ	0.0050	
PBDE 207	n>LOQ	5	0	0	0	1	0.00072-0.0032
	Median	LOQ	-	-	-	LOQ	
	Maximum	0.017	LOQ	LOQ	LOQ	0.0032	
PBDE 209	n>LOQ	6	0	0	0	1	0.012- 0.054
	Median	LOQ	-	-	-	LOQ	
	Maximum	0.12	LOQ	LOQ	LOQ	0.12	

Table 16 . Hexabromocyclododecane (HBCD) and tetrabromobisphenol A (TBBP-A) (ng/g w.w.) in fillets of different farmed fish species. The table shows the number of samples analyzed per species, number of samples with values above LOQ (n > LOQ), and the maximum concentration measured of different perfluorinated compounds. Where none of the samples had values above LOQ, "-" is given as the median, and the maximum value was set at LOQ. LOQs are given in the last column.

		Species				
HBCDs and TBBP-A		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**LOQ (ng/g w.w.)**
n	**20**	17	1	1	1	
Alpha-HBCD	n>LOQ	17	1	1	0	0.006
	Median	0.040	0.024	0.047	-	
	Maximum	0.059	0.024	0.047	LOQ	
Beta-HBCD	n>LOQ	1	0	0	0	0.0060-0.0061
	Median	LOQ	-	-	-	
	Maximum	0.0098	LOQ	LOQ	LOQ	
Gamma-HBCD	n>LOQ	1	0	0	0	0.006-0.0067
	Median	LOQ	-	-	-	
	Maximum	0.080	LOQ	LOQ	LOQ	
Sum HBCDs (UB)*	n>LOQ	17	1	1	1	*
	Median	0.052	0.036	0.059	0.018	
	Maximum	0.15	0.036	0.059	0.018	
TBBP-A	n>LOQ	0	0	0	0	0.040
	Median	-	-	-	-	
	Maximum	LOQ	LOQ	LOQ	LOQ	

** The sum is calcuated as the the upper bound (UB). No LOQ for the sum given. Refer to LOQs of the individual analytes.*

Table 17 . Novel flame retardants in fillet of farmed fish. The table shows the total number of pooled samples analyzed in 2024, number of samples analyzed per fish species, number of samples with residues above LOQ (n >LOQ), method LOQs, and legal maximum residue limits (MRL). Where residues above LOQ were detected, the maximum value measured (pg/g w.w.) is given in the row underneath. The median is presented as the upper bound when more than 50% were above LOQ.

		Species				
Novel flame retardants		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**LOQ (pg/g w.w.)**
n	**20**	17	1	1	1	
1,5-Dechlorane Plus mono adduct	n>LOQ	0	0	0	0	3.87-4.25
2,3-Dibrompropyl-2,4,6-tribromophenyl ether	n>LOQ	0	0	0	0	581-600
2,4,6-Tribromoanisole	n>LOQ	16	1	1	0	197-198
	Median	3 470	18 200	408	-	
	Maximum	20 500	18 200	408	LOQ	
2,4,6-Tribromophenylallyl ether	n>LOQ	0	0	0	0	19.4-20
2-Bromallyl-2,4,6- tribromophenyl ether	n>LOQ	0	0	0	0	19.4-20
2-Ethylhexyl-2,3,4,5- tetrabromobenzoate	n>LOQ	0	0	0	0	58.1-60

		Species				
Novel flame retardants		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**LOQ (pg/g w.w.)**
anti-Dechlorane Plus	n>LOQ	1	0	0	0	11.6-12
	Maximum	17.3	LOQ	LOQ	LOQ	
Bis(2-ethylhexyl)tetrabromo phthalate	n>LOQ	0	0	0	0	387-400
BTBPE (1,2-Bis(2,4,6-tribromophenoxy)ethane)	n>LOQ	0	0	0	0	387-400
Cl10-Dechlorane Plus	n>LOQ	0	0	0	0	3.87-4
Cl11-Dechlorane Plus	n>LOQ	0	0	0	0	3.87-4
Decabromodiphenylethane	n>LOQ	0	0	0	0	2710-2800
Dechlorane 602	n>LOQ	0	0	0	0	38.7-40
Dechlorane 603	n>LOQ	0	0	0	0	3.87-4
Dechlorane 604	n>LOQ	0	0	0	0	11.6-12
Hexabromobenzene	n>LOQ	1	0	0	0	7.74-8
	Maximum	12.8	LOQ	LOQ	LOQ	
Pentabromoethylbenzene	n>LOQ	0	0	0	0	3.87-4
Pentabromotoluene	n>LOQ	0	0	0	0	58.1-60
syn-Dechlorane Plus	n>LOQ	0	0	0	0	38.7-40

3.4.5.2 - Short + medium chain chlorinated paraffins (SCCP/MCCP)

Short- and medium-chain chlorinated paraffins (SCCPs and MCCPs) are industrial chemicals and contaminants of emerging concern regarding food safety, due to their persistence, bioaccumulation potential and possible toxic effects. SCCPs and MCCPs are complex mixtures used mainly as flame retardants, plasticizers, and lubricant additives. Classified as persistent organic pollutants, SCCPs are listed under Annex A of the Stockholm Convention on POPs, mandating their global phase-out with time-limited exemptions for specific applications. MCCPs are being reviewed under REACH[18] and evaluated for classification as PBT (Persistent, Bioaccumulative, Toxic) or vPvB in the EU. Their presence in food is being monitored and assessed due to potential health impacts. There are limited data on levels in food, especially in fish, highlighting the need for collection of occurrence data. Therefore, measurement of SCCPs and MCCPs was included in the monitoring in farmed fish in 28 samples of Atlantic salmon and two samples Atlantic halibut (Table 18). While MCCPs were measured in over 50% of the measured samples, SCCPs were present at quantifiable concentrations in fewer samples and only in Atlantic salmon. The upper bound calculated sums had maximum values of 8.7 mg SCCPs/kg ww in salmon and 4.8 mg SCCPs/kg ww in Atlantic halibut, and 42.9 and 19.8 mg MCCPs/kg ww in Atlantic salmon and Atlantic halibut, respectively.

Table 18 . Short- and medium-chain chlorinated paraffins (SCCPs and MCCPs) in fillets of farmed fish (µg/kg w.w.). The table shows the number of samples analyzed in 2024 per species, number of samples above LOQ (n >LOQ), median, and maximum measured value. Analytical method LOQs are given in Table A 1.

		Species	
Chlorinated paraffins		**Atlantic salmon**	**Atlantic halibut**
n	**30**	28	2
Sum SCCP (C10-C13)	n >LOQ	8	0

		Species	
Chlorinated paraffins		**Atlantic salmon**	**Atlantic halibut**
Lower bound (LB)	Median	0	0
	Maximum	6.2	0
Upper bound (UB)	Median	5.1	4.5
	Maximum	8.7	4.8
Sum MCCP (C14-C17)	n >LOQ	19	2
Lower bound (LB)	Median	8.4	9.5
	Maximum	25.7	10.3
Upper bound (UB)	Median	20.5	18.8
	Maximum	42.9	19.8

3.4.6 - Processing contaminants from feed

Monochloropropanediol (MCPD) and glycidyl esters are process contaminants that can be introduced into farmed fish through the use of refined vegetable oils in aquafeed. These compounds may be transferred to fish fillets, particularly in lipid-rich tissue, raising concerns for food safety. Monitoring their occurrence in fish is important to assess potential dietary exposure, support regulatory risk assessments, and ensure the safety and quality of farmed fish products. In 2024, measurement of 2-monochloropropane-1,3-diol (2-MCPD), 3-monochloropropane-1,2-diol (3-MCPD), 3-MCPD esters as well as glycidyl esters were measured in 20 samples of farmed fish (Table 19). Total MCPD was found below measurement LOQs in all included samples. Glycidyl esters were detected in two samples of Atlantic salmon, with a maximum value of 44 µg glycidyl esters/kg fillet.

Table 19 . Processing contaminants from feed. The table shows the number of samples analyzed in 2024 per species, number of samples above LOQ (n >LOQ), median, and maximum measured value (µg/kg w.w.). Where none of the samples had values above LOQ, "-" is given as the median, and the maximum value was set at LOQ. Method LOQs for the different compounds are given in the last column.

		Species					
Processing contaminants		**Atlantic salmon**	**Rainbow trout**	**Brown trout**	**Atlantic cod**	**Atlantic halibut**	**LOQ (µg/kg w.w.)**
n	**20**	16	1	1	1	1	
Total MCPD (free and bound)	n >LOQ	0	0	0	0	0	20
	Median	-	-	-	-	-	
	Maximum	LOQ	LOQ	LOQ	LOQ	LOQ	
Glycidyl esters	n >LOQ	2	0	0	0	0	10
	Median	LOQ	-	-	-	-	
	Maximum	44	LOQ	LOQ	LOQ	LOQ	

3.4.7 - Antifouling treatment for sea cages

Tralopyril is a novel active compound authorized for use in anti-fouling treatments for sea cages. A total of 10 samples (seven Atlantic salmon samples, one brown trout, one Atlantic cod and one Atlantic halibut sample) were screened for residues of tralopyril using LC-MS/MS. There was no tralopyril detected above LOQ (0.05 µg tralopyril/kg ww) in any of the samples.

3.4.8 - Feed additives

Butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT) are synthetic antioxidants authorized for use as feed and feed ingredients additives in animal nutrition within the EU/EEA. Specific maximum inclusion levels for BHA and BHT are 150 mg/kg complete feed alone or in combination.[19] In aquaculture, BHA and BHT help maintain the nutritional integrity of high-fat feed, which are particularly susceptible to rancidity. In 2024, a total of 14 fillet samples were included for monitoring of residues of BHA and BHT in fish fillet. BHA was below LOQ in all samples, while BHT was detected above LOQ in all 14 analyzed samples (Table 20). The maximum level measured was 8.2 mg BHT/kg ww, in Atlantic salmon.

Table 20 . Antioxidants in fillets of farmed fish. The table shows the number of samples analyzed in 2024 per species, number of samples above LOQ (n >LOQ), median, and maximum measured value (mg/kg w.w). Where none of the samples had values above LOQ, "-" is given as the median, and the maximum value was set at LOQ. Method LOQs for the different compounds are given in the last column.

		Species		
Feed additives		**Atlantic salmon**	**Rainbow trout**	**LOQ (mg/kg w.w.)**
n	**14**	13	1	
BHA	n >LOQ	0	0	0.2
	Median	-	-	
	Maximum	LOQ	LOQ	
BHT	n >LOQ	13	1	0.2
	Median	3.9	4.8	
	Maximum	8.2	4.8	

3.4.9 - Aromatic hydrocarbons

3.4.9.1 - Monocyclic aromatic hydrocarbons

Monocyclic aromatic hydrocarbons (MAHs) are environmental pollutants introduced into aquatic environments from for example industrial discharges, shipping activities, oil pollution or atmospheric deposition. Because some MAHs are classified as toxic and potentially carcinogenic (e.g. benzene), but occurrence data in fish fillet are scarce, measurement of benzene, ethylbenzene, styrene, toluene and xylene were included into the monitoring program of farmed fish in 2024. Most monocyclic aromatic hydrocarbons were below LOQ, and only toluene was above LOQ in any sample (Table 21). Toluene was above LOQ in eight of 28 salmon, with a maximum value of 0.11 mg/kg ww; it was also above LOQ in one of the two halibut samples, showing a maximum concentration of 0.027 mg/kg ww.

Table 21 . Monocyclic aromatic hydrocarbons in fillets of farmed fish. The table shows the number of samples analyzed in 2024 per species, number of samples above LOQ (n >LOQ), median, and maximum measured value (mg/kg w.w.). When more than 50% of samples are above LOQ, the median is calculated using upper bound method. Method LOQs for the different compounds are given in the last column.

		Species		
MAHs		**Atlantic salmon**	**Atlantic halibut**	**LOQ (mg/kg w.w.)**
n	**30**	28	2	
Benzene	n >LOQ	0	0	0.01
Ethylbenzene	n >LOQ	0	0	0.01
Styrene	n >LOQ	0	0	0.01
	n >LOQ	8	1	
	Median	LOQ	0.019	

		Species		
MAHs		**Atlantic salmon**	**Atlantic halibut**	**LOQ (mg/kg w.w.)**
Toluene	Maximum	0.11	0.027	0.01
Xylene, meta- and para-	n >LOQ	0	0	0.01
Xylene, ortho-	n >LOQ	0	0	0.01

3.4.9.2 - Polycyclic aromatic hydrocarbons in smoked fish fillet

Polycyclic aromatic hydrocarbons (PAHs) arise from incomplete combustion and can affect human health. PAHs are considered processing contaminants in smoked products, like smoked fish fillet. There are no MLs established for PAHs in fresh fish fillet. However, as PAHs have established MLs in smoked fishery products for benzo(*a*)pyrene and the sum of 4 PAHs (PAH-4: benzo(*a*)pyrene, benz(*a*)anthracene, benzo(*b*)fluoranthene, and chrysene), some analyses on processed (smoked) fish fillet were included in the monitoring programme for farmed fish in 2024, as a first survey of these processed fish products. In 2024, 12 samples of smoked salmon and one sample of smoked brown trout were analyzed for PAHs (Table 22). Residues of benz(*a*)anthracene, benzo(*c*)fluorene, and chrysene were detected in two samples of smoked Atlantic salmon products. One of these samples also contained 5-methylchrysene. All levels were found close to the LOQ for the respective compounds, and the sum PAH4 was below the established ML in smoked fish products.

Table 22 . PAH in fillets of farmed fish (mg/kg w.w.). The table shows the number of samples analyzed in 2024 per species, number of samples above LOQ (n >LOQ) and maximum measured value. Where none of the samples had values above LOQ, the maximum value was set at LOQ. Method LOQs and MLs for the different compounds are given in the last columns.

		Species			
PAHs		**Atlantic salmon**	**Brown trout**	**LOQ (µg/kg ww)**	**ML[6]**
n	**13**	12	1		
Benz(a)anthracene	n >LOQ	2	0	0.1	†
	Maximum	0.2	LOQ		
Benzo(a)pyrene	n >LOQ	0	0	0.1	2.0
Benzo(b)fluoranthene	n >LOQ	0	0	0.1	†
Benzo(c)fluorene	n >LOQ	2	0	0.1	†
	Maximum	0.1	LOQ		
Benzo(ghi)perylene	n >LOQ	0	0	0.1	†
Benzo(j)fluoranthene	n >LOQ	0	0	0.1	†
Benzo(k)fluoranthene	n >LOQ	0	0	0.1	†
Chrysene	n >LOQ	2	0	0.1	†
	Maximum	0.2	LOQ		
Cyclopenta(cd)pyrene	n >LOQ	0	0	0.1	†
Dibenz(ah)anthracene	n >LOQ	0	0	0.1	†
Dibenzo(a,e)pyrene	n >LOQ	0	0	0.5-0.7	†
Dibenzo(a,h)pyrene	n >LOQ	0	0	0.5-0.7	†
Dibenzo(a,i)pyrene	n >LOQ	0	0	0.5-0.7	†

		Species			
PAHs		**Atlantic salmon**	**Brown trout**	**LOQ (µg/kg ww)**	**ML**
Dibenzo(a,l)pyrene	n >LOQ	0	0	0.5-0.7	†
Indeno(1,2,3,-cd)pyrene	n >LOQ	0	0	0.1	†
5-methylchrysene	n >LOQ	1	0	0.1	†
	Maximum	0.1	LOQ		
Sum PAH4 (UB) *	Median	0.5	0.4	0.4	12
	Maximum	0.7	0.4		

**sum of benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene, and chrysene. Values are the upper bound, where results <LOQ are included as the sum of the 4 numerical LOQ values of the individual PAHs † No ML established*

3.4.10 - Nitrate and nitrite

Nitrate and nitrite are precursors to the formation of nitrosamines, some of which are carcinogenic compounds. The existing data on nitrate and nitrite levels in food, particularly regarding their occurrence in non-vegetable products are limited. However, monitoring these substances in food is essential for evaluating potential risks to public health, particularly in relation to long-term exposure. In fresh unprocessed fillet of farmed fish, nitrate accumulation is often a result of nitrate accumulation in the water at the production site either as a byproduct of the nitrogen cycle or environmental pollution, from for example agricultural runoff or wastewater discharge. In addition, some fish feed may contain nitrate residues naturally from plant-based ingredients. To ensure that potential food safety hazards are identified and mitigated, EFSA is calling for occurrence data of nitrate and nitrite, including specific products such as processed meats, vegetables, and even fish. Therefore, a total of 30 samples were analyzed for nitrate and nitrite in farmed fish fillet in the monitoring program in 2024, including 27 samples of Atlantic salmon, one sample of rainbow trout, and two samples Atlantic halibut. Levels of nitrate and nitrate were below LOQ only in all samples (Table 23).

Table 23 . Nitrate and nitrite in fillets of farmed fish (mg/kg w.w.). The table shows the number of samples analyzed in 2024 per species, along with the number of samples above LOQ (n >LOQ), Method LOQs for the different compounds are given in the last column.

		Species			
Nitrate and nitrite		**Atlantic salmon**	**Rainbow trout**	**Atlantic halibut**	**LOQ (mg/kg ww)**
n	**30**	27	1	2	
Nitrate	n >LOQ	3	0	0	5
Nitrite	n >LOQ	0	0	0	5

4 - Conclusions

No residues of illegal substances were detected in any of the farmed fish samples analysed in 2024.

Residues of the authorized anti-sea lice agents emamectin and diflubenzuron were detected each in one sample. In addition, cypermethrin and deltamethrin, which are authorized for use as anti-sea lice treatment but are also broadly used as plant protection agent were found. However, the concentrations of all measured residues were below the respective MRLs for the compounds.

No residues of other authorized veterinary pharmaceuticals, such as antibiotics, endoparasitic agents or sedatives were detected in any of the samples.

There were no exceedances of EU maximum levels for contaminants that have established MLs for fish fillet (sum dioxins, sum dioxins and dl-PCBs, PCB-6, mercury, lead, cadmium, and PFAS).

In 2024, the occurrence of several contaminants of emerging concern for food safety was surveyed in farmed fish fillets. For many of these newly included contaminants occurrence data in food and particularly fish are scarce and thus the contribution of fish to the overall exposure could not be assessed in consumer exposure assessments. Some of the surveyed contaminants of emerging concern were detected in farmed fish fillets. These contaminants will be included further into the monitoring program for farmed fish. All data will be submitted to the NFSA and the EFSA to support a comprehensive risk assessment of these compounds.

5 - References

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6 - Appendix

Summary of analytical methods.

Table A 1 . Summary of analytical methods

Group of substances	Analyte	Method	LOQ (µg/kg w.w.)	Reference limit (µg/kg w.w.)	Lab
A1a Stilbenes	Diethylstilbestrol	LC-MS/MS	1*	Presence	Eurofins
	Dienestrol		1*		
	Hexestrol		1*		
	B-Estradiol		1*		
	α-Estradiol		1*		
	Estriol		1*		
	Estrone		1*		
	Ethinyl estradiol		1*		
A1c Steroids	α-nandrolone	LC-MS/MS	1*	Presence	Eurofins
	α-trenbolone		1*		
	β-trenbolone		1*		
	Trenbolone-acetate		2*		
	16-Hydroxy stanozolol		1*		
	α -Boldenone		1*		
	Boldenone		1*		
	Chlor-Testosterone (Clostebol)		1*		
	Epitestosterone		1*		
	Methyl-Boldenone (Dianabol)		1*		
	Methyltestosterone		1*		
	Nortestosterone/ Nandrolone		1*		
	Stanozolol		1*		
	Testosterone		1*		
	Testosterone-propionate		0.7-2*		
A1d Resorcylic acid lactones, incl. Zeranol	Zeranol	LC-MS/MS	1*	Presence	Eurofins
	Beta-Zearalanol		1*		
	Bromobuterol		0.10*		
	Cimaterol		0.50*		
	Cimbuterol		0.50*		
	Clenbuterol		0.10*		
	Clencyclohexerol		1.0*		
	Clenpenterol		0.50*		

Group of substances	Analyte	Method	LOQ (µg/kg w.w.)	Reference limit (µg/kg w.w.)	Lab
A1e Beta-agonists	Clenproperol	LC-MS/MS	0.50*	Presence	Eurofins
	Fenoterol		5.0*		
	Hydroxymethyl-clenbuterol		0.10*		
	Isoxsuprine		0.50*		
	Chlorbrombuterol		0.10*		
	Mabuterol		0.10*		
	Mapenterol		0.10*		
	Metaproterenol (Orciprenalin)		10*		
	Ractopamine		1.0*		
	Ritodrine		0.50*		
	Salbutamol		5.0*		
	Salmeterol		5.0*		
	Terbutaline		10*		
	Tulobuterol		0.10*		
	Zilpaterol		5.0*		
A2a Chloramphenicol	Chloramfenicol	LC-MS/MS	0.13*	Presence	IMR
A2b Nitrofurans	Nitrofuran AOZ	LC-MS/MS	0.5*	Presence	
	Nitrofuran AHD		0.37*	Presence	
	Nitrofuran AMOZ		0.4*	Presence	
	Nitrofuran SEM		0.5*	Presence	
A2c Metronidazole	Metronidazole	LC-MS/MS	0.24*	Presence	
	Hydroxy-metronidazole		0.71*		
A2d Other substances	Dapsone	LC-MS/MS	2-30*	Presence	Eurofins
A3a Dyes	Malachite green	LC-MS/MS	0.15*	Presence	IMR
	Leuco malachite green		0.15*	Presence	
	Crystal violet		0.30*	Presence	
	Leuco crystal violet		0.15*	Presence	
	Brilliant green		0.15*	Presence	
B1a Antibacterial substances (micro-biological method)	Quinolones	3-plate Screening Method	200	‡	IMR
	Sulfonamides		400	‡	
	Tetracyclines		200	‡	
	Amphenicols		200	‡	
	Oxolinic acid		40	100	
	Flumequine		40	600	
	Enrofloxacin		10		

Group of substances	Analyte	LC-MS/MS Method	LOQ (µg/kg w.w.)	Reference limit (µg/kg w.w.)	IMR Lab
B1a Antibacterial substances (chemical methods)	Ciprofloxacin	LC-MS/MS	10	100 (Sum)	Eurofins
	Trimethoprim		2	50	
	Florfenicol		4	1000	
	Tetracycline	LC-MS/MS	30	100	
	Doxycycline		30	100	
	Chlortetracycline		30	100	
	Oxytetracycline		30	100	
	Ormethoprim†	LC-MS/MS	30	‡	Eurofins
	Trimethoprim†		30	50	
	Sulfabenzamide†		30	100 (Sum sulfonamides)	
	Sulfacetamide†		30		
	Sulfachloropyridazine†		30		
	Sulfaclozine†		30		
	Sulfadiazine†		30		
	Sulfadimethoxine†		30		
	Sulfadimidine†		30		
	Sulfadoxine†		30		
	Sulfaguanidine†		30		
	Sulfamerazine†		30		
	Sulfameter†		30		
	Sulfamethizole†		30		
	Sulfamethoxazole†		30		
	Sulfamethoxypyridazine†		30		
	Sulfamonomethoxine†		30		
	Sulfanilamide†		30		
	Sulfaphenazole†		30		
	Sulfapyridine†		30		
	Sulfaquinoxaline†		30		
	Sulfathiazole†		30		
	Sulfisomidine†		30		
	Sulfisoxazole†		30		
	Cypermethrin	GC-MS/MS	0.49-1.0	50	
	Deltamethrin		0.49-1.0	10	
	Emamectin	LC-MS/MS	2	100	
	Imidacloprid		2	600	
		LC-MS/MS			

Group of substances	Analyte	Method	LOQ (µg/kg w.w.)	Reference limit (µg/kg w.w.)	Lab
B1b Insecticides, fungicides, anthelmintics and other antiparasitic drugs	Praziquantel	LC-MS/MS	2	20	IMR
	Fenbendazole[§]		3	‡	
	Diflubenzuron	LC-MS/MS	1	10	
	Teflubenzuron		1	500	
	Hexaflumuron		1	500	
	Lufenuron		1	1350	
	Fluazuron		1	200	
	Abamectin	LC-MS/MS	2	‡	Eurofins
	Doramectin		2	‡	
	Eprinomectin		2	50	
	Ivermectin		2	‡	
	Moxidectin		2	‡	
B1c Sedatives	Isoeugenol[§]	GC-FID	50	6000	Eurofins
Dioxins and PCBs	Sum dioxins	HRGC-HRMS	0.0000015-0.09 ng TEQ/kg ww	3.5 ng TEQ/kg	IMR
	Sum dioxins and dl-PCBs.	HRGC-HRMS GC-MS/MS	0.0000010-0.03 ng TEQ/kg	6.5 ng TEQ/kg	
	PCB-6 (sum of PCB 28, 52, 101, 138, 153, and 180)	GC-MS/MS	0.0052 – 0.040	75	
PFAS	Sum PFAS-4	LC-MS/MS	-	8 (2)[¶]	IMR
	PFOS		0.1-0.2	7 (2)[¶]	
	PFOA		0.1-0.2	1 (0.2)[¶]	
	PFNA		0.1-0.5	2.5 (0.5)[¶]	
	PFHxS		0.1	0.2 (0.2)[¶]	
	Other PFAS, see Table A 1		0.1-1	‡	
Heavy metals	Total Mercury	ICP-MS	0.0008-0.002	0.3/0.5/1 mg/kg[#]	IMR
	Cadmium		0.0008-0.002	0.05 mg/kg[#]	
	Lead		0.0008-0.01	0.3 mg/kg	
Other chemical elements	Total Arsenic	ICP-MS	0.002-0.004	‡	IMR
	Cobalt		0.004-0.01	‡	
	Chromium		0.004-0.01	‡	
	Copper		0.02-0.04	‡	
	Iron		0.02-0.04	‡	
	Manganese		0.004-0.01	‡	
	Molybdenum		0.02	‡	

Other chemical elements		ICP-MS			IMR
Group of substances	**Analyte**	**Method**	**LOQ (µg/kg w.w.)**	**Reference limit (µg/kg w.w.)**	**Lab**
	Nickel		0.04	‡	
	Selenium		0.002-0.004	‡	
	Silver		0.002-0.004	‡	
	Vanadium		0.0008-0.002	‡	
	Zinc		0.08-0.2	‡	
Arsenic species[§]	Arsenobetaine	ICP-MS	0.004	‡	IMR
	Arsenocholine		0.003-0.02	‡	
	Dimethylarsinate		0.002-0.004	‡	
	Trimethylarsine oxide		0.003-0.02	‡	
	Tetramethylarsonium ion		0.001-0.008	‡	
	Inorganic arsenic	HPLC-ICP-MS	1.4-2.8	‡	IMR
Mercury species	Methyl mercury	GC-ICPMS	0.001	‡	IMR
Pesticides: organochlorine, organophosphorus, and pyrethroid	α-Hexachlorocyclohexane	GC-MS/MS	0.02-0.04	‡	IMR
	β-Hexachlorocyclohexane		0.02-0.04	‡	
	γ-Hexachlorocyclohexane (Lindane)		0.02-0.04	‡	
	Hexachlorobenzene		0,098-0.1	‡	
	Pentachlorobenzene		0.49-1.0	‡	
	Toxaphene Parlar 32		0.49-1.0	‡	
	Toxaphene Parlar 40+41		0.98-2.0	‡	
	cis-Nonachlor		0.20-0.40	‡	
	trans-Nonachlor		0.049-0.050	‡	
	Endrin		0.49-1.0	‡	
	Endrin-ketone		0.49-1.0	‡	
	Mirex		0.02-0.04	‡	
	Isodrin		0.49-1.0	‡	
	Chlorpyrifos		0.02-0.04	‡	
	Chlorpyrifos-methyl		0.098-0.2	‡	
	Pirimiphos-methyl		0.098-0.2	‡	
	o,p-DDT		0.098-0.2	‡	
	p,p-DDT		0.098-0.2	‡	
	o,p-DDD		0.02-0.04	‡	
	p,p-DDD		0.02-0.04	‡	
	o,p-DDE		0.02-0.04	‡	
	p,p-DDE		0.02-0.04	‡	

Group of substances	Analyte	Method	LOQ (µg/kg w.w.)	Reference limit (µg/kg w.w.)	Lab
	alpha-endosulfan		0.49-1.0	‡	
	beta-endosulfan		0.49-1.0	‡	
	endosulfan sulfate		0.098-0.2	‡	
	dieldrin		0.2-0.4	‡	
	aldrin		0.2-0.4	‡	
	trans-chlordane		0.49-1.0	‡	
	cis-chlordane		0.098-0.2	‡	
	oxychlordane		0.098-0.2	‡	
	heptachlor		0.02-0.04	‡	
	trans-heptachlor epoxide		0.49-1.0	‡	
	cis-heptachlor epoxide		0.098-0.2	‡	
	Toxaphene 26		0.2-0.4	‡	
	Toxaphene 50		0.2-0.4	‡	
	Toxaphene 62		0.49-1.0	‡	
Pesticides: herbicides	Glyphosate		0.01 mg/kg	‡	
	Glufosinate		0.01 mg/kg	‡	Eurofins
	AMPA		0.01 mg/kg	‡	
Pesticides: widescope screening	Refer to List A 1, Appendix		List A 1 Appendix	‡	Eurofins
Mycotoxins	Aflatoxin B1	LC-MS/MS	0.1	‡	Eurofins
	Aflatoxin B2		0.1	‡	
	Aflatoxin G1		0.1	‡	
	Aflatoxin G2		0.1	‡	
	Deoxynivalenol		20	‡	
	Fumonisin B1 (FB1)		20	‡	
	Fumonisin B2 (FB2)		20	‡	
	HT2-Toxin		7.5	‡	
	Nivalenol (NIV)		20	‡	
	Okratoxin A		0.2	‡	
	T2-toxin		7.5	‡	
	Zearalenon (ZON)		10	‡	
	PBDE -28, -35, -49, -66, -71, -75, -77, -85, -100, -118, -119, -153, -154, -183, -196, -197		0.00024-0.0011	‡	
	PBDE -99, -206, -207		0.00072-0.0032	‡	
		GC-MS/MS			IMR

Group of substances	Analyte	Method	LOQ (µg/kg w.w.)	Reference limit (µg/kg w.w.)	Lab
Brominated flame retardants	PBDE -47, -138		0.00095-0.0043	‡	
	PBDE -209		0.5-0.9	‡	
	alpha-HBCD	LC-MS/MS	0.0006	‡	Eurofins
	beta-HBCD		0.006	‡	
	Gamma-HBCD		0.006	‡	
	Tetrabromobisphenol-A (TBBP-A)		0.04	‡	
	Novel BFRs[§] See list in Table 17	APGC-MS/MS	3.9-2800 pg/g	‡	Eurofins
Chlorinated paraffins	Sum SCCPs	GC-MS	3.7-6.1	‡	Eurofins
	Sum MCCPs		18-23	‡	
Processing contaminants from feed	2-monochloropropane-1,3-diol	GC-MS/MS	10	‡	Eurofins
	3-monochloropropane-1,2-diol		10	‡	
	3-MCDP esters		10	‡	
	Total 3-MCPD (free and bound)		20	‡	
	Glycidyl esters		10	‡	
Antifouling treatments	Tralopyril [§]	LC-MS/MS	0.05	‡	IMR
Antioxidant feed additives[§]	Butylated hydroxyanisole (BHA)	LC-MS	0.2	‡	IMR
	Butylated hydroxytoluene (BHT)		0.2	‡	
Monocyclic aromatic hydrocarbons	Benzene	HS-GC-MS	0.01	‡	Eurofins
	Ethylbenzene		0.01	‡	
	Styrene		0.01	‡	
	Toluene		0.01	‡	
	Xylene (meta-, para-)		0.01	‡	
	Xylene (ortho-)		0.01	‡	
PAHs in smoked fish fillet	Benz(a)anthracene	GC-MS/MS	0.1	‡	IMR
	Benzo(a)pyrene		0.1	2.0	
	Benzo(b)fluoranthene		0.1	‡	
	Benzo(c)fluorene		0.1	‡	
	Benzo(ghi)perylene		0.1	‡	
	Benzo(j)fluoranthene		0.1	‡	
	Benzo(k)fluoranthene		0.1	‡	
	Chrysene		0.1	‡	
	Cyclopenta(cd)pyrene		0.1	‡	
	Dibenz(ah)anthracene		0.1	‡	
	Dibenzo(a,e)pyrene		0.5-0.7	‡	

Group of substances	Analyte	Method	LOQ (µg/kg w.w.)	Reference limit (µg/kg w.w.)	Lab
	Dibenzo(a,h)pyrene		0.5-0.7	‡	
	Dibenzo(a,i)pyrene		0.5-0.7	‡	
	Dibenzo(a,l)pyrene		0.5-0.7	‡	
	Indeno(1,2,3,-cd)pyrene		0.1	‡	
	5-methylchrysene		0.1	‡	
	Sum PAH4		-	12.0	
Nitrate and nitrite	Nitrate, calculated as NO_3	HPLC-UV	5.0 mg/kg	‡	Eurofins
	Nitrite, calculated as NO_2		5.0 mg/kg	‡	

** For analytes in Group A, the value provided is the LOD (rather than the LOQ). † All chemical analyses included for B1a Antibacterial substances used muscle from fish sampled at slaughterhouses, except for chemical analysis of sulfonamides, which was performed on muscle samples from fish sampled at fish farms.*

‡ No MRL or ML established. § Not accredited. ¶ The Maximum Levels established for four individual PFAS compounds, and their sum is depending on both the fish species and the intended use; the given values denote MLs for fillet not intended to be used for the production of food for infants and children, and MLs for fillet that is intended to be used in the production of food for infants and children are given in brackets. [6] # Maximum levels for mercury and cadmium are dependent on fish species. Maximum levels for mercury are 0.3 mg/kg for Atlantic salmon, rainbow trout, and Atlantic cod; 0.5 mg/kg for brown trout; and 1 mg/kg for Atlantic halibut . The maximum level for cadmium is 0.05 mg/kg for all included species. [6]

Table A 2 . Abbreviations and names of measured PFAS compounds.

Abbreviation	Norwegian full name
PFBA	Perfluorbutylkarboksylsyre
PFBS	Perfluorbutylsulfonsyre
PFDA	Perfluordekylkarboksylsyre
PFDoDA	Perfluordodekylkarboksylsyre
PFDoDS	Perfluordodekylsulfonsyre
PFDS	Perfluordekylsulfonsyre
PFHpA	Perfluorheptylkarboksylsyre
PFHpS	Perfluorheptylsulfonsyre
PFHxA	Perfluorheksylkarboksylsyre
PFHxDA	Perfluorheksadekylkarboksylsyre
PFHxS	Perfluorheksylsulfonsyre
PFNA	Perfluornonylkarboksylsyre
PFNS	Perfluornonylsulfonsyre
PFOA	Perfluoroktylkarboksylsyre
PFOS	Perfluoroktylsulfonsyre
FOSA	Perfluoroktylsulfonamid
PFPeA	Perfluorpentylkarboksylsyre

PFPeS	Perfluorpentylsulfonsyre
PFTeDA	Perfluortetradekylkarboksylsyre
PFTrDA	Perfluortridekylkarboksylsyre
PFUnDA	Perfluorundekylkarboksylsyre
PFUnDS	Perfluorundekylsulfonsyre

Table A 3. Calculations of sums for certain pesticides based on molecular weights according to EU DG SANTE (2022).16

Sum	Substances included in the sum	Conversion factor
DDT (sum of p.p-DDT. o.p-DDT. p.p-DDD. o.p-DDD. p.p-DDE.and o.p-DDE expressed as DDT)	op-DDT	1
	pp-DDT	1
	op-DDD	1.108
	pp-DDD	1.108
	op-DDE	1.115
	pp-DDE	1.115
DDT (sum of p.p´-DDT. o.p´-DDT. p-p´-DDE and p.p´-DDD expressed as DDT) *	op-DDT	1
	pp-DDT	1
	pp-DDD	1.108
	pp-DDE	1.115
Endosulfan (sum of alpha- and beta-isomers and endosulfan-sulphate expressed as endosulfan) †	alpha-endosulfan	1
	beta-endosulfan	1
	endosulfan sulphate	0.962
Dieldrin (Aldrin and dieldrin combined expressed as dieldrin) ‡	dieldrin	1
	aldrin	1.044
Chlordane (sum of cis- and trans-isomers and oxychlordane expressed as chlordane)	trans-chlordane	1
	cis-chlordane	1
	oxychlordane	0.967
Chlordane (sum of cis- and trans-chlordane) *	trans-chlordane	1
	cis-chlordane	1
Heptachlor (sum of heptachlor and heptachlor epoxide expressed as heptachlor) *	heptachlor	1
	trans-heptachlor epoxide	0.959
	cis-heptachlor epoxide	0.959
Toxaphene (sum of Parlar No 26. Parlar No 50 and Parlar No 62) §	Toxaphene 26	1
	Toxaphene 50	1
	Toxaphene 62	1

** Legal residue definition according to Reg. (EC) No 149/2008 [17]*

† *Legal residue definition according to Reg. (EU) No 310/2011* [20]

‡ *Legal residue definition according to Reg. (EC) No 839/2008* [21]

§ *Legal residue definition according to Reg. (EU) 2015/868* [22] *; Campechlor (Toxaphene).*

List A 1 . Full list of compounds in the widescope pesticide screen. LOQ in mg/kg w.w is given in parentheses.

2,4,5-T-Methylester (0,02), 2,4-D-Methylester (0,1), 2,4'-Formoxylidid (0,01), 3,4,5-Trimetacarb (0,01), 3-Hydroksycarbofuran (0,01), 4,4-Dibrombenzofenon (0,01), 5-Hydroksy-Thiabendazol (0,01), 6-Klor-3-fenylpyridazin-4-ol (Pyridafol) (0,01), Abamektin (), Acefat (0,01), Acetamiprid (0,01), Acetochlor (0,02), Aclonifen (0,02), Acrinathrin (0,01), Alaklor (0,01), Aldicarb (0,01), Aldicarb sulfoksid (0,01), Aldicarb sulfone (0,01), Aldrin (0,005), alfa-HCH (0,005), alfa-Klordan (cis) (0,01), Alletrin (0,03), Ametoctradin (0,01), Ametryn (0,01), Amidithion (0,03), Amidosulfuron (0,01), Aminocarb (0,01), Amitraz (0,01), Ancymidol (0,01), Atrazin (0,01), Avermectin B1a (0,01), Avermectin B1b (0,01), Azakonazol (0,01), Azametifos (0,01), Azinfos-etyl (0,01), Azinfos-metyl (0,01), Aziprotryn (0,01), Azoxystrobin (0,01), Benalaksyl (0,01), Bendiocarb (0,01), Benfluralin (0,005), Benfuracarb (0,01), Benodanil (0,01), Benomyl (0,01), Benoxacor (0,01), Bensulfuron metyl (0,01), Benthiavalicarb-isopropyl (0,01), Benzoylprop-etyl (0,01), beta-HCH (0,005), Bifenox (0,01), Bifentrin (0,005), Binapacryl (0,02), Bitertanol (0,01), Boscalid (0,01), Bromacil (0,01), Bromfenvinfos (0,01), Bromocyclen (0,01), Bromofos-etyl (0,005), Bromofos-metyl (0,005), Bromopropylate (0,01), Bromukonazol (totalt) (0,01), Bupirimat (0,01), Buprofezin (0,01), Butachlor (0,1), Butamifos (0,01), Butocarboxim (0,01), Butocarboxim sulfoksid (0,01), Butoxycarboxim (0,01), Butralin (0,01), Buturon (0,01), Captan (0,02), Carbaryl (0,01), Carbendazim (0,01), Carbophenothion (0,005), Carboxin (0,01), Carfentrazone-ethyl (0,01), Chinomethionat (0,01), Chlorantraniliprole (0,01), CHLORETHOXYFOS (0,01), Chlorfenprop-metyl (0,005), Chloropropylate (0,005), Cinidonetyl (0,05), Cinosulfuron (0,01), Clodinafop-propargyl (0,01), Clofentezin (0,01), Clomazon (0,01), Clothianidin (0,01), Coumaphos (0,005), Cyanazin (0,01), Cyanofenfos (0,005), Cyanofos (0,01), Cyazofamid (0,01), Cyfenotrin (0,01), Cyflutrin (0,005), Cyhalotrin, lambda- (0,005), Cymoxanil (0,02), Cyproconazol (0,01), Cyprodinil (0,01), Cyprofuram (0,01), Cyromazin (0,01), delta-HCH (0,005), Deltametrin (0,01), Demeton (0,01), Demeton-S-metyl (0,01), Demeton-S-metylsulfon (0,01), Desetyl-atrazin (0,01), Desetyl-terbutylazin (0,01), Desmedifam (0,01), Desmethyl-formamido-pirimicarb (0,05), Desmetryn (0,01), Desmetyl-pirimicarb (0,01), Dialifos (0,01), Diallat (0,01), Diazinon (0,01), Dicapthon (0,01), Dichlofenthion (0,005), Dichlofluanid (0,01), Dichlorvos (0,01), Diclofop-methyl (0,01), Dieldrin (0,01), Dietofencarb (0,01), Dietyltoluamid (DEET) (0,01), Difenoconazol (0,01), Difenoxuron (0,01), Diflubenzuron (0,01), Diflufenican (0,01), Diklobenil (0,02), Diklobutrazol (0,01), Dikloran (0,005), Dikrotofos (0,01), Dimefox (0,01), Dimefuron (0,01), Dimetaklor (0,1), Dimetenamid (0,01), Dimethipin (0,005), Dimethoat (0,01), Dimetilan (0,01), Dimetomorf (0,01), Dimoxystrobin (0,01), Dinikonazol (0,01), Dinitramin (0,01), Dinotefuran (0,02), Disulfoton (0,01), Disulfoton sulfoksid (0,01), Disulfoton sulfon (0,01), Ditalimfos (0,005), Diuron (0,01), Edifenphos (0,02), Emamectin B1A benzoate (0,01), Emamectin B1B benzoate (0,01), Endosulfan beta (0,005), Endosulfan, alfa- (0,005), Endosulfan-sulfat (0,005), Endrin (0,01), EPN (0,01), Epoksyconazol (0,005), epsilon-HCH (0,005), Etakonazol (0,01), Ethalfluralin (0,005), Ethiofencarb (0,01), Ethiofencarb-sulfoksid (0,01), Ethiofencarb-sulfon (0,01), Ethion (0,005), Ethiprol (0,01), Ethofumesat (0,01), Ethofumesat-2-keto (0,05), Etofenproks (0,01), Etoprofos (0,005), Etoxasol (0,01), Etridiazol (0,005), Etrimfos (0,005), Famophos (0,02), Famoxadon (0,01), Fenamidon (0,01), Fenamiphos (0,01), Fenamiphos-sulfoksid (0,01), Fenamiphos-sulfon (0,01), Fenarimol (0,01), Fenazaquin (0,01), Fenbuconazol (0,01), Fenchlorazole-ethyl (0,02), Fenheksamid (0,01), Fenitrotion (0,005), Fenklorfos (0,005), Fenmedifam (0,01), Fenobucarb (0,01), Fenoksycarb (0,01), Fenovalerat (RR-/SS-isomere) (0,005), Fenoxaprop-etyl (0,01), Fenpiclonil (0,01), Fenpropatrin (0,005), Fenpropidin (0,01), Fenpropimorph (0,01), Fenpyroximat (0,01), Fenson (0,005), Fensulfothion (0,01), Fensulfothion sulfon (0,01), Fensulfothion-oxon

(0,01), Fensulfothion-oxon-sulfon (0,01), Fenthion (0,01), Fenthion-oxon (0,01), Fenthion-oxon-sulfoksid (0,01), Fenthion-oxon-sulfon (0,01), Fenthion-sulfoksid (0,01), Fenthion-sulfon (0,01), Fenuron (0,01), Fenvalerat (alle isomere inkl esfenvalerat) (), Fenvalerat (RS-/SR-isomer) (0,005), Fipronil (0,005), Fipronil, desulfinyl- (0,005), Fipronil-sulfide (0,005), Fipronil-sulfone (0,005), Flamprop-isopropyl (0,02), Flamprop-methyl (0,02), Flazasulfuron (0,01), Flonicamid (0,01), Florasulam (0,01), Fluazifop-butyl (0,1), Fluazifop-P-butyl (0,01), Fluazuron (0,02), Flucycloxuron (0,01), Flucytrinat (0,01), Fludioxonil (0,01), Flufenacet (0,01), Flufenoxuron (0,01), Flukloralin (0,025), Flumetralin (0,005), Fluometuron (0,01), Fluopicolid (0,01), Fluorodifen (0,005), Fluotrimazole (0,01), Fluquinconazol (0,01), Flurenol-butyl (0,01), Flurochloridon (0,01), Flurprimidol (0,01), Flurtamon (0,01), Flusilazol (0,01), Flutriafol (0,01), FM-6-1(triflumizolmetabolitt) (0,05), Folpet (0,025), Fonofos (0,005), Formetanat (0,01), Formothion (0,005), Fosthiazat (0,01), Fuberidazol (0,01), Furathiocarb (0,01), gamma-Klordan (trans) (0,01), Genite (0,02), Halfenprox (0,005), Halofenozid (0,01), Haloksyfop-etoksietyl (0,01), Haloksyfop-metyl (0,01), Heksaflumuron (0,05), Heksaklorbenzen (HCB) (0,005), Heksazinon (0,01), Heksythiazoks (0,01), Heptaklor (0,005), Heptaklorepoksid (cis) (0,01), Heptaklorepoksid (trans) (0,01), Heptenophos (0,005), Hexaconazol (0,005), Imazalil (0,01), Imibenconazol (0,01), Imidacloprid (0,01), INDANOFAN (0,02), Iodofenphos (0,005), Ioxynil-Octanoat (0,02), Iprobenfos (0,01), Iprodione (0,02), Iprovalicarb (0,01), Isazofos (0,02), Isobenzan (0,005), Isocarbofos (0,005), Isodrin (0,005), Isofenphos (0,005), Isofenphos-Methyl (0,005), Isomethiozin (0,005), Isoprocarb (0,01), Isopropalin (0,005), Isoprotiolan (0,01), Isoproturon (0,01), Isoxaben (0,01), Isoxadifen-ethyl (0,01), Isoxaflutol (0,01), Isoxathion (0,01), Jodosulfuron metyl (0,01), Kadusafos (0,01), Karbofenotion-metyl (0,01), Karbofuran (0,01), Karbosulfan (0,01), Kletodim (0,01), Klorbensid (0,005), Klorbromuron (0,01), Klorfenapyr (0,005), Klorfenson (0,005), Klorfenvinfos (0,02), Klorfluazuron (0,01), Kloridazon (0,01), Klormefos (0,005), Klorneb (0,1), Kloroxuron (0,01), Klorprofam (0,05), Klorpyrifos (0,005), Klorpyrifos-metyl (0,005), Klorsulfuron (0,01), Klortal-dimetyl (0,005), Klortalonil (0,005), Klortiofos (0,005), Klortion (0,01), Klortoluron (0,01), Klozolinat (0,005), Kresoksim-metyl (0,01), Krotoksyfos (0,01), Kvintozen (0,005), Lactofen (0,01), Lenacil (0,01), Leptophos (0,01), Lindan (gamma-HCH) (0,005), Linuron (0,01), Lufenuron (0,02), Malaoxon (0,01), Malathion (0,005), Mandipropamid (0,01), Mecarbam (0,01), Mepanipyrim (0,01), Mephosfolan (0,01), Merphos (0,01), Metabenzthiazuron (0,01), Metacrifos (0,01), Metalaksyl (0,01), Metamidofos (0,01), Metamitron (0,01), Metazachlor (0,01), Metconazole (0,01), Methidathion (0,01), Methiocarb (0,01), Methiocarb sulfoksid (0,01), Methiocarb sulfon (0,01), Metobromuron (0,01), Metoksyfenozid (0,01), Metolachlor (0,01), Metolcarb (0,01), Metomyl (0,01), Metoprotryn (0,01), Metoxiklor (0,05), Metoxuron (0,01), Metrafenon (0,01), Metribuzin (0,01), Metsulfuron-metyl (0,01), Mirex (0,01), Molinat (0,01), Monokrotofos (0,01), Monolinuron (0,01), Monuron (0,01), Myclobutanil (0,01), N-2,4-dimetylfenyl-N-metylformamidin (0,05), Napropamid (0,01), Neburon (0,01), Nicosulfuron (0,01), Nitralin (0,01), Nitrapyrin (0,02), Nitrofen (0,01), Nitrothal-isopropyl (0,02), Norflurazon (0,025), Novaluron (0,02), Nuarimol (0,01), o,p`-DDE (0,005), o,p'-DDD (0,005), o,p-Dicofol (0,01), Ofurace (0,01), Oksadiazon (0,01), Oksamyl (0,01), Oksydemeton-metyl (0,01), Ometoate (0,01), Orbencarb (0,01), Oxadixyl (0,01), Oxamyl-oxim (0,01), Oxyfluorfen (0,005), Oxyklordan (0,01), p,p-dicofol (0,01), Paclobutrazol (0,01), Paraoxon-etyl (0,01), Paraoxon-metyl (0,01), Parathion-etyl (0,01), Parathion-metyl (0,01), PCB nr. 101 (0,01), PCB nr. 138 (0,005), PCB nr. 153 (0,005), PCB nr. 180 (0,005), PCB nr. 28 (0,01), PCB nr. 52 (0,01), Penconazol (0,01), Pencycuron (0,01), Pendimetalin (0,01), Pentakloranilin (0,01), Pentakloranisol (0,005), Pentaklorbenzen (0,005), Pentanochlor (0,01), Pertan (0,1), Phenkapton (0,01), Phenothrin (0,05), Phenthoate (0,01), Phorat (0,05), Phorat-sulfoksid (0,01), Phorat-sulfon (0,01), Phosalone (0,01), Phosfolan (0,01), Phosmet (0,01), Phosphamidon (0,01), Phoxim (0,01), Picolinafen (0,01), Picoxystrobin (0,01), Piperonyl butoxide (PBO) (0,01), Piperophos (0,05), Pirimicarb (0,01), Pirimiphos-ethyl (0,01), Pirimiphos-methyl (0,01), Plifenat (0,01), Prallethrin (0,02), Primsulfuron metyl (0,02), Prochloraz (0,01), Procymidon (0,04), Profenofos (0,005), Profluralin (0,005), Promecarb (0,01), Prometon (0,01), Prometryn (0,01), Propaklor (0,1), Propamokarb (0,01), Propanil (0,01), Propargit (0,01), Propazin (0,01), Propetamphos (0,005), Propham (0,05), Propoxur (0,01), Propoxycarbazon (0,02), Propyzamid

(0,02), Proquinazid (0,01), Prosulfocarb (0,01), Prosulfuron (0,01), Prothiofos (0,005), Prothoate (0,01), Pymetrozin (0,01), Pyraclostrobin (0,01), Pyraflufen-etyl (0,01), Pyrazofos (0,01), Pyrethriner (total) (0,02), Pyridaben (0,01), Pyridaphenthion (0,01), Pyridat (0,05), Pyrifenox (0,02), Pyrimetanil (0,01), Pyrimidifen (0,01), Pyriproxifen (0,01), Quinalphos (0,005), Quinoxyfen (0,02), Quizalofop etyl (0,01), Rabenzazol (0,01), Resmethrin (0,1), Rimsulfuron (0,05), Rotenon (0,01), S 421 (0,01), Sebutylazin (0,01), Setoksydim (0,01), Silafluofen (0,02), Simazin (0,01), Simazin, desetyl- (0,01), Simeconazol (0,01), Spinosyn A (0,01), Spinosyn D (0,01), Spirodiclofen (0,01), Spiromesifen (0,01), Spirotetramat (0,01), Spiroxamin (0,01), Sulfotep (0,025), Sulprofos (0,01), Swep (0,1), Tebuconazol (0,01), Tebufenozid (0,01), Tebufenpyrad (0,01), Tebupirimfos (0,01), Teflubenzuron (0,05), Teflutrin (0,005), Teknazen (0,005), Temephos (0,01), TEPP (0,01), Terbacil (0,01), Terbufos (0,005), Terbufos-sulfoksid (0,01), Terbufos-sulfon (0,01), Terbutryn (0,01), Terbutylazin (0,01), Tetrachlorvinphos (0,005), Tetraconazole (0,01), Tetradifon (0,005), Tetrametrin (0,01), Tetrasul (0,01), Thiabendazol (0,01), Thiacloprid (0,01), Thiametoxam (0,01), Thiazafluron (0,01), Thifensulfuron metyl (0,01), Thiofanox (0,05), Thiofanox-sulfoksid (0,01), Thiofanox-sulfon (0,01), Thionazin (0,01), Tiocarbazil (0,01), Tiodikarb (0,01), Tiofanat (-etyl) (0,01), Tiofanatmetyl (0,01), Tolclofos-metyl (0,005), Tolylfluanid (0,01), Transflutrin (0,01), Triadimefon (0,01), Triadimenol (0,01), Triallat (0,01), Triamifos (0,01), Triasulfuron (0,01), Triazamat (0,01), Triazofos (0,01), Tribenuron-metyl (0,01), Tribufos (0,005), Trichlorfon (0,02), Tricyclazol (0,01), Tridemorf (0,1), Tridiphane (0,05), Trietazin (0,01), Trifloksysulfuron (0,01), Trifloxystrobin (0,01), Triflumizol (0,01), Triflumuron (0,01), Trifluralin (0,005), Triflusulfuron-metyl (0,05), Triforin (0,01), Trikloronat (0,005), Triticonazol (0,01), Uniconazol (0,01), Vamidothion (0,01), Vamidothion-sulfoksid (0,01), Vamidothion-sulfon (0,01), Vinclozolin (0,005), Zoxamid (0,01)

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