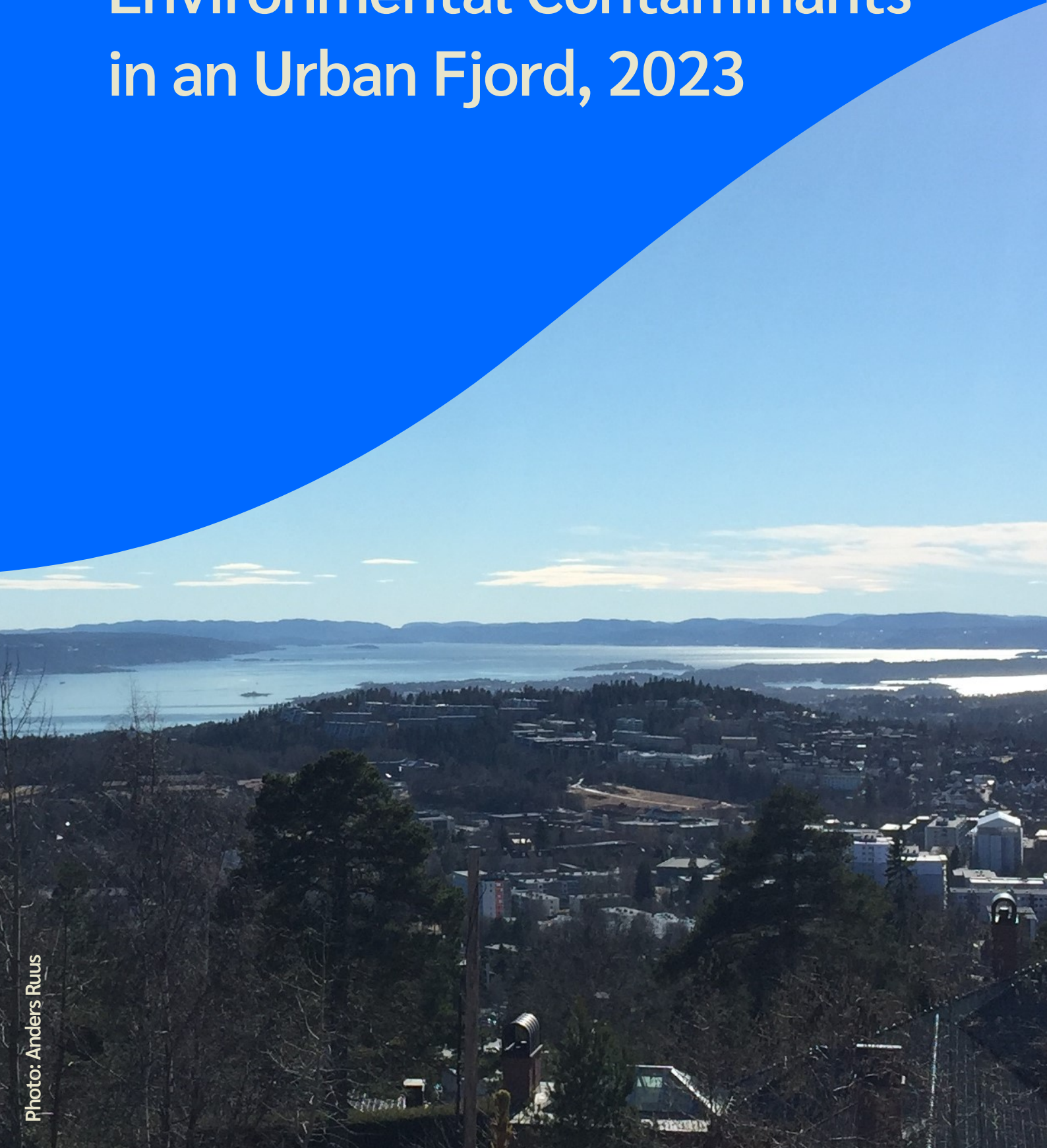


7994-2024

# Environmental Contaminants in an Urban Fjord, 2023



# Report

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### Abstract

This report presents data from the third year of a new 5-year period of the Urban Fjord programme. The programme started in 2013 and has since been altered/advanced. In 2023 the programme covers sampling and analyses of sediment, blue mussels and cod from the Inner Oslofjord, as well as water and trout from Alna River. In addition, samples of stormwater, and waste water from Bekkelaget wastewater treatment plant, are analysed. A total of ~230 single compounds/isomers were analysed, and frequent detection was found of specific PFAS compounds in aqueous phases, other specific PFAS compounds in fish liver, certain QACs in particulate phases, certain benzothiazoles in aqueous phases, chlorinated paraffins (MCCP in particular) in sediment and biota, certain siloxanes in biota and particulate phases, metals in all matrices, and PCBs in sediment and biota.

**Keywords:** Contaminants, Urban Areas, Bioaccumulation, Inputs

**Emneord:** Miljøgifter, Urbane områder, Bioakkumulering, Tilførsler

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# Preface

This report presents data from the third year of a new 5-year period of the Urban Fjord programme. The programme started in 2013 and has since been advanced. The content now differs between years, and the 2023 programme covers sampling and analyses of sediment, blue mussels and cod from the Inner Oslofjord, as well as water and trout from Alna River. In addition, samples of stormwater, and wastewater from Bekkelaget wastewater treatment plant, are analysed.

This year's campaign was carried out by NIVA, with a majority of the chemical analyses performed by the Norwegian Institute for Air Research, NILU.

Besides the authors of this report, several persons are acknowledged for their contribution in sample collection, sample preparation, data treatment and analysis: Ingar Johansen, Merete Schøyen, Gunhild Borgersen, Camilla With Fagerli, Marthe Torunn Solhaug Jenssen, Pawel Rostowski, Mikael Harju, Hilde Uggerud, Marit Vadset, Inger-Christin Steen, Carsten Lome, Benno Dillinger, Dag Hjermann.

This report represents an extended summary of the Urban Fjord 2023 campaign and has been quality assured by Research Manager Morten Jartun.

Oslo, June 2024

Anders Ruus

## Summary

The 2023 “Urban fjord” programme covers sampling and analyses of sediment, blue mussels and cod from the Inner Oslofjord, as well as water and trout from Alna River. Furthermore, samples of stormwater, and wastewater from Bekkelaget wastewater treatment plant, are analysed. A total of ~230 single compounds/isomers were analysed, and frequent detection was found of:

- specific PFAS compounds in aqueous phases,
- other specific PFAS compounds in fish liver,
- certain QACs in particulate phases,
- certain benzothiazoles in aqueous phases,
- chlorinated paraffins (MCCP in particular) in sediment and biota,
- certain siloxanes in biota and particulate phases,
- metals in all matrices,
- PCBs in sediment and biota.

Concentrations of PFAS were highest in fish (cod and trout) livers (ng/g basis) and in the dissolved fraction of aqueous phases (ng/L basis). In sediment and biota, PFOS was a dominating PFAS. PFOSA was also a dominating PFAS in fish livers. In aqueous phases, TFA was a dominating compound. In sediment and cod liver, UV-327 and -328 were important UV-compounds. In aqueous phases Octocrylen, Benzophenone-3 and Homosalate were major UV-compounds. ATAC-C20 and especially ATAC-C22 were dominating QACs in biota. Dechloranes were only detected in cod liver and particulate matrices. Dechlorane plus syn and anti were important compounds in particulate matrices. Dechlorane 602 constituted the highest proportion of the sum-dechloranes concentration in cod liver. The highest concentrations of chlorinated paraffins were encountered in biota and particulate matrices. MCCPs and LCCPs generally constituted the highest proportions of the sum-chlorinated paraffins concentrations. Phthalates were found in high concentrations in the particulate fractions of river water, and WWTP effluent water, as well as in stormwater. DIDP and DIUP constituted the highest proportions of the sum-phthalates concentrations. The most conspicuous concentrations of OPFRs were observed in abiotic matrices, and particularly in the dissolved phase of WWTP effluent water. TEP, TCEP, TCPP and TBEP were important constituents of the sum-OPFRs concentrations dissolved in water matrices. Conspicuous concentrations of siloxanes were observed in the particulate fraction of river water, as well as in sediment and cod liver from the Inner Oslofjord. The cyclic siloxanes D5 and D6 were dominating. Among the musks, Galaxolide was found in the highest concentrations, followed by Tonalide and Iso-E-super (OTNE). The most conspicuous concentrations were observed in WWTP effluent water.

# Sammendrag

"Urban fjord"-programmet for 2023 har omfattet prøvetaking og analyse av sediment, blåskjell og torsk fra Indre Oslofjord, samt vann og ørret fra Alna. Videre er overvann og avløpsvann fra Bekkelaget renseanlegg analysert. Totalt ~230 enkeltforbindelser/isomerer ble analysert og hyppig deteksjon ble funnet av:

- spesifikke PFAS-forbindelser i ulike vannprøver,
- andre spesifikke PFAS-forbindelser i fiskelever,
- visse kvartære ammoniumforbindelser (QAC) i partikkelfaser,
- visse benzotiazoler i ulike vannprøver,
- klorparafiner (særlig MCCP) i sediment og biota,
- visse siloksaner i biota og partikkelfaser,
- metaller i alle prøvetyper,
- PCB i sediment og biota.

Konsentrasjonene av PFAS var høyest i lever av fisk (torsk og ørret; ng/g basis) og i den oppløste fraksjonen av vannfaser (ng/L basis). I sediment og biota var PFOS en dominerende PFAS-forbindelse. PFOSA var også en dominerende PFAS i fiskelever. I ulike vannprøver var TFA en dominerende forbindelse. I sediment og torskelever var UV-327 og -328 viktige UV-stoffer. I ulike vannprøver var Octocrylen, Benzofenon-3 og Homosalat viktige UV-forbindelser. ATAC-C20 og spesielt ATAC-C22 var dominerende kvartære ammoniumforbindelser i biota. Dekloraner ble kun påvist i torskelever og partikkelfaser. Dekloran pluss syn og anti var viktige forbindelser i partikkelfaser. Dekloran 602 utgjorde den høyeste konsentrasjonen blant dekloranene i torskelever. De høyeste konsentrasjonene av klorparafiner ble påtruffet i biota og partikkelfaser. MCCP og LCCP utgjorde generelt de høyeste andelene av totalsummen av klorerte parafiner. Ftalater ble funnet i høye konsentrasjoner i partikkelfraksjonene av ellevann og avløpsvann fra renseanlegg, samt i overvann. DIDP og DIUP utgjorde her de høyeste konsentrasjonene blant ftalatene. De mest iøynefallende konsentrasjonene av fosfororganiske flammehemmere (OPFR) ble observert i abiotiske prøver, og spesielt i den oppløste fasen av avløpsvann fra renseanlegg. TEP, TCEP, TCPP og TBEP utgjorde her de største andelene av de totale OPFR-konsentrasjonene. Det ble observert iøynefallende konsentrasjoner av siloksaner i partikkelfraksjonen av ellevann, samt i sediment og torskelever fra Indre Oslofjord. De sykliske siloksanene D5 og D6 var dominerende. Blant muskstoffene ble Galaxolide funnet i de høyeste konsentrasjonene, etterfulgt av Tonalide og Iso-E-super (OTNE). De mest iøynefallende konsentrasjonene ble observert i avløpsvann fra renseanlegg.

# 1 Introduction

"Environmental contaminants in an urban fjord" is a programme designed to monitor discharges of anthropogenic chemicals in a densely populated area and to study how this contaminant input affects a fjord system. The programme addresses inputs of pollutants from potential sources, measurements of contaminant concentrations in different marine species, assessment of bioaccumulation patterns within a food web and estimation of effect risks in organisms.

This report presents data from the third year of a new 5-year period of the Urban Fjord programme. The programme started in 2013 and has since been altered/advanced, and the content differs between years. The 2023 programme covers sampling and analyses of sediment, blue mussels and cod from the Inner Oslofjord, as well as water and trout from Alna River. Furthermore, samples of stormwater, and wastewater from Bekkelaget wastewater treatment plant, are analysed.

This year's campaign was carried out by NIVA, with a majority of the chemical analyses performed by the Norwegian Institute for Air Research, NILU.

## 2 Extended summary of Urban Fjord 2023

### 2.1 Samples and localities

An overview of the samples collected in the Urban Fjord programme 2023 is presented in **Table 1**. Localities for sample collection are shown in **Figure 1**.

**Table 1.** Overview of samples collected for the “Urban Fjord” programme 2023.

| Species/Sample                    | Matrix                                     | Locality                                                                                            | Station code                                             | No. for analysis                                                           |
|-----------------------------------|--------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------|
| <b>Sediment</b>                   | Whole sediment                             | Bekkelaget (Bq41)                                                                                   | Bq41                                                     | 1                                                                          |
| <b>Blue mussel</b>                | Pooled samples, soft body                  | Steilene                                                                                            | IO Blåskjell                                             | 1 pooled sample <sup>1</sup>                                               |
| <b>Cod</b>                        | Muscle, liver, bile                        | Midtmeie                                                                                            | IO                                                       | 3 pooled samples <sup>2</sup>                                              |
| <b>Stormwater</b>                 | Water (dissolved) and particulate fraction | See <b>Figure 1</b> :<br>Breivoll<br>Vollaveien<br>Smalvollveien<br>Gamle Oslo<br>Hovin/Grenseveien | Urban #1<br>Urban #2<br>Urban #3<br>Urban #4<br>Urban #5 | 5 samples (5 samples of dissolved fraction plus 5 of particulate fraction) |
| <b>Wastewater treatment plant</b> | Water (dissolved) and particulate fraction | Bekkelaget                                                                                          | BRA                                                      | 3 samples (3 samples of dissolved fraction plus 3 of particulate fraction) |
| <b>River water (Alna)</b>         | Water (dissolved) and particulate fraction | Alna                                                                                                | Alna Vann                                                | 4 samples (4 samples of dissolved fraction plus 4 of particulate fraction) |
| <b>(River) Trout</b>              | Muscle, liver                              | Alna                                                                                                | Alna Fisk                                                | 3 pooled samples <sup>2</sup>                                              |

<sup>1</sup> 32 mussels (shell length 30–64 mm).

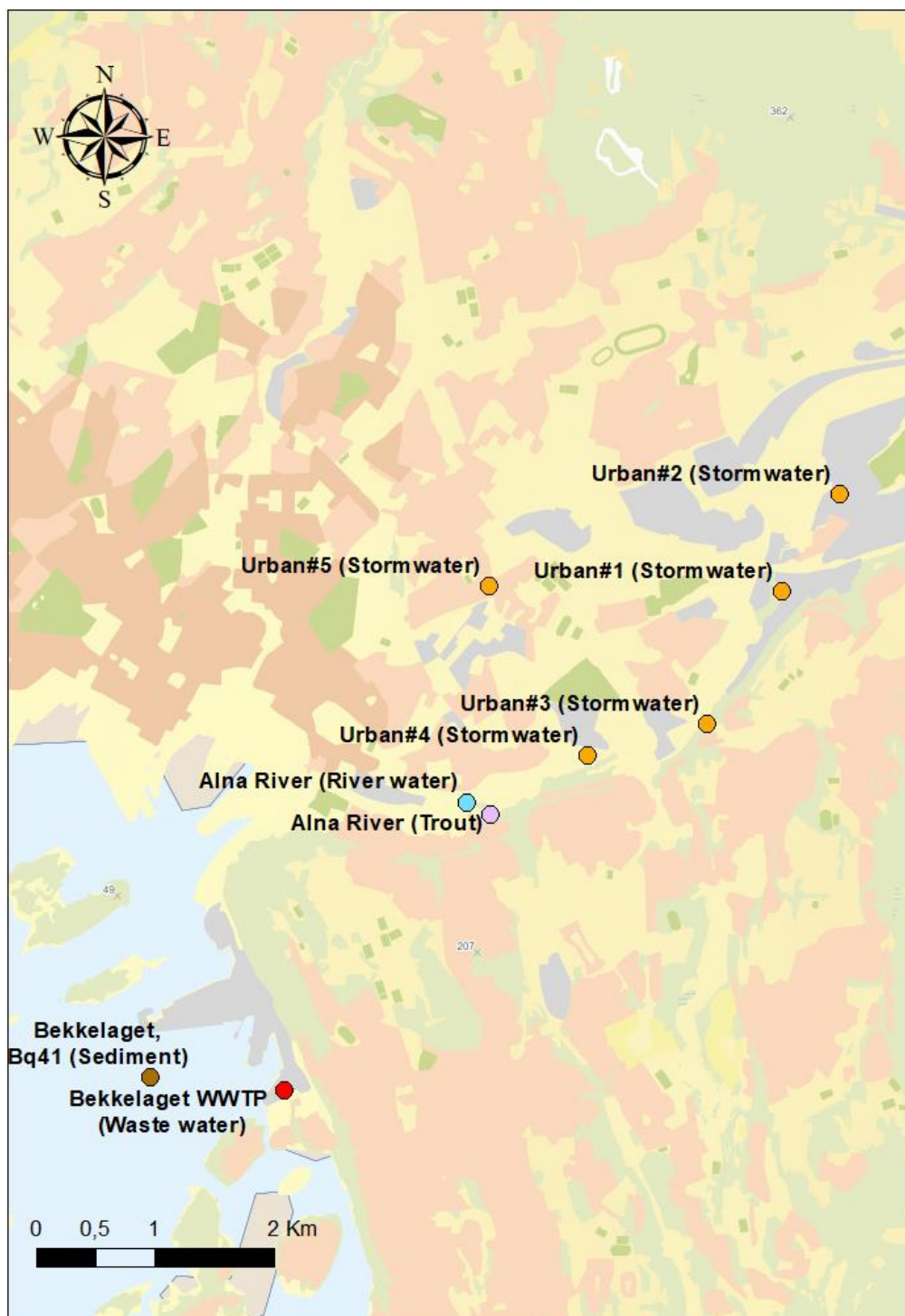
<sup>2</sup> Each of 5 specimens (biometric data are presented in Appendix, Chapter 4).

**A.**



**Figure 1.** Map depicting stations for collection of sediment, blue mussel and cod in the Inner Oslofjord (A.), and map depicting stations for collection of samples from Bekkelaget WWTP, stormwater, river water and trout (B.; next page). A figure showing time of stormwater sampling in relation to precipitation can be found in **Figure 18** in the Appendix, Chapter 4).

**B.**



## 2.2 Chemical analysis

Details of the chemical analysis are presented in Chapter 3. **Table 2** shows an overview of the chemical analyses performed in the different samples, while **Table 9** (in Appendix, Chapter 4) shows the specific analytes in the programme.

## 2.3 Assessment of biomagnification

Since only blue mussel and cod were analysed in 2023, a crude assessment of biomagnification was done, applying Biomagnification Factors (concentration ratio in predator to prey, i.e. cod to blue mussel). In these calculations, concentrations of the following contaminants were expressed on a wet weight basis: Metals, PFASs, QACs and musks. The concentrations of the following contaminants were expressed on a lipid weight basis: PCBs and other organochlorine compounds, chlorinated paraffins, siloxanes, dechloranes and UV-compounds. The other contaminants were not sufficiently detected in both species for BMF calculation. Cod was represented by the concentrations in liver, except for mercury concentrations which were in muscle. Concentrations in cod were represented by the median, and only concentrations >LoQ were used in the calculations.

When calculating a BMF between blue mussel and cod, it is of interest to know the difference in trophic position between the species. Trophic position was estimated from  $\delta^{15}\text{N}$  levels, assuming an enrichment,  $\Delta^{15}\text{N}$ , of 3.8 between each integer trophic level.

**Table 2.** Overview: Analyses in different matrices in 2022.

|                            | Sediment | Blue mussel | Cod <sup>1</sup> | Stormwater <sup>2</sup> | WWTP <sup>2</sup> | River water <sup>2</sup> | Trout <sup>3</sup> |
|----------------------------|----------|-------------|------------------|-------------------------|-------------------|--------------------------|--------------------|
| Metals                     | X        | X           | X                | X                       | X                 | X                        | X                  |
| Siloxanes                  | X        | X           | X                | X                       | X                 | X                        | X                  |
| PCBs (and organochlorines) | X        | X           | X                | X                       | X                 | X                        | X                  |
| OPFRs                      | X        | X           | X                | X                       | X                 | X                        |                    |
| Phenolic comp.             | X        | X           | X                | X                       | X                 | X                        |                    |
| PFAS                       | X        | X           | X                | X                       | X                 | X                        | X                  |
| UV-chemicals               | X        | X           | X                | X                       | X                 | X                        |                    |
| Dechloranes                | X        | X           | X                | X                       | X                 | X                        | X                  |
| QAC                        | X        | X           | X                | X                       | X                 | X                        |                    |
| Pesticides/Fungicides      |          |             |                  | X                       | X                 | X                        |                    |
| Musk                       | X        | X           | X                | X                       | X                 | X                        |                    |
| Benzothiazoles             | X        | X           | X                | X                       | X                 | X                        |                    |
| Phthalates                 | X        | X           | X                | X                       | X                 | X                        |                    |
| Chlorinated paraffins      | X        | X           | X                | X                       | X                 | X                        | X                  |
| Stable isotopes of C and N |          | X           | X                |                         |                   |                          | X                  |

<sup>1</sup> Liver, muscle and bile (stable isotopes and Hg in muscle, phenolic compounds in bile, other compounds in liver).

<sup>2</sup> Dissolved and particulate fractions.

<sup>3</sup> Muscle. PFAS in liver.

## 2.4 Results and discussion

In this chapter, key findings are presented. All results are presented in electronic Appendices.

### 2.4.1. Stable isotopes

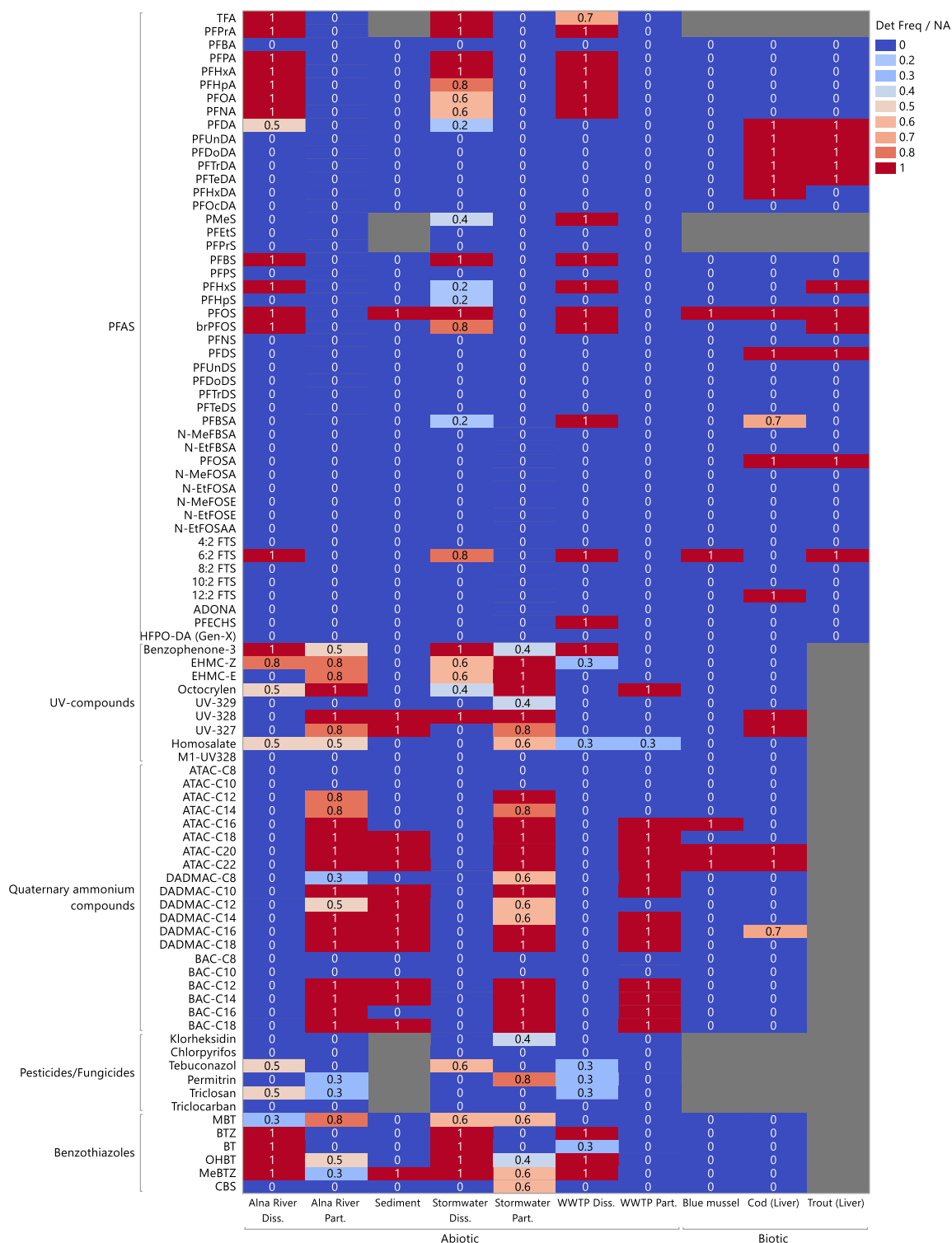
The results regarding the stable isotopes of C and N are given in the Appendix (Chapter 4).

### 2.4.2. Detection frequencies of contaminants

A total of ~230 single compounds/isomers were analysed in this study. **Figure 2** gives the detection frequency of the various compounds in the different samples. The figure shows frequent detection of specific PFAS compounds in aqueous phases, other specific PFAS compounds in fish liver, certain QACs in particulate phases, certain benzothiazoles in aqueous phases, chlorinated paraffins (MCCP in particular) in sediment and biota, certain siloxanes in biota and particulate phases, metals in all matrices, and PCBs in sediment and biota.

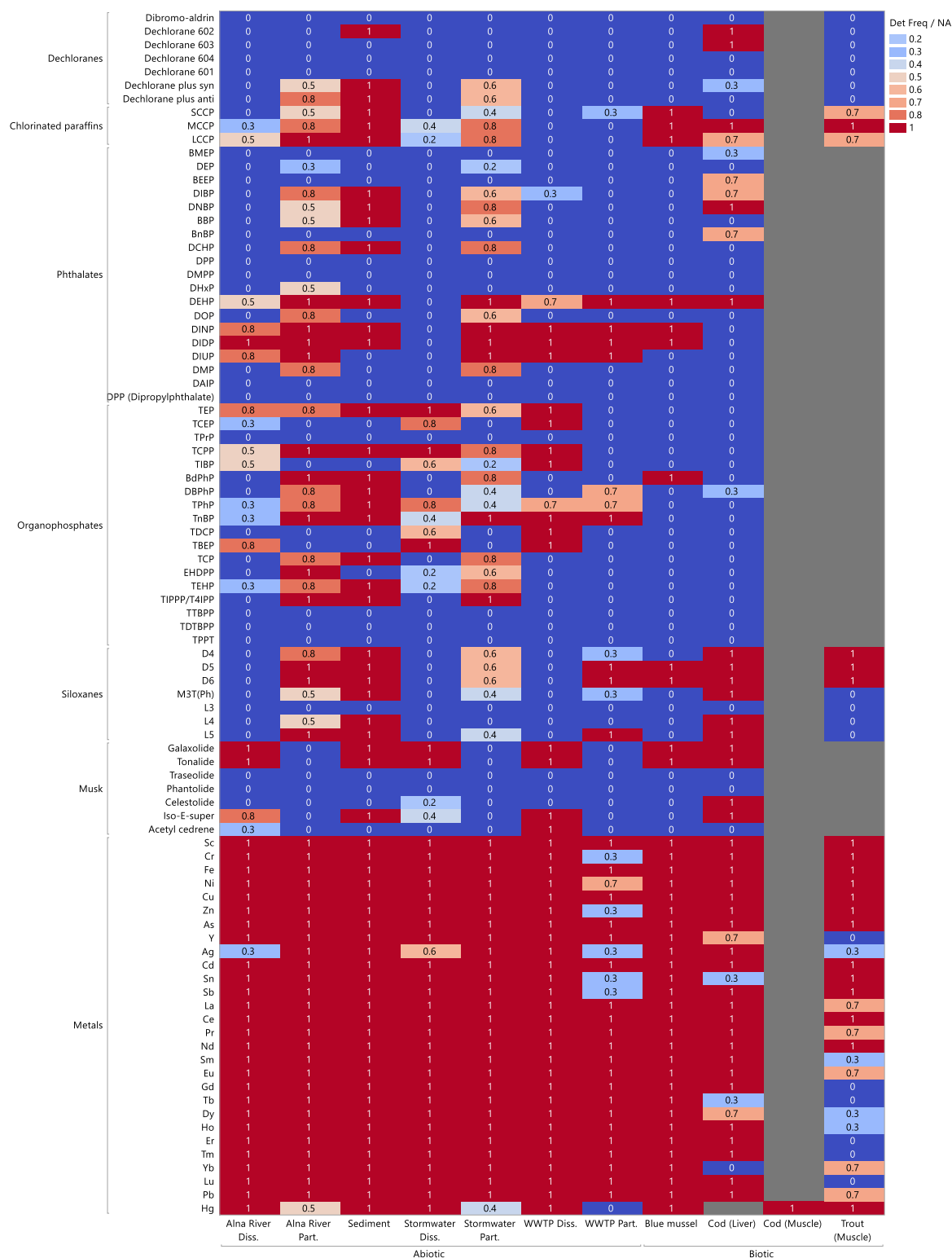
See Chapter 3.2.1 for an indication of analyses/analytes with the lowest/highest uncertainties.

A.

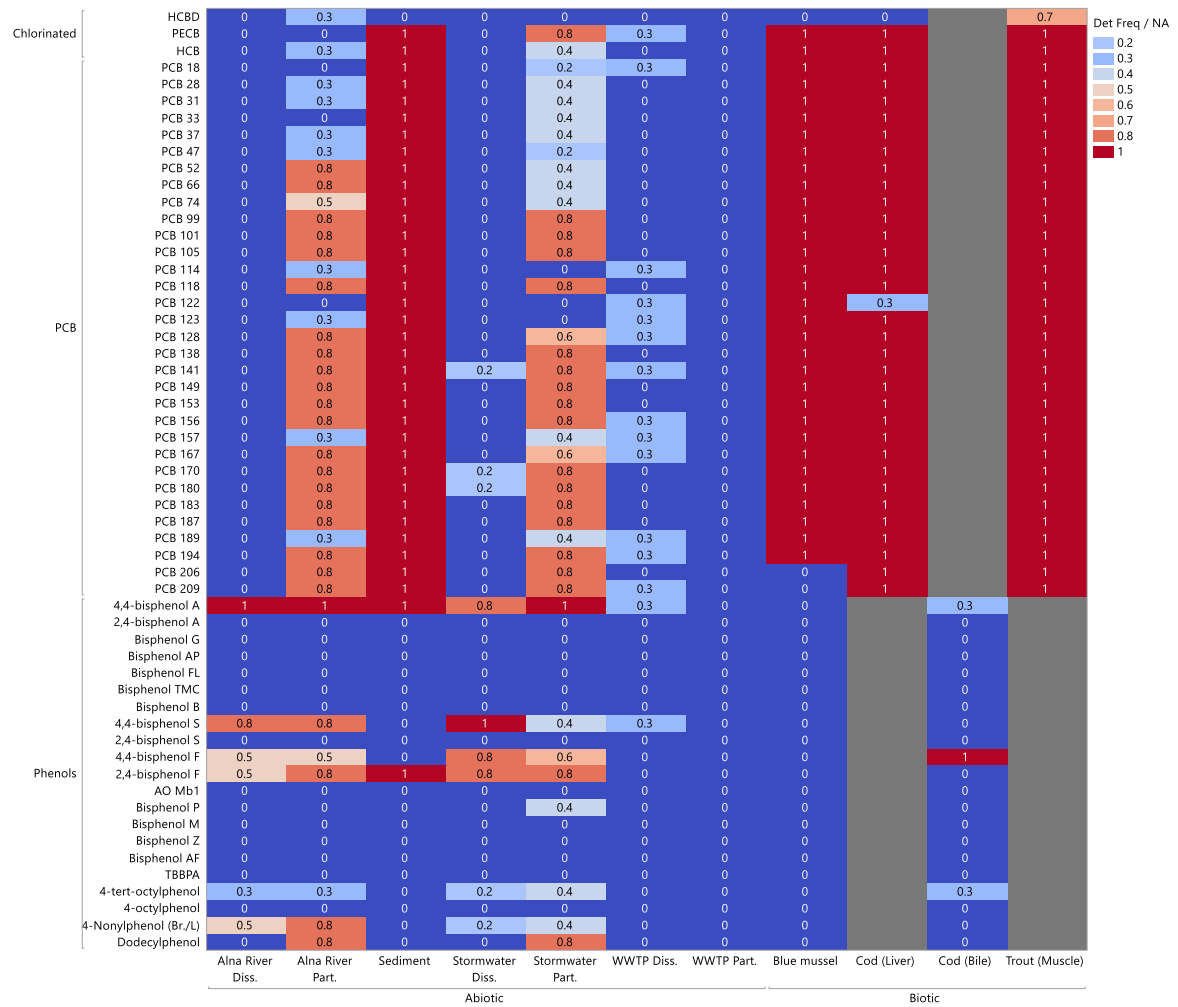


**Figure 2.** Detection frequency (as fraction; %/100) of all the analysed compounds in the different species/matrices in this study. **A:** PFAS, UV-compounds, quaternary ammonium compounds, pesticides/fungicides and benzothiazoles; **B:** Chlorinated compounds, phthalates, OPFRs, siloxanes, musks and metals; **C:** More chlorinated compounds, and phenolic compounds. Grey cells: NA.

B.



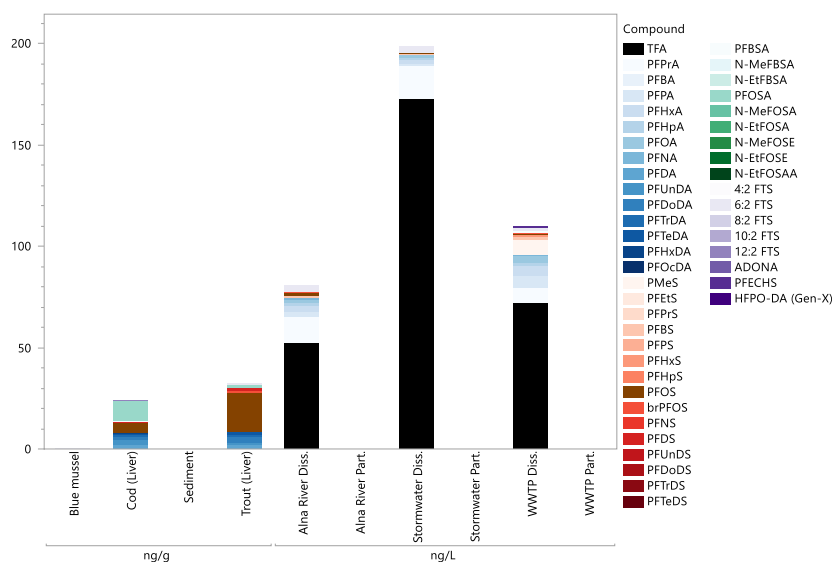
C.



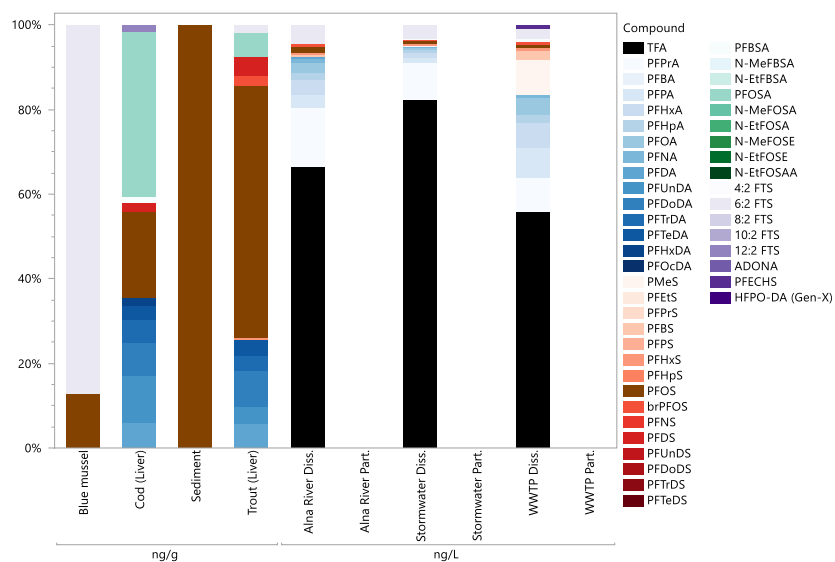
### 2.4.3. PFAS

Concentrations of PFAS were highest in fish (cod and trout) livers (ng/g basis) and in the dissolved fraction of aqueous phases (ng/L basis; **Figure 3**). In sediment and biota, PFOS was a dominating PFAS. PFOSA was also a dominating PFAS in fish livers. In aqueous phases, TFA was a dominating compound.

**A.**



**B.**

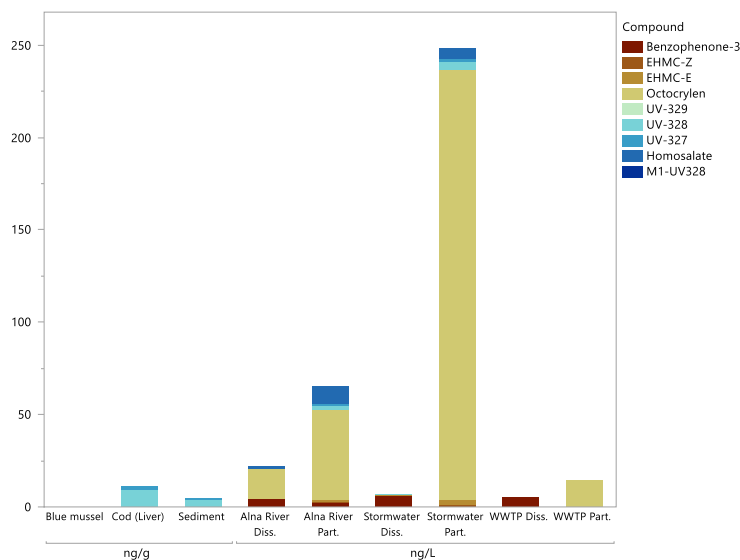


**Figure 3.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of PFAS compounds in all matrices (A) and their contribution (%) to the sum-PFAS concentration (B). Non-detected compounds are assigned a value of zero (0). TFA, PFPrA, PMeS, PFETs and PFPrS were not analysed in sediment and biota.

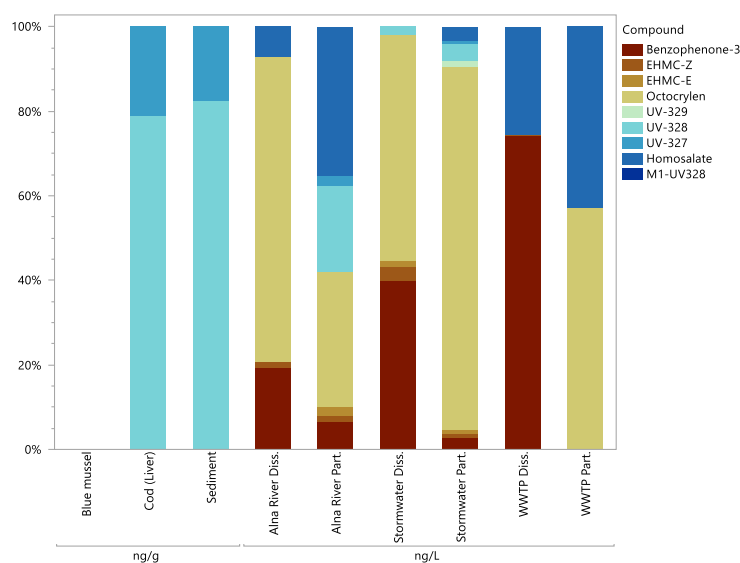
#### 2.4.4. UV-compounds

UV-compounds were not detected in blue mussel. In sediment and cod liver, UV-327 and -328 were important UV-compounds (**Figure 4**). In aqueous phases Octocrylen, Benzophenone-3 and Homosalate were major UV-compounds.

**A.**



**B.**

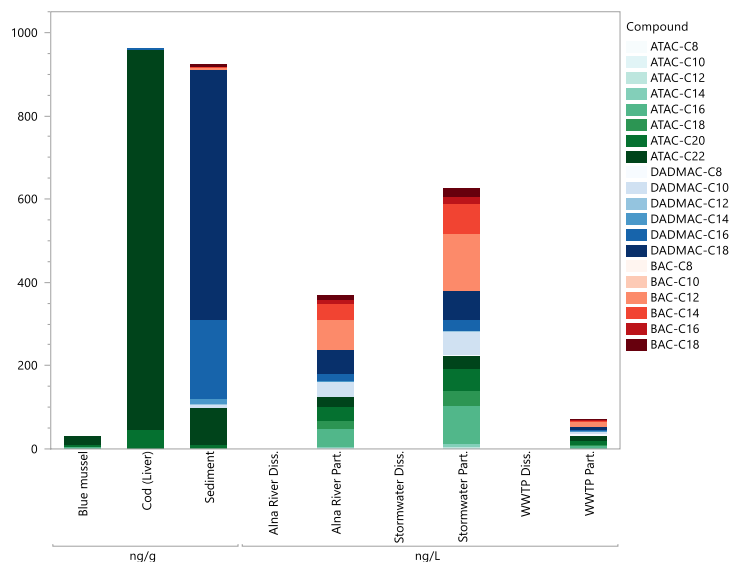


**Figure 4.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of UV-compounds in all matrices (**A**) and their contribution (%) to the sum-UV-compounds concentration (**B**). Non-detected compounds are assigned a value of zero (0).

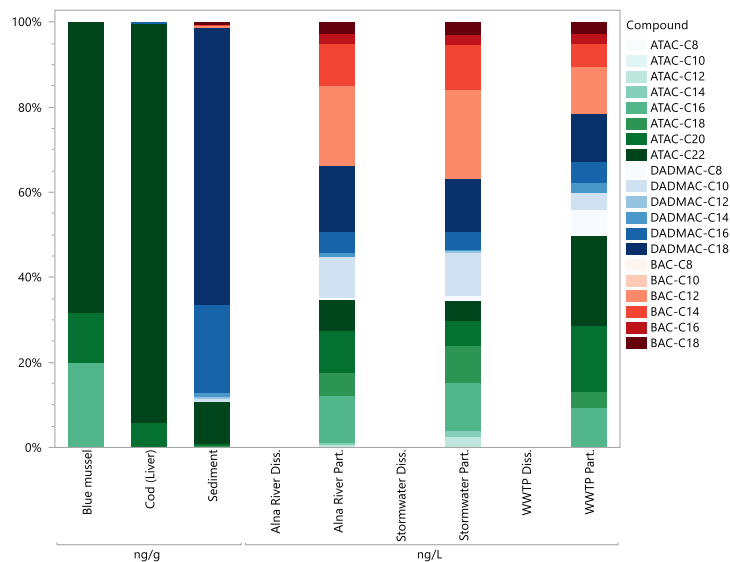
### 2.4.5. Quaternary ammonium compounds

Of the quaternary ammonium compounds (QACs), ATAC-C20 and especially ATAC-C22 were dominating in biota (**Figure 5**). In abiotic matrices, also the benzylalkyldimethyl ammonium compounds (BAC) and the dialkyldimethyl ammonium compounds (DADMAC) constituted notable proportions of the sum-QAC concentrations. QACs were only detected in the particulate fraction of aqueous phases.

**A.**



**B.**



**Figure 5.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of quaternary ammonium compounds in all matrices (**A**) and their contribution (%) to the sum-QAC concentration (**B**). Non-detected compounds are assigned a value of zero (0).

#### 2.4.6. Pesticides/Fungicides

Tebuconazol and Triclosan was detected in 2 (of 4) samples of river water (dissolved fraction; see electronic Appendix). Tebuconazol was also detected in 3 (of 5) stormwater samples (dissolved fraction). Klorheksidin was detected in 2 (of 5) stormwater samples (particulate fraction) and the highest concentration was ~40 ng/L. Pesticides/Fungicides were not analysed in sediment or biota.

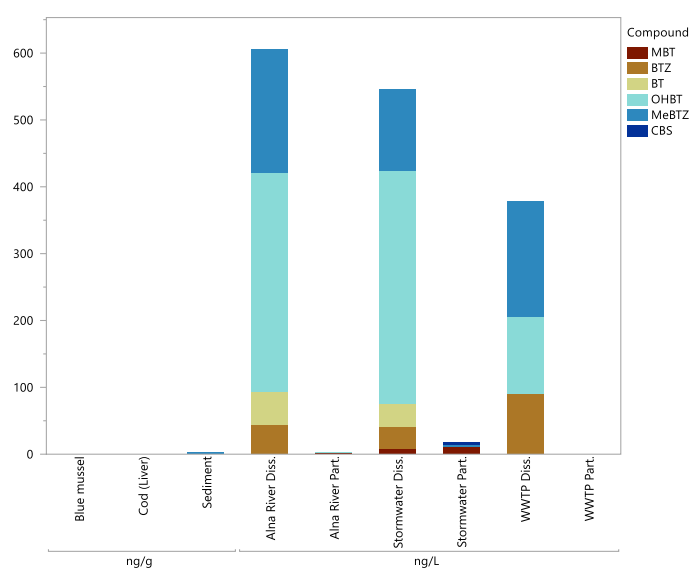
#### 2.4.7. Benzothiazoles

Benzothiazoles were not detected in biota (blue mussel and cod; **Figure 6**). The highest concentrations were observed in the dissolved fraction of river water, stormwater and WWTP effluent water. MeBTZ, OHBT and BTZ were major constituents in all of these water matrices.

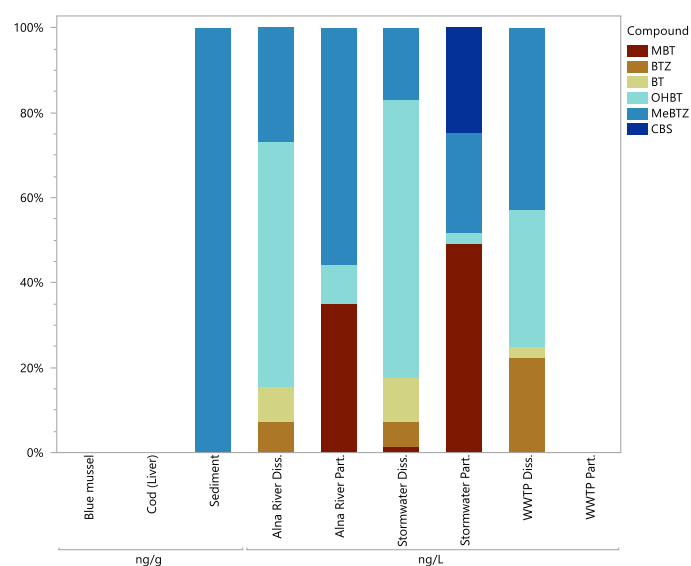
#### 2.4.8. Organochlorines and PCBs

PCBs were detected in all matrices, except the dissolved fraction of river water, and the particulate fraction of WWTP effluent water. The highest concentrations were found in the lipid rich cod liver (median >2000 ng/g wet wt.). Also, PeCB and HCB were found in the highest concentrations in cod liver, followed by trout muscle (see electronic Appendix). HCBd, however, was not detected in cod liver, while in trout muscle, the median concentration appeared equal to that of HCB.

**A.**



**B.**

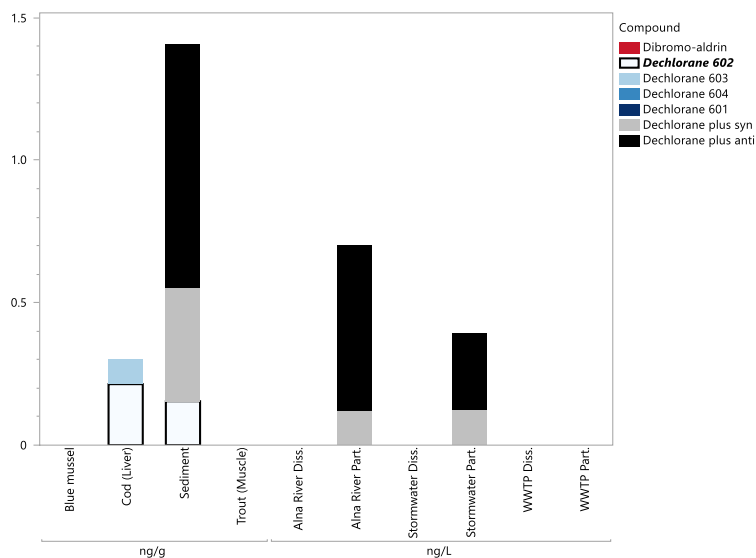


**Figure 6.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of benzothiazoles in all matrices (**A**) and their contribution (%) to the sum-benzothiazoles concentration (**B**). Non-detected compounds are assigned a value of zero (0).

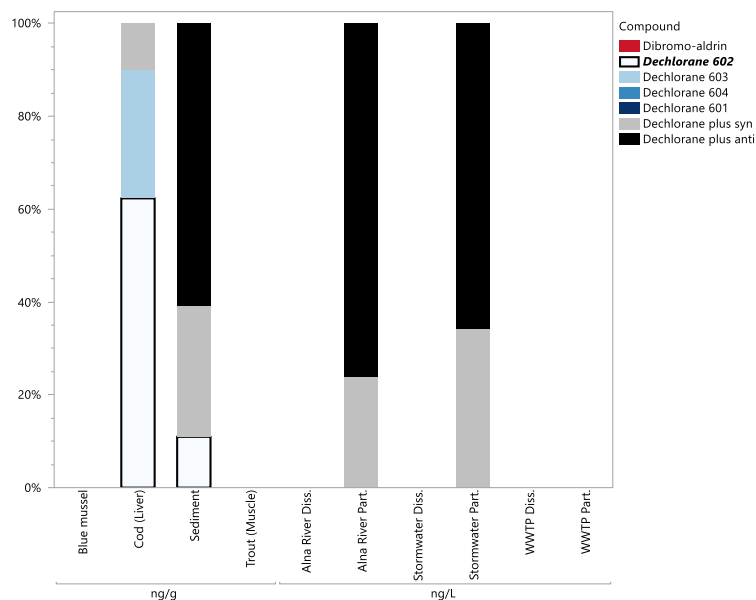
### 2.4.9. Dechloranes

Dechloranes were only detected in cod liver and particulate matrices (sediment and particulate fractions of river water and stormwater (**Figure 7**). Dechlorane plus syn and anti were important compounds in particulate matrices. Dechlorane 602 constituted the highest proportion of the sum-dechloranes concentration in cod liver. This compound was also found in sediment. In addition, dechlorane 603 was detected in cod liver.

**A.**



**B.**

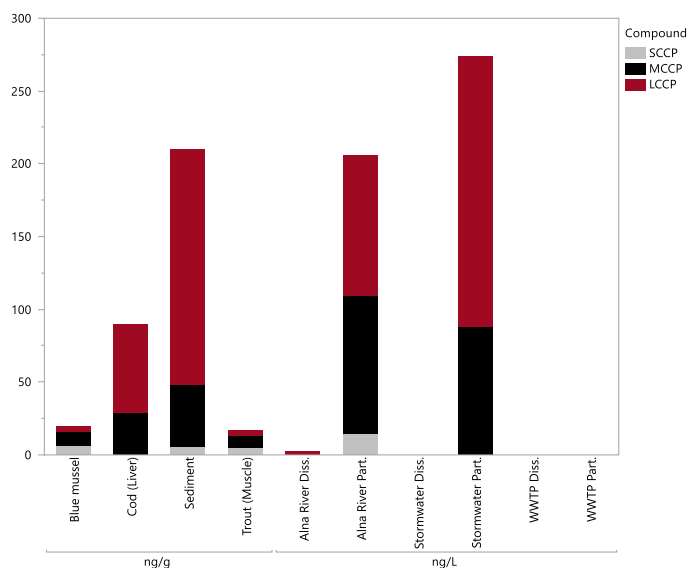


**Figure 7.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of dechloranes in all matrices (**A**) and their contribution (%) to the sum-dechloranes concentration (**B**). Non-detected compounds are assigned a value of zero (0).

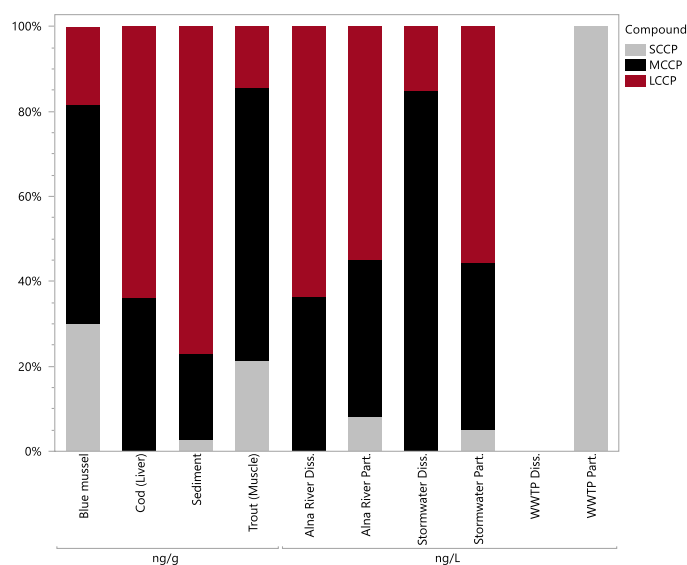
#### 2.4.10. Chlorinated paraffins

The highest concentrations of chlorinated paraffins were encountered in biota and particulate matrices (**Figure 8**). MCCPs and LCCPs generally constituted the highest proportions of the sum-chlorinated paraffins concentrations, but were not detected in WWTP effluent water.

**A.**



**B.**

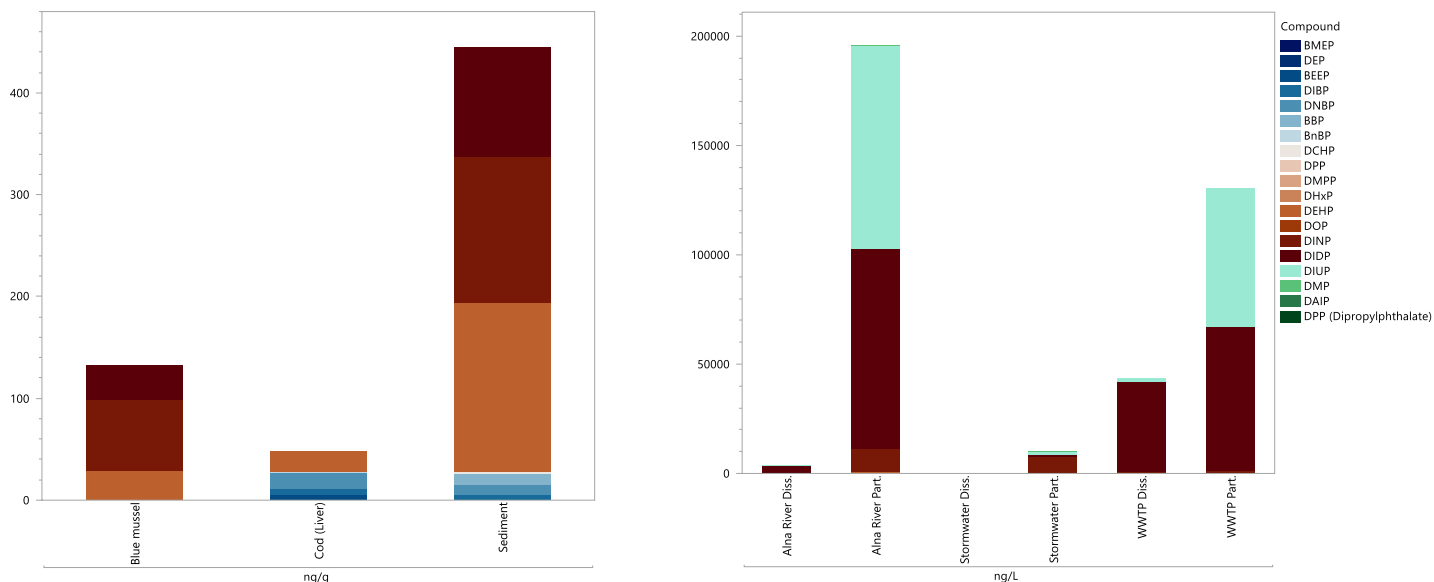


**Figure 8.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of chlorinated paraffins in all matrices (**A**) and their contribution (%) to the sum-chlorinated paraffins concentration (**B**). Non-detected compounds are assigned a value of zero (0).

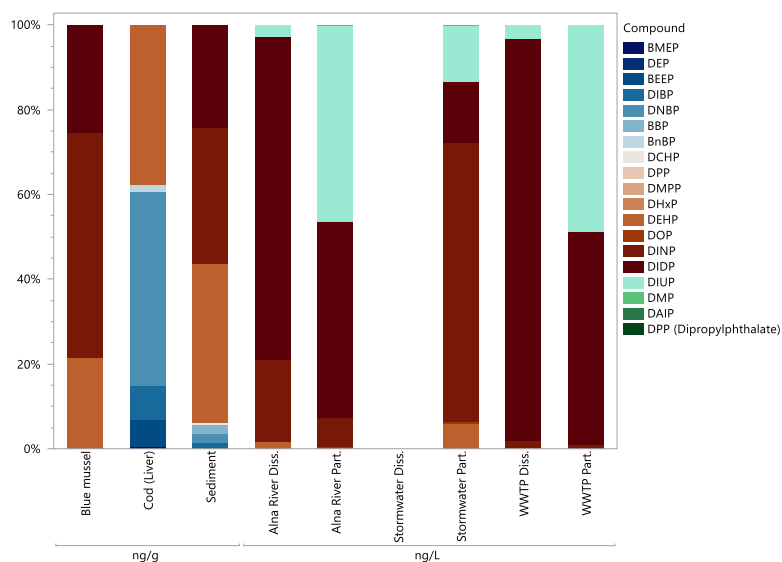
### 2.4.11. Phthalates

Phthalates were found in high concentrations in the particulate fractions of river water, and WWTP effluent water, as well as in stormwater (**Figure 9**). DIDP and DIUP constituted the highest proportions of the sum-phthalates concentrations. Also, DINP was a dominating compound in stormwater. In marine samples (blue mussel, cod liver and sediment), DEHP constituted large proportions of the sum-phthalates concentrations. In cod, also DNBP.

**A.**



**B.**

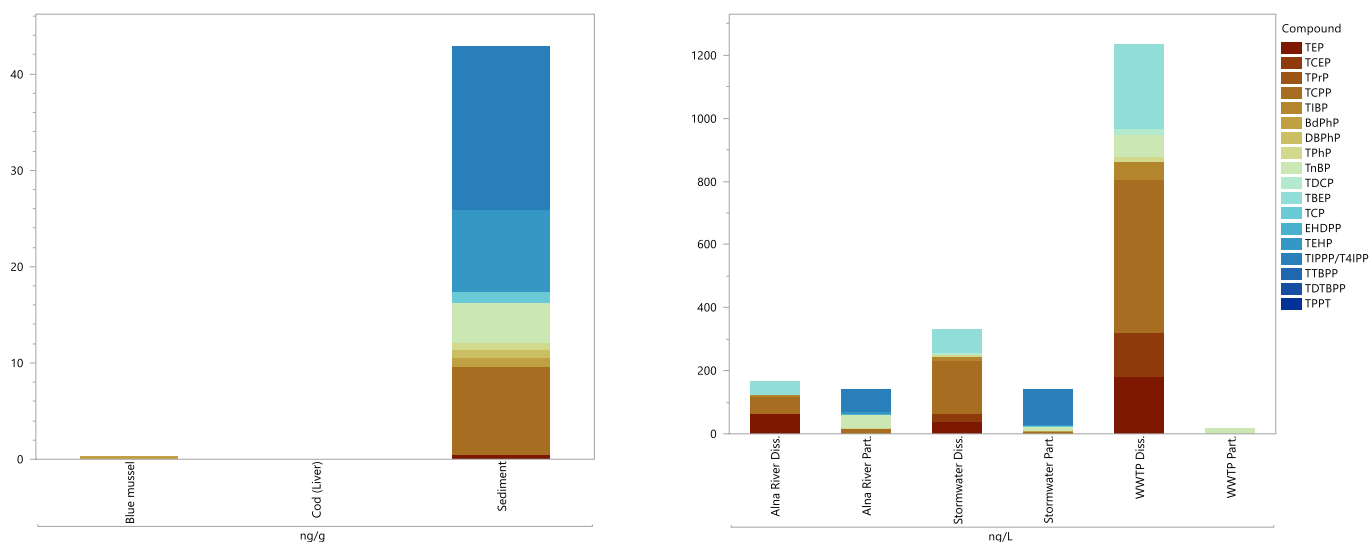


**Figure 9.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of phthalates in all matrices (graph divided in biota and sediment, and water samples; Note different concentration scales on axes; **A**) and their contribution (%) to the sum-phthalates concentration (**B**). Non-detected compounds are assigned a value of zero (0).

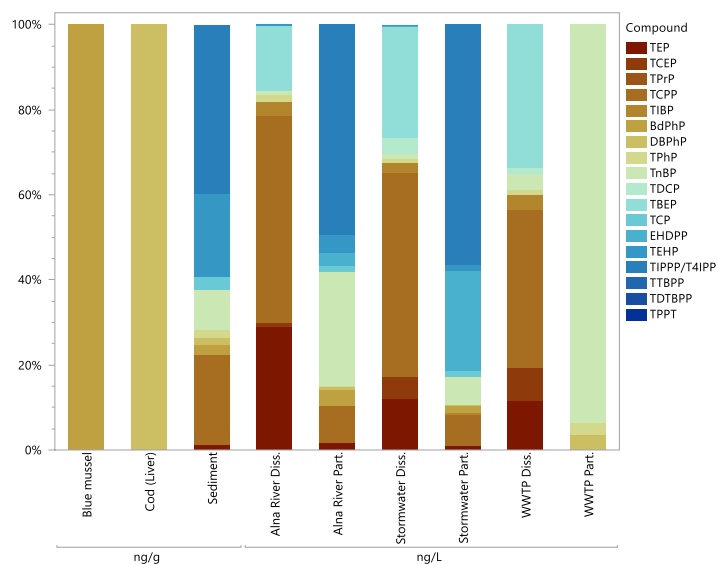
### 2.4.12. OPFRs

The most conspicuous concentrations of OPFRs were observed in abiotic matrices, and particularly in the dissolved phase of WWTP effluent water (**Figure 10**). TEP, TCEP, TCP and TBEP were Important constituents of the sum-OPFRs concentrations dissolved in water matrices. In particulate matrices (sediment and particulate phases of river water and stormwater), TIPPP/T4IPP constituted large proportions of the sum-OPFRs concentrations.

**A.**



**B.**

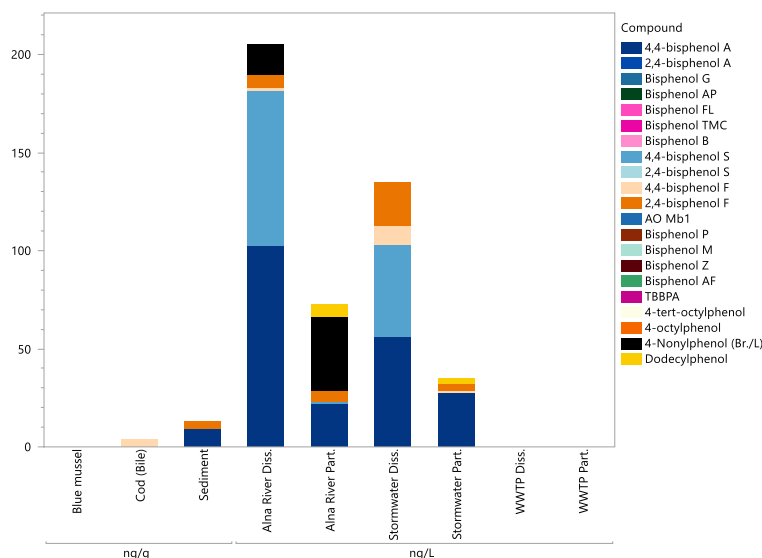


**Figure 10.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of OPFRs in all matrices (graph divided in biota and sediment, and water samples; Note different concentration scales on axes; **A**) and their contribution (%) to the sum-OPFRs concentration (**B**). Non-detected compounds are assigned a value of zero (0).

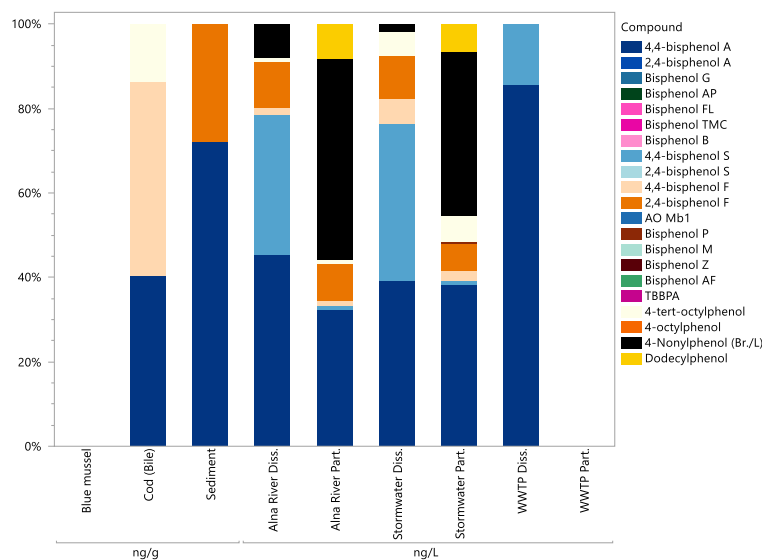
### 2.4.13. Phenolic compounds

Phenolic compounds were detected in all matrices, except in the particulate fraction of WWTP effluent water and in blue mussel (**Figure 11**). The most conspicuous concentrations were observed in river water and stormwater. 4,4-bisphenol A was a dominating compound in all matrices. Furthermore, 4,4-bisphenol S, 2,4-bisphenol F, and 4-nonylphenol were important constituents of the sum-phenolic compounds concentrations in the water samples.

**A.**



**B.**

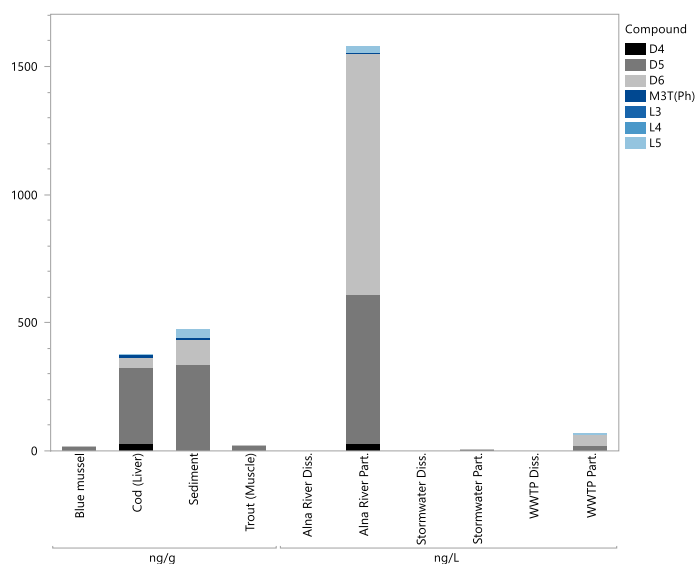


**Figure 11.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of phenolic compounds in all matrices (**A**) and their contribution (%) to the sum-phenolic compounds concentration (**B**). Non-detected compounds are assigned a value of zero (0).

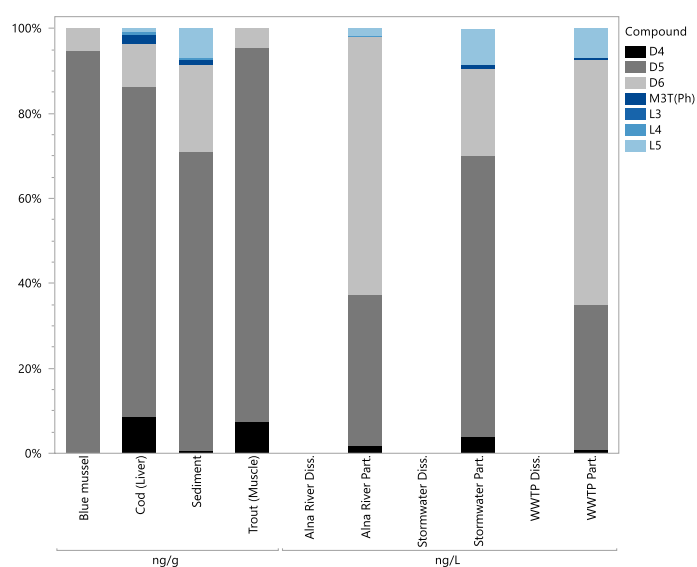
#### 2.4.14. Siloxanes

Siloxanes were not detected in the dissolved fractions of water matrices (**Figure 12**). Conspicuous concentrations of siloxanes were, however, observed in the particulate fraction of river water, as well as in sediment and cod liver from the Oslofjord. The cyclic siloxanes D5 and D6 were dominating.

**A.**



**B.**

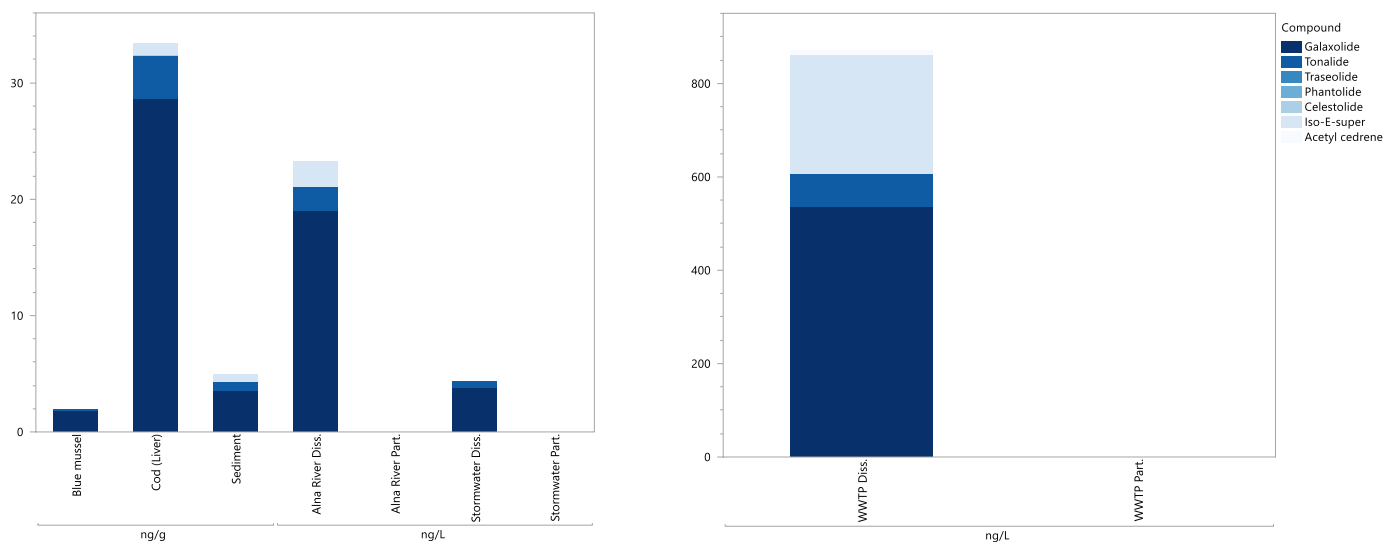


**Figure 12.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of siloxanes in all matrices (**A**) and their contribution (%) to the sum-siloxanes concentration (**B**). Non-detected compounds are assigned a value of zero (0).

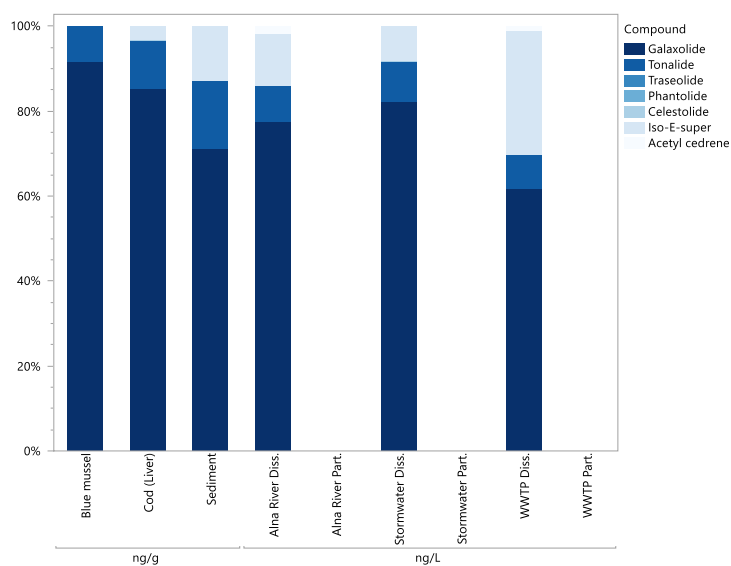
#### 2.4.15. Musks

Musks were detected in all matrices, however, only in the dissolved phase of the water samples (**Figure 13**). Galaxolide was found in the highest concentrations, followed by Tonalide and Iso-E-super (OTNE). The most conspicuous concentrations were observed in WWTP effluent water.

**A.**



**B.**



**Figure 13.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of musks in all matrices (graph divided to present WWTP samples in separate graph; Note different concentration scales on axes; **A**) and their contribution (%) to the sum-musks concentration (**B**). Non-detected compounds are assigned a value of zero (0).

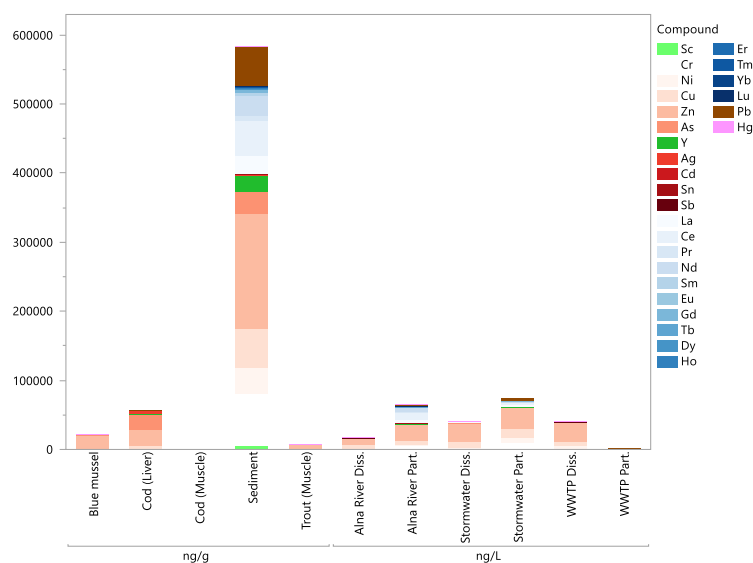
#### 2.4.16. Metals

Iron (Fe) is the dominating metal in all matrices (only Hg analysed in cod muscle; see electronic Appendix), and concentrations are so much higher than the other metals in the particulate phases, that it is omitted from graphical display in **Figure 14**. The essential metals zinc (Zn) and copper (Cu) also constituted large proportions of the sum of metals in all matrices. Conspicuous concentrations/proportions of arsenic (constituting >40% of the sum-metal concentration in cod, excluding iron) were also observed in sediment and organisms from the Inner Oslofjord, and in trout from Alna river. It is known that a significant proportion of arsenic in marine organisms is organic As species (such as arsenobetaine), which are much less toxic than inorganic As (Amlund 2005). Here, total As is analysed. A notable proportion (9.7% of the sum-metal concentration, excluding iron) of silver (Ag) was also observed in cod (liver). Rare earth metals (Sc, Y and lanthanides) were found in notable concentrations mainly in sediment, river water and stormwater.

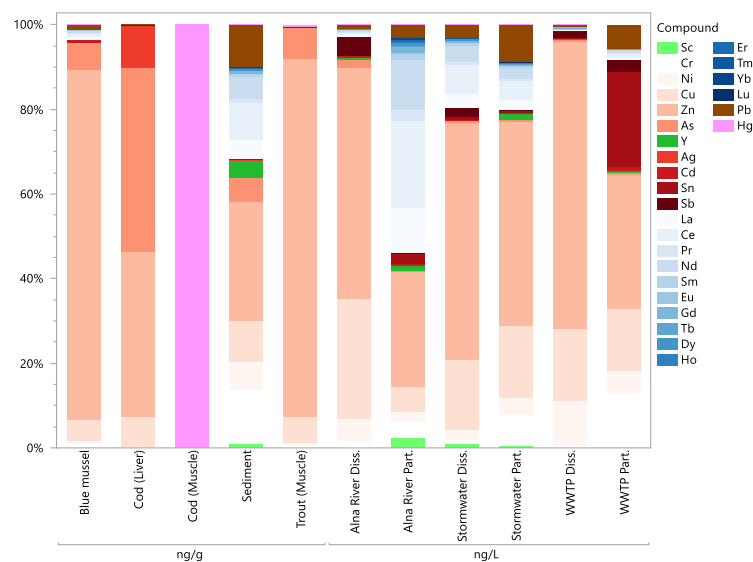
The homogenizing effects of sedimentary processes should result in nearly constant distributions of rare earth elements (REE) in sedimentary rocks, and the pattern should reflect upper continental crust abundances (Taylor and McLennan, 1985). Furthermore, The REE distribution in modern sedimentary environments is similar to that of the post-Archean shales (such as the Post Archean Australian Shale, PAAS; Taylor and McLennan, 1985).

In sediments from station Bq41, Bekkelaget, post Archean Australian Shale (PAAS)-normalized ratios (Taylor and McLennan, 1985) of light rare earth elements (LREE), middle REE (MREE) and heavy REE (HREE) were (on average) 0.74, 0.63 and 0.40, while “continental crust”-normalized ratios (from McLennan, 2001) of LREE, MREE and HREE were (on average) 0.92, 0.78 and 0.51 (**Figure 15**). As such, in 2023, no enrichment could be observed, and anthropogenic influence could not be indicated. Only neodymium, Nd, showed “continental crust”-normalized ratio > 1. Nd alloys are used to make magnets for use in e.g. electric motors and generators.

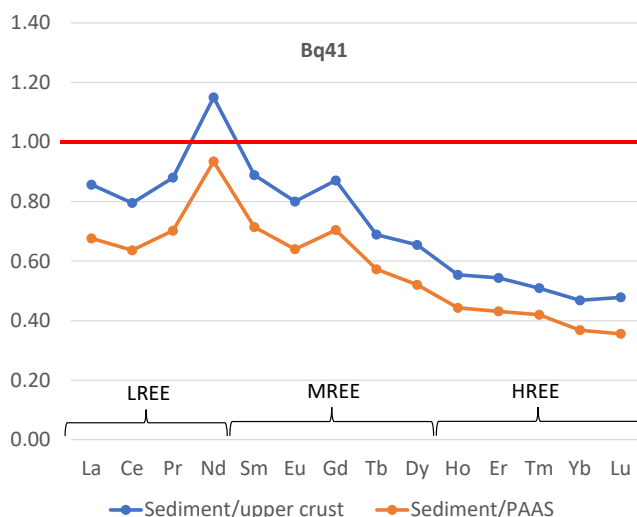
**A.**



**B.**



**Figure 14.** Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment and ng/L in river water, stormwater and WWTP effluent water) of metals in all matrices (**A**) and their contribution (%) to the sum-metals concentration (**B**). Non-detected compounds are assigned a value of zero (0). Note that iron (Fe) has been omitted from the figure because of much higher concentrations than the other metals. In cod, Hg was analysed in muscle, while all other metals were analysed in liver.



**Figure 15.** Ratio of lanthanide content in Inner Oslofjord sediments (from Bekkelaget, Bq41) to lanthanide content in Post Archean Australian Shale (PAAS; Taylor and McLennan; 1985) and continental crust (McLennan, 2001).

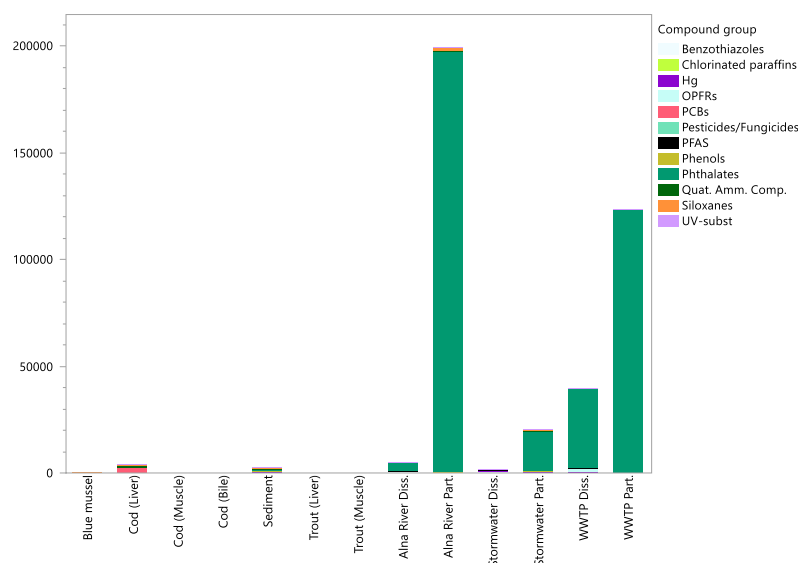
#### 2.4.17. Comparisons of the different contaminant groups

**Figure 16** shows concentrations of selected compounds/compound groups in all matrices, and their contribution (in %) to the sum concentration of all these compounds/compound groups. In terms of sources and sinks of contaminants in the Oslo Urban fjord system, it is of interest to give a general impression of the dominating contaminants/groups of contaminants in the different matrices analysed.

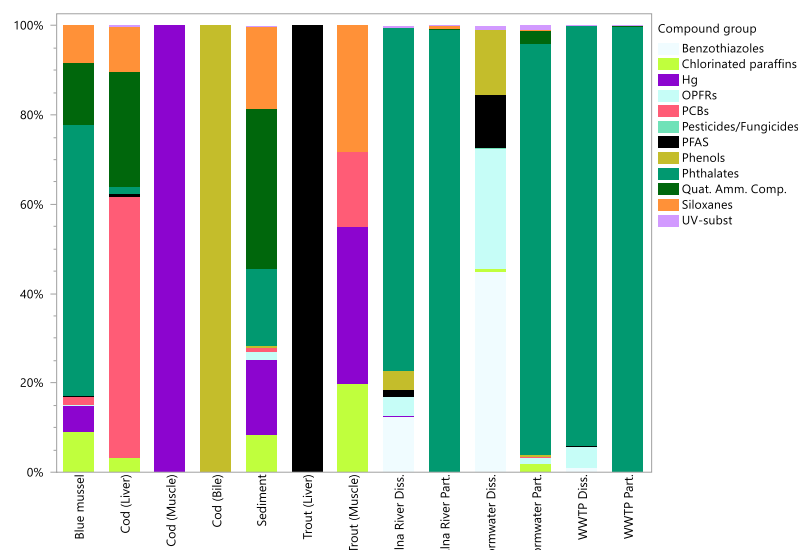
Phthalates were a dominating group in aqueous matrices (mainly associated with the particulate fraction) and the highest concentrations were found in river water from Alna. Furthermore, phthalates were a dominating group in blue mussel and sediment from the Inner Oslofjord. Siloxanes, Hg and chlorinated paraffins were dominating contaminants in sediment and biota (including trout), while QACs were important in sediment and biota (blue mussel and cod) from the Inner Oslofjord. Furthermore, PCBs constituted large proportions of the sum of all selected contaminants especially in the lipid rich cod liver, as well as trout muscle.

Since concentrations of phthalates were so much higher than the other compound groups in Alna River water, storm water and wastewater from Bekkelaget WWTP, phthalates were omitted from graphical display in **Figure 17**. Excluding the phthalates emphasizes the importance of siloxanes in the particulate fraction of Alna River water and WWTP wastewater, in addition to sediment and biota. It also emphasizes the importance of chlorinated paraffins in the particulate fraction of Alna River water and storm water, in addition to sediment and biota, as well as the importance of QACs in the particulate fraction of aqueous matrices, in addition to sediment and biota from the Inner Oslofjord. Furthermore, the exclusion of phthalates emphasizes the importance of OPFRs and benzothiazoles in the dissolved fraction of wastewater from Bekkelaget WWTP.

**A.**

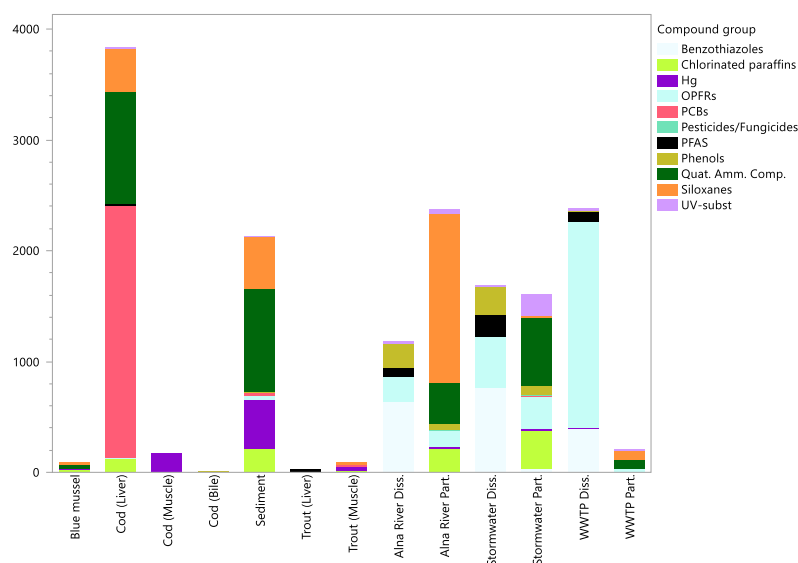


**B.**

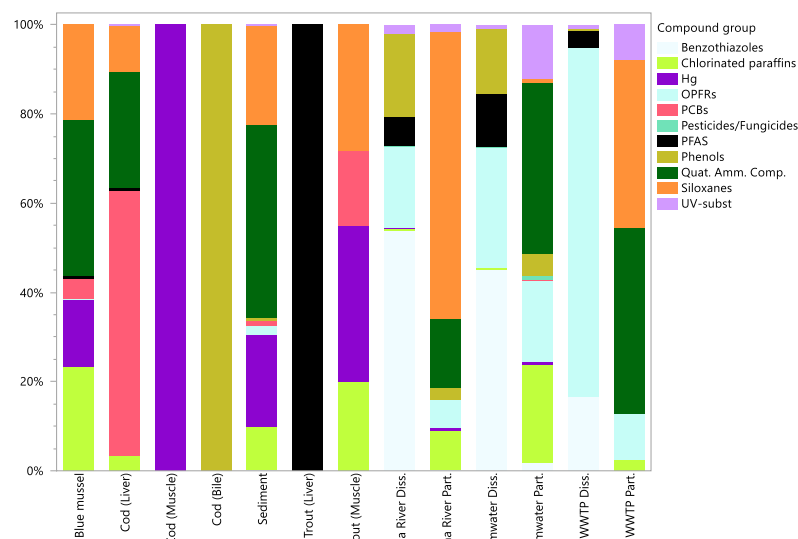


**Figure 16.** Concentrations (means; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of selected compounds/compound groups in all matrices (A) and their contribution (%) to the sum concentration of all these compounds/compound groups (B). Non-detected compounds are assigned a value of zero (0). Note: In cod, phenols were analysed in bile, Hg was analysed in muscle, and other compounds were analysed in liver. In trout, PFASs were analysed in liver, while other compounds were analysed in muscle. Among the PFASs, TFA, PFPrA, PMeS, PFETs and PFPrS were not analysed in sediment or biota. Pesticides/Fungicides were not analysed in sediment or biota. UV-compounds, QACs, benzothiazoles, phthalates, OPFRs, musks and phenols were not analysed in trout.

**A.**



**B.**



**Figure 17.** Concentrations (means; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of selected compounds/compound groups in all matrices (A) and their contribution (%) to the sum concentration of all these compounds/compound groups (B). Non-detected compounds are assigned a value of zero (0). Note: In cod, phenols were analysed in bile, Hg was analysed in muscle, and other compounds were analysed in liver. In trout, PFASs were analysed in liver, while other compounds were analysed in muscle. Among the PFASs, TFA, PFPrA, PMeS, PFETs and PFPrS were not analysed in sediment or biota. Pesticides/Fungicides were not analysed in sediment or biota. UV-compounds, QACs, benzothiazoles, OPFRs, musks and phenols were not analysed in trout. This figure corresponds to Figure 16, excluding phthalates.

#### 2.4.18. Relation to Environmental Quality Standards (EQS)

In **Table 3** to **Table 5** concentrations are compared to environmental quality standards (EQS).

Concentrations are means and according to Direktoratgruppen vanndirektivet (2018), ½ LoQ is applied when one or more (but not all) values are below LoQ. For sums of analogues, non-detected analogues are assigned a value of zero (0).

**Table 3.** Concentrations of contaminants (mg/kg dry wt.) in sediments from the inner Oslofjord, and the respective Norwegian quality standards (Direktoratsgruppen vanndirektivet 2018). Red numbers indicate concentrations exceeding the quality standard.

| River basin specific compounds        | EQS<br>(mg/kg dry wt.) | Sediment conc.<br>(mg/kg dry wt.) |
|---------------------------------------|------------------------|-----------------------------------|
| Bisphenol A *                         | 0.0011                 | 0.00957                           |
| Dodecylphenol                         | 0.0044                 | <0.005 ***                        |
| Decamethylcyclopentasiloxane (D5)     | 0.044                  | 0.334                             |
| Medium chained chloroparafins (MCCPs) | 4.6                    | 0.0422                            |
| Copper (Cu)                           | 84                     | 56.5                              |
| PCB7                                  | 0.0041                 | 0.0124                            |
| PFOA                                  | 0.071                  | <0.0005                           |
| Zinc (Zn)                             | 139                    | 165                               |
| TBBPA                                 | 0.11                   | <0.004                            |
| Arsenic (As)                          | 18                     | 33.2                              |
| Chromium (Cr)                         | 620                    | 75.5                              |
| TCEP                                  | 0.072                  | <0.0003                           |
| Triclosan                             | 0.009                  |                                   |
| <b>EU priority substances</b>         |                        |                                   |
| Cadmium (Cd)                          | 2.5                    | 0.168                             |
| Lead (Pb)                             | 150                    | 57.7                              |
| Nickel (Ni)                           | 42                     | 38.1                              |
| Mercury (Hg)                          | 0.52                   | 0.438                             |
| Brominated diphenyl ethers *          | 0.062                  |                                   |
| Hexachlorobenzene                     | 0.017                  | 0.000501                          |
| C10-13 chloroalkanes **               | 0.8                    | 0.00576                           |
| Pentachlorobenzene                    | 0.4                    | 0.000313                          |
| Nonylphenol (4-)                      | 0.016                  | <0.070 ***                        |
| Octylphenol (4-tert-)                 | 0.0003                 | <0.003 ***                        |
| PFOS *                                | 0.00023                | 0.00006                           |
| DEHP                                  | 10                     | 0.166                             |

\* Bisphenol A is sum of 4,4'- and 2,4'-; BDEs are Sum of BDE-28, -47, -99, -100, -153 and -154; PFOS is sum of PFOS and brPFOS.

\*\* Short chained chloroparaffins (SCCPs)

\*\*\* Too high limit of detection to evaluate

**Table 4.** Concentrations of contaminants (µg/L) in Alna river water, stormwater and WWTP effluent water (dissolved fraction of all), and the respective Norwegian quality standards (fresh water annual average, AA-EQS; Direktoratgruppen vanndirektivet 2018). Red numbers indicate concentrations exceeding the quality standard.

| River basin specific compounds               | AA-EQS (µg/L) | Alna River water conc. (dissolved; µg/L) | Stormwater conc. (dissolved; µg/L) | Effluent water (WWTP) conc. (dissolved; µg/L) |
|----------------------------------------------|---------------|------------------------------------------|------------------------------------|-----------------------------------------------|
| Bisphenol A *                                | 1.5           | 0.100                                    | 0.0975                             | 0.0130                                        |
| Dodecylphenol                                | 0.04          | <0.001                                   | <0.001                             | <0.001                                        |
| Decamethylcyclopentasiloxane (D5)            | 1.7           | <0.07                                    | <0.04                              | <0.02                                         |
| Medium chained chlorinated paraffins (MCCPs) | 0.05          | 0.0024                                   | 0.00751                            | <0.003                                        |
| Copper (Cu)                                  | 7.8           | 4.98                                     | 9.32                               | 6.94                                          |
| PCB7                                         | 0.0000024     | <0.00022 ****                            | <0.00022 ****                      | <0.00027****                                  |
| PFOA                                         | 9.1           | 0.00195                                  | 0.0011                             | 0.0036                                        |
| Zinc (Zn)                                    | 11            | 9.67                                     | 31.66                              | 27.3                                          |
| TBBPA                                        | 0.254         | <0.01                                    | <0.01                              | <0.01                                         |
| Arsenic (As)                                 | 0.5           | 0.337                                    | 0.279                              | 0.253                                         |
| Chromium (Cr)                                | 3.4           | 0.291                                    | 0.495                              | 0.213                                         |
| TCEP                                         | 65            | 0.0032                                   | 0.0228                             | 0.141                                         |
| Triclosan                                    | 0.1           | 0.00011                                  | <0.0001                            | 0.0008                                        |
| <b>EU priority substances</b>                |               |                                          |                                    |                                               |
| Cadmium (Cd)                                 | 0.08          | 0.0651                                   | 0.0415                             | 0.0408                                        |
| Lead (Pb)                                    | 1.2           | 0.152                                    | 1.688                              | 0.178                                         |
| Nickel (Ni)                                  | 4             | 0.931                                    | 1.406                              | 4.257                                         |
| Mercury (Hg)                                 | 0.07 ***      | 0.0018                                   | 0.00152                            | 0.00203                                       |
| Brominated diphenyl ethers *                 | 0.14 ***      | n.a.                                     | n.a.                               | n.a.                                          |
| Hexachlorobenzene                            | 0.05 ***      | <0.00009                                 | <0.00009                           | <0.00009                                      |
| C10-13 chloroalkanes **                      | 0.4           | <0.01                                    | <0.01                              | <0.01                                         |
| Pentachlorobenzene                           | 0.007         | <0.00008                                 | <0.00008                           | 0.0000415                                     |
| Nonylphenol (4-)                             | 0.3           | 0.0224                                   | 0.0124                             | <0.02                                         |
| Octylphenol (4-tert-)                        | 0.1           | 0.00381                                  | 0.017                              | <0.006                                        |
| PFOS *                                       | 0.00065       | 0.00167                                  | 0.00222                            | 0.00128                                       |
| DEHP                                         | 1.3           | 0.0838                                   | <0.07                              | 0.118                                         |

\* Bisphenol A is sum of 4,4'- and 2,4'-; BDEs are Sum of BDE-28, -47, -99, -100, -153 and -154; PFOS is sum of PFOS and brPFOS.

\*\* Short chained chlorinated paraffins (SCCPs)

\*\*\* No AA-EQS for these substances, thus this is the MAC-EQS

\*\*\*\* Too high limit of detection to evaluate. However, single congeners exceeded EQS, when red.

**Table 5.** Concentrations of contaminants (µg/kg wet wt.) in blue mussel and cod from the Inner Oslofjord, as well as in brown trout from Alna river, and the respective Norwegian quality standards (Direktoratsgruppen vanndirektivet 2018). Red numbers indicate concentrations exceeding the quality standard.

| River basin specific compounds               | EQS (µg/kg) | Blue mussel conc. (µg/kg) | Cod <sup>1</sup> conc. (µg/kg) | Brown trout <sup>2</sup> conc. (µg/kg) |
|----------------------------------------------|-------------|---------------------------|--------------------------------|----------------------------------------|
| Decamethylcyclopentasiloxane (D5)            | 15000       | 17.3                      | 304                            | 22.4                                   |
| Medium chained chlorinated paraffins (MCCPs) | 170         | 10.3                      | 45.8                           | 11.5                                   |
| PCB7                                         | 0.6         | 2.21                      | 1525                           | 8.23                                   |
| PFOA                                         | 91          | <0.5                      | <0.5                           | <0.5                                   |
| TCEP                                         | 7300        | <0.3                      | <0.3                           | n.a.                                   |
| Triclosan                                    | 15000       | n.a.                      | n.a.                           | n.a.                                   |
| <b>EU priority substances</b>                |             |                           |                                |                                        |
| Mercury (Hg)                                 | 20          | 12.8                      | 171                            | 31.5                                   |
| Brominated diphenyl ethers *                 | 0.0085      | n.a.                      | n.a.                           | n.a.                                   |
| Hexachlorobenzene                            | 10          | 0.0343                    | 3.37                           | 0.604                                  |
| C10-13 chloroalkanes **                      | 6000        | 5.94                      | <30                            | 4.52                                   |
| Pentachlorobenzene                           | 50          | 0.00932                   | 0.443                          | 0.127                                  |
| Nonylphenol (4-)                             | 3000        | <60                       | <80                            | n.a.                                   |
| Octylphenol (4-tert-)                        | 0.004       | <2 ***                    | 1.55                           | n.a.                                   |
| PFOS *                                       | 9.1         | 0.05                      | 5.21                           | 19.2                                   |
| DEHP                                         | 2900        | 28.4                      | 20.9                           | n.a.                                   |

\* BDEs are Sum of BDE-28, -47, -99, -100, -153 and -154; PFOS is sum of PFOS and brPFOS.

\*\* Short chained chlorinated paraffins (SCCPs)

\*\*\* Too high limit of detection to evaluate. However, single congeners exceeded EQS, when red.

<sup>1</sup> Liver, except for Mercury (analysed in muscle), as well as 4-nonylphenol and 4-tert-octylphenol (analysed in bile).

<sup>2</sup> Muscle, except for PFOA and PFOS (analysed in liver).

#### 2.4.19. Biomagnification of environmental contaminants in the Inner Oslofjord food web

In 2023, only blue mussel and cod were analysed from the Inner Oslofjord food web, thus no trophic magnification factors (TMFs) were calculated. Instead, biomagnification factors (BMFs) were applied. It is noted that blue mussel occupies trophic level 2, while cod occupies trophic level 4.43 (mean; derived from  $\delta^{15}\text{N}$ ). No normalization to trophic level has been performed.

Biomagnification ( $\text{BMF} > 1$ ) was observed for D6, PeCB, HCB and most PCB congeners (lipid wt. basis; **Table 6**), as well as PFOS, ATAC-C20, ATAC-C22, Galaxolide, Tonalide and several metals (including Ag and Hg; wet wt. basis; **Table 7**).

*Table 6. Biomagnification factors >1 calculated between blue mussel and cod, on a lipid wt. concentration basis.*

| Compound | BMF  |
|----------|------|
| D6       | 1.3  |
| PeCB     | 2.2  |
| HCB      | 4.1  |
| PCB 18   | 1.1  |
| PCB 28   | 3.0  |
| PCB 31   | 1.1  |
| PCB 47   | 6.2  |
| PCB 52   | 4.5  |
| PCB 66   | 6.3  |
| PCB 74   | 8.0  |
| PCB 99   | 20.1 |
| PCB 101  | 10.0 |
| PCB 105  | 17.9 |
| PCB 114  | 13.1 |
| PCB 118  | 18.5 |
| PCB 122  | 3.1  |
| PCB 123  | 12.8 |
| PCB 128  | 23.1 |
| PCB 138  | 33.0 |
| PCB 141  | 58.8 |
| PCB 149  | 7.6  |
| PCB 153  | 32.7 |
| PCB 156  | 28.8 |
| PCB 157  | 26.9 |
| PCB 167  | 28.5 |
| PCB 170  | 94.1 |
| PCB 180  | 62.7 |
| PCB 183  | 41.0 |
| PCB 187  | 19.5 |
| PCB 189  | 39.3 |
| PCB 194  | 241  |

**Table 7.** Biomagnification factors >1 calculated between blue mussel and cod, on a wet wt. concentration basis.

| Compound   | BMF  |
|------------|------|
| PFOS       | 102  |
| ATAC-C20   | 13.1 |
| ATAC-C22   | 44.8 |
| Galaxolide | 15.7 |
| Tonalide   | 22.7 |
| Fe         | 1.2  |
| Cu         | 3.9  |
| Zn         | 1.4  |
| As         | 15.9 |
| Ag         | 1178 |
| Sn         | 3.5  |
| Sb         | 5.7  |
| Hg         | 15.3 |

Calculation of BMF for ATAC-C20, ATAC-C22, Galaxolide and Tonalide on a **lipid wt. basis** would yield BMF = 0.3, 1.1, 0.5 and 0.8, respectively. Thus no, or very low (ATAC-C22) biomagnification. There are other examples of studies where Galaxolide and Tonalide display lack of biomagnification (or biodilution) expressed on a lipid wt. basis (e.g. Chen et al. 2024, and references therein).

## 3 Material and Methods Appendix

### 3.1 Sampling and matrices

#### 3.1.1. Sediment

Sediment was collected at station Bekkelaget (Bq41; **Figure 1**) by means of a van Veen grab (0.15 m<sup>2</sup>) from Research Vessel Trygve Braarud on August 28<sup>th</sup>, 2023. Four grabs of the top layer (0-2 cm in grab samples with undisturbed surface) were prepared for one sample.

#### 3.1.2. Blue mussel

Mussels (*Mytilus edulis*) were collected at Steilene (**Figure 1**), on August 22<sup>nd</sup>, 2023, by standard procedures (handpicked, using rake, or snorkeling; as done in the project "Contaminants in coastal waters", MILKYS; Schøyen et al. 2023; The Norwegian Environment Agency M-2124). The method for collecting and preparing blue mussels was based on the National Standard for mussel collection (NS 9434:2017).

#### 3.1.3. Cod

Cod (*Gadus morhua*) were caught with trawl from RV Trygve Braarud at Midtmeie, southwest of Steilene (**Figure 1**), on August 28<sup>th</sup>, 2023. Biometric data for the fish are given in Appendix (Chapter 4). 15 specimens were pooled into 3 pooled samples (5 individuals in each) for chemical analyses. Stable isotopes of carbon and nitrogen were performed on individual muscle samples (n=15).

#### 3.1.4. Stormwater

Stormwater samples were collected on one occasion at five specific sampling points (**Figure 1**), September 18<sup>th</sup>, 2023. The samples were collected from manholes or streams by filling bottles directly in the stormwater. Subsequently, the stormwater samples were separated into a filtered fraction (hereafter referred to as "dissolved fraction") and a particulate fraction by filtering, using Whatman GF/F filter, pore size 0.7 µm prior to analysis of per- and polyfluorinated substances, UV-compounds, QACs, pesticides/fungicides and benzothiazoles (at NIVA), and Whatman Glass Microfilters GF, pore size 1.2 µm, prior to analysis of other chemical parameters (at NILU).

#### 3.1.5. Municipal wastewater treatment plant

Flow-proportional 24-hour composite samples of fully treated effluent were collected at Bekkelaget wastewater treatment plant (WWTP; **Figure 1**) on June 26<sup>th</sup>, September 28<sup>th</sup> and October 1<sup>st</sup>, 2023. The plant's own automatic composite samplers were used for sampling. The samples were separated into a filtered fraction (hereafter referred to as "dissolved fraction") and a particulate fraction by filtering, using Whatman GF/F filter, pore size 0.7 µm prior to analysis of per- and polyfluorinated substances, UV-compounds, QACs, pesticides/fungicides and benzothiazoles (at NIVA), and Whatman Glass Microfilters GF, pore size 1.2 µm, prior to analysis of other chemical parameters (at NILU).

#### 3.1.6. River water (Alna River)

Four water samples were collected at "Kvæner" in Alna, downstream the main part of the industrial area in the Alna area (**Figure 1**). The samples were collected as time-proportional 24-hour composite samples (50 mL every 5 min) with an automatic composite sampler (Avalanche). The samples were taken during different rainfall conditions (on June 21<sup>st</sup>, June 26<sup>th</sup>, September 21<sup>st</sup> and October 1<sup>st</sup>, 2023). Oslo Municipality measures and reports the water flow in Alna river at the same station ("Kværnerristen"). The river water samples were separated into a filtered fraction (hereafter referred to as "dissolved fraction") and a particulate fraction by filtering, using Whatman GF/F filter, pore size 0.7 µm prior to analysis of per- and polyfluorinated substances, UV-compounds, QACs, pesticides/fungicides and

benzothiazoles (at NIVA), and Whatman Glass Microfilters GF, pore size 1.2 µm, prior to analysis of other chemical parameters (at NILU).

#### 3.1.7. Trout

Brown trout (*Salmo trutta*) were collected in an approximately 500 m stretch of Alna River (**Figure 1**), on July 14<sup>th</sup>, 2023, using backpack electrofishing equipment. Biometric data for the fish are given in Appendix (Chapter 4). 15 specimens were pooled into 3 pooled samples (5 individuals in each) for chemical analyses. Stable isotopes of carbon and nitrogen were performed on individual muscle samples (n=15).

## 3.2 Analytical procedures

#### 3.2.1. QA/QC

In **Table 8** there is a short method description, including LoQ and an assessment and categorization of the uncertainty for every individual compound analyzed. The uncertainty is divided into three groups from 1-3.

Group 1 includes the compounds with the highest certainty. For the compounds in this group the method is well established, not only at NIVA/NILU, but also internationally. That means the quality of this analysis has been proven with intercalibration studies and quality parameters are good. Most of these analyses are accredited according to ISO 17025.

Group 2 includes the compounds with medium certainty. The internal control parameters in the lab are good, the method is fit for purpose, but the quality cannot, or has not been proven within intercalibration studies. This group also includes parameters that have been tested in intercalibration studies, but the results within the studies show that the uncertainty of this analysis is still high (typically more than 50%).

Group 3 includes the compounds with the highest uncertainty. This could be due to not satisfying recovery data, method not fit for purpose, high variability in blanks, or others.

**Table 8. Method information.**

Uncertainty categories:

1. Results from analysis of control samples (spikes and blanks etc) are accurate and precise. The laboratory has participated in and has passed ring-tests and proficiency tests for this analysis. Results are considered to be very reliable.
2. Results from analysis of control samples (spikes and blanks etc) are accurate and precise. The laboratory has not participated in proficiency tests for this analysis, or ring-tests included too few participants to be reliable. Results are considered to be reliable.
3. Results from analysis of control samples (spikes and blanks etc) are variable and precision is not acceptable. Results of these analyses are considered to be least reliable.

UV-Compounds.

| Parameter group | Name parameter                                                                   | CAS Number | Blank subtraction and determination of LOQ                                                                                                        | LOQ range ng/g or ng/L | Method                                                                                                                  | Uncertainty category |
|-----------------|----------------------------------------------------------------------------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------|
| UV compounds    | Benzophenone-3                                                                   | 131-57-7   | Three blanks per batch. Blank-subtraction and LOQ based on average signal of blanks + 3*std. Octocylene usually has the highest levels in blanks. | 0,2-4                  | Internal Standard (IS) added. Samples then extracted twice, followed by clean-up via GPC and/or PSA. GC-MS/MS detection | 2                    |
|                 | Ethylhexylmethoxycinnamate (EHMZ-Z)                                              | 5466-77-3  |                                                                                                                                                   | 0,05-0,3               |                                                                                                                         | 2                    |
|                 | Ethylhexylmethoxycinnamate (EHMZ-E)                                              | 5466-77-3  |                                                                                                                                                   | 0,05-0,3               |                                                                                                                         | 2                    |
|                 | Octocylene                                                                       | 6197-30-4  |                                                                                                                                                   | 0,5-2                  |                                                                                                                         | 2                    |
|                 | UV-327                                                                           | 3864-99-1  |                                                                                                                                                   | 0,1-1                  |                                                                                                                         | 2                    |
|                 | UV-328                                                                           | 25973-55-1 |                                                                                                                                                   | 0,1-1                  |                                                                                                                         | 2                    |
|                 | UV-329                                                                           | 3147-75-9  |                                                                                                                                                   | 0,2-5                  |                                                                                                                         | 2                    |
|                 | homosalate                                                                       | 118-56-9   |                                                                                                                                                   | 1-25                   |                                                                                                                         | 3                    |
|                 | 3-(2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxy-benzenepropanoic acid I | 84268-36-0 | One blank pr batch. LOQ based on 10 x signal-to-noise as measured in each sample                                                                  | 0,5-1                  | IS added. Solid samples then extracted twice, and water samples pre-concentrated on SPE. LC-MS/MS detection             | 2                    |

Comments to UV filters:

Tests of the extraction and analysis recovery of UV-329 based on spiking experiments give results in the range of 60-140%. The measured results of the analysis of complex samples (such as liver) could be overestimates as a consequence. An alternative and more appropriate internal standard will be considered to improve accuracy in future analyses.

**Table 8 cont.** Method information. Pesticides/Fungicides.

| Parameter group       | Name parameter    | CAS Number  | Blank subtraction and determination of LOQ                                        | LOQ range, ng/g or ng/L | Method                                                                                                                                                                  | Uncertainty category |
|-----------------------|-------------------|-------------|-----------------------------------------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Pesticides/Fungicides | Klorheksidin      | 55-56-01    | One blank per batch. LOQ based on 10 x signal-to-noise as measured in each sample | 1,0-20                  | Internal Standard (IS) added. Solid samples then extracted twice, while water samples were pre-concentrated on SPE. Clean-up via PSA when required. LC-MS/MS detection. | 2                    |
|                       | Brodifacoum       | 56073-10-0  |                                                                                   | 0,2-0,5                 |                                                                                                                                                                         | 2                    |
|                       | Bromodiolone      | 28772-56-7  |                                                                                   | 0,2-0,5                 |                                                                                                                                                                         | 2                    |
|                       | Difenacoum        | 56073-07-5  |                                                                                   | 0,2-0,5                 |                                                                                                                                                                         | 2                    |
|                       | Difethialone      | 104653-34-1 |                                                                                   | 0,2-0,5                 |                                                                                                                                                                         | 2                    |
|                       | Flocumafen        | 90035-08-8  |                                                                                   | 0,2-0,5                 |                                                                                                                                                                         | 2                    |
|                       | Chlorpyrifos      | 2921-88-2   |                                                                                   | 0,5-1                   |                                                                                                                                                                         | 2                    |
|                       | Tebuconazol       | 107534-96-3 |                                                                                   | 0,5-1                   |                                                                                                                                                                         | 2                    |
|                       | Triclorcarban     | 101-20-2    |                                                                                   | 0,2-1                   |                                                                                                                                                                         | 2                    |
|                       | Permitrin (cis)   | 52645-53-1  |                                                                                   | 0,4-4                   | IS added. Samples then extracted twice before clean-up via GPC and/or PSA. GC-MS/MS detection                                                                           | 2                    |
|                       | Permitrin (trans) | 52645-53-1  |                                                                                   | 0,4-4                   |                                                                                                                                                                         | 2                    |
|                       | Triclosan         | 3380-34-5   |                                                                                   | 0,05-100                |                                                                                                                                                                         | 2                    |

**Table 8 cont.** Method information. PFAS.

| Parameter group | Name parameter | CAS Number   | Blank subtraction and determination of LOQ                                              | LOQ range, ng/g or ng/L | Method                                                                                                                                   | Uncertainty category |
|-----------------|----------------|--------------|-----------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| PFAS            | PFSA           |              |                                                                                         |                         |                                                                                                                                          |                      |
|                 | TFA            | 76-05-1      | One blank per batch. LOQ as validated and externally controlled in proficiency testing. | 5                       | Internal standard is added, and solid samples are extracted twice. Water samples are concentrated by freeze drying. LC-MS/MS detection   | 2                    |
|                 | PFPrA          | 422-64-0     |                                                                                         | 0,5                     |                                                                                                                                          | 2                    |
|                 | PFBA           | 375-22-4     |                                                                                         | 0,5                     | Internal standard is added, and solid samples are extracted twice. Water samples are concentrated on an SPE column. LC-QTOF-MS detection | 2                    |
|                 | PFPA           | 2706-90-3    |                                                                                         | 0,5                     |                                                                                                                                          | 2                    |
|                 | PFHxA          | 307-24-4     |                                                                                         | 0,5                     |                                                                                                                                          | 1                    |
|                 | PFHpA          | 375-85-9     |                                                                                         | 0,5                     |                                                                                                                                          | 2                    |
|                 | PFOA           | 335-67-1     |                                                                                         | 0,5                     |                                                                                                                                          | 1                    |
|                 | PFNA           | 375-95-1     |                                                                                         | 0,5                     |                                                                                                                                          | 1                    |
|                 | PFDA           | 335-76-2     |                                                                                         | 0,4                     |                                                                                                                                          | 1                    |
|                 | PFUnA          | 2058-94-8    |                                                                                         | 0,4                     |                                                                                                                                          | 1                    |
|                 | PFDoA          | 307-55-1     |                                                                                         | 0,4                     |                                                                                                                                          | 1                    |
|                 | PFTriA         | 72629-94-8   |                                                                                         | 0,4                     |                                                                                                                                          | 1                    |
|                 | PFTeA          | 376-06-7     |                                                                                         | 0,4                     |                                                                                                                                          | 1                    |
|                 | PFHxDA         | 67905-19-5   |                                                                                         | 0,4                     |                                                                                                                                          | 2                    |
|                 | PFOcDA         | 16517-11-6   |                                                                                         | 0,4                     |                                                                                                                                          | 2                    |
|                 | PFSA           |              |                                                                                         |                         |                                                                                                                                          |                      |
|                 | PMeS           | 1493-13-6    | One blank per batch. LOQ as validated and externally controlled in proficiency testing. | 0,1                     | Same method as for TFA                                                                                                                   | 2                    |
|                 | PFETs          | 354-88-1     |                                                                                         | 0,1                     |                                                                                                                                          | 2                    |
|                 | PFPrS          | 423-41-6     |                                                                                         | 0,1                     |                                                                                                                                          | 2                    |
|                 | PFBS           | 375-73-5     |                                                                                         | 0,2                     | Internal standard is added, and solid samples are extracted twice. Water samples are concentrated on an SPE column. LC-QTOF-MS detection | 1                    |
|                 | PFPS           | 2706-91-4    |                                                                                         | 0,2                     |                                                                                                                                          | 2                    |
|                 | PFHxS          | 355-46-4     |                                                                                         | 0,1                     |                                                                                                                                          | 1                    |
|                 | PFHpS          | 375-92-8     |                                                                                         | 0,1                     |                                                                                                                                          | 1                    |
|                 | PFOS           | 2795-39-3    |                                                                                         | 0,05                    |                                                                                                                                          | 1                    |
|                 | brPFOS         | 1763-23-1    |                                                                                         | 0,05                    |                                                                                                                                          | 2                    |
|                 | PFNS           | 474511-07-4  |                                                                                         | 0,1                     |                                                                                                                                          | 2                    |
|                 | PFDCS          | 335-77-3     |                                                                                         | 0,2                     |                                                                                                                                          | 1                    |
|                 | PFUnS          | 441296-91-9  |                                                                                         | 0,2                     |                                                                                                                                          | 2                    |
|                 | PFDoS          | 79780-39-5   |                                                                                         | 0,2                     |                                                                                                                                          | 2                    |
|                 | PFTTrS         | 791563-89-8  |                                                                                         | 0,3                     |                                                                                                                                          | 2                    |
|                 | PFTS           | 1379460-39-5 |                                                                                         | 0,3                     |                                                                                                                                          | 3                    |
|                 | nPFAS          |              |                                                                                         |                         |                                                                                                                                          |                      |

| Parameter group | Name parameter  | CAS Number  | Blank subtraction and determination of LOQ                                              | LOQ range, ng/g or ng/L | Method                                                                                                                                   | Uncertainty category |
|-----------------|-----------------|-------------|-----------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
|                 | PFBSA           | 30334-69-1  | One blank per batch. LOQ as validated and externally controlled in proficiency testing. | 0,3                     | Internal standard is added, and solid samples are extracted twice. Water samples are concentrated on an SPE column. LC-QTOF-MS detection | 2                    |
|                 | N-MeFBSA        | 68298-12-4  |                                                                                         | 0,3                     |                                                                                                                                          | 2                    |
|                 | N-EtFBSA        | 40630-67-9  |                                                                                         | 0,3                     |                                                                                                                                          | 2                    |
|                 | PFOSA           | 754-91-6    |                                                                                         | 0,1                     |                                                                                                                                          | 1                    |
|                 | meFOSA          | 31506-32-8  |                                                                                         | 0,3                     |                                                                                                                                          | 2                    |
|                 | etFOSA          | 4151-50-2   |                                                                                         | 0,3                     |                                                                                                                                          | 2                    |
|                 | meFOSE          | 24448-09-7  |                                                                                         | 1,0                     |                                                                                                                                          | 2                    |
|                 | etFOSE          | 1691-99-2   |                                                                                         | 1,0                     |                                                                                                                                          | 2                    |
|                 | etFOSAA         | 2991-50-6   |                                                                                         | 0,3                     |                                                                                                                                          | 2                    |
|                 | newPFAS         |             |                                                                                         |                         |                                                                                                                                          |                      |
|                 | 4:2 FTS         | 757124-72-4 | One blank per batch. LOQ as validated and externally controlled in proficiency testing. | 0,3                     | Internal standard is added, and solid samples are extracted twice. Water samples are concentrated on an SPE column. LC-QTOF-MS detection | 2                    |
|                 | 6:2 FTS         | 27619-97-2  |                                                                                         | 0,3                     |                                                                                                                                          | 2                    |
|                 | 8:2 FTS         | 481071-78-7 |                                                                                         | 0,3                     |                                                                                                                                          | 2                    |
|                 | 10:2 FTS        | 120226-60-0 |                                                                                         | 0,3                     |                                                                                                                                          | 2                    |
|                 | 12:2 FTS        | 149246-64-0 |                                                                                         | 0,3                     |                                                                                                                                          | 3                    |
|                 | NaDONA          | 958445-44-8 |                                                                                         | 0,3                     |                                                                                                                                          | 2                    |
|                 | PFECHS          | 67584-42-3  |                                                                                         | 0,3                     |                                                                                                                                          | 2                    |
|                 | HFPO-DA (Gen-X) | 13252-13-6  |                                                                                         | 0,3                     |                                                                                                                                          | 3                    |

Comments to PFAS:

PFTeS and 12:2 FTS; Reference standard materials were unavailable for these compounds. Uncertainty category is therefore reported as 3. However, knowledge from similar compounds provides confidence and we judge the results to be reliable.

brPFOS: The reference standard for branched PFOS is provided as a technical mixture. It is therefore difficult to get reliable results on spiked samples. It is possible that additional branched PFOS have not been reported, but the results here present the most significant.

HFPO-DA (Gen-X): The recovery of this compounds can vary, so the concentration can be a bit uncertain. There might also be some false negative results.

**Table 8 cont.** Method information. Quaternary ammonium compounds.

| Parameter group               | Name parameter | CAS Number | Blank subtraction and determination of LOQ                                                   | LOQ range, ng/g or ng/L | Method                                                                                                     | Uncertainty category |
|-------------------------------|----------------|------------|----------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------------------------------------------------------------------|----------------------|
| Quaternary ammonium compounds | DADMAC-C8      | 3026-69-5  | Three blanks per batch. Blank-subtraction and LOQ based on average signal of blanks + 3*std. | 5                       | Internal Standard (IS) added. Samples are then extracted twice before clean-up via SPE. LC-MS/MS detection | 2                    |
|                               | DADMAC-C10     | 2390-68-3  |                                                                                              | 50                      |                                                                                                            | 2                    |
|                               | DADMAC-C12     | 3282-73-3  |                                                                                              | 5                       |                                                                                                            | 2                    |
|                               | DADMAC-C14     | 68105-02-2 |                                                                                              | 1                       |                                                                                                            | 2                    |
|                               | DADMAC-C16     | 70755-47-4 |                                                                                              | 5                       |                                                                                                            | 2                    |
|                               | DADMAC-C18     | 3700-67-2  |                                                                                              | 5                       |                                                                                                            | 2                    |
|                               | BAC-C8         | 959-55-7   |                                                                                              | 5                       |                                                                                                            | 2                    |
|                               | BAC-C10        | 965-32-2   |                                                                                              | 5                       |                                                                                                            | 2                    |
|                               | BAC-C12        | 139-07-1   |                                                                                              | 25                      |                                                                                                            | 2                    |
|                               | BAC-C14        | 139-08-2   |                                                                                              | 25                      |                                                                                                            | 2                    |
|                               | BAC-C16        | 122-18-9   |                                                                                              | 25                      |                                                                                                            | 2                    |
|                               | BAC-C18        | 122-19-0   |                                                                                              | 25                      |                                                                                                            | 2                    |
|                               | ATAC-C8        | 2083-68-3  |                                                                                              | 5                       |                                                                                                            | 2                    |
|                               | ATAC-C10       | 2082-84-0  |                                                                                              | 5                       |                                                                                                            | 2                    |
|                               | ATAC-C12       | 1119-94-4  |                                                                                              | 5                       |                                                                                                            | 2                    |
|                               | ATAC-C14       | 1119-97-7  |                                                                                              | 50                      |                                                                                                            | 2                    |
|                               | ATAC-C16       | 57-09-0    |                                                                                              | 50                      |                                                                                                            | 2                    |
|                               | ATAC-C18       | 1120-02-1  |                                                                                              | 50                      |                                                                                                            | 2                    |
|                               | ATAC-C20       | 15809-05-9 |                                                                                              | 25                      |                                                                                                            | 2                    |
|                               | ATAC-C22       | 17301-53-0 |                                                                                              | 5                       |                                                                                                            | 2                    |

Comments to QACs: The method has been significant improved since earlier years and the blank, and then also the LOQs has been reduced. The results are now considered have higher certainty than earlier years.

**Table 8 cont.** Method information. Benzothiazoles.

| Parameter group | Name parameter                          | CAS Number | Blank subtraction and determination of LOQ                                        | LOQ range, ng/g or ng/L | Method                                                                                                                                    | Uncertainty category |
|-----------------|-----------------------------------------|------------|-----------------------------------------------------------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Benzothiazoles  | Mercaptobenzothiazole mBZT              | 149-30-4   | One blank per batch. LOQ based on 10 x signal-to-noise as measured in each sample | 1,0                     | Internal Standard (IS) added. Solid samples are then extracted twice, while water samples are pre-concentrated on SPE. LC-MS/MS detection | 2                    |
|                 | Benzotriazole BZT                       | 95-14-7    |                                                                                   | 0,5                     |                                                                                                                                           | 2                    |
|                 | Benzothiazole                           | 95-16-9    |                                                                                   | 10,0                    |                                                                                                                                           | 2                    |
|                 | 2(3H)-Benzothiazolone (HBT)             | 934-34-9   |                                                                                   | 1                       |                                                                                                                                           | 2                    |
|                 | metyl-1H-benzotriazole                  | 29385-43-1 |                                                                                   | 0,5                     |                                                                                                                                           | 2                    |
|                 | N-cyclohexylbenzothiazole-2-sulfenamide | 95-33-0    |                                                                                   | 1,0                     |                                                                                                                                           | 2                    |
|                 | Cl-benzotriazole                        | 94-97-3    |                                                                                   | 0,5                     |                                                                                                                                           | 2                    |
|                 | 6 PPD quinone                           | No CAS     |                                                                                   | 0,5                     |                                                                                                                                           | 2                    |

**Table 8 cont.** Method information. Metals.

| Parameter group | Compound | Cas no    | Blank                                                                                               | LOD range (mg/kg) | LOQ range (mg/kg) | Method                                                                                                                   | Uncertainty category |
|-----------------|----------|-----------|-----------------------------------------------------------------------------------------------------|-------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------|----------------------|
| Metals Biota    | Sc       | 7440-20-2 | Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively | 0.0001-0.0002     | 0.0005-0.001      | In-house accredited method. Microwave assisted decomposition with HNO <sub>3</sub> . Analysed by ICP-MS (Agilent 7700x). | 2                    |
|                 | V        | 7440-62-2 |                                                                                                     | 0.001-0.002       | 0.005-0.01        |                                                                                                                          | 1                    |
|                 | Cr       | 7440-47-3 |                                                                                                     | 0.0001-0.0005     | 0.001-0.002       |                                                                                                                          | 1                    |
|                 | Mn       | 7439-96-5 |                                                                                                     | 0.0001-0.0002     | 0.0005-0.001      |                                                                                                                          | 1                    |
|                 | Fe       | 7439-89-6 |                                                                                                     | 0.002-0.01        | 0.02-0.1          |                                                                                                                          | 1                    |
|                 | Co       | 7440-48-4 |                                                                                                     | 0.0001-0.0002     | 0.0005-0.001      |                                                                                                                          | 1                    |
|                 | Ni       | 7440-02-0 |                                                                                                     | 0.0002-0.0005     | 0.001-0.002       |                                                                                                                          | 1                    |
|                 | Cu       | 7440-50-8 |                                                                                                     | 0.0005-0.001      | 0.002-0.005       |                                                                                                                          | 1                    |
|                 | Zn       | 7440-66-6 |                                                                                                     | 0.002-0.005       | 0.01-0.05         |                                                                                                                          | 1                    |
|                 | As       | 7440-38-2 |                                                                                                     | 0.0001-0.0002     | 0.0005-0.001      |                                                                                                                          | 1                    |
|                 | Y        | 7440-65-5 |                                                                                                     | 0.00005-0.0001    | 0.0002-0.0005     |                                                                                                                          | 2*                   |
|                 | Ag       | 7440-22-4 |                                                                                                     | 0.0001-0.0002     | 0.0005-0.001      |                                                                                                                          | 1*                   |
|                 | Cd       | 7440-43-9 |                                                                                                     | 0.0001-0.0002     | 0.0004-0.001      |                                                                                                                          | 1                    |
|                 | Sn       | 7440-31-5 |                                                                                                     | 0.0005-0.001      | 0.002-0.005       |                                                                                                                          | 2*                   |
|                 | Sb       | 7440-36-0 |                                                                                                     | 0.0001-0.0001     | 0.0005-0.001      |                                                                                                                          | 1                    |
|                 | La       | 7439-91-0 |                                                                                                     | 0.00003-0.0001    | 0.0002-0.0005     |                                                                                                                          | 2                    |
|                 | Ce       | 7440-00-8 |                                                                                                     | 0.00003-0.00010   | 0.0002-0.0005     |                                                                                                                          | 2*                   |
|                 | Pr       | 7440-10-0 |                                                                                                     | 0.00001-0.0001    | 0.0002-0.0005     |                                                                                                                          | 2                    |
|                 | Nd       | 7440-00-8 |                                                                                                     | 0.00004-0.0001    | 0.0002-0.0005     |                                                                                                                          | 2*                   |
|                 | Sm       | 7440-19-9 |                                                                                                     | 0.00001-0.0001    | 0.0002-0.0005     |                                                                                                                          | 2*                   |
|                 | Eu       | 7440-53-1 |                                                                                                     | 0.00005-0.0001    | 0.0002-0.0005     |                                                                                                                          | 2*                   |
|                 | Gd       | 7440-53-2 |                                                                                                     | 0.00005-0.0001    | 0.0002-0.0005     |                                                                                                                          | 2*                   |
|                 | Tb       | 7440-27-9 |                                                                                                     | 0.00001-0.0001    | 0.0002-0.0005     |                                                                                                                          | 2*                   |
|                 | Dy       | 7429-91-6 |                                                                                                     | 0.00001-0.0001    | 0.0002-0.0005     |                                                                                                                          | 2*                   |
|                 | Ho       | 7440-60-0 |                                                                                                     | 0.00001-0.0001    | 0.0002-0.0005     |                                                                                                                          | 2*                   |
|                 | Er       | 7440-52-0 |                                                                                                     | 0.00001-0.0001    | 0.0002-0.0005     |                                                                                                                          | 2*                   |

| Parameter group | Compound | Cas no    | Blank | LOD range (mg/kg) | LOQ range (mg/kg) | Method                                                                                                                                                  | Uncertainty category |
|-----------------|----------|-----------|-------|-------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
|                 | Tm       | 7440-28-0 |       | 0.00001-0.0001    | 0.0002-0.0005     |                                                                                                                                                         | 2*                   |
|                 | Yb       | 7440-64-0 |       | 0.00001-0.0001    | 0.0002-0.0005     |                                                                                                                                                         | 2*                   |
|                 | Lu       | 7439-94-3 |       | 0.00001-0.0001    | 0.0002-0.0005     |                                                                                                                                                         | 2*                   |
|                 | Pb       | 7439-92-1 |       | 0.0001-0.0003     | 0.0005-0.001      |                                                                                                                                                         | 1                    |
|                 | Hg       | 7440-02-0 |       | 0.0002-0.0004     | 0.0007-0.001      | In-house accredited method. Microwave assisted decomposition with HNO <sub>3</sub> . digestate stabilized with HCl. Analysed by ICP-MS (Agilent 7700x). | 1                    |

\*Not accredited

**Table 8 cont.** Method information. Metals cont.

| Parameter group | Compound | Cas no    | Blank                                                                                               | LOD range (mg/kg) | LOQ range (mg/kg) | Method                                                                                                                | Uncertainty category |
|-----------------|----------|-----------|-----------------------------------------------------------------------------------------------------|-------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------|
| Metals Sediment | Sc       | 7440-20-2 | Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively | 0.001-0.002       | 0.005-0.01        | In-house accredited method. Microwave assisted decomposition with HNO <sub>3</sub> . Analysed by ICP-HRMS (ELEMENTZ). | 2                    |
|                 | V        | 7440-62-2 |                                                                                                     | 0.01-0.02         | 0.05-0.1          |                                                                                                                       | 1                    |
|                 | Cr       | 7440-47-3 |                                                                                                     | 0.001-0.002       | 0.005-0.01        |                                                                                                                       | 1                    |
|                 | Mn       | 7439-96-5 |                                                                                                     | 0.001-0.002       | 0.005-0.01        |                                                                                                                       | 1                    |
|                 | Fe       | 7439-89-6 |                                                                                                     | 0.02-0.1          | 0.2-0.5           |                                                                                                                       | 1                    |
|                 | Co       | 7440-48-4 |                                                                                                     | 0.001-0.002       | 0.005-0.01        |                                                                                                                       | 1                    |
|                 | Ni       | 7440-02-0 |                                                                                                     | 0.002-0.005       | 0.01-0.02         |                                                                                                                       | 1                    |
|                 | Cu       | 7440-50-8 |                                                                                                     | 0.005-0.01        | 0.02-0.05         |                                                                                                                       | 1                    |
|                 | Zn       | 7440-66-6 |                                                                                                     | 0.02-0.05         | 0.1-0.2           |                                                                                                                       | 1                    |
|                 | As       | 7440-38-2 |                                                                                                     | 0.001-0.002       | 0.005-0.01        |                                                                                                                       | 1                    |
|                 | Y        | 7440-65-5 |                                                                                                     | 0.0005-0.001      | 0.002-0.005       |                                                                                                                       | 2*                   |
|                 | Ag       | 7440-22-4 |                                                                                                     | 0.001-0.002       | 0.005-0.01        |                                                                                                                       | 1*                   |
|                 | Cd       | 7440-43-9 |                                                                                                     | 0.001-0.002       | 0.005-0.01        |                                                                                                                       | 1                    |
|                 | Sn       | 7440-31-5 |                                                                                                     | 0.005-0.01        | 0.02-0.05         |                                                                                                                       | 2*                   |
|                 | Sb       | 7440-36-0 |                                                                                                     | 0.001-0.002       | 0.005-0.01        |                                                                                                                       | 1                    |
|                 | La       | 7439-91-0 |                                                                                                     | 0.0002-0.001      | 0.002-0.003       |                                                                                                                       | 2                    |
|                 | Ce       | 7440-00-8 |                                                                                                     | 0.0003-0.001      | 0.002-0.003       |                                                                                                                       | 2*                   |
|                 | Pr       | 7440-10-0 |                                                                                                     | 0.0001-0.001      | 0.002-0.003       |                                                                                                                       | 2                    |
|                 | Nd       | 7440-00-8 |                                                                                                     | 0.0004-0.001      | 0.002-0.003       |                                                                                                                       | 2*                   |
|                 | Sm       | 7440-19-9 |                                                                                                     | 0.0001-0.001      | 0.002-0.003       |                                                                                                                       | 2*                   |
|                 | Eu       | 7440-53-1 |                                                                                                     | 0.000-0.001       | 0.002-0.003       |                                                                                                                       | 2*                   |
|                 | Gd       | 7440-53-2 |                                                                                                     | 0.0005-0.001      | 0.002-0.003       |                                                                                                                       | 2*                   |
|                 | Tb       | 7440-27-9 |                                                                                                     | 0.0001-0.001      | 0.002-0.003       |                                                                                                                       | 2*                   |
|                 | Dy       | 7429-91-6 |                                                                                                     | 0.0001-0.001      | 0.002-0.003       |                                                                                                                       | 2*                   |
|                 | Ho       | 7440-60-0 |                                                                                                     | 0.0001-0.001      | 0.002-0.003       |                                                                                                                       | 2*                   |
|                 | Er       | 7440-52-0 |                                                                                                     | 0.0001-0.001      | 0.002-0.003       |                                                                                                                       | 2*                   |

| Parameter group | Compound | Cas no    | Blank | LOD range (mg/kg) | LOQ range (mg/kg) | Method                                                                                                                                                                                              | Uncertainty category |
|-----------------|----------|-----------|-------|-------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
|                 | Tm       | 7440-28-0 |       | 0.0001-0.001      | 0.002-0.003       |                                                                                                                                                                                                     | 2*                   |
|                 | Yb       | 7440-64-0 |       | 0.0001-0.001      | 0.002-0.003       |                                                                                                                                                                                                     | 2*                   |
|                 | Lu       | 7439-94-3 |       | 0.0001-0.001      | 0.002-0.003       |                                                                                                                                                                                                     | 2*                   |
|                 | Pb       | 7439-92-1 |       | 0.001-0.002       | 0.005-0.01        |                                                                                                                                                                                                     | 1                    |
|                 | Hg       | 7440-02-0 |       | 0.0006-0.001      | 0.001-0.002       | In-house accredited method. Filtration of water. Microwave assisted decomposition of particles on filter with HNO <sub>3</sub> . Digestate stabilized with HCl. Analysed by ICP-MS (Agilent 7700x). | 1                    |

\*Not accredited

**Table 8 cont.** Method information. PCBs and organochlorines.

| Parameter group | Name parameter | Cas no     | Blank                                                                                               | LOD range<br>ng/g (ng/L) | LOQ range<br>ng/g (ng/L) | Method                                                                                                                                                                       | Uncertainty<br>category | Stable<br>isotope<br>labeled<br>(SIL)<br>analogue |
|-----------------|----------------|------------|-----------------------------------------------------------------------------------------------------|--------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------|
| PCB/HCB         | PECB           | 608-93-5   | Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively | 0,02-0,1                 | 0,06-0,3                 | In-house, accredited method for PCB, PeCB and HCB. Internal standard addition, extraction, GPC and/or H2SO4 cleanup followed by adsorption chromatography. GC/HRMS (autspec) | 1                       | Y                                                 |
|                 | HCB            | 118-74-1   |                                                                                                     | 0,03-0,15                | 0,07-0,3                 |                                                                                                                                                                              | 1                       | Y                                                 |
|                 | HCBD           | 87-68-3    |                                                                                                     | 0,1-0,5                  | 0,3-1,5                  |                                                                                                                                                                              | 3                       | N                                                 |
|                 | PCB 28         | 7012-37-5  |                                                                                                     | 0,001-0,03               | 0,003- 0,2               |                                                                                                                                                                              | 1                       | Y                                                 |
|                 | PCB 52         | 35693-99-3 |                                                                                                     | 0,002-0,07               | 0,007-0,2                |                                                                                                                                                                              | 1                       | Y                                                 |
|                 | PCB 101        | 37680-73-2 |                                                                                                     | 0,001-0,1                | 0,003-0,2                |                                                                                                                                                                              | 1                       | Y                                                 |
|                 | PCB 118        | 31508-00-6 |                                                                                                     | 0,001-0,1                | 0,003-0,1                |                                                                                                                                                                              | 1                       | Y                                                 |
|                 | PCB 138        | 35065-28-2 |                                                                                                     | 0,001-0,05               | 0,003-1,                 |                                                                                                                                                                              | 1                       | Y                                                 |
|                 | PCB 153        | 35065-27-1 |                                                                                                     | 0,002-0,06               | 0,007-0,2                |                                                                                                                                                                              | 1                       | Y                                                 |
|                 | PCB 180        | 35065-29-3 |                                                                                                     | 0,001-0,3                | 0,003-0,1                |                                                                                                                                                                              | 1                       | Y                                                 |

**Table 8 cont.** Method information. Dechloranes.

| Parameter group | Navn compound        | Cas no      | Blank                                                                                               | LOD range ng/g (ng/L) | LOQ range ng/g (ng/L) | Method                                                                                                                              | Uncertainty category | Stable isotope labeled (SIL) analogue |
|-----------------|----------------------|-------------|-----------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------------|
| Dechlorane      | Dibromoaldrin        | 20389-65-5  | Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively | 0,1-0,5               | 0,3-1,6               | In-house method. Internal standard addition, extraction, GPC cleanup followed by adsorption chromatography. GC/MS-qToF 7200 in ECNI | 2                    | N                                     |
|                 | Dechlorane 602       | 31107-44-5  |                                                                                                     | 0,01-0,06             | 0,03-2                |                                                                                                                                     | 2                    | Y                                     |
|                 | Dechlorane 603       | 13560-92-4  |                                                                                                     | 0,01-0,06             | 0,03-2                |                                                                                                                                     | 2                    | N                                     |
|                 | Dechlorane 604       | 34571-16-9  |                                                                                                     | 0,2-1,4               | 0,7-4,6               |                                                                                                                                     | 2                    | N                                     |
|                 | Dechlorane 601       | 13560-90-2  |                                                                                                     | 0,02-0,1              | 0,07-0,3              |                                                                                                                                     | 2                    | N                                     |
|                 | Dechlorane plus syn  | 135821-03-3 |                                                                                                     | 0,03-0,2              | 0,1-0,7               |                                                                                                                                     | 2                    | Y                                     |
|                 | Dechlorane plus anti | 135821-74-8 |                                                                                                     | 0,05-0,2              | 0,2-0,7               |                                                                                                                                     | 2                    | N                                     |

**Table 8 cont.** Method information. Chlorinated paraffins.

| Parameter group | Name parameter | Cas no     | Blank                                                                                                                                                                                                                                                                      | LOD range ng/g (ng/L) | LOQ range ng/g (ng/L) | Method                                                                                                                                                                 | Uncertainty category | Stable isotope labeled (SIL) analogue |
|-----------------|----------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------------|
| CP              | SCCP           | 85535-84-8 | Method blanks following sample series. S, M and LCCP are corrected for blanks prior to deconvolution. Results are corrected for blanks. Blanks are subtracted on congener group level prior to deconvolution. LOD/LOQ based on calculation of 3 and 10 stddev respectively | 0,8-30                | 2,7-100               | In-house method. Internal standard addition, extraction, H <sub>2</sub> SO <sub>4</sub> cleanup followed by adsorption chromatography.                                 | 3                    | <sup>13</sup> C-hexachlorodecane      |
|                 | MCCP           | 85535-85-9 |                                                                                                                                                                                                                                                                            | 1,5-7                 | 5-23                  | In some cases with high levels of sulfur and/or PCB an additional cleanup with florsil is needed. GC-qToF 7200 in ECNI                                                 | 3                    |                                       |
|                 | LCCP           | 63449-39-8 |                                                                                                                                                                                                                                                                            | 1,7-7                 | 5,7-23                | In-house method. Internal standard addition, extraction, GPC and/or H <sub>2</sub> SO <sub>4</sub> cleanup followed by adsorption chromatography. Agilent LC-qToF 6546 | 3                    |                                       |

**Table 8 cont.** Method information. Chlorinated paraffins.

| Parameter group    | Compound | Cas no     | Blank                                                                                                                                                 | LOD range (ng/g)   | LOQ range (ng/g)   | Method                                                                                                                                                                                                                                                                                                                      | Uncertainty category | Stable isotope labeled (SIL) analogue |
|--------------------|----------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------------|
| Phthalate sediment | DEP      | 84-66-2    | Three blanks pr batch. Blank subtraction for each batch based on the blank average. LOD and LOQ calculated from 3 x stdev and 10 x stdev. From blanks | 10-20              | 20-60              | 2-5 g of soil was dried overnight and 2 g of dry material and deuterated internal standard was added and was extracted with acetone using vortex and sonication for 10 min (done three times). Samples was centrifuged and evaporated and transferred to analytical glass. Recovery standard added and analysis on LC-MSMS. | 2                    | N                                     |
|                    | DiBP     | 84-69-5    |                                                                                                                                                       | 1-5                | 5-10               |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DnBP     | 84-74-2    |                                                                                                                                                       | 1-5                | 5-10               |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DHxP     | 84-75-3    |                                                                                                                                                       | 0.1-0.5            | 0.5-2              |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | BBP      | 85-68-7    |                                                                                                                                                       | 0.1-0.5            | 0.5-2              |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DEHP     | 117-81-7   |                                                                                                                                                       | 5-20               | 10-50              |                                                                                                                                                                                                                                                                                                                             | 2                    | Y                                     |
|                    | DCHP     | 84-61-7    |                                                                                                                                                       | 0.5-2              | 0.5-2              |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DOP      | 117-84-0   |                                                                                                                                                       | 0.1-1              | 0.5-2              |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DNP      | 84-76-4    |                                                                                                                                                       | 1-10               | 10-20              |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DiNP     | 28553-12-0 |                                                                                                                                                       | 10-30              | 20-50              |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DiDP     | 26761-40-0 |                                                                                                                                                       | 10-30              | 20-50              |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DAIP     | 131-17-9   |                                                                                                                                                       | 0.5-2              | 1-3                |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DPP      | 131-16-8   |                                                                                                                                                       | 0.5-2              | 1-3                |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DCHA     | 849-99-0   |                                                                                                                                                       | 0.2-1              | 1-3                |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DHP      | 3648-21-3  |                                                                                                                                                       | 0.2-1              | 1-3                |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DEHT     | 6422-86-2  |                                                                                                                                                       | Coelutes with DEHP | Coelutes with DEHP |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |
|                    | DPHP     | 53306-54-0 |                                                                                                                                                       | 0.2-1              | 1-3                |                                                                                                                                                                                                                                                                                                                             | 2                    | N                                     |

**Table 8 cont.** Method information. OPFRs.

| Parameter group | Name of parameter | Cas no     | Blank                                                                                                                                                  | LOD range (ng/g) | LOQ range (ng/g) | Method                                                                                                                                                                                                                                                                                                                              | Uncertainty category | Stable isotope labeled (SIL) analogue |
|-----------------|-------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------------|
| OPFR sediment   | TEP               | 78-40-0    | Three blanks per batch. Blank subtraction for each batch based on the blank average. LOD and LOQ calculated from 3 x stdev and 10 x stdev. From blanks | 1-5              | 5-10             | 2-5 g of soil was dried overnight and 2 g of dry material and deuterated internal standard was added and was taken for extraction with acetone using vortex and sonication for 10min (done three times). Samples were centrifuged, evaporated and transferred to analytical glass. Recovery standard added and analysis on LC-MSMS. | 2                    | Y                                     |
|                 | TCEP              | 115-96-8   |                                                                                                                                                        | 0.5-2            | 2-3              |                                                                                                                                                                                                                                                                                                                                     | 2                    | Y                                     |
|                 | TPrP              | 513-08-6   |                                                                                                                                                        | 0.2-1            | 1-2              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | TCPP              | 13674-84-5 |                                                                                                                                                        | 0.5-2            | 2-5              |                                                                                                                                                                                                                                                                                                                                     | 2                    | Y                                     |
|                 | TIBP              | 126-71-6   |                                                                                                                                                        | 0.5-2            | 2-3              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | DBPhP             | 2528-36-1  |                                                                                                                                                        | 0.2-1            | 1-2              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | TPP               | 115-86-6   |                                                                                                                                                        | 0.2-1            | 1-2              |                                                                                                                                                                                                                                                                                                                                     | 2                    | Y                                     |
|                 | TnBP              | 126-73-8   |                                                                                                                                                        | 0.5-2            | 2-3              |                                                                                                                                                                                                                                                                                                                                     | 2                    | Y                                     |
|                 | BdPhP             | 2752-95-6  |                                                                                                                                                        | 0.2-1            | 1-2              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | TDCPP             | 13674-87-8 |                                                                                                                                                        | 0.5-2            | 2-3              |                                                                                                                                                                                                                                                                                                                                     | 2                    | Y                                     |
|                 | TBOEP             | 78-51-3    |                                                                                                                                                        | 0.2-1            | 1-2              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | 2-IPPDPP          | 64532-94-1 |                                                                                                                                                        | 0.2-1            | 1-2              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | 4-IPPDPP          | 55864-04-5 |                                                                                                                                                        | 0.2-1            | 1-2              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | TCP               | 1330-78-5  |                                                                                                                                                        | 0.5-3            | 1-6              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | EHP               | 1241-94-7  |                                                                                                                                                        | 0.2-1            | 1-2              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | IDDP              | 29761-21-5 |                                                                                                                                                        | 0.2-1            | 1-2              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | B4IPPPP           | 55864-07-8 |                                                                                                                                                        | 0.5-3            | 1-6              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | TXP               | 25155-23-1 |                                                                                                                                                        | 0.5-3            | 1-6              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |
|                 | TIPPP             | 64532-95-2 |                                                                                                                                                        | 0.5-3            | 1-6              |                                                                                                                                                                                                                                                                                                                                     | 2                    | Y                                     |
|                 | TEHP              | 78-42-2    |                                                                                                                                                        | 0.2-1            | 1-2              |                                                                                                                                                                                                                                                                                                                                     | 2                    | Y                                     |
|                 | TTBPP             | 78-33-1    |                                                                                                                                                        | 0.5-3            | 2-6              |                                                                                                                                                                                                                                                                                                                                     | 2                    | N                                     |

**Table 8 cont.** Method information. Siloxanes.

| Parameter group                            | Name parameter                     | Cas nr                   | Blank                                                                                                                                                 | LOQ range<br>ng/g or ng/L | Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Uncertainty<br>category | Stable isotope<br>labeled (SIL)<br>analogue |
|--------------------------------------------|------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------|
| Siloxanes,<br>biota/sediment/<br>particles | D4 - octamethylcyclotetrasiloxane  | 556-67-2                 | Three blanks per<br>batch. Blank<br>subtraction for each<br>batch based on the<br>blank average.<br>LOQ calculated from<br>10 x stdev. From<br>blanks | 0.255-0.6383              | To 1-2 g of sample, <sup>13</sup> C D4, D5<br>and D6 were added as internal<br>standard, followed by addition<br>of acetonitrile and hexane.<br>Ultrasonic bath and shaking<br>before centrifugation. No<br>further cleanup. Recovery<br>standard added to a sub sample<br>before analysis on GC/MSD. As<br>described in previous<br>MILFERSK/Urban fjord reports.<br>No standard was available for<br>L9-L10, and we used a crude<br>product to estimate the<br>retention time and transitions. | 2                       | Y                                           |
|                                            | D5 - decamethylcyclopentasiloxane  | 541-02-6                 |                                                                                                                                                       | 0.174-0.910               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                       | Y                                           |
|                                            | D6 - dodecamethylcyclohexasiloxane | 540-97-6                 |                                                                                                                                                       | 0.316-1.20                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                       | Y                                           |
|                                            | M3T (Ph)                           |                          |                                                                                                                                                       | 0.035-0.791               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                       | N                                           |
|                                            | L3 - octamethyltrisiloxane         | 107-51-7                 |                                                                                                                                                       | 0.167-0.513               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                       | N                                           |
|                                            | L4 - decamethyltetrasiloxane       | 141-62-8                 |                                                                                                                                                       | 0.764-2.50                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                       | N                                           |
|                                            | L5 - dodecamethylpentasiloxane     | 141-63-9                 |                                                                                                                                                       | 2.23-10.02                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                       | N                                           |
|                                            | L6                                 | 107-52-8                 |                                                                                                                                                       |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                       | N                                           |
|                                            | L7                                 |                          |                                                                                                                                                       |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                       | N                                           |
|                                            | L8                                 |                          |                                                                                                                                                       |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                       | N                                           |
|                                            | L9                                 | no standard<br>available |                                                                                                                                                       |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                       | N                                           |
|                                            | L10                                | no standard<br>available |                                                                                                                                                       |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                       | N                                           |

**Table 8 cont.** Method information. Musks.

| Parameter group                                                 | Name parameter | Cas nr     | Blank                                                                                                                                                                                                                                                                                          | LOQ range ng/g or ng/L | Method                                                                                                                                                                                                                                                                                                                                                | Uncertainty category | Stable isotope labeled (SIL) analogue |
|-----------------------------------------------------------------|----------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------------|
| Musk, filtered water/<br>suspended particles/<br>sediment/biota | Traseolide     | 68140-48   | Filtered water: 100 mL of MilliQ water was prepared as a laboratory blank alongside each batch of ~8 samples.                                                                                                                                                                                  | 0.132-1.24             | 1 g sample was mixed with Na <sub>2</sub> SO <sub>4</sub> , added d11-Tonalide as internal standard, and extracted with acetone/hexane (1:3). After up-concentration the extract was cleaned up with EZ-POP.<br><br>The extracts were analysed on a GC/MSD with EI ionization. 5 µL of the extract were injected on a DB5 column with 5 m pre column. | 3                    | N                                     |
|                                                                 | Phantolide     | 15323-35-0 |                                                                                                                                                                                                                                                                                                | 0.029-0.28             |                                                                                                                                                                                                                                                                                                                                                       | 3                    | N                                     |
|                                                                 | Otne           | 54464-57-2 | Suspended particles: Three blanks were prepared per batch. All extractions were done in a clean room or clean cabinet.                                                                                                                                                                         | 0.132-1.24             |                                                                                                                                                                                                                                                                                                                                                       | 3                    | N                                     |
|                                                                 | Acetyl cedrene | 32388-55-9 | Sediment/Biota: One laboratory blank was prepared alongside each batch of ~6 samples.                                                                                                                                                                                                          | 0.132-1.24             |                                                                                                                                                                                                                                                                                                                                                       | 3                    | N                                     |
|                                                                 | Galaxolide     | 1222-05-5  | For all samples, LODs were calculated by 3xSD of the associated laboratory blanks. Where compounds were not present in the laboratory blanks, sample/calibration standard peaks with signal:noise ratios of ~3:1 were converted to a sample concentration using the average blank volume/mass. | 0.068-0.64             |                                                                                                                                                                                                                                                                                                                                                       | 3                    | N                                     |
|                                                                 | AHMT/Tonalide  | 21145-77-7 |                                                                                                                                                                                                                                                                                                | 0.132-1.24             |                                                                                                                                                                                                                                                                                                                                                       | 3                    | Y                                     |
|                                                                 | Celestolide    | 13171-00-1 |                                                                                                                                                                                                                                                                                                | 0.021-0.18             |                                                                                                                                                                                                                                                                                                                                                       | 3                    | N                                     |

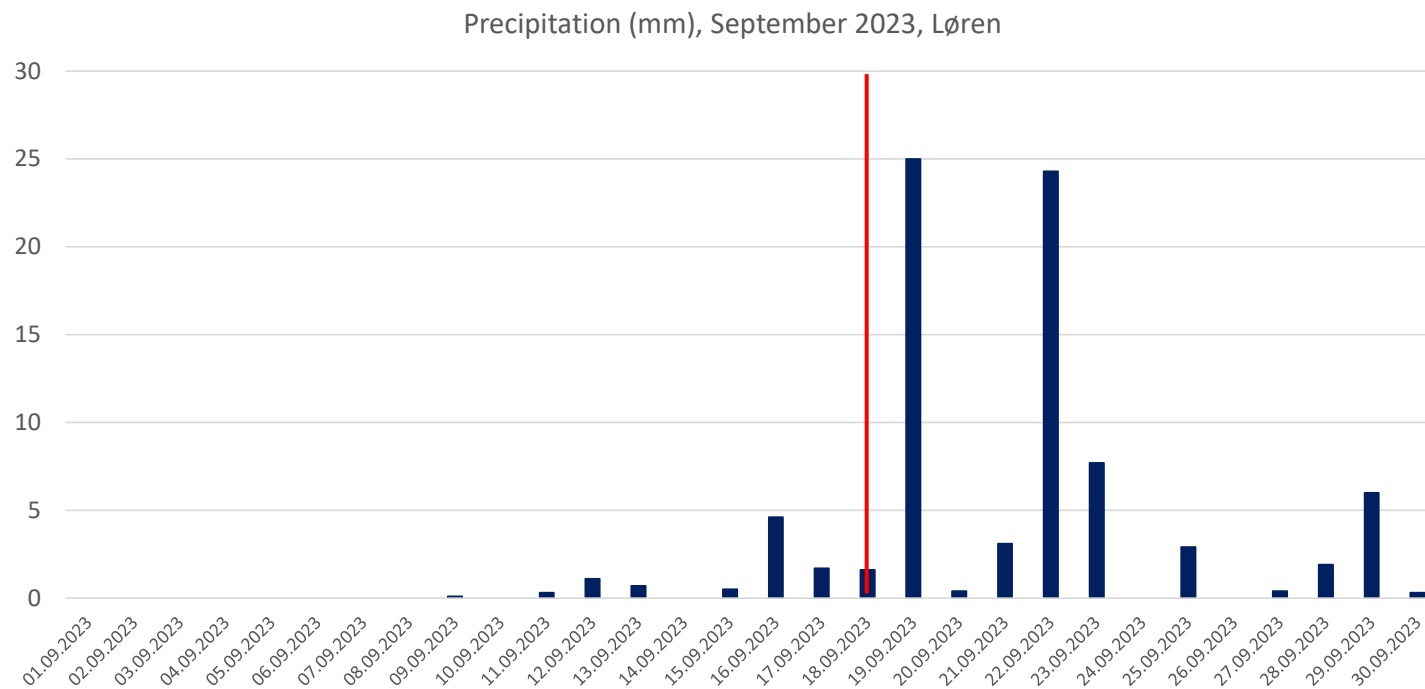
**Table 8 cont.** Method information. Phenolic compounds.

| Parameter group          | Name parameter           | Cas nr      | Blank                                                                                                                                                | Method                                                                                                                                                                              | LOD range (ng/g) | LOQ range (ng/g) | Uncertainty category | Stable isotope labelled (SIL) analogue |
|--------------------------|--------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|----------------------|----------------------------------------|
| Bisphenols               | 4,4-bisphenol A          | 80-05-7     | Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stdev respectively (or instrument detection limit if this is higher) | In-house method. Internal standard addition, accelerated solvent extraction (ASE) or supramolecular solvent extraction (SUPRAS), solid phase extraction cleanup. LC/HRMS (Orbitrap) | 2-10             | 10-30            | 3                    | Y                                      |
|                          | 2,4-bisphenol A          | 837-08-1    |                                                                                                                                                      |                                                                                                                                                                                     | 0,5-6            | 1,7-20           | 3                    | N                                      |
|                          | bisphenol G              | 127-54-8    |                                                                                                                                                      |                                                                                                                                                                                     | 1-5,4            | 3-17             | 3                    | N                                      |
|                          | 4,4-Bisphenol S          | 80-09-1     |                                                                                                                                                      |                                                                                                                                                                                     | 0,2-1            | 0,7-3            | 3                    | Y                                      |
|                          | 2,4-bisphenol S          | 5397-34-2   |                                                                                                                                                      |                                                                                                                                                                                     | 1-8              | 3-26             | 3                    | Y                                      |
|                          | 4,4-bisphenol F          | 620-92-8    |                                                                                                                                                      |                                                                                                                                                                                     | 0,6-5            | 2-17             | 3                    | Y                                      |
|                          | 2,4-bisphenol F          | 2467-03-0   |                                                                                                                                                      |                                                                                                                                                                                     | 1-8              | 3-26             | 3                    | N                                      |
|                          | Bisphenol P              | 2167-51-3   |                                                                                                                                                      |                                                                                                                                                                                     | 0,8-4            | 3-13             | 3                    | Y                                      |
|                          | Bisphenol Z              | 843-55-0    |                                                                                                                                                      |                                                                                                                                                                                     | 1-6              | 3-20             | 3                    | Y                                      |
|                          | TBBPA                    | 79-94-7     |                                                                                                                                                      |                                                                                                                                                                                     | 2-10             | 7-30             | 3                    | Y                                      |
|                          | Bisphenol TMC            | 129188-99-4 |                                                                                                                                                      |                                                                                                                                                                                     | 1,2-6            | 4-20             | 3                    | N                                      |
|                          | Bisphenol FL             | 3236-71-3   |                                                                                                                                                      |                                                                                                                                                                                     | 0,7-7            | 2,3-23           | 3                    | N                                      |
|                          | Bisphenol B              | 77-40-7     |                                                                                                                                                      |                                                                                                                                                                                     | 0,4-2            | 1,3-7            | 3                    | Y                                      |
|                          | Bisphenol M              | 13595-25-0  |                                                                                                                                                      |                                                                                                                                                                                     | 0,2-1            | 0,7-3            | 3                    | N                                      |
|                          | Bisphenol AF             | 1478-61-1   |                                                                                                                                                      |                                                                                                                                                                                     | 0,1-0,7          | 0,3-2,3          | 3                    | Y                                      |
|                          | Bisphenol AP             | 1571-75-1   |                                                                                                                                                      |                                                                                                                                                                                     | 0,4-2,4          | 1,3-8            | 3                    | N                                      |
| Alkylphenols             | 4-tert-octylphenol       | 140-66-9    |                                                                                                                                                      |                                                                                                                                                                                     | 0,6-6            | 2-20             | 3                    | Y                                      |
|                          | Dodecylphenol (branched) | 27193-86-8  |                                                                                                                                                      |                                                                                                                                                                                     | 1,4-5            | 4,6-17           | 3                    | N                                      |
|                          | 4-octylphenol            | 1806-26-4   |                                                                                                                                                      |                                                                                                                                                                                     | 0,7-5,2          | 2,3-18           | 3                    | N                                      |
|                          | Nonylphenol (branched)   | 84852-15-3  |                                                                                                                                                      |                                                                                                                                                                                     | 20-76            | 66-250           | 3                    | N                                      |
|                          | 4-nonylphenol            | 104-40-5    |                                                                                                                                                      |                                                                                                                                                                                     | 1,5-2,2          | 5-7,3            | 3                    | Y                                      |
| Other phenolic compounds | MB1                      | 118-82-1    |                                                                                                                                                      | In-house method. Internal standard addition, extraction. HRMS                                                                                                                       | 0,6-2            | 2-7              | 3                    | N                                      |

## 4 Appendix

Three electronic appendices are also associated with this report:

1. concentrations of all compounds/isomers in all matrices (n, mean, median, min, max, LoQ and number of detected are presented)
2. Median concentrations of all compounds/isomers in all matrices, compared (cross table). Two tables where (a.) medians are calculated with non-detected compounds assigned a value of zero (0) and (b.) medians are calculated from concentrations >LoQ only.
3. Additional figures:  $\delta^{15}\text{N}$  vs length in cod and trout, as well as all concentrations in all samples presented in bar plots.



**Figure 18.** Time of stormwater sampling (I) in relation to precipitation (mm). Data from the Norwegian Centre for Climate Services (<https://seklima.met.no/>), measuring station Løren (SN18205).

**Table 9.** Analytes and support parameters analysed/evaluated in this study.

| Substances       | Abbreviation | CAS       |
|------------------|--------------|-----------|
| <b>Metals</b>    |              |           |
| Mercury          | Hg           | 7439-97-6 |
| Chromium         | Cr           | 7440-47-3 |
| Iron             | Fe           | 7439-89-6 |
| Nickel           | Ni           | 7440-02-0 |
| Copper           | Cu           | 7440-50-8 |
| Zinc             | Zn           | 7440-66-6 |
| Arsenic          | As           | 7440-38-2 |
| Yttrium          | Y            | 7440-65-5 |
| Silver           | Ag           | 7440-22-4 |
| Cadmium          | Cd           | 7440-43-9 |
| Antimony         | Sb           | 7440-36-0 |
| Lead             | Pb           | 7439-92-1 |
| Scandium         | Sc           | 7440-20-2 |
| Lanthanum        | La           | 7439-91-0 |
| Cerium           | Ce           | 7440-45-1 |
| Praeseodymium    | Pr           | 7440-10-0 |
| Neodymium        | Nd           | 7440-00-8 |
| Samarium         | Sm           | 7440-19-9 |
| Europium         | Eu           | 7440-53-1 |
| Gadolinium       | Gd           | 7440-54-2 |
| Terbium          | Tb           | 7440-27-9 |
| Dysprosium       | Dy           | 7429-91-6 |
| Holmium          | Ho           | 7440-60-0 |
| Erbium           | Er           | 7440-52-0 |
| Thulium          | Tm           | 7440-30-4 |
| Ytterbium        | Yb           | 7440-64-4 |
| Lutetium         | Lu           | 7439-94-3 |
| <b>Siloxanes</b> |              |           |

|                                                                            |         |            |
|----------------------------------------------------------------------------|---------|------------|
| 2,2,4,4,6,6,8,8-Octamethyl-1,3,5,7,2,4,6,8-tetroxatetrasiloxane            | D4      | 556-67-2   |
| 2,2,4,4,6,6,8,8,10,10-Decamethyl-1,3,5,7,9,2,4,6,8,10-pentoxapentasiloxane | D5      | 541-02-6   |
| Dodecamethylcyclotetrasiloxane                                             | D6      | 540-97-6   |
| tris(trimethylsiloxy)phenylsilane                                          | M3T     | 2116-84-9  |
| Octamethyltrisiloxane (L3)                                                 | L3      | 107-51-7   |
| Decamethyltetrasiloxane (L4)                                               | L4      | 141-62-8   |
| Dodecamethylpentasiloxane (L5)                                             | L5      | 141-63-9   |
| <i>Polychlorinated biphenyls (PCB)</i>                                     |         |            |
| 2,2',5-Trichlorobiphenyl                                                   | PCB 18  | 37680-65-2 |
| 2,4,4'-Trichlorobiphenyl                                                   | PCB 28  | 7012-37-5  |
| 2,4',5-Trichlorobiphenyl                                                   | PCB 31  | 16606-02-3 |
| 2,3',4'-Trichlorobiphenyl                                                  | PCB 33  | 38444-86-9 |
| 3,4,4'-Trichlorobiphenyl                                                   | PCB 37  | 38444-90-5 |
| 2,2',4,4'-Tetrachlorobiphenyl                                              | PCB 47  | 2437-79-8  |
| 2,2',5,5'-Tetrachlorobiphenyl                                              | PCB 52  | 35693-99-3 |
| 2,3',4,4'-Tetrachlorobiphenyl                                              | PCB 66  | 32598-10-0 |
| 2,4,4',5-Tetrachlorobiphenyl                                               | PCB 74  | 32690-93-0 |
| 2,2',4,4',5-Pentachlorobiphenyl                                            | PCB 99  | 38380-01-7 |
| 2,2',4,5,5'-Pentachlorobiphenyl                                            | PCB 101 | 37680-73-2 |
| 2,3,3',4,4'-Pentachlorobiphenyl                                            | PCB 105 | 32598-14-4 |
| 2,3,4,4',5-Pentachlorobiphenyl                                             | PCB 114 | 74472-37-0 |
| 2,3',4,4',5-Pentachlorobiphenyl                                            | PCB 118 | 31508-00-6 |
| 2,3,3',4',5'-Pentachlorobiphenyl                                           | PCB 122 | 76842-07-4 |
| 2,3',4,4',5'-Pentachlorobiphenyl                                           | PCB 123 | 65510-44-3 |
| 2,2',3,3',4,4'-Hexachlorobiphenyl                                          | PCB 128 | 38380-07-3 |
| 2,2',3,4,4',5'-Hexachlorobiphenyl                                          | PCB 138 | 35065-28-2 |
| 2,2',3,4,5,5'-Hexachlorobiphenyl                                           | PCB 141 | 52712-04-6 |
| 2,2',3,4',5',6-Hexachlorobiphenyl                                          | PCB 149 | 38380-04-0 |
| 2,2',4,4',5,5'-Hexachlorobiphenyl                                          | PCB 153 | 35065-27-1 |
| 2,3,3',4,4',5-Hexachlorobiphenyl                                           | PCB 156 | 38380-08-4 |
| 2,3,3',4,4',5'-Hexachlorobiphenyl                                          | PCB 157 | 69782-90-7 |

|                                                  |             |            |
|--------------------------------------------------|-------------|------------|
| 2,3',4,4',5,5'-Hexachlorobiphenyl                | PCB 167     | 52663-72-6 |
| 2,2',3,3',4,4',5-Heptachlorobiphenyl             | PCB 170     | 35065-30-6 |
| 2,2',3,4,4',5,5'-Heptachlorobiphenyl             | PCB 180     | 35065-29-3 |
| 2,2',3,4,4',5',6-Heptachlorobiphenyl             | PCB 183     | 52663-69-1 |
| 2,2',3,4',5,5',6-Heptachlorobiphenyl             | PCB 187     | 52663-68-0 |
| 2,3,3',4,4',5,5'-Heptachlorobiphenyl             | PCB 189     | 39635-31-9 |
| 2,2',3,3',4,4',5,5'-Octachlorobiphenyl           | PCB 194     | 35694-08-7 |
| 2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl         | PCB 206     | 40186-72-9 |
| Decachlorobiphenyl                               | PCB 209     | 2051-24-3  |
| <b>Organochlorines</b>                           |             |            |
| Pentachlorobenzene                               | PECB        | 608-93-5   |
| Hexachlorobenzene                                | HCB         | 118-74-1   |
| Hexachlorobutadiene                              | HCBD        | 87-68-3    |
| <b>Organophosphorus Flame Retardants (OPFRs)</b> |             |            |
| Triethyl phosphate                               | TEP         | 78-40-0    |
| Tris(2-chloroethyl) phosphate                    | TCEP        | 115-96-8   |
| Tripropyl phosphate                              | TPrP        | 513-08-6   |
| Tris(1-chloropropyl) phosphate                   | T CPP       | 13674-84-5 |
| Triisobutyl phosphate                            | TiBP        | 126-71-6   |
| Butyl diphenyl phosphate                         | BdPhP       | 2752-95-6  |
| Dibutyl phenyl phosphate                         | DBPhP       | 2528-36-1  |
| Triphenyl phosphate                              | TPhP        | 115-86-6   |
| Tri-n-butyl phosphate                            | TnBP        | 126-73-8   |
| Tris(1,3-dichloro-2-propyl) phosphate            | TD CP       | 13674-87-8 |
| Tris(2-butoxyethyl) phosphate                    | TBEP        | 78-51-3    |
| Tricresyl phosphate                              | TCP         | 1330-78-5  |
| 2-Ethylhexyl diphenyl phosphate                  | EHDPP       | 1241-94-7  |
| Tris(2-ethylhexyl) phosphate                     | TEHP        | 78-42-2    |
| Tris(4-isopropylphenyl) phosphate                | TIPPP/T4IPP | 26967-76-0 |
| Tris(4-Tert-butylphenyl) phosphate               | TTBPP       | 78-33-1    |
| Tri(2,4-di-t-butylphenyl) phosphate              | TDTBPP      | 95906-11-9 |
| O,O,O-triphenylphosphorothiate                   | TPPT        | 597-82-0   |
| <b>Phenols</b>                                   |             |            |

|                                                                      |                                    |                                     |
|----------------------------------------------------------------------|------------------------------------|-------------------------------------|
| 4-[2-(4-hydroxyphenyl)propan-2-yl]phenol                             | 4,4-bisphenol A                    | 80-05-7                             |
| 2-[2-(4-hydroxyphenyl)propan-2-yl]phenol                             | 2,4-bisphenol A                    | 837-08-1                            |
| 4-[2-(4-hydroxy-3-propan-2-ylphenyl)propan-2-yl]-2-propan-2-ylphenol | Bisphenol G                        | 127-54-8                            |
| 4-[1-(4-hydroxyphenyl)-1-phenylethyl]phenol                          | Bisphenol AP                       | 1571-75-1                           |
| 4-[9-(4-hydroxyphenyl)fluoren-9-yl]phenol                            | Bisphenol FL                       | 3236-71-3                           |
| 4-[1-(4-hydroxyphenyl)-3,3,5-trimethylcyclohexyl]phenol              | Bisphenol TMC                      | 129188-99-4                         |
| 4-[2-(4-hydroxyphenyl)butan-2-yl]phenol                              | Bisphenol B                        | 77-40-7                             |
| 4-(4-hydroxyphenyl)sulfonylphenol                                    | 4,4-bisphenol S                    | 80-09-1                             |
| 2-(4-hydroxyphenyl)sulfonylphenol                                    | 2,4-bisphenol S                    | 5397-34-2                           |
| 4-[(4-hydroxyphenyl)methyl]phenol                                    | 4,4-bisphenol F                    | 620-92-8                            |
| 2-[(4-hydroxyphenyl)methyl]phenol                                    | 2,4-bisphenol F                    | 2467-03-0                           |
| 2,6-ditert-butyl-4-[(3,5-ditert-butyl-4-hydroxyphenyl)methyl]phenol  | AO-MB1                             | 118-82-1                            |
| 4-[2-[4-[2-(4-hydroxyphenyl)propan-2-yl]phenyl]propan-2-yl]phenol    | Bisphenol P                        | 2167-51-3                           |
| 4-[2-[3-[2-(4-hydroxyphenyl)propan-2-yl]phenyl]propan-2-yl]phenol    | Bisphenol M                        | 13595-25-0                          |
| 4-[1-(4-hydroxyphenyl)cyclohexyl]phenol                              | Bisphenol Z                        | 843-55-0                            |
| 4-[1,1,1,3,3,3-hexafluoro-2-(4-hydroxyphenyl)propan-2-yl]phenol      | Bisphenol AF                       | 1478-61-1                           |
| 2,6-dibromo-4-[2-(3,5-dibromo-4-hydroxyphenyl)propan-2-yl]phenol     | TBBPA                              | 79-94-7                             |
| 4-(2,4,4-trimethylpentan-2-yl)phenol                                 | 4-tert-octylphenol                 | 140-66-9                            |
| 4-octylphenol                                                        | 4-octylphenol                      | 1806-26-4                           |
| 4-(7-methyloctyl)phenol                                              | 4-nonylphenol, branched and linear | 104-40-5, 84852-15-3*               |
| Dodecylphenol                                                        | Dodecylphenol                      | 27193-86-8, 104-43-8, 121158-58-5** |
| <i>Per- and polyfluoroalkyl substances (PFAS)</i>                    |                                    |                                     |
| <i>PFCA (perfluorinated carboxylate acids)</i>                       |                                    |                                     |
| Tri fluoro acetic acid                                               | TFA                                | 76-05-1                             |
| Perfluoro propanoic acid                                             | PFPrA                              | 422-64-0                            |
| Perfluorinated butanoic acid                                         | PFBA                               | 375-22-4                            |
| Perfluorinated pentanoic acid                                        | PFPA                               | 2706-90-3                           |

|                                                         |          |              |
|---------------------------------------------------------|----------|--------------|
| Perfluorinated hexanoic acid                            | PFHxA    | 307-24-4     |
| Perfluorinated heptanoic acid                           | PFHpA    | 375-85-9     |
| Perfluorinated octanoic acid                            | PFOA     | 335-67-1     |
| Perfluorinated nonanoic acid                            | PFNA     | 375-95-1     |
| Perfluorinated decanoic acid                            | PFDA     | 335-76-2     |
| Perfluorinated undecanoic acid                          | PFUnDA   | 2058-94-8    |
| Perfluorinated dodecanoic acid                          | PFDoDA   | 307-55-1     |
| Perfluorinated tridecanoic acid                         | PFTTrDA  | 72629-94-8   |
| Perfluorinated tetradecanoic acid                       | PFTeDA   | 376-06-7     |
| Perfluorinated hexadecanoic acid                        | PFHxDA   | 67905-19-5   |
| Perfluorinated octadecanoic acid                        | PFOcDA   | 16517-11-6   |
| <b><i>PFSA (Perfluoroalkane sulfonic acids)</i></b>     |          |              |
| Perfluoro methane sulfonic acid                         | PMeS     | 1493-13-6    |
| Perfluoro ethan sulfonic acid                           | PFEtS    | 354-88-1     |
| perfluoropropan sulfonic acid                           | PFPrS    | 423-41-6     |
| Perfluorinated butane sulfonic acid                     | PFBS     | 375-73-5     |
| Perfluorinated pentane sulfonic acid                    | PFPS     | 2706-91-4    |
| Perfluorinated hexane sulfonic acid                     | PFHxS    | 355-46-4     |
| Perfluorinated heptane sulfonic acid                    | PFHpS    | 375-92-8     |
| Perfluorinated octane sulfonic acid (linear)            | PFOS     | 2795-39-3    |
| Perfluorinated octane sulfonic acid (branched)          | brPFOS   | 1763-23-1    |
| Perfluorinated nonane sulfonic acid                     | PFNS     | 474511-07-4  |
| Perfluorinated decane sulfonic acid                     | PFDS     | 335-77-3     |
| Perfluoroundecane sulfonic acid                         | PFUnDS   | 441296-91-9  |
| Perfluorododecane sulfonic acid                         | PFDoDS   | 79780-39-5   |
| Perfluorotridecane sulfonic acid                        | PFTTrDS  | 791563-89-8  |
| Perfluorotetradecane sulfonic acid                      | PFTeDS   | 1379460-39-5 |
| <b><i>nPFAS (polyfluorinated neutral compounds)</i></b> |          |              |
| Perfluorobutylsulphonamide                              | PFBSA    | 30334-69-1   |
| n-(methyl)nonafluorobutanesulfonamide                   | N-MeFBSA | 68298-12-4   |
| N-ethyl-perfluorobutane-1-sulfonamide                   | N-EtFBSA | 40630-67-9   |
| Perfluorooctane sulfonamide                             | PFOSA    | 754-91-6     |
| N-Methyl perfluorooctane sulphonamide                   | N-MeFOSA | 31506-32-8   |

|                                                                                  |                 |             |
|----------------------------------------------------------------------------------|-----------------|-------------|
| N-Ethyl perfluorooctane sulfonamide                                              | N-EtFOSA        | 4151-50-2   |
| N-Methyl perfluorooctane sulfonamidoethanol                                      | N-MeFOSE        | 24448-09-7  |
| N-Ethyl perfluorooctane sulfonamidoethanol                                       | N-EtFOSE        | 1691-99-2   |
| N-Ethyl perfluorooctane sulfonamidoacetic acid                                   | N-EtFOSAA       | 2991-50-6   |
| <i>newPFAS</i>                                                                   |                 |             |
| 4:2 Fluorotelomer sulfonic acid                                                  | 4:2 FTS         | 757124-72-4 |
| 6:2 Fluorotelomer sulfonic acid                                                  | 6:2 FTS         | 27619-97-2  |
| 8:2 Fluorotelomer sulfonic acid                                                  | 8:2 FTS         | 481071-78-7 |
| 10:2 Fluorotelomer sulfonic acid                                                 | 10:2 FTS        | 120226-60-0 |
| 12:2 Fluorotelomer sulfonic acid                                                 | 12:2 FTS        | 149246-64-0 |
| Sodium Dodecafluoro-3H- 4,8-dioxanonoate                                         | ADONA           | 958445-44-8 |
| Cyclohexanesulfonic acid                                                         | PFECHS          | 67584-42-3  |
| 2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)propanoic acid (Gen-X)   | HFPO-DA (Gen-X) | 13252-13-6  |
| <i>UV Chemicals</i>                                                              |                 |             |
| Benzophenone-3                                                                   | BP3             | 131-57-7    |
| Ethylhexylmethoxycinnamate Z                                                     | EHMC-Z          | 177352-99-7 |
| Ethylhexylmethoxycinnamate E                                                     | EHMC-E          | 5466-77-3   |
| Octocrylene                                                                      | OC              | 6197-30-4   |
| UV-329                                                                           | UV-329          | 3147-75-9   |
| UV-328                                                                           | UV-328          | 25973-55-1  |
| UV-327                                                                           | UV-327          | 3864-99-1   |
| Homosalate                                                                       | Homosalate      | 118-56-9    |
| 3-(2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxy-benzenepropanoic acid I | M1-UV328        | 84268-36-0  |
| <i>Dechloranes</i>                                                               |                 |             |
| Dibromoaldrin                                                                    | DBA             | 20389-65-5  |
| Dechlorane 602                                                                   | Dec-602         | 31107-44-5  |
| Dechlorane 603                                                                   | Dec-603         | 13560-92-4  |
| Dechlorane 604                                                                   | Dec-604         | 34571-16-9  |
| Dechlorane 601                                                                   | Dec-601         | 3560-90-2   |
| Dechlorane plus syn                                                              | syn-DP          | 135821-03-3 |
| Dechlorane plus anti                                                             | anti-DP         | 135821-74-8 |

|                                             |            |            |
|---------------------------------------------|------------|------------|
| <b><i>Quaternary ammonium compounds</i></b> |            |            |
| Trimethyloctylammonium                      | ATAC-C8    | 2083-68-3  |
| Decyltrimethylammonium                      | ATAC-C10   | 2082-84-0  |
| Dodecyltrimethylammonium                    | ATAC-C12   | 1119-94-4  |
| Tetradecyltrimethylammonium                 | ATAC-C14   | 1119-97-7  |
| Hexadecyltrimethylammonium                  | ATAC-C16   | 57-09-0    |
| Trimethyloctadecylammonium                  | ATAC-C18   | 1120-02-1  |
| ATAC-C20                                    | ATAC-C20   | 15809-05-9 |
| ATAC-C22                                    | ATAC-C22   | 17301-53-0 |
| Dimethyldioctylammonium                     | DADMAC-C8  | 3026-69-5  |
| Didecyl dimethylammonium                    | DADMAC-C10 | 2390-68-3  |
| Didodecyl dimethylammonium                  | DADMAC-C12 | 3282-73-3  |
| Dimethylditetradecylammonium                | DADMAC-C14 | 68105-02-2 |
| Dihexadecyl dimethylammonium                | DADMAC-C16 | 70755-47-4 |
| Dimethyldioctadecylammonium                 | DADMAC-C18 | 3700-67-2  |
| Benzyldimethyloctylammonium                 | BAC-C8     | 959-55-7   |
| Benzyldimethyldecylammonium                 | BAC-C10    | 965-32-2   |
| Benzyldimethyldodecylammonium               | BAC-C12    | 139-07-1   |
| Benzyldimethyltetradecylammonium            | BAC-C14    | 139-08-2   |
| Benzyldimethylhexadecylammonium             | BAC-C16    | 122-18-9   |
| Benzyldimethyloctadecylammonium             | BAC-C18    | 122-19-0   |
| <b><i>Musks</i></b>                         |            |            |
| Galaxolide                                  | HHCB       | 1222-05-5  |
| Tonalide                                    | TONA       | 21145-77-7 |
| Traseolide                                  | TRAS       | 68140-48-7 |
| Phantolide                                  | PANT       | 15323-35-0 |
| Celestolide                                 | KELE       | 13171-00-1 |
| Iso-E-super                                 | OTNE       | 54464-57-2 |
| Acetyl cedrene                              | MCKETON    | 32388-55-9 |
| <b><i>Benzothiazoles</i></b>                |            |            |
| Mercaptobenzothiazole                       | MBT        | 149-30-4   |
| Benzotriazole                               | BTZ        | 95-14-7    |
| Benzothiazole                               | BT         | 95-16-9    |

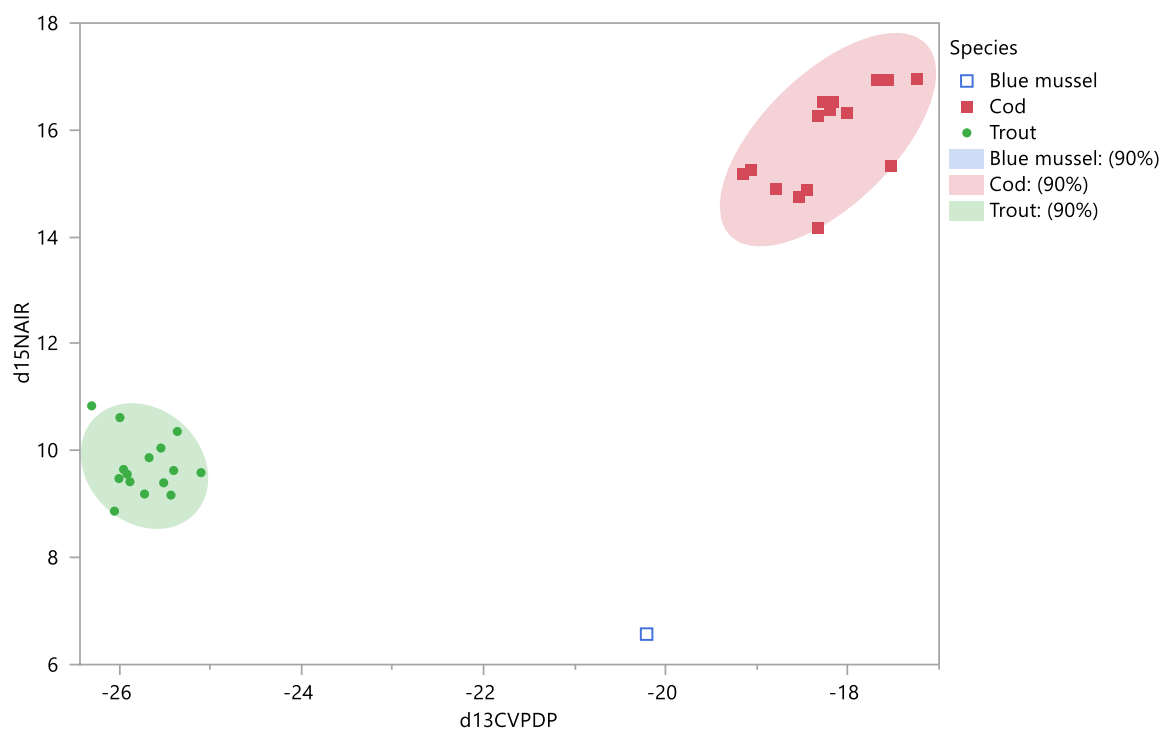
|                                                                                           |                            |            |
|-------------------------------------------------------------------------------------------|----------------------------|------------|
| <b>2(3H)-Benzothiazolone</b>                                                              | OHBT                       | 934-34-9   |
| <b>Methyl-1H-benzotriazole</b>                                                            | MeBTZ                      | 29385-43-1 |
| <b>N-cyclohexylbenzothiazole-2-sulfenamide</b>                                            | CBS                        | 95-33-0    |
| <i><b>Phthalates</b></i>                                                                  |                            |            |
| <b>Bis(2-methoxyethyl) phthalate</b>                                                      | BMEP (DMEP)                | 117-82-8   |
| <b>Diethyl phthalate</b>                                                                  | DEP                        | 84-66-2    |
| <b>Bis(2-ethoxyethyl) phthalate</b>                                                       | BEEP                       | 605-54-9   |
| <b>Diisobutyl phthalate</b>                                                               | DIBP                       | 84-69-5    |
| <b>Di-n-butyl phthalate</b>                                                               | DNBP                       | 84-74-2    |
| <b>Butylbenzyl phthalate</b>                                                              | BBP                        | 85-68-7    |
| <b>Bis(2-butoxyethyl) phthalate</b>                                                       | BnBP (DBOEP)               | 117-83-9   |
| <b>Dicyclohexyl phthalate</b>                                                             | DcHP                       | 84-61-7    |
| <b>Dipentylphthalate</b>                                                                  | DDP                        | 131-18-0   |
| <b>Bis(4-methyl-2-pentyl) phthalate</b>                                                   | DMPP                       | 84-63-9    |
| <b>Dihexylphthalate</b>                                                                   | DHxP                       | 84-75-3    |
| <b>Bis(2-ethylhexyl) phthalate</b>                                                        | DEHP                       | 117-81-7   |
| <b>Diocetyl phthalate</b>                                                                 | DOP                        | 117-84-0   |
| <b>Diisononyl phthalate</b>                                                               | DINP                       | 28553-12-0 |
| <b>Diisodecyl phthalate</b>                                                               | DIDP                       | 68515-49-1 |
| <b>Diundecyl phthalate, branched and linear</b>                                           | DiUP                       | 85507-79-5 |
| <b>Dimethyl phthalate</b>                                                                 | DMP                        | 131-11-3   |
| <b>Diallylphthalate</b>                                                                   | DAIP                       | 131-17-9   |
| <b>Dipropylphthalate</b>                                                                  | DPP<br>(dipropylphthalate) | 131-16-8   |
| <i><b>Chlorinated paraffins</b></i>                                                       |                            |            |
| <b>Short-chain chlorinated paraffins (C10-C13)</b>                                        | SCCP                       | 85535-84-8 |
| <b>Medium-chain chlorinated paraffins (C14-C17)</b>                                       | MCCP                       | 85535-85-9 |
| <b>Long-chain chlorinated paraffins (C&gt;17)</b>                                         | LCCP                       | 63449-39-8 |
| <i><b>Support parameters</b></i>                                                          |                            |            |
| <b>Stable isotopes <math>\delta^{15}\text{N}</math>, <math>\delta^{13}\text{C}</math></b> |                            |            |
| <b>Lipid content (biota)</b>                                                              |                            |            |
| <b>Length/weight (fish)</b>                                                               |                            |            |
| <b>TOC (sediment) and pH</b>                                                              |                            |            |

## Stable isotopes

The results of the individual stable isotope-analysis of C and N are given in **Table 10**.

Stable isotopes of carbon and nitrogen are useful indicators of food origin and trophic levels.  $\delta^{13}\text{C}$  gives an indication of carbon source in the diet or a food web.  $\delta^{15}\text{N}$  increases in organisms with higher trophic level because of a greater retention of the heavier isotope ( $^{15}\text{N}$ ) and provides a continuous descriptor of trophic position.

**Figure 19** shows that trout and cod differ in carbon source (terrestrial vs marine) and that cod is a higher trophic species than blue mussel (an average of 2.4 trophic levels higher, assuming an increase in  $\delta^{15}\text{N}$  between integer trophic levels,  $\Delta^{15}\text{N}$ , of 3.8). There was no significant relationship between  $\delta^{15}\text{N}$  and fish length for any of the species (see electronic Appendix).



**Figure 19.**  $\delta^{15}\text{N}$  plotted against  $\delta^{13}\text{C}$  in individual samples of cod from the Inner Oslofjord and brown trout from Alna River, as well as in a pooled sample of blue mussel from the Inner Oslofjord. The 90% confidence areas are indicated.

**Table 10.** Biometric data for individual specimens of cod from the Inner Oslofjord (**A**), brown trout from Alna River (**B**), and the single (pooled) sample of blue mussel (**C**), as well as characteristics of sediments (**D**) from the inner Oslofjord

**A. (Cod)**

| Ind. No. | $\delta^{13}\text{C}$ | $\delta^{15}\text{N}$ | W%C   | W%N   | Part of pooled sample | Length (cm) | Weight (g) | Sex | Trophic Level |
|----------|-----------------------|-----------------------|-------|-------|-----------------------|-------------|------------|-----|---------------|
| 1        | -17.68                | 16.93                 | 48.39 | 14.95 | 1                     | 38.5        | 576        | F   | 4.73          |
| 2        | -18.33                | 16.26                 | 46.3  | 14.47 | 1                     | 30.8        | 309        | M   | 4.55          |
| 3        | -18.16                | 16.53                 | 48.43 | 15.1  | 1                     | 34.8        | 471        | F   | 4.62          |
| 4        | -19.15                | 15.18                 | 40.07 | 12.09 | 1                     | 26.5        | 157        | M   | 4.27          |
| 5        | -17.53                | 15.32                 | 38.69 | 12.23 | 1                     | 26.5        | 169        | M   | 4.30          |
| 6        | -18.01                | 16.32                 | 46.93 | 14.86 | 2                     | 25          | 143        | M   | 4.57          |
| 7        | -17.24                | 16.96                 | 35.81 | 11.34 | 2                     | 32.5        | 320        | M   | 4.73          |
| 8        | -18.27                | 16.52                 | 42.09 | 13.08 | 2                     | 32.5        | 318        | M   | 4.62          |
| 9        | -17.56                | 16.94                 | 49.01 | 15.64 | 2                     | 32          | 288        | F   | 4.73          |
| 10       | -18.45                | 14.88                 | 47.34 | 14.66 | 2                     | 36          | 458        | F   | 4.19          |
| 11       | -18.54                | 14.74                 | 44.09 | 14.2  | 3                     | 30          | 264        | M   | 4.15          |
| 12       | -18.79                | 14.9                  | 47.93 | 14.97 | 3                     | 36          | 375        | M   | 4.19          |
| 13       | -18.2                 | 16.38                 | 41.16 | 12.88 | 3                     | 30.5        | 312        | F   | 4.58          |
| 14       | -19.06                | 15.26                 | 38.33 | 11.77 | 3                     | 28          | 180        | F   | 4.29          |
| 15       | -18.33                | 14.17                 | 45.65 | 14.27 | 3                     | 30          | 240        | M   | 4.00          |

## B. (Trout)

| Ind. No. | $\delta^{13}\text{C}$ | $\delta^{15}\text{N}$ | W%C   | W%N   | Part of pooled sample | Length (cm) | Weight (g) | Sex |
|----------|-----------------------|-----------------------|-------|-------|-----------------------|-------------|------------|-----|
| 1        | -26                   | 9.48                  | 47.32 | 12.67 | 1                     | 13.5        | 30.9       | F   |
| 2        | -25.43                | 9.17                  | 47.93 | 14.08 | 1                     | 14          | 36.2       | F   |
| 3        | -25.4                 | 9.63                  | 50.46 | 14.4  | 1                     | 14.5        | 42.2       | F   |
| 4        | -25.1                 | 9.59                  | 46.5  | 13.58 | 1                     | 15          | 46.8       | F   |
| 5        | -25.51                | 9.4                   | 49.5  | 14.27 | 1                     | 15.5        | 50.2       | F   |
| 6        | -25.95                | 9.65                  | 47.7  | 12.8  | 2                     | 16.5        | 60.7       | M   |
| 7        | -25.72                | 9.19                  | 52.01 | 14.09 | 2                     | 16          | 56.9       | F   |
| 8        | -26.3                 | 10.84                 | 56.26 | 11.85 | 2                     | 16          | 53.4       | M   |
| 9        | -25.67                | 9.87                  | 49.42 | 12.99 | 2                     | 16.5        | 58.5       | F   |
| 10       | -25.91                | 9.56                  | 52.51 | 13.48 | 2                     | 16.5        | 65.5       | M   |
| 11       | -25.88                | 9.42                  | 53.23 | 13.04 | 3                     | 17.5        | 67.5       | F   |
| 12       | -25.36                | 10.36                 | 50.7  | 13.79 | 3                     | 17          | 72.9       | F   |
| 13       | -26.05                | 8.87                  | 51.39 | 13.28 | 3                     | 22.5        | 171.9      | F   |
| 14       | -25.54                | 10.05                 | 46.83 | 12.88 | 3                     | 26          | 290.4      | F   |
| 15       | -25.99                | 10.62                 | 44.46 | 10.94 | 3                     | 27          | 337.5      | F   |

## C. (Blue mussel)

| $\delta^{13}\text{C}$ | $\delta^{15}\text{N}$ | W%C   | W%N  | Trophic Level |
|-----------------------|-----------------------|-------|------|---------------|
| -20.21                | 6.57                  | 44.91 | 7.96 | 2.00          |

## D. (Sediments)

| Station          | Total Organic Carbon (TOC) | Total Inorganic Carbon (TIC) | pH  |
|------------------|----------------------------|------------------------------|-----|
| Bq41, Bekkelaget | 2.5                        | 0.1                          | 8.1 |

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