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Environmental Contaminants in an Urban Fjord, 2021

Photo: Anders Ruus

Norwegian Institute for Water Research

REPORT

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Summary

This report presents data from the first year of a new 5-year period of the Urban Fjord programme. The programme started in 2013 and has since been altered/advanced. In 2021 the programme covers sampling and analyses of stormwater, river water, effluent from a wastewater treatment plant (inputs to the fjord), fjord sediment, blue mussel, cod and (river) trout, all from the Inner Oslofjord area. A total of ~260 single compounds/isomers were analysed and frequent detection was found of benzothiazoles in abiotic aqueous phases, UV-compounds in most matrices, metals in all matrices, PBDEs in biota, chlorinated paraffins in all matrices and PCBs in biota and abiotic particle phases.

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1.	Contaminants	1.	Miljøgifter
2.	Urban Areas	2.	Urbane områder
3.	Bioaccumulation	3.	Bioakkumulering
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This report is quality assured in accordance with NIVA's quality system and approved by:

Anders Ruus	*Morten Jartun*	*Morten Jartun*
Project Manager/Main Author	Quality Assurance	Research Manager

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Environmental Contaminants in an Urban Fjord, 2021

Preface

This report presents data from the first 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 2021 programme covers sampling and analyses of stormwater, river water, effluent from a wastewater treatment plant (inputs to the fjord), fjord sediment, blue mussel, cod and (river) trout. Next year (2022) it is planned to sample fjord sediments, polychaetes, zooplankton, prawns, blue mussel, herring and cod, as well as blood and eggs from Herring gull and Eider ducks (with the University of Oslo as project partner).

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, Espen Lund, Anne Luise Ribeiro, Merete Schøyen, Gunhild Borgersen, Alfhild Kringstad, Camilla With Fagerli, Marthe Torunn Solhaug Jenssen, Pawel Rostowski, Mikael Harju, Hilde Uggerud, Marit Vadset, Inger-Christin Steen, Carsten Lome, Dag Hjermann.

This report represents an extended summary of the Urban Fjord 2021 campaign and has been quality assured by Research Manager Morten Jartun.

Oslo, July 2022

Anders Ruus

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Summary

The 2021 “Urban fjord” programme covers sampling and analyses of stormwater, river water, effluent from a wastewater treatment plant (inputs to the fjord), fjord sediment, blue mussel, cod and (river) brown trout, all from the Inner Oslofjord area. A total of ~260 single compounds/isomers were analysed, and frequent detection was found of benzothiazoles in abiotic aqueous phases, UV-compounds in most matrices, metals in all matrices, PBDEs in biota, chlorinated paraffins in all matrices and PCBs in biota and abiotic particle phases.

Phthalates were found in high concentrations, especially in the particulate fractions of river water and stormwater. Both short (SCCPs) and medium (MCCPs) chained chlorinated paraffins were detected in all matrices. OPFRs were not detected in biota. In the aqueous abiotic matrices, the compounds were mostly associated with the particulate fraction. The cyclic siloxanes D4, D5 and D6 were the dominating siloxane compounds in all matrices. In biota, PFOS and PFOSA were dominating PFAS. TFA was dominating in aqueous phases (dissolved), while PFOS and branched PFOS (brPFOS) were particularly found in the particulate fractions. UV-327 and -328 were important UV-compounds in biota, while octocrylene (OC) was important in abiotic matrices. Of the quaternary ammonium compounds, ATAC-C22 was dominating in biota. In abiotic phases, DADMAC-10 was found in the dissolved fraction, while DADMAC-18 was found in the particle fraction. Pesticides/Fungicides were not detected in biota, and triclocarban was dominating in abiotic particle phases. Benzothiazoles were not detected in biota, while in abiotic aqueous phases (dissolved), most benzothiazoles were detected. Dechlorane plus *syn* and *anti* were the most important dechloranes. Dechloranes were not found in Brown trout or WWTP effluent water. Among the musks, only Galaxolide was detected, and only in the dissolved fraction of WWTP effluent water.

Sammendrag

Tittel: Environmental Contaminants in an Urban Fjord, 2021
År: 2022
Forfatter(e): Anders Ruus, Merete Grung, Morten Jartun, Kine Bæk, Thomas Rundberget, Christian Vogelsang, Bjørnar Beylich, Espen Lund, Ian Allan, Martin Schlabach (NILU), Linda Hansen (NILU), Ellen Katrin Enge (NILU)
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"Urban fjord"-programmet for 2021 har dekket prøvetaking og analyse av overvann, elvevann, avløpsvann fra et avløpsrenseanlegg (tilførsler til fjorden), fjordsediment, blåskjell, torsk og (elve)ørret, alt fra indre Oslofjord-området. Totalt ~260 enkeltforbindelser/isomerer ble analysert og hyppig deteksjon ble funnet for benzotiazoler i abiotiske vannfaser, UV-forbindelser i de fleste matriser (prøvetyper), metaller i alle matriser, PBDE i biota, klorparafiner i alle matriser og PCB i biota og abiotiske partikkelfaser.

Ftalater ble funnet i høye konsentrasjoner, spesielt i partikkelfraksjonene av elvevann og overvann. Både kort- (SCCP) og medium- (MCCP) kjedede klorparafiner ble påvist i alle matriser. OPFR ble ikke påvist i biota. I de vandige abiotiske matrisene var forbindelsene for det meste assosiert med partikkelfraksjonen. De sykliske siloksanene D4, D5 og D6 var de dominerende siloksanforbindelsene i alle matriser. I biota var PFOS og PFOSA de dominerende PFAS. TFA var dominerende i vandige faser (løst), mens PFOS og forgrenet PFOS (brPFOS) ble spesielt funnet i partikkelfraksjonene. I biota var UV-327 og -328 dominerende UV-forbindelser, mens oktokrylen (OC) var viktig i abiotiske prøver/matriser. Av de kvaternære ammoniumforbindelsene var ATAC-C22 dominerende i biota. I abiotiske faser ble DADMAC-10 funnet i den løste fraksjonen, mens DADMAC-18 ble funnet i partikkelfraksjonen. Pesticider/fungicider ble ikke påvist i biota, og triklokarban dominerte i abiotiske partikkelfaser. Benzotiazoler ble ikke påvist i biota, mens i abiotiske vannfaser (løst) ble de fleste benzotiazoler påvist. Dekloran pluss *syn* og *anti* var de viktigste dekloranene. Dekloraner ble ikke funnet i ørret eller avløpsvann fra renseanlegg. Blant muskstoffene ble det bare påvist Galaxolide, og kun i den oppløste fraksjonen av avløpsvannet fra renseanlegget.

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 first 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 2021 programme covers sampling and analyses of stormwater, river water, effluent from a wastewater treatment plant (inputs to the fjord), fjord sediment, blue mussel, cod and (river) trout. Next year (2022) it is planned to sample fjord sediments, polychaetes, zooplankton, prawns, blue mussel, herring and cod, as well as blood and eggs from Herring gull and Eider ducks (with the University of Oslo as project partner).

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 2021

2.1 Samples and localities

An overview of the samples collected in the Urban Fjord programme 2021 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 2021.

Species/sample	Matrix	Locality	Station code	No. for analysis
Sediment	Whole sediment	Bekkelaget (Bq41)	Bq41	1
Blue mussel	Pooled samples, soft body	Steilene	IO Blåskjell	1 pooled sample[1]
Cod	Muscle, liver, bile	Midtmeie	IO	3 pooled samples[2]
Inputs stormwater	Water (dissolved) and particulate fraction	See **Figure 1**: Alna Vollaveien Smalvollveien Gamle Oslo Hovin/Grenseveien	 Aln 125x Urban #2 Urban #3 Urban #4 Urban #5	5 samples (5 samples of dissolved fraction plus 5 of particulate fraction)
Inputs from Wastewater Treatment Plant	Water (dissolved) and particulate fraction	Bekkelaget	BRA	3 samples (3 samples of dissolved fraction plus 3 of particulate fraction)
River water (Alna)	Water (dissolved) and particulate fraction	Alna	Alna Vann	2 samples (2 samples of dissolved fraction plus 2 of particulate fraction)
(River) Trout	Muscle, liver	Alna	Alna Fisk	3 pooled samples[2]

[1] 35 mussels (shell length 31-67 mm).

[2] Each of 5 specimens (biometric data are given in Appendix, chapter 4).

A.

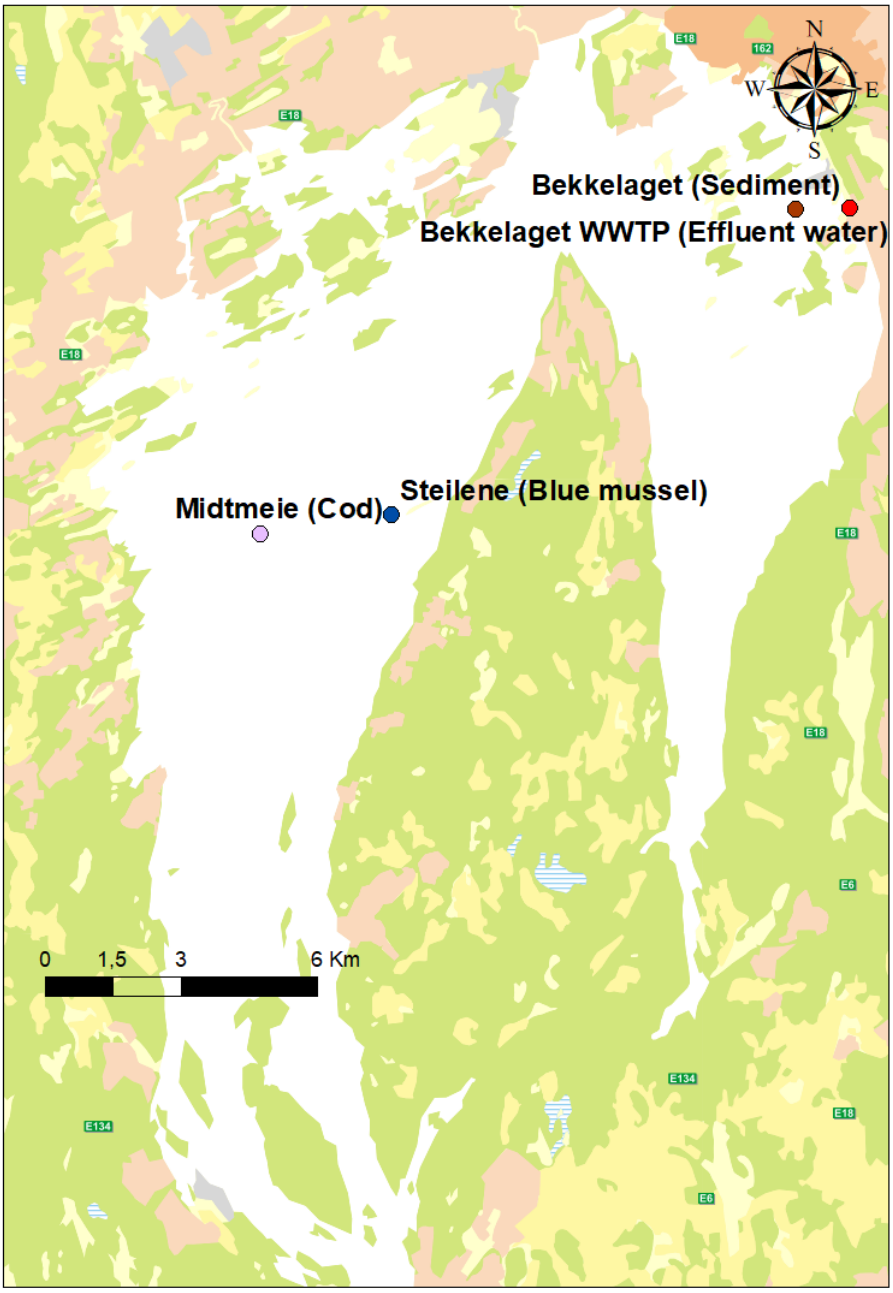
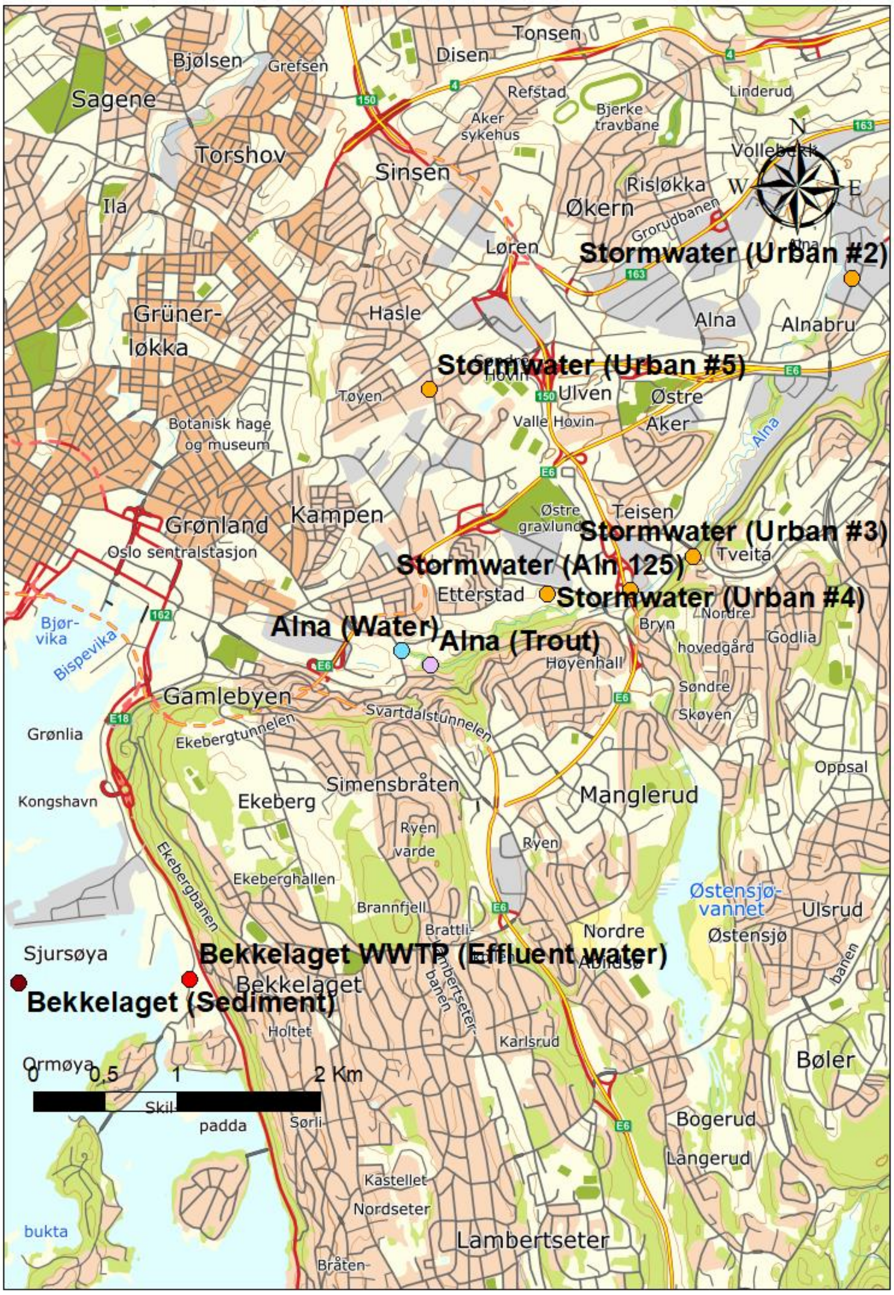


Figure 1. Map depicting stations for collection of sediment blue mussel and cod in the Inner Oslofjord (**A.**), and map depicting stations for collection of samples from Bekkelaget WWTP, stormwater, river water and trout (**B.**; next page). A figure showing time of stormwater sampling in relation to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

B.


Stormwater (Urban #2)
Stormwater (Urban #5)
Stormwater (Urban #3)
Stormwater (Aln 125)
Stormwater (Urban #4)
Alna (Water)
Alna (Trout)
Bekkelaget WWTP (Effluent water)
Bekkelaget (Sediment)
N
W
E
0
0.5
1
2 Km
Sagene
Bjølsen
Grefsen
Torshov
Sinsen
Tonsen
Disen
Refstad
Aker sykehus
Bjerke travbane
Linderud
Vollebekk
Risløkka
Økern
Løren
Ila
Grüner-løkka
Hasle
Alna
Alnabru
Tøyen
Ulven
Østre Aker
Valle Hovin
Botanisk hage og museum
Grønland
Kampen
Oslo sentralstasjon
Østre gravlund
Teisen
Tveita
Etterstad
Bryn
Bjør-vika
Bispevika
Gamlebyen
Høyenhall
Nordre hovedgård
Godlia
Søndre Skøyen
Grønlia
Ekebergtunnelen
Svartdalstunnelen
Kongshavn
Simensbråten
Ekeberg
Manglerud
Oppsal
Ryen
Ryenvarde
Ekeberghallen
Ekebergbanen
Brannfjell
Brattli
Nordre Abildsø
Østensjø-vannet
Østensjø
Ulsrud
Sjursøya
Bekkelaget
Holtet
Karlsrud
Bøler
Ormøya
Sørli
padda
Bogerud
Langerud
Kastellet
Nordseter
Lambertseter
Bråten
bukta

2.2 Chemical analysis

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

Table 2. Overview: Analyses in different matrices from the different localities in 2021.

	Sediment[1]	**Blue mussel**[2]	**Cod**[3] *	**Stormwater**[4] **	**WWTP**[5] **	**River water**[6] ***	**Trout**[7] ***
Metals	X	X	X	X	X	X	X
Siloxanes	X	X	X	X	X	X	X
PCBs	X	X	X	X	X	X	X
PBDEs	X	X	X	X	X	X	X
Other BFRs	X	X	X	X	X	X	
OPFRs	X	X	X	X	X	X	
PFCA, PFSA, nPFAS, new PFAS	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		X	X	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	
Stable isotopes of C and N		X	X				X

[1] Bekkelaget Bq41 (Inner Oslofjord)
[2] Steilene
[3] Midtmeie
[4] See **Figure 1**
[5] Bekkelaget
[6] Alna
[7] Alna
* Liver. Mercury in fillet.
** Dissolved and particulate fractions.
*** Muscle. Metals in liver.

2.3 Results and discussion

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

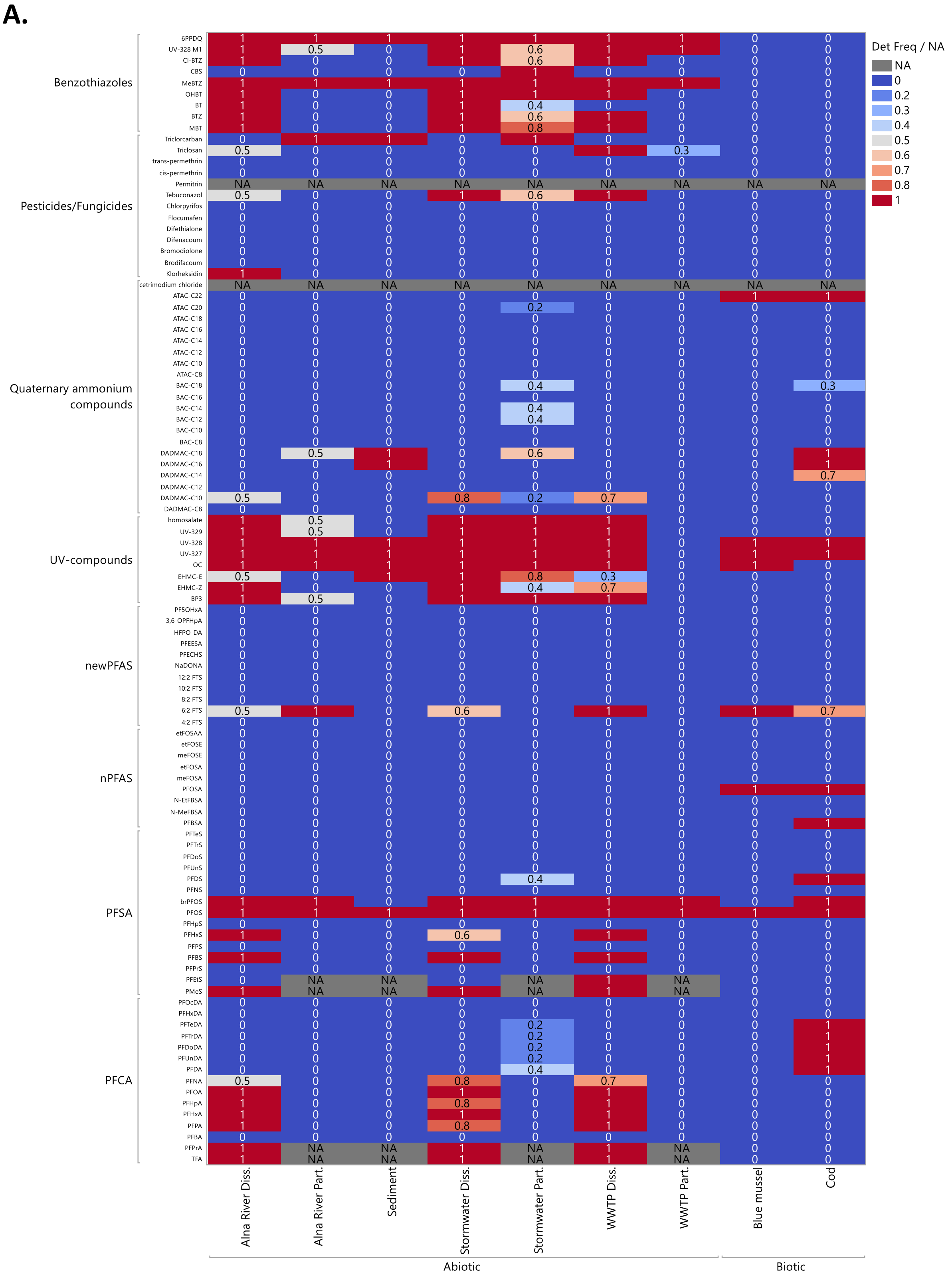
2.3.1 Stable isotopes

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

2.3.2 Detection frequencies of contaminants

A total of ~260 single compounds/isomers were analysed in this study. **Figure 2** gives the detection frequency (in %) of the various compounds in the different samples. The figure shows frequent detection of Benzothiazoles in abiotic aqueous phases, UV-compounds in most matrices, metals in all matrices, PBDEs in biota, chlorinated paraffins in all matrices and PCBs in biota and abiotic particle phases.

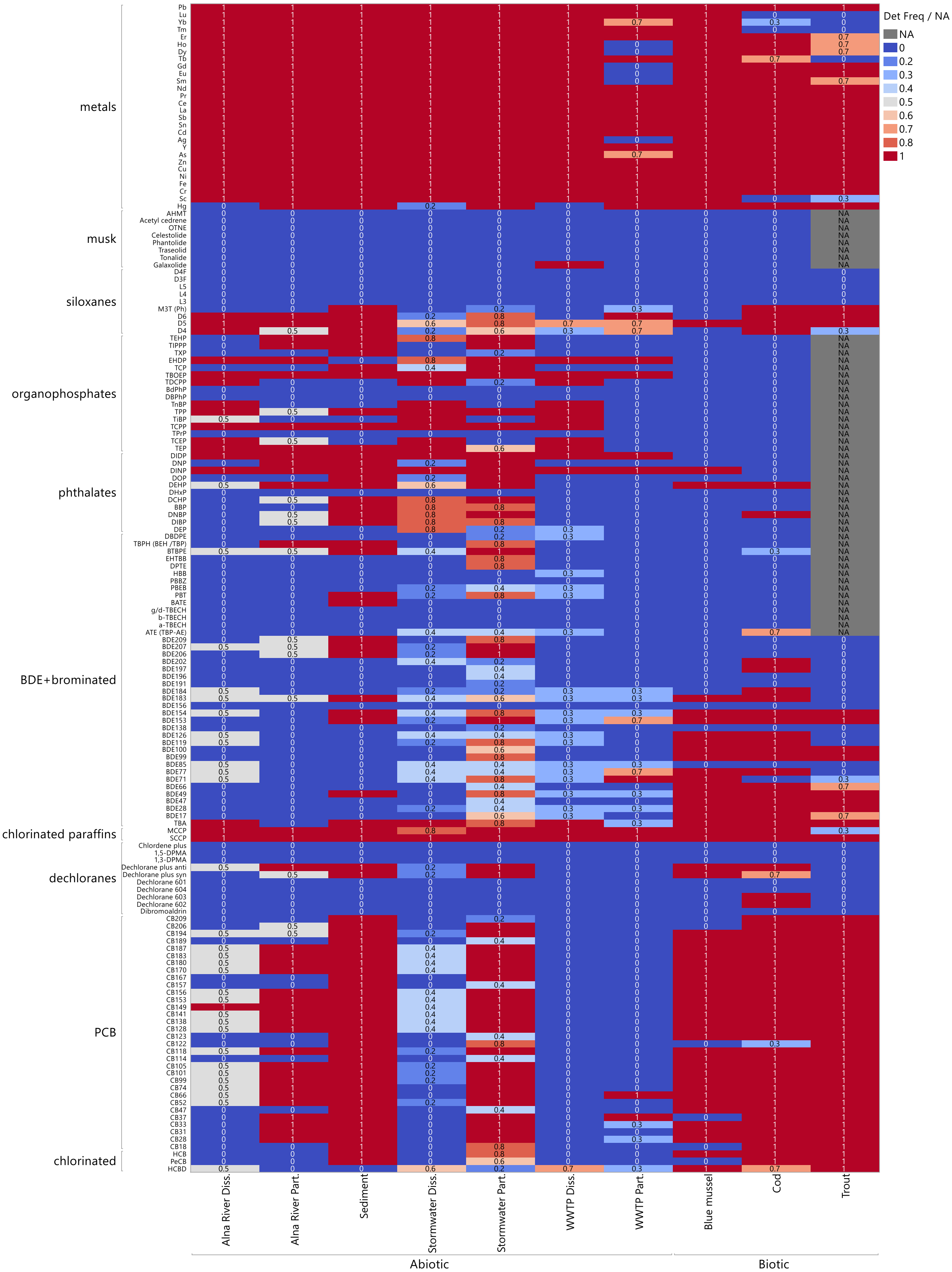
See chapter 3.3 for an indication of analyses/analytes with the lowest/highest uncertainties.



		Abiotic							Biotic	
		Alna River Diss.	Alna River Part.	Sediment	Stormwater Diss.	Stormwater Part.	WWTP Diss.	WWTP Part.	Blue mussel	Cod
Benzothiazoles	6PPDQ	1	1	1	1	1	1	1	0	0
	UV-328 M1	1	0.5	0	1	0.6	1	1	0	0
	Cl-BTZ	1	0	0	1	0.6	1	0	0	0
	CBS	0	0	0	0	1	0	0	0	0
	MeBTZ	1	1	1	1	1	1	1	0	0
	OHBT	1	0	0	1	1	1	0	0	0
	BT	1	0	0	1	0.4	0	0	0	0
	BTZ	1	0	0	1	0.6	1	0	0	0
	MBT	1	0	0	1	0.8	1	0	0	0
Pesticides/Fungicides	Triclorcarban	0	1	1	0	1	0	0	0	0
	Triclosan	0.5	0	0	0	0	1	0.3	0	0
	trans-permethrin	0	0	0	0	0	0	0	0	0
	cis-permethrin	0	0	0	0	0	0	0	0	0
	Permitrin	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Tebuconazol	0.5	0	0	1	0.6	1	0	0	0
	Chlorpyrifos	0	0	0	0	0	0	0	0	0
	Flocumafen	0	0	0	0	0	0	0	0	0
	Difethialone	0	0	0	0	0	0	0	0	0
	Difenacoum	0	0	0	0	0	0	0	0	0
	Bromodiolone	0	0	0	0	0	0	0	0	0
	Brodifacoum	0	0	0	0	0	0	0	0	0
	Klorheksidin	1	0	0	0	0	0	0	0	0
Quaternary ammonium compounds	cetrimodium chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
	ATAC-C22	0	0	0	0	0	0	0	1	1
	ATAC-C20	0	0	0	0	0.2	0	0	0	0
	ATAC-C18	0	0	0	0	0	0	0	0	0
	ATAC-C16	0	0	0	0	0	0	0	0	0
	ATAC-C14	0	0	0	0	0	0	0	0	0
	ATAC-C12	0	0	0	0	0	0	0	0	0
	ATAC-C10	0	0	0	0	0	0	0	0	0
	ATAC-C8	0	0	0	0	0	0	0	0	0
	BAC-C18	0	0	0	0	0.4	0	0	0	0.3
	BAC-C16	0	0	0	0	0	0	0	0	0
	BAC-C14	0	0	0	0	0.4	0	0	0	0
	BAC-C12	0	0	0	0	0.4	0	0	0	0
	BAC-C10	0	0	0	0	0	0	0	0	0
	BAC-C8	0	0	0	0	0	0	0	0	0
	DADMAC-C18	0	0.5	1	0	0.6	0	0	0	1
	DADMAC-C16	0	0	1	0	0	0	0	0	1
	DADMAC-C14	0	0	0	0	0	0	0	0	0.7
	DADMAC-C12	0	0	0	0	0	0	0	0	0
	DADMAC-C10	0.5	0	0	0.8	0.2	0.7	0	0	0
	DADMAC-C8	0	0	0	0	0	0	0	0	0
UV-compounds	homosalate	1	0.5	0	1	1	1	0	0	0
	UV-329	1	0.5	0	1	1	1	0	0	0
	UV-328	1	1	1	1	1	1	0	1	1
	UV-327	1	1	1	1	1	1	0	1	1
	OC	1	1	1	1	1	1	0	1	0
	EHMC-E	0.5	0	1	1	0.8	0.3	0	0	0
	EHMC-Z	1	0	0	1	0.4	0.7	0	0	0
	BP3	1	0.5	0	1	1	1	0	0	0
newPFAS	PF5OHxA	0	0	0	0	0	0	0	0	0
	3,6-OPFHpA	0	0	0	0	0	0	0	0	0
	HFPO-DA	0	0	0	0	0	0	0	0	0
	PFEESA	0	0	0	0	0	0	0	0	0
	PFECHS	0	0	0	0	0	0	0	0	0
	NaDONA	0	0	0	0	0	0	0	0	0
	12:2 FTS	0	0	0	0	0	0	0	0	0
	10:2 FTS	0	0	0	0	0	0	0	0	0
	8:2 FTS	0	0	0	0	0	0	0	0	0
	6:2 FTS	0.5	1	0	0.6	0	1	0	1	0.7
	4:2 FTS	0	0	0	0	0	0	0	0	0
nPFAS	etFOSAA	0	0	0	0	0	0	0	0	0
	etFOSE	0	0	0	0	0	0	0	0	0
	meFOSE	0	0	0	0	0	0	0	0	0
	etFOSA	0	0	0	0	0	0	0	0	0
	meFOSA	0	0	0	0	0	0	0	0	0
	PFOSA	0	0	0	0	0	0	0	1	1
	N-EtFBSA	0	0	0	0	0	0	0	0	0
	N-MeFBSA	0	0	0	0	0	0	0	0	0
	PFBSA	0	0	0	0	0	0	0	0	1
PFSA	PFTeS	0	0	0	0	0	0	0	0	0
	PFTrS	0	0	0	0	0	0	0	0	0
	PFDoS	0	0	0	0	0	0	0	0	0
	PFUnS	0	0	0	0	0	0	0	0	0
	PFDS	0	0	0	0	0.4	0	0	0	1
	PFNS	0	0	0	0	0	0	0	0	0
	brPFOS	1	1	0	1	1	1	1	0	1
	PFOS	1	1	1	1	1	1	1	1	1
	PFHpS	0	0	0	0	0	0	0	0	0
	PFHxS	1	0	0	0.6	0	1	0	0	0
	PFPS	0	0	0	0	0	0	0	0	0
	PFBS	1	0	0	1	0	1	0	0	0
	PFPrS	0	0	0	0	0	0	0	0	0
	PFEtS	0	NA	NA	0	NA	1	NA	0	0
	PMeS	1	NA	NA	1	NA	1	NA	0	0
PFCA	PFOcDA	0	0	0	0	0	0	0	0	0
	PFHxDA	0	0	0	0	0	0	0	0	0
	PFTeDA	0	0	0	0	0.2	0	0	0	1
	PFTrDA	0	0	0	0	0.2	0	0	0	1
	PFDoDA	0	0	0	0	0.2	0	0	0	1
	PFUnDA	0	0	0	0	0.2	0	0	0	1
	PFDA	0	0	0	0	0.4	0	0	0	1
	PFNA	0.5	0	0	0.8	0	0.7	0	0	0
	PFOA	1	0	0	1	0	1	0	0	0
	PFHpA	1	0	0	0.8	0	1	0	0	0
	PFHxA	1	0	0	1	0	1	0	0	0
	PFPA	1	0	0	0.8	0	1	0	0	0
	PFBA	0	0	0	0	0	0	0	0	0
	PFPrA	1	NA	NA	1	NA	1	NA	0	0
	TFA	1	NA	NA	1	NA	1	NA	0	0

Figure 2. Detection frequency (as fraction; %/100) of all the analysed compounds in the different environmental samples in this study. A: PFAS, UV-compounds, quaternary ammonium compounds, pesticides/fungicides and benzothiazoles (note these were not analysed in trout); B (next page): Chlorinated and brominated compounds, phthalates, OPFRs, siloxanes, musks and metals.

B.


metals
musk
siloxanes
organophosphates
phthalates
BDE+brominated
chlorinated paraffins
dechloranes
PCB
chlorinated
Pb
Lu
Yb
Tm
Er
Ho
Dy
Tb
Gd
Eu
Sm
Nd
Pr
Ce
La
Sb
Sn
Cd
Ag
Y
As
Zn
Cu
Ni
Fe
Cr
Sc
Hg
AHMT
Acetyl cedrene
OTNE
Celestolide
Phantolide
Traseolid
Tonalide
Galaxolide
D4F
D3F
L5
L4
L3
M3T (Ph)
D6
D5
D4
TEHP
TIPPP
TXP
EHDP
TCP
TBOEP
TDCPP
BdPhP
DBPhP
TnBP
TPP
TiBP
TCPP
TPrP
TCEP
TEP
DIDP
DNP
DINP
DOP
DEHP
DHxP
DCHP
BBP
DNBP
DIBP
DEP
DBDPE
TBPH (BEH /TBP)
BTBPE
EHTBB
DPTE
HBB
PBBZ
PBEB
PBT
BATE
g/d-TBECH
b-TBECH
a-TBECH
ATE (TBP-AE)
BDE209
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BDE206
BDE202
BDE197
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BDE183
BDE156
BDE154
BDE153
BDE138
BDE126
BDE119
BDE100
BDE99
BDE85
BDE77
BDE71
BDE66
BDE49
BDE47
BDE28
BDE17
TBA
MCCP
SCCP
Chlordene plus
1,5-DPMA
1,3-DPMA
Dechlorane plus anti
Dechlorane plus syn
Dechlorane 601
Dechlorane 604
Dechlorane 603
Dechlorane 602
Dibromoaldrin
CB209
CB206
CB194
CB189
CB187
CB183
CB180
CB170
CB167
CB157
CB156
CB153
CB149
CB141
CB138
CB128
CB123
CB122
CB118
CB114
CB105
CB101
CB99
CB74
CB66
CB52
CB47
CB37
CB33
CB31
CB28
CB18
HCB
PeCB
HCBD
Alna River Diss.
Alna River Part.
Sediment
Stormwater Diss.
Stormwater Part.
WWTP Diss.
WWTP Part.
Blue mussel
Cod
Trout
Abiotic
Biotic
Det Freq / NA
NA
0
0.2
0.3
0.4
0.5
0.6
0.7
0.8
1

2.3.3 PFAS

In biota, PFOS and PFOSA were dominating PFAS compounds (**Figure 3**). Regarding abiota, TFA was dominating in aqueous phases (dissolved), while PFOS and branched PFOS (brPFOS) were particularly found in the particulate fractions. Concentrations were highest in the abiotic dissolved fractions.

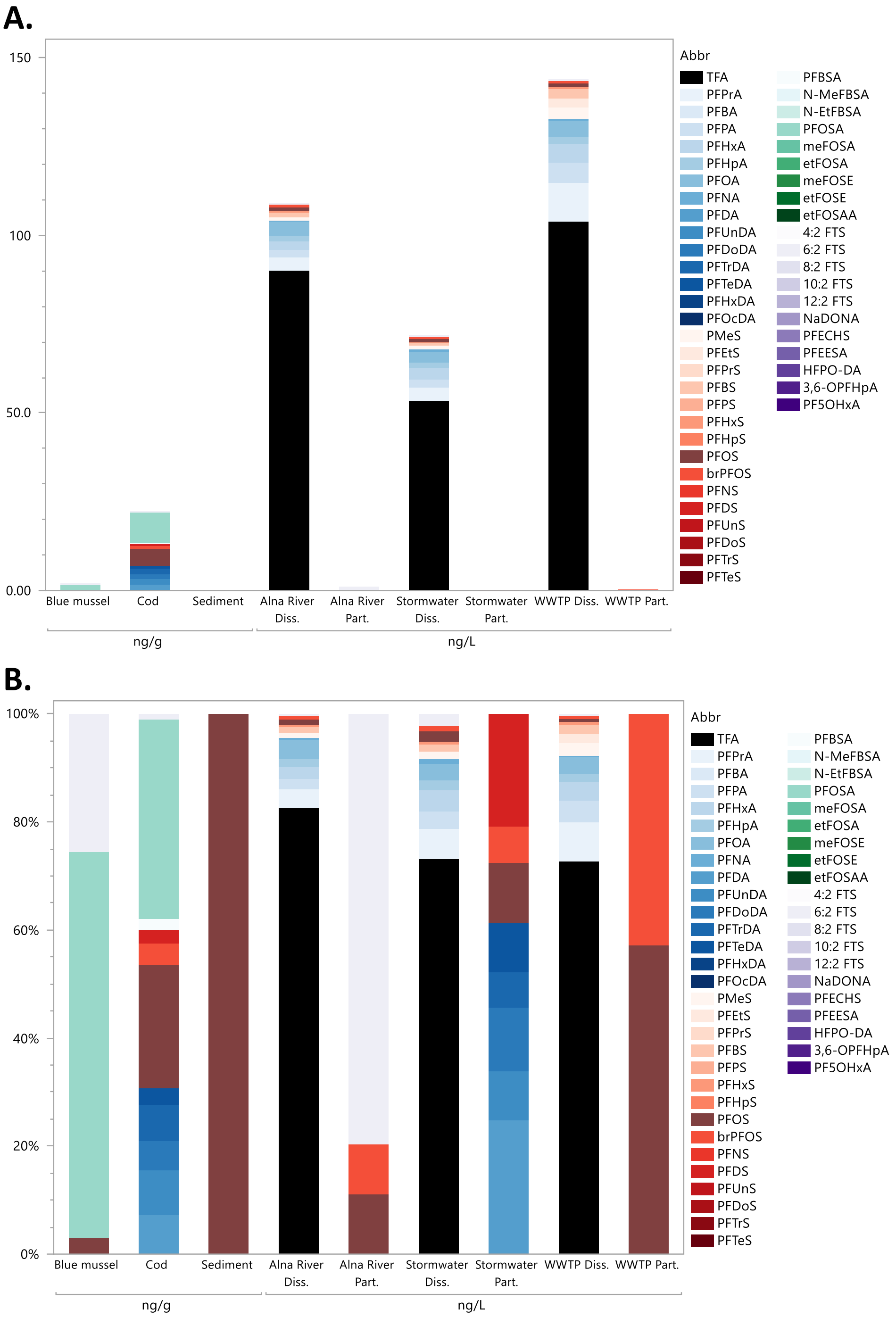


Figure 3. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of PFAS compounds in all matrices (**A**) and their contribution (%) to the sum-PFAS concentration (**B**). Non-detected compounds are assigned a value of zero (0).

2.3.4 UV-compounds

UV-327 and -328 were important UV-compounds in biota (**Figure 4**). These were also found in sediment, however, octocrylene (OC) showed the highest concentration in this matrix. Also in stormwater, river water and WWTP effluent water, OC was dominating (BP3 was also dominating in the dissolved phase). Although concentrations were generally higher in the particle phase, than in the dissolved phase, UV-compounds were not detected in the particle phase of WWTP effluent water.

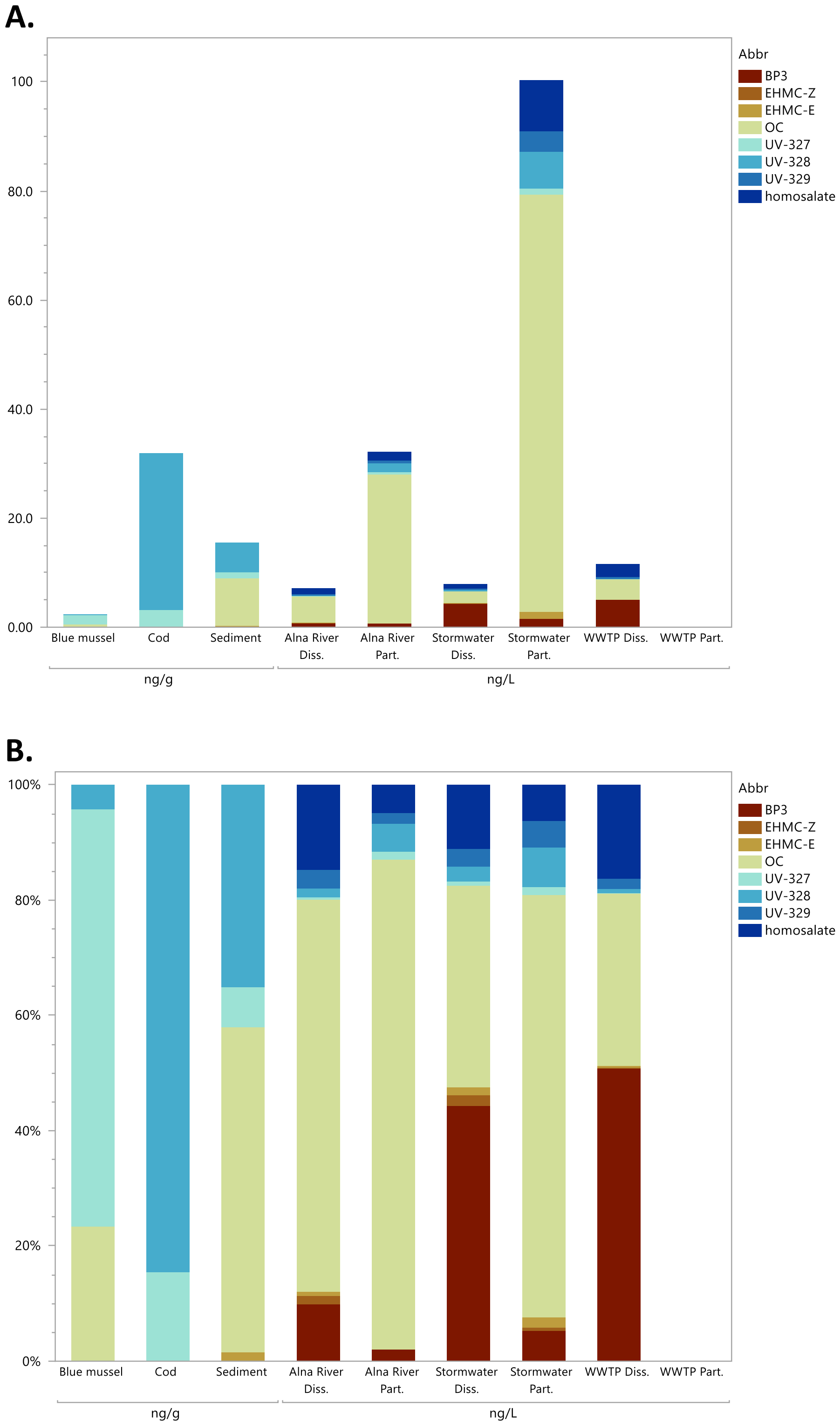


Figure 4. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of UV-compounds in all matrices (**A**) and their contribution (%) to the sum-UV-compounds concentration (**B**). Non-detected compounds are assigned a value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

2.3.5 Quaternary ammonium compounds

Of the quaternary ammonium compounds, ATAC-C22 was dominating in biota (**Figure 5**). In abiotic phases, DADMAC-10 was found in the dissolved fraction, while DADMAC-18 was found in the particle fraction. Quaternary ammonium compounds were not detected in the particle fraction of WWTP effluent water.

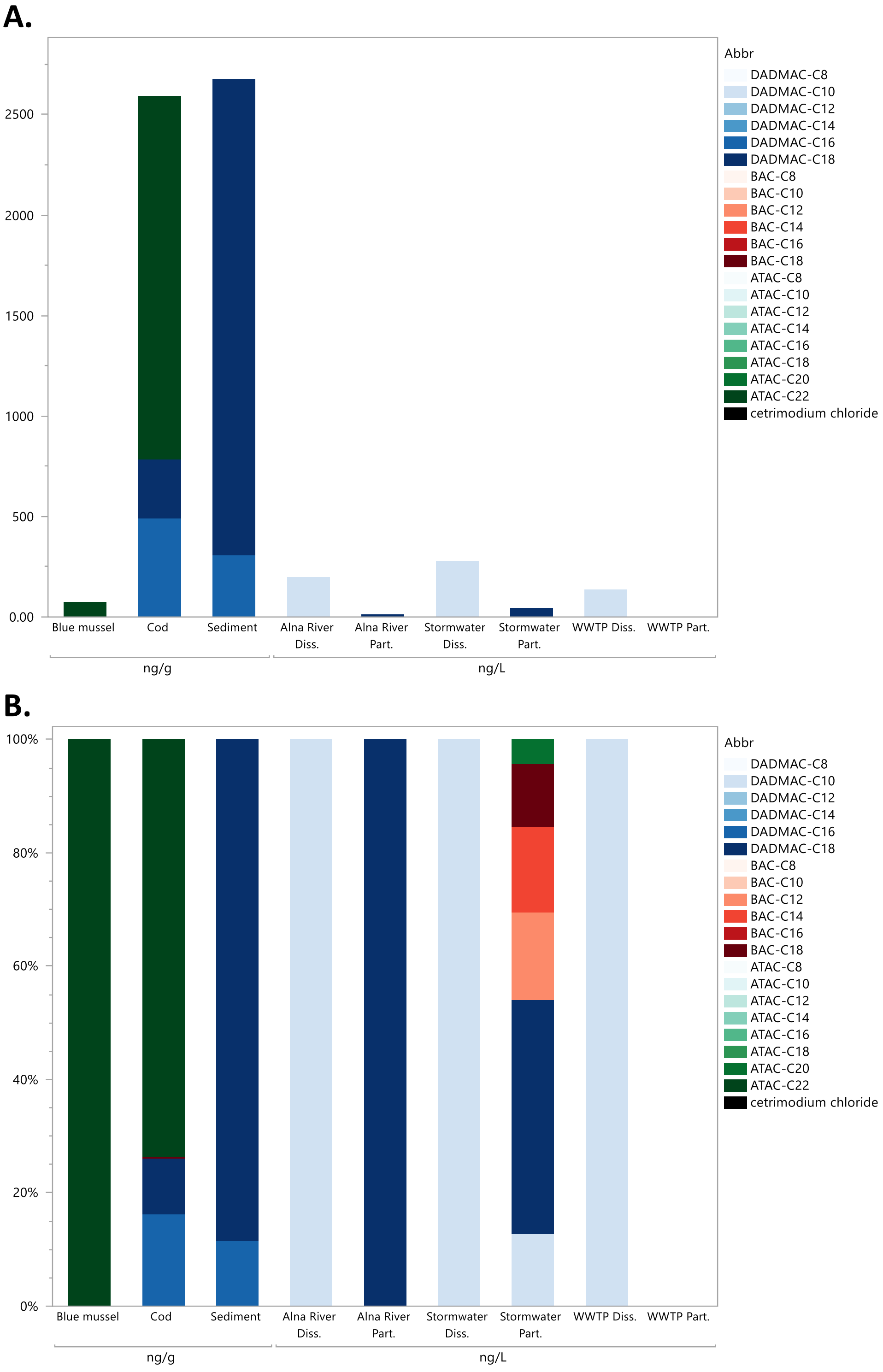
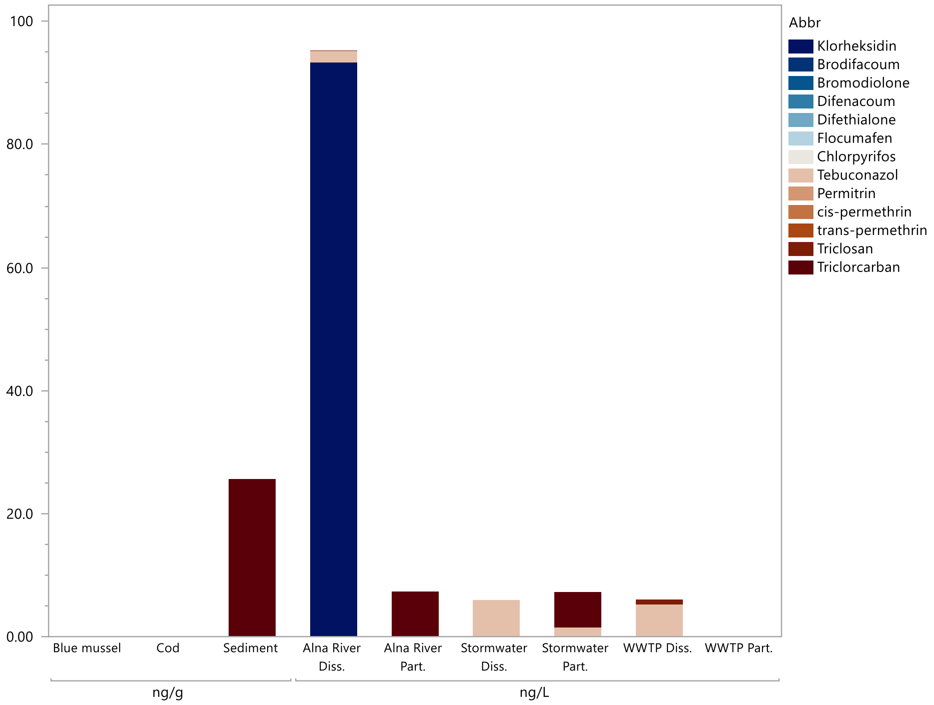


Figure 5. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of quaternary ammonium compounds in all matrices (**A**) and their contribution (%) to the sum-quaternary ammonium compounds concentration (**B**). Non-detected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

2.3.6 Pesticides/Fungicides

Pesticides/Fungicides were not detected in biota (**Figure 6**). Triclocarban was dominating in abiotic particle phases. Tebuconazol was observed dissolved in stormwater and WWTP effluent water. Triclosan was also observed in the latter. Conspicuous concentrations of Chlorhexidine are shown in Alna River water (dissolved).

A.



B.

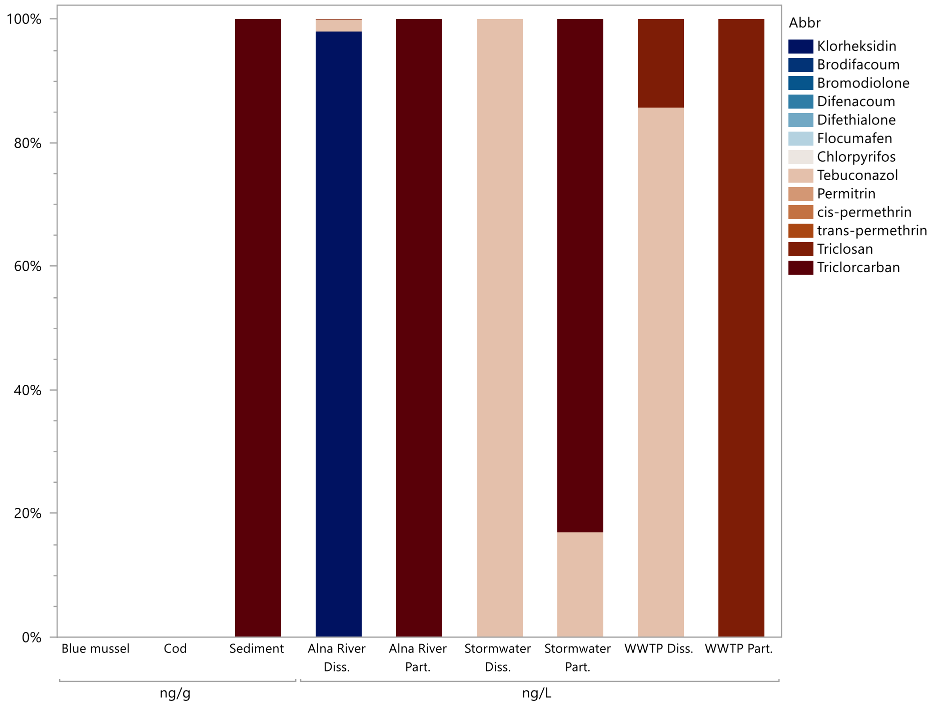


Figure 6. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of pesticides/fungicides in all matrices (**A**) and their contribution (%) to the sum-pesticides/fungicides concentration (**B**). Non-detected compounds are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

2.3.7 Benzothiazoles

Benzothiazoles were not detected in biota (**Figure 7**). In abiotic aqueous phases (dissolved) most benzothiazoles were detected, except CBS. In abiotic particle phases, MeBTZ and 6PPDQ were important constituents. Concentrations appeared higher in the dissolved phase, than in the particle phase.

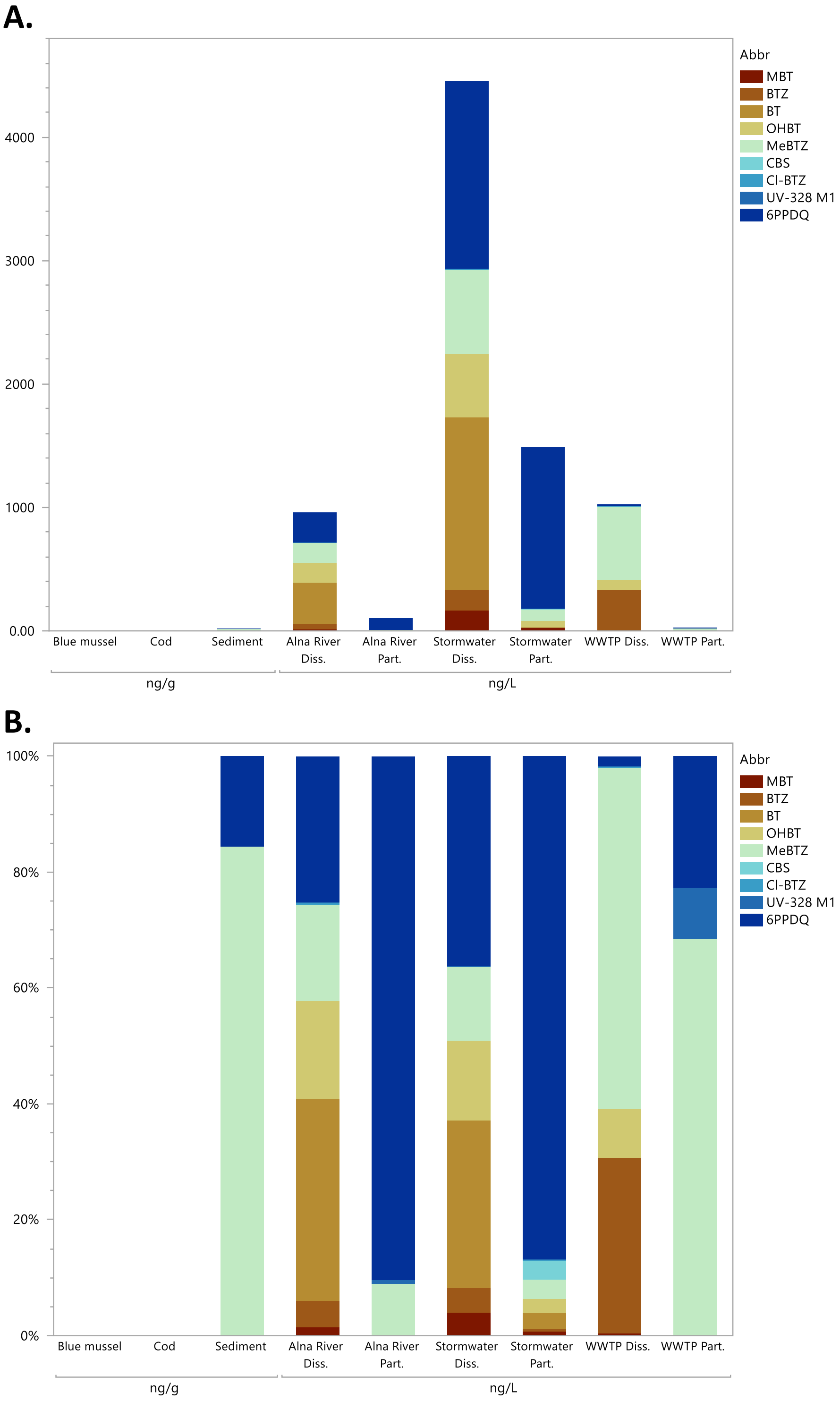


Figure 7. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of benzothiazoles in all matrices (**A**) and their contribution (%) to the sum-benzothiazoles concentration (**B**). Non-detected compounds are assigned a value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

2.3.1 Organochlorines and PCBs

PCBs were detected in all matrices, except the dissolved fraction of WWTP effluent water. Highest concentrations were found in the lipid rich cod livers followed by the other biotic matrices and sediment, which could also be observed for HCBD, PeCB and HCB.

2.3.2 Dechloranes

Dechloranes were not detected in brown trout or WWTP effluent water (**Figure 8**). In river water and stormwater concentrations were highest in the particulate fraction. Dechlorane plus *syn* and *anti* were the most important dechloranes.

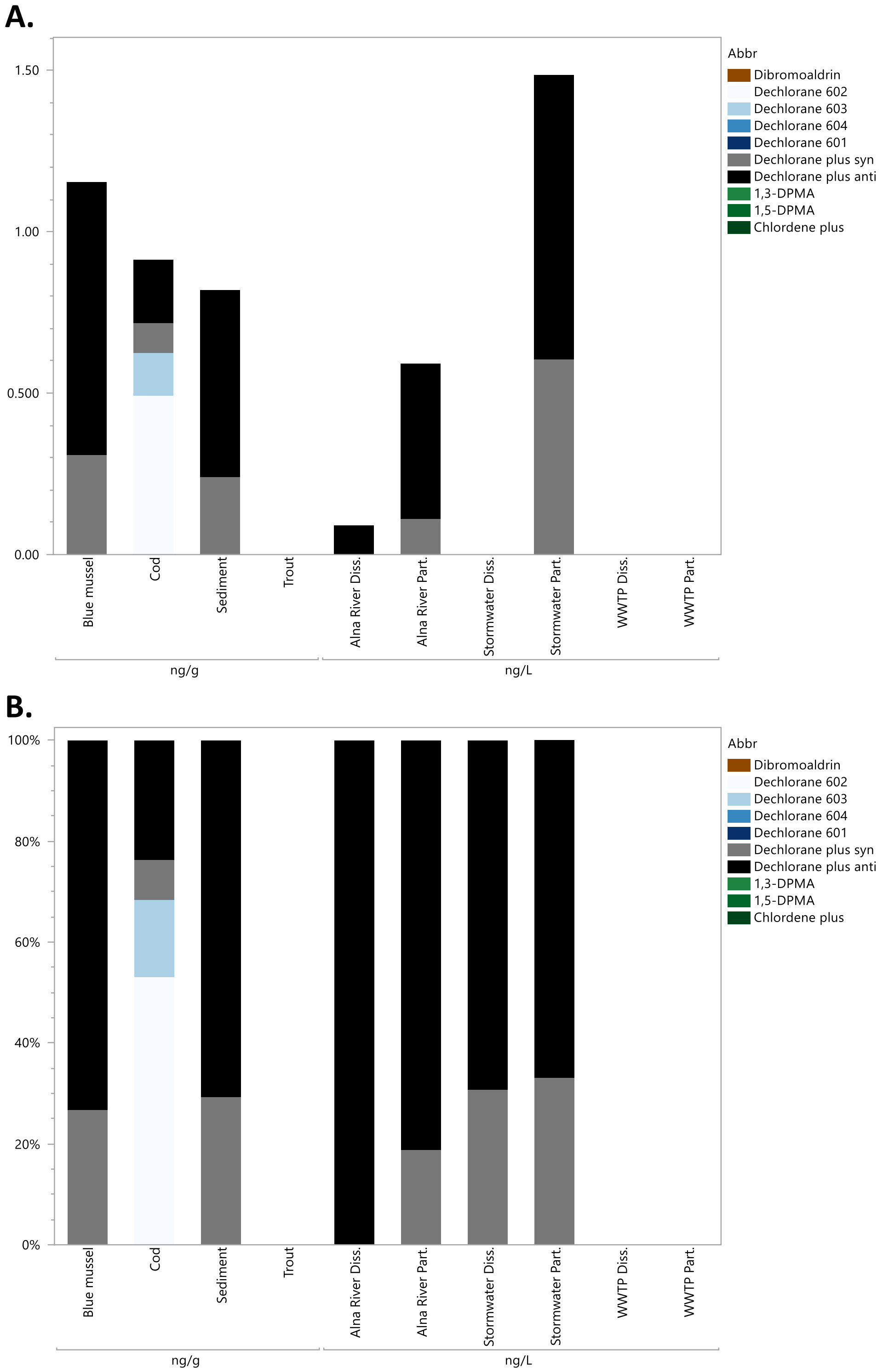


Figure 8. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of dechloranes in all matrices (**A**) and their contribution (%) to the sum-dechloranes concentration (**B**). Non-detected compounds are assigned a value of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

2.3.3 Chlorinated paraffins

Both short (SCCPs) and medium (MCCPs) chained chlorinated paraffins were detected in all matrices (**Figure 9**). In abiotic matrices, most was found in the particulate fractions. Here the SCCPs constituted the highest concentrations, while the MCCPs constituted the highest concentrations in biota.

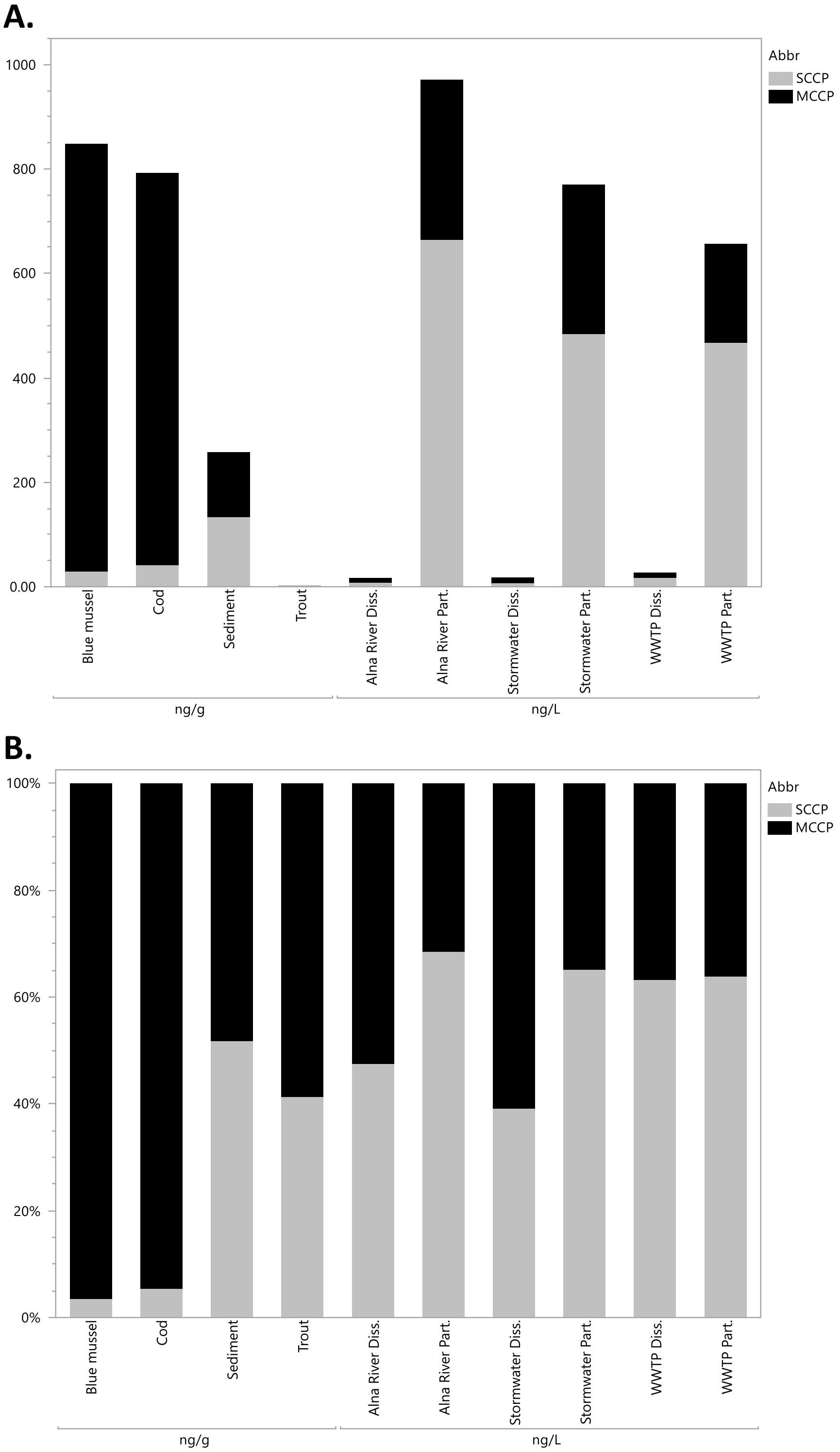


Figure 9. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of chlorinated paraffins (S/MCCPs) in all matrices (**A**) and their contribution (%) to the sum-S/MCCP concentration (**B**). Non-detected compounds are assigned a value of zero (0).

2.3.4 PBDEs and other brominated compounds

PBDEs were the dominating brominating compounds in biota, and the highest concentrations were observed in the lipid rich liver of cod (**Figure 10**). Furthermore, BDE-47 constituted a high proportion of the sum of PBDEs. In abiotic matrices the highest concentrations were observed in the particulate fractions, where the higher brominated homologues (especially BDE-209) constituted higher proportions. Also other brominated compounds were observed in abiotic matrices.

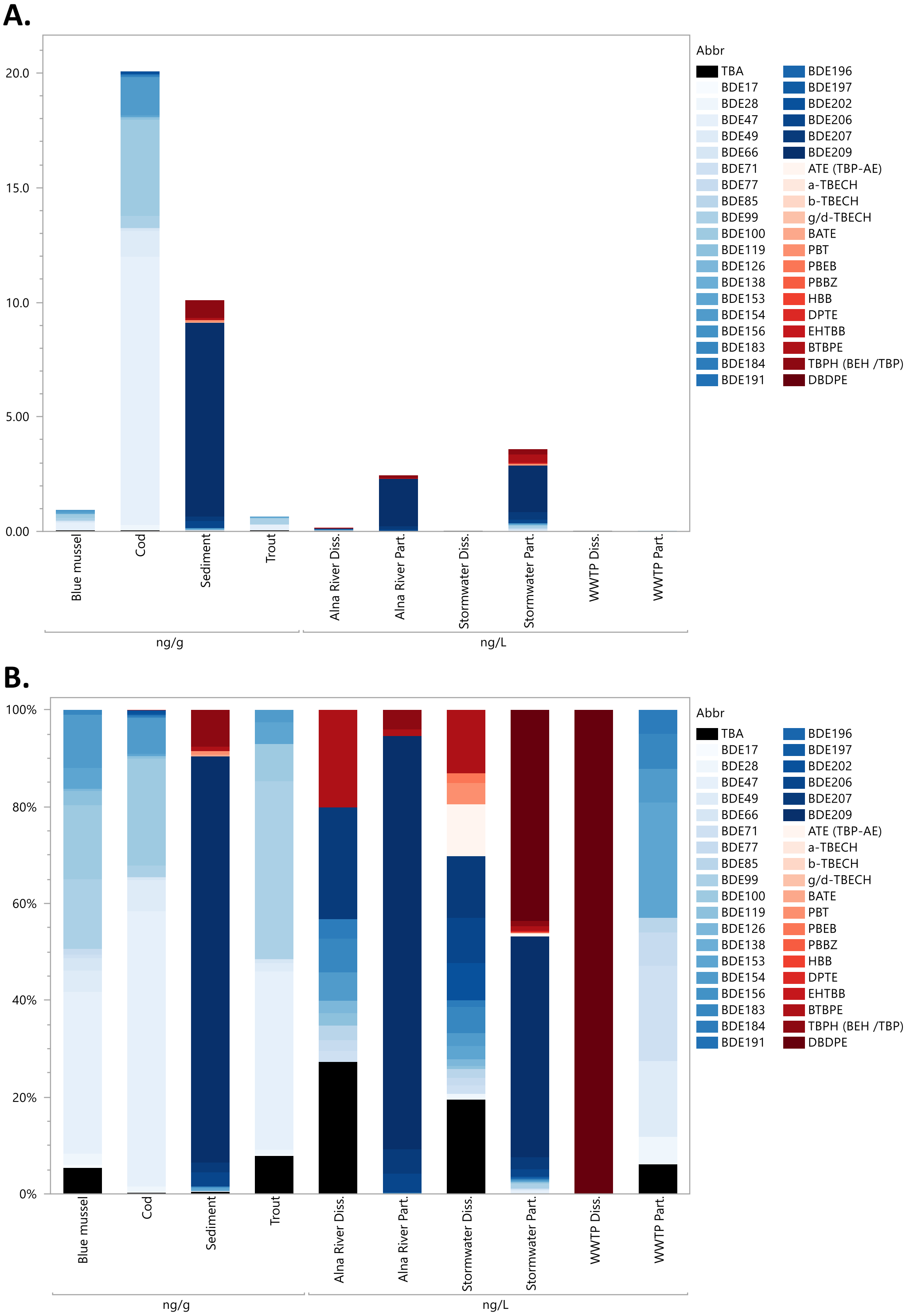


Figure 10. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of PBDEs and other brominated compounds in all matrices (**A**) and their contribution (%) to the sum-brominated compounds concentration (**B**). Non-detected compounds are assigned a value of zero (0). Note that “other brominated compounds” were not analysed in brown trout.

2.3.5 Phthalates

Phthalates were found in high concentrations, especially in the particulate fractions of river water and stormwater. (**Figure 11**). DINP and DIDP were dominating compounds in the abiotic matrices. In Blue mussel DEHP and DINP was observed, while in cod DEHP and DNBP was observed.

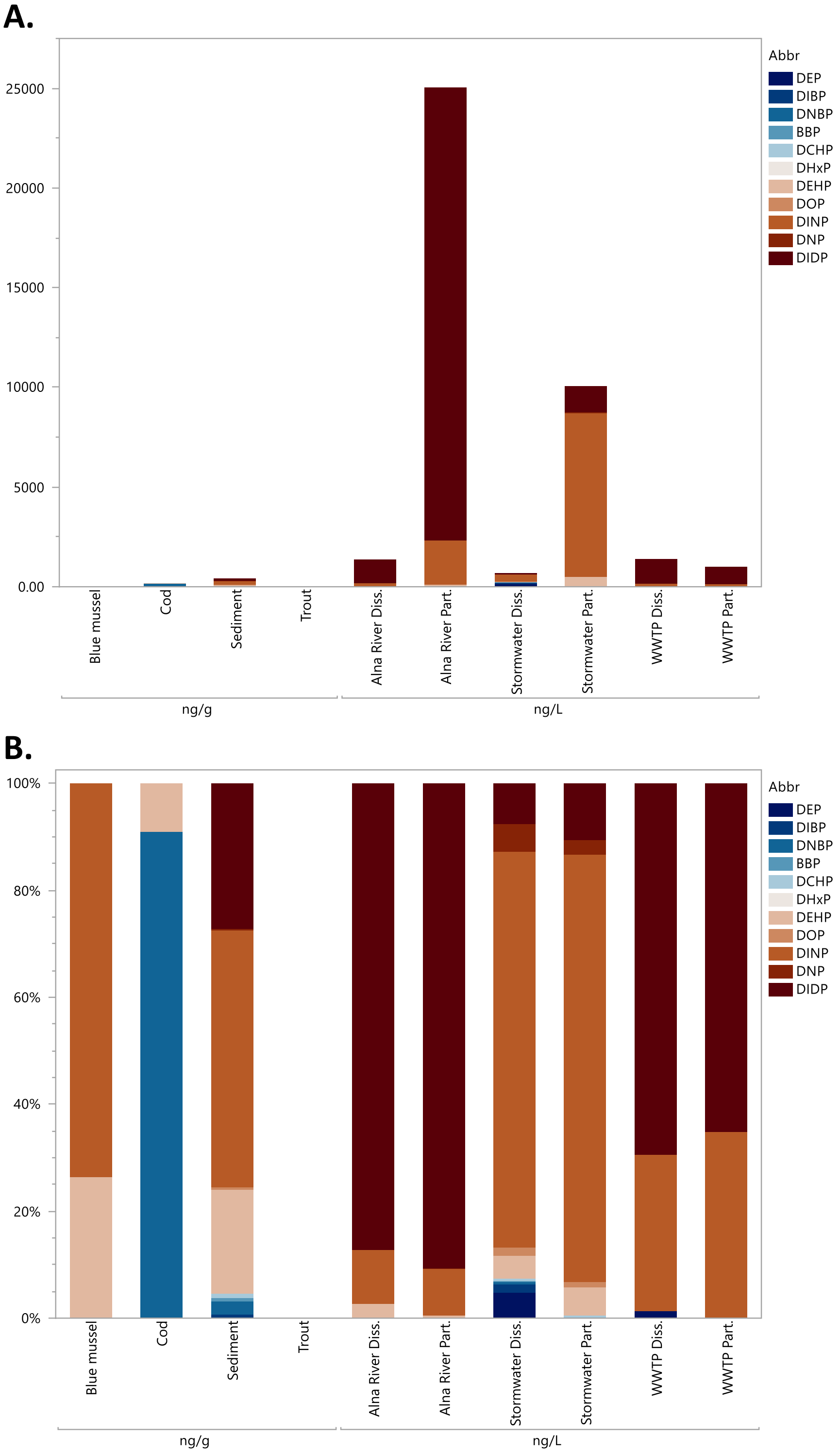


Figure 11. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of phthalates in all matrices (**A**) and their contribution (%) to the sum-phthalates concentration (**B**). Non-detected compounds are assigned a value of zero (0). Phthalates were not analysed in brown trout.

2.3.6 OPFRs

OPFRs were not detected in biota (**Figure 12**). In the aqueous abiotic matrices, the compounds were mostly associated with the particulate fraction. Here, TCPP generally constituted the highest proportion of sum-OPFR concentrations, followed by TBOEP. In the particulate fraction, also TEHP constituted large proportions of sum-OPFRs.

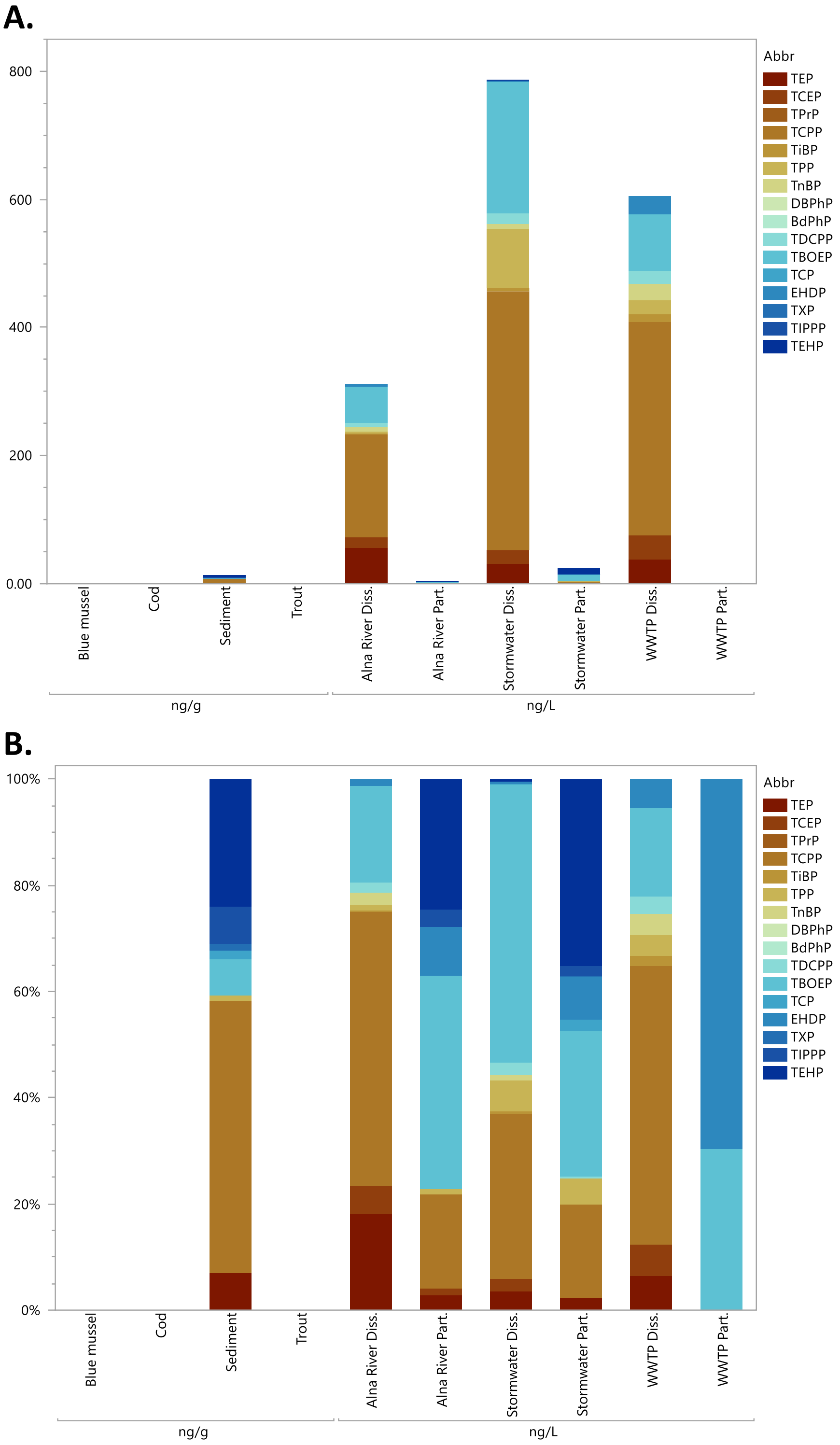


Figure 12. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of OPFRs in all matrices (**A**) and their contribution (%) to the sum-OPFRs concentration (**B**). Non-detected compounds are assigned a value of zero (0). OPFRs were not analysed in brown trout.

2.3.7 Siloxanes

The cyclic siloxanes D4, D5 and D6 were the dominating compounds in all matrices (**Figure 13**). Concentrations were most conspicuous in cod and Alna river water. M3T(Ph) was detected in biota and particulate fractions and constituted a large proportion of sum-siloxanes in brown trout from Alna River.

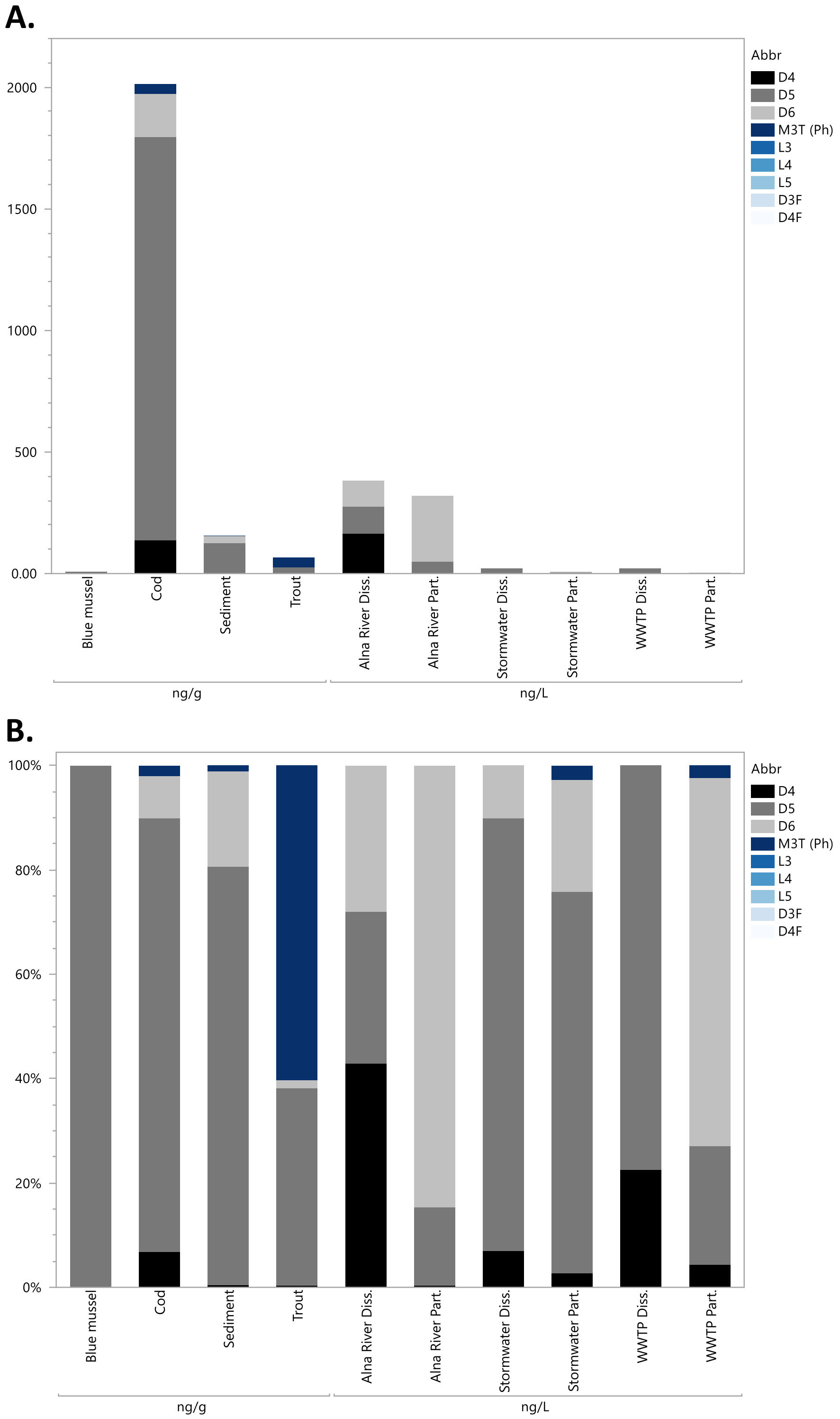


Figure 13. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of siloxanes in all matrices (**A**) and their contribution (%) to the sum-siloxanes concentration (**B**). Non-detected compounds are assigned a value of zero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

2.3.1 Musks

Among the musks, only Galaxolide was detected, and only in the dissolved fraction of WWTP effluent water.

2.3.2 Metals

Iron is the dominating metal in all matrices (see electronic Appendix), and concentrations are so much higher than the other metals in the particulate phases (especially sediment and particulate fractions of river water and stormwater), 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 of arsenic were observed in the marine organisms (cod and blue mussel). 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). A conspicuous proportion of silver (Ag) was also found in cod. Rare earth metals (Sc, Y and lanthanides) were found mainly in the particulate matrices (sediment and particulate fractions of stormwater and river water).

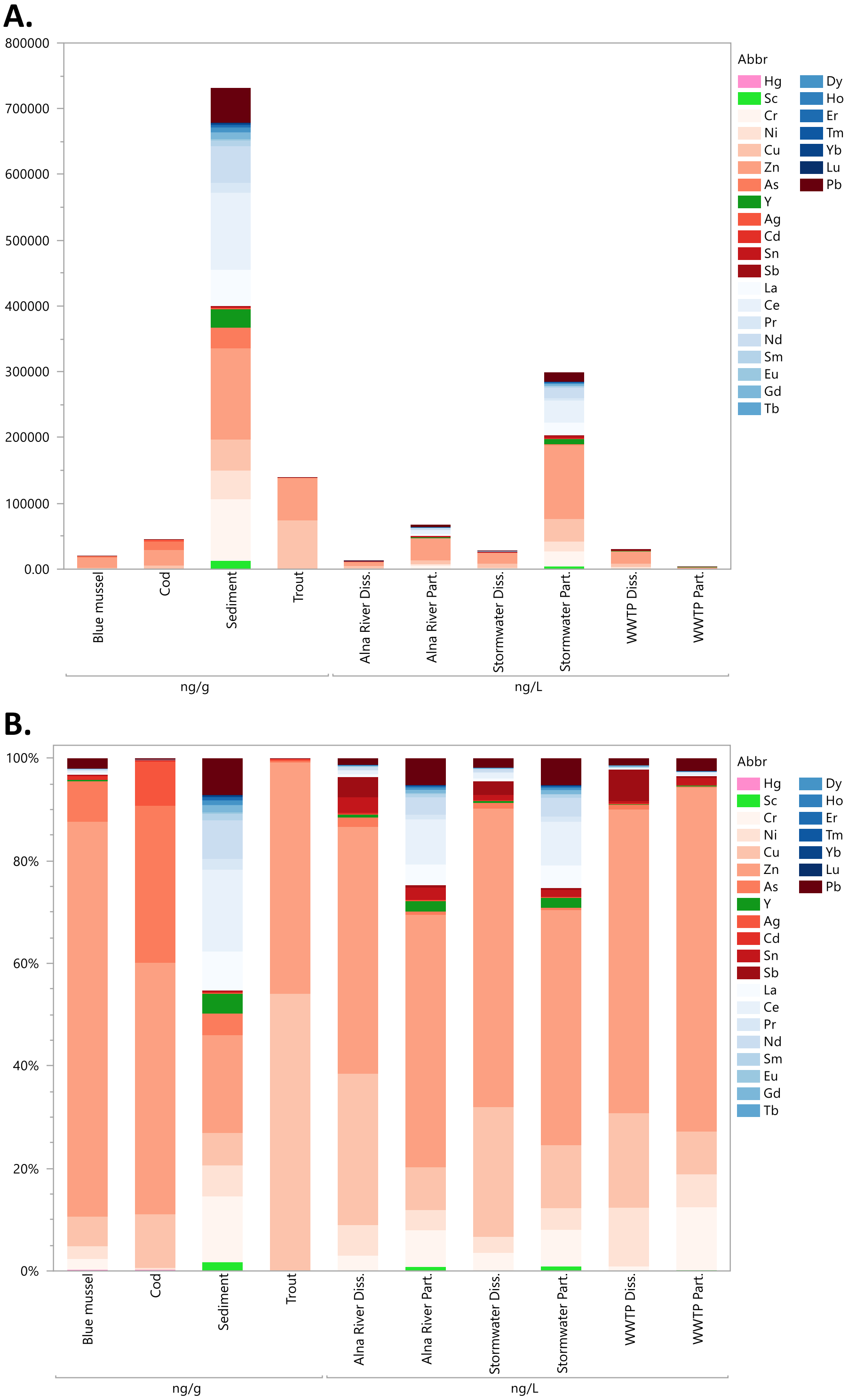


Figure 14. Concentrations (median; ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of metals in all matrices (**A**) and their contribution (%) to the sum-metals concentration (**B**). Non-detected compounds are assigned a value of zero (0).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

The homogenizing effects of sedimentary processes should result in nearly constant distributions of rear 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).

Post Archean Australian Shale (PAAS)-normalized ratios (Taylor and McLennan, 1985) of light rear earth elements (LREE), middle REE (MREE) and heavy REE (HREE) were (on average) 1.59, 1.69 and 1.00, while "continental crust"-normalized ratios (from McLennan, 2001) of LREE, MREE and HREE were (on average) 1.99, 2.09 and 1.27 (**Figure 15**). As such, enrichment is shown, especially in MREE, with gadolinium showing the highest ratios, suggesting anthropogenic influence (Olmez et al. 1991; Migaszewski and Galuszka, 2015). Gadolinium complexes have e.g. been used as contrast agents in magnetic resonance imaging (MRI; Migaszewski and Galuszka, 2015).

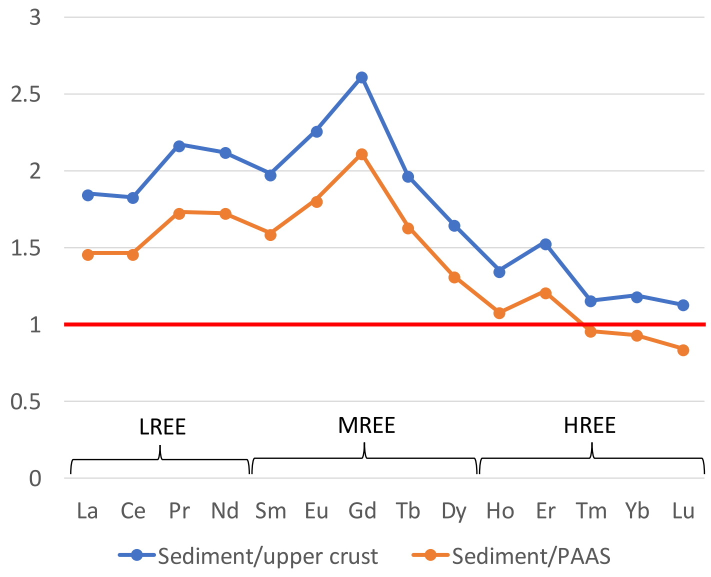


Figure 15. Ratio of lanthanide content in Inner Oslofjord sediments to lanthanide content in Post Archean Australian Shale (PAAS; Taylor and McLennan; 1985) and continental crust (McLennan, 2001).

2.3.3 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 was a dominating compound group in aqueous matrices (both in the dissolved and particulate fraction). Also the proportions of benzothiazoles and OPFRs were conspicuous in the dissolved phase of Alna River water, stormwater and WWTP effluent water. Quaternary ammonium compounds constituted large proportions of the sum of the selected contaminants in cod and sediment. PCBs and siloxanes constituted large proportions of the sum of all selected contaminants in fish (cod and trout). Notable proportions of mercury were found in biota and sediment from the inner Oslofjord, while proportions of chlorinated paraffins were notable in biota and abiotic particulate phases.

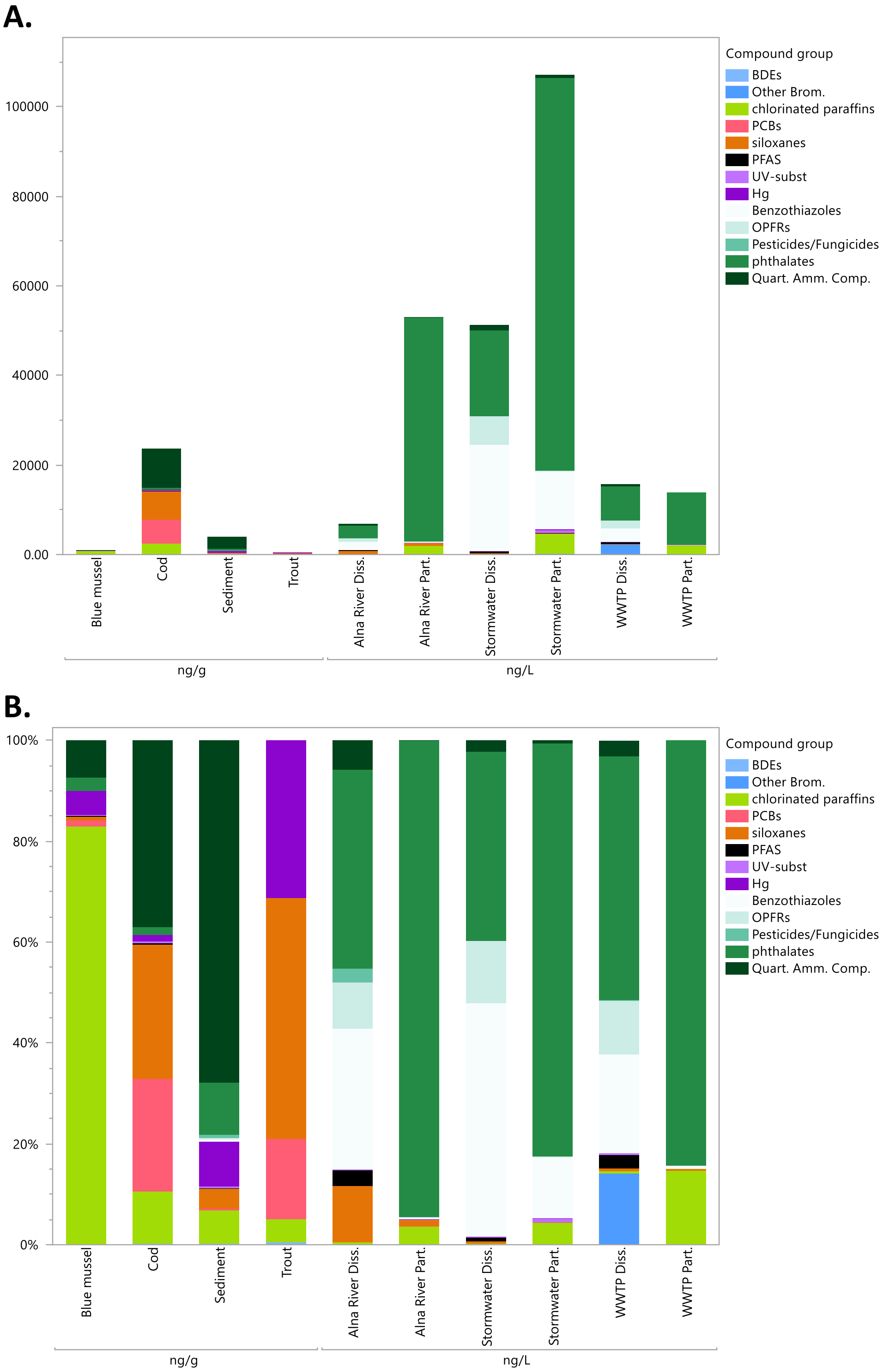


Figure 16. Concentrations (ng/g wet wt. in biota, ng/g dry wt. in sediment, and ng/L in river water, stormwater and WWTP effluent water) of selected compounds/compound groups in all matrices (**A**) and their contribution (%) to the sum concentration of all these compounds/compound groups (**B**). Non-detected compounds are assigned a value of zero (0). Note that the following compound groups were not analysed in brown trout: “Other brominated compounds”, PFAS, UV-substances, Benzothiazoles, OPFRs, Pesticides/Fungicides, Phthalates and Quaternary ammonium compounds.

2.3.4 Relation to Environmental Quality Standards (EQSs)

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

Table 3. Concentrations of contaminants (mg/kg dry wt) of which Norwegian quality standards (Direktoratsgruppen vanndirektivet 2018) exist in sediment from the inner Oslofjord. Red numbers indicate concentrations exceeding the quality standard (annual average, AA-EQS).

River basin specific compounds	**EQS (mg/kg dry wt.)**	**Sediment conc. (mg/kg dry wt.)**
Decamethylcyclopentasiloxane (D5)	0.044	0.125
Medium chained chloroparafins (MCCPs)	4.6	0.124
Copper (Cu)	84	47
PCB7	0.0041	0.0077
PFOA	0.071	<0.0005
Zinc (Zn)	139	139
TBBPA	0.11	-
Arsenic (As)	18	31
Chromium (Cr)	620	94
TCEP	0.072	<0.00006
Triclosan ***	0.009	<0.02
EU priority substances		
Cadmium (Cd)	2.5	0.18
Lead (Pb)	150	52
Nickel (Ni)	42	44
Mercury (Hg)	0.52	0.35
Brominated diphenyl ethers *	0.062	<0.0005
Hexachlorobenzene	0.017	0.0003
C10-13 chloroalkanes **	0.8	0.133
Pentachlorobenzene	0.4	0.0002
PFOS	0.00023	0.00015
DEHP	10	0.079

* Sum of BDE-28, -47, -99, -100, -153 and -154.
** 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) of which Norwegian quality standards (Direktoratsgruppen vanndirektivet 2018) exist in fresh water. 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),
Decamethylcyclopentasiloxane (D5)	1.7	0.111	0.0366	0.0205
Medium chained chlorinated paraffins (MCCPs)	0.05	0.0086	0.0127	0.00941
Copper (Cu)	7.8	3.8	8.5	6.0
PCB7	0.0000024	<0.000432 ****	<0.000367 ****	<0.000243 ****
PFOA	9.1	0.0039	0.00258	0.00457
Zinc (Zn)	11	6.15	19.5	19.5
TBBPA	0.254	-	-	-
Arsenic (As)	0.5	0.236	0.384	0.308
Chromium (Cr)	3.4	0.376	1.17	0.295
TCEP	65	0.0165	0.0292	0.033
Triclosan	0.1	0.00003	<0.002	0.000897
EU priority substances				
Cadmium (Cd)	0.08	0.0378	0.0641	0.0331
Lead (Pb)	1.2	0.154	0.588	0.428
Nickel (Ni)	4	0.757	1.05	3.77
Mercury (Hg)	0.07 ***	<0.002	<0.002	<0.002
Brominated diphenyl ethers *	0.14 ***	<0.00027	<0.00028	<0.00023
Hexachlorobenzene	0.05 ***	<0.00018	<0.000257	<0.000128
C10-13 chloroalkanes **	0.4	0.0078	0.00813	0.0162
Pentachlorobenzene	0.007	<0.00011	<0.000156	<0.000078
PFOS	0.00065	0.001	0.00158	0.00086
DEHP	1.3	0.036	0.167	<0.014

* Sum of BDE-28, -47, -99, -100, -153 and -154.
** 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 (liver; except for mercury analysed in muscle) from the Inner Oslofjord, as well as in brown trout from Alna river, of which Norwegian quality standards (Direktoratsgruppen vanndirektivet 2018) exist in biota. Red numbers indicate concentrations exceeding the quality standard.

River basin specific compounds	**EQS (µg/kg)**	**Blue mussel conc. (µg/kg)**	**Cod conc. (µg/kg)**	**Brown trout conc. (µg/kg),**
Decamethylcyclopentasiloxane (D5)	15000	7.16	1740	25.7
Medium chained chlorinated paraffins (MCCPs)	170	818	770	3.84
PCB7	0.6	7.64	1158	11.3
PFOA	91	<0.5	<0.5	-
TCEP	7300	<0.06	<0.06	-
Triclosan	15000	<1	<2	-
EU priority substances				
Mercury (Hg)	20	47.8	99.8	44.5
Brominated diphenyl ethers *	0.0085	0.752	17.5	0.638
Hexachlorobenzene	10	0.125	3.85	0.717
C10-13 chloroalkanes **	6000	29.2	43.6	2.7
Pentachlorobenzene	50	<0.031	0.444	0.127
PFOS	9.1	0.06	5.81	-
DEHP	2900	7.3	11.3	-

* Sum of BDE-28, -47, -99, -100, -153 and -154.
** Short chained chlorinated paraffins (SCCPs)
*** Too high limit of detection to evaluate. However, single congeners exceeded EQS, when red.

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^2) from Research Vessel Trygve Braarud on August 5th 2021. Four grabs of the top layer (0-2 cm in grab samples with undisturbed surface) were prepared[1] for one sample.

3.1.2 Blue mussel

Mussels were collected at Steilene (**Figure 1**) , on August 19th 2021,by standard procedures (handpicked, using rake, or snorkelling; as done in the project "Contaminants in coastal waters", MILKYS; Schøyen et al. 2021; The Norwegian Environment Agency M-2124). One pooled sample (35 shells; shell length 31 to 67 mm) was prepared. 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 October 15th 2021. Samples of muscle tissue, liver and bile were taken. 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 at one occasion at five specific sampling points (**Figure 1**; ALN125x was sampled September 30th 2021, while the other stations were sampled November 17th 2021). 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 (polyethylene (PE) frit, 20 µm porosity prior to analysis of per-and polyfluorinated substances (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 Bekkelaget wastewater treatment plant (WWTP). The plant’s own automatic composite samplers were used for sampling. **Table 6** shows the time period for sampling, the total amount of wastewater that was

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[1] According to the Norwegian Environment Agency guidelines for risk assessment of contaminated sediment (M-409/2015)

treated at the plant during each sampling campaign, as well as the suspended solids (SS) concentration in each individual water sample (measurements made by the plant itself).

In addition, samples were collected of stabilized dewatered sludge (the same that is transported away from the plant), for analysis of microplastics. This is handled elsewhere.

Table 6. Period for sampling of treated effluent for analysis of environmental contaminants at Bekkelaget WWTPs. The samples were taken as water flow-proportional samples with the plant's own automatic composite sampler during dry weather conditions. The concentrations of suspended solids (SS) (the plant's own measurements) and the amount of wastewater that was treated at the plant during each sampling campaign.

Start	**End**	**SS**	**Total treated volume**
-	-	**mg/L**	**m³**
17.10.2021 08:00	18.10.2021 08:00	9	172 847
18.10.2021 08:00	19.10.2021 08:00	4	172 847
21.10.2021 08:00	22.10.2021 08:00	2	138 999

3.1.6 River water (Alna River)

Two water samples were collected at "Kværner" 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 (Avalange). The first sample was taken in connection with a heavy rainfall event, while the second sample was collected during dry weather conditions showing a declining water flow prior to sampling (see **Figure 17** and **Table 7**). The reported water flow was measured by Oslo Municipality at the same station ("Kværnerristen").

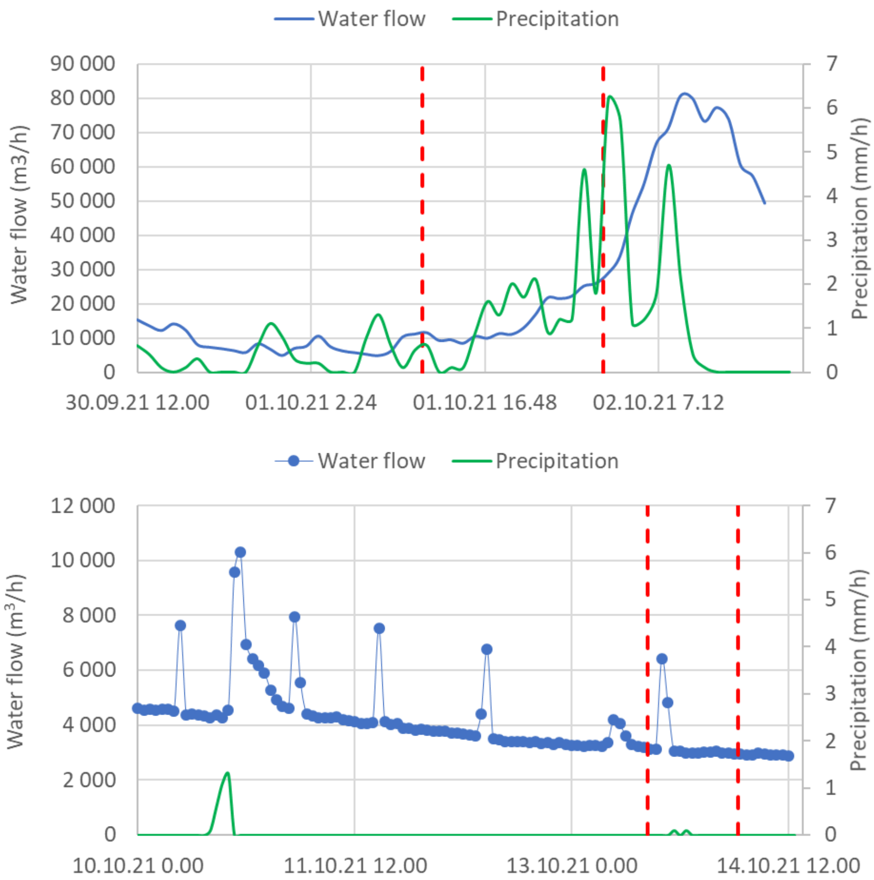

Figure 17. Precipitation and water flow from 1-4 days prior to the start of each sampling event and through the sampling event. The start and end of each sampling are marked with red dotted lines.

Table 7. Period for sampling at the station "Kværner" along the river Alna. Rainfall before and during the sampling period (data from Frost API (met.no) at the weather station Brobekk), as well as the amount of water that had passed and the average water flow during each sampling campaign as measured at Oslo municipality's sampling station "Kværnerristen".

Station	**Start**	**End**	**Rainfall the week before mm**	**Rainfall 24 h before mm**	**Rainfall during mm**	**Amount of water**	
						m³	**m³/time**
Kværner	01.10.2021 11:34	02.10.2021 02:34	41,70	8,6	23,3	238 971	15 931
	13.10.2021 12:40	14.10.2021 03:40	8,50	0	0,2	50 376	3 358

3.1.7 Trout

Brown trout (*Salmo trutta*) were collected in an approximately 500 m stretch of Alna River (**Figure 1**), on August 31st 2021, 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

3.3 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 divides in three groups from 1-3.

Group 1 includes the compounds with the highest certainty. For the compounds in this group the method is vel establish, not only at NIVA/NILU, but also internationally. That means the quality of this analysis have been proven with intercalibration studies and quality parameters are good. Most of these analyses is 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 have not been proven within intercalibration studies. These group also includes parameters that have been tested in intercalibration studies, but the results within the studies show that the uncertainty of this analysis still is 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.	0,16-1,3	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		0,02-0,7		2
	Ethylhexylmethoxycinnamate (EHMZ-E)	5466-77-3		0,06-1,3		2
	Octocrylene	6197-30-4		0,5-7		2
	UV-327	3864-99-1		0,01-0,2		2
	UV-328	25973-55-1		0,1-1		2
	UV-329	3147-75-9		0,2-5		3
	homosalate	118-56-9		0,6-6		2
	3-(2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxy-benzenepropanoic acid l	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	3
	Permitrin (trans)	52645-53-1		0,4-4		3
	Triclosan	3380-34-5		0,05-100		2

Comment to Permitrin: Tests of the extraction and analysis recovery of Permithrin based on spiking experiments give results in the range of 60-140%. The measured results of the analysis of complex samples 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. 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.	10	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		1		2
	PFBA	375-22-4		1	Internal standard is added and solid samples are extracted twice. Water samples are concentrated on an SPE column. LC-QTOF-MS detection	2
	PFPA	422-64-0		0,5		2
	PFHxA	307-24-4		0,5		1
	PFHpA	335-67-1		0,5		2
	PFOA	375-95-1		0,5		1
	PFNA	335-76-2		0,5		1
	PFDcA	2058-94-8		0,4		1
	PFUnA	307-55-1		0,4		1
	PFDoA	72629-94-8		0,4		1
	PFTriA	376-06-7		0,4		1
	PFTeA	67905-19-5		0,4		1
	PFHxDA	16517-11-6		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.	0,5	Same method as for TFA	2
	PFEtS	354-88-1		0,5		2
	PFPrS	423-41-6		0,1		2
	PFBS	375-73-5		0,1	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		0,1		2
	PFHxS	355-46-4		0,1		1
	PFHpS	375-92-8		0,1		1
	PFOS	2795-39-3		0,1		1
	brPFOS	1763-23-1		0,1		2
	PFNS	17202-41-4		0,2		2
	PFDcS	67906-42-7		0,2		1
	PFUnS	441296-91-9		0,2		2
	PFDoS	79780-39-5		0,2		2
	PFTrS	749786-16-1		0,2		2
	PFTS	n/a		0,2		3

Parameter group	Name parameter	CAS Number	Blank subtraction and determination of LOQ	LOQ range, ng/g or ng/L	Method	Uncertainty category
	nPFAS					
	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		0,3		1
	meFOSA	31506-32-8		0,3		2
	etFOSA	4151-50-2		0,1		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		2

Comments to PFAS:
PFTS and 12:2 FTS: Reference standard materials are unavailable for these two compounds. Uncertainty category is therefore reported as 3. However, knowledge from similar compounds provides confidence and we judge the results to be reliable.
Br-PFOS: 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.
TOF: To be continued…

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	3
	DADMAC-C10	2390-68-3		50		3
	DADMAC-C12	3282-73-3		5		3
	DADMAC-C14	68105-02-2		1		3
	DADMAC-C16	70755-47-4		5		3
	DADMAC-C18	3700-67-2		5		3
	BAC-C8	959-55-7		5		3
	BAC-C10	965-32-2		5		3
	BAC-C12	139-07-1		25		3
	BAC-C14	139-08-2		25		3
	BAC-C16	122-18-9		25		3
	BAC-C18	122-19-0		25		3
	ATAC-C8	2083-68-3		5		3
	ATAC-C10	2082-84-0		5		3
	ATAC-C12	1119-94-4		5		3
	ATAC-C14	1119-97-7		50		3
	ATAC-C16	57-09-0		50		3
	ATAC-C18	1120-02-1		50		3
	ATAC-C20	15809-05-9		25		3
	ATAC-C22	17301-53-0		5		3

Comments to QACs: Challenges seen with elevated levels of some QACs in blank samples. Carry-over or cross-contamination from a sample to the next one injected on the LCMS has also been observed. This is reflected in the elevated LOQs. Work on improvements to the method is ongoing.

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		1,0		2
	Benzothiazole	95-16-9		10,0-50,0		2
	2(3H)-Benzothiazolone (HBT)	934-34-9		10,0		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

Comments to benzothiazoles: Some of the abiotic samples show results outside the range of the method (i.e. greater than 100 ng/g or 100 ng/L). For these results the uncertainty is greater and, it is likely that results are underestimates.

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	Cr	7440-47-3	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively	0.0004-0.0006	0.001-0.002	In-house accredited method. Microwave assisted decomposition with HNO3. Analysed by ICP-MS (Agilent 7700x).	1
	Fe	7439-89-6		0.02-0.03	0.07-0.1		1
	Ni	7440-02-0		0,00007-0,0001	0,0002-0,0003		1
	Cu	7440-50-8		0.02-0.04	0.01-0.08		1
	Zn	7440-66-6		0.04-0.06	0.1-0.2		1
	As	7440-38-2		0.0009-0.002	0.003-0.005		1
	Ag	7440-22-4		6,0E-06 - 1,0E-05	0.00002-0.00003		1*
	Cd	7440-43-9		0.0001-0.0002	0.0004-0.001		1
	Sn	7440-31-5		0.0002-0.0003	0.001-0.006		2*
	Sb	7440-36-0		1.0E-05-1,6E-05	3.2E-05-5.4E-05		1
	Ce	7440-00-8		1.1E-05-1.9E-05	3.8E-05-6.3E-05		2*
	Nd	7440-00-8		3.1E-05-5.2E-05	0.0001-0.0002		2*
	Pb	7439-92-1		4.0E-05-6.7E-05	0.0001-0.0002		1
	Hg	7440-02-0		0.0002-0.0004	0.0007-0.001	In-house accredited method. Microwave assisted decomposition with HNO_3. 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 ng/L water (particles)	LOQ range ng/L water (particles)	Method	Uncertainty category
Metals / Water and particles	Cr	7440-47-3	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively	5	17	In-house accredited method. Microwave assisted decomposition with HNO_3. Water samples conserved with HNO_3. Analysed by ICP-HRMS (ELEMENT2)	1
	Fe	7439-89-6		100	333		1
	Ni	7440-02-0		8	27		1
	Cu	7440-50-8		30	100		1
	Zn	7440-66-6		100	333		1
	As	7440-38-2		5	17		1
	Ag	7440-22-4		4	13		1*
	Cd	7440-43-9		1	3		1
	Sn	7440-31-5		5	17		2*
	Sb	7440-36-0		2	7		1
	Ce	7440-00-8		0,3	1		2*
	Nd	7440-00-8		0,4	1		2*
	Pb	7439-92-1		10	33		1
Mercury/ Particles	Hg	7440-02-0		(0,2-0,3)	(1-2)	In-house accredited method. Filtration of water. Microwave assisted decomposition of particles on filter with HNO_3. Digestate stabilizased with HCl. Analysed by ICP-MS (Agilent 7700x).	1
Mercury/ Water	Hg	7440-02-0	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively	0,5	2	Water samples stabilized with HCl. BrCl added. Analysed by CV-AFS (Tekran).	1

*Not accredited

Table 8 cont. Method information. PCBs and organochlorines.

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
PCB/HCB	PECB	608-93-5	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively	0,02-0,2	0,04-0,4	In-house, accredited method. Internal standard addition, extraction, GPC and/or H2SO4 cleanup followed by adsorption chromatography. GC/HRMS (autspec)	1	Y
	HCB	118-74-1		0,05-0,1	0,006-0,2		1	Y
	HCBD	87-68-3		0,1-0,5			3	N
	PCB 28	7012-37-5		0,001-0,03	0,003-0,1		1	y
	PCB 52	35693-99-3		0,002-0,07	0,004-0,2		1	y
	PCB 101	37680-73-2		0,001-0,1	0,003-0,3		1	y
	PCB 118	31508-00-6		0,001-0,1	0,003-0,4		1	y
	PCB 138	35065-28-2		0,001-0,5	0,004-1,4		1	y
	PCB 153	35065-27-1		0,002-0,7	0,006-2		1	y
	PCB 180	35065-29-3		0,001-0,2	0,004-0,5		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	0,03-0,2	0,1-0,4	In-house method. Internal standard addition, extraction, GPC and/or H2SO4 cleanup followed by adsorption chromatography. GCGC-qToF 7200 in ECNI	2	N
	Dechlorane 602	31107-44-5		0,008-0,03	0,02-0,1		2	y
	Dechlorane 603	13560-92-4		0,01-0,04	0,03-0,1		2	N
	Dechlorane 604	34571-16-9		0,2-0,7	0,4-2		2	N
	Dechlorane 601	13560-90-2		0,02-0,7	0,04-0,4		2	N
	Dechlorane plus syn	135821-03-3		0,04-0,2	0,1-0,4		2	y
	Dechlorane plus anti	135821-74-8		0,03-0,1	0,07-0,3		2	N
	1,3-DPMA	N/A		0,03-0,1	0,08-0,3		2	N
	1,5-DPMA	N/A		0,06-0,2	0,1-0,5		2	N
	Chlordene Plus	13560-91-3		0,02-0,08	0,05-0,2		2	N
	Chlorendic anhydrid (nytt alternativ fra Velsicol)	115-27-5					3	N

Table 8 cont. Method information. PBDEs (next page)

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
PBDE	TBA	607-99-8	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively	0,003-0,02	0,006-0,04	In-house method. Internal standard addition, extraction, GPC and/or H2SO4 cleanup followed by adsorption chromatography. GC/HRMS (autspec)	2	N
	BDE-17	147217-75-2		0,003-0,02	0,01-0,05		2	N
	BDE-28	41318-75-6		0,003-0,02	0,01-0,05		1	Y
	BDE-47	5436-43-1		0,03-0,2	0,07-0,6		2	N
	BDE-49	123982-82-3		0,002-0,02	0,006-0,05		2	N
	BDE-66	189084-61-5		0,006-0,07	0,02-0,2		2	N
	BDE-71	189084-62-6		0,001-0,01	0,003-0,02		2	N
	BDE-77	93703-48-1		0,002-0,01	0,006-0,02		2	N
	BDE-85	446254-52-0		0,003-0,01	0,01-0,02		2	N
	BDE-99	60348-60-9		0,006-0,1	0,01-0,2		1	Y
	BDE-100	189084-64- 8		0,003-0,03	0,007-0,08		2	N
	BDE-119	189084-66-0		0,002-0,01	0,006-0,03		2	N
	BDE-126	366791-32-4		0,001-0,01	0,003-0,02		2	N
	BDE-138	182677-30-1		0,005-0,02	0,01-0,05		2	N
	BDE-153	68631-49-2		0,004-0,03	0,01-0,09		1	Y
	BDE-154	207122-15-4		0,004-0,02	0,01-0,05		2	N
	BDE-156	405237-85-6		0,007-0,03	0,02-0,07		2	N
	BDE-183	207122-16-5		0,004-0,02	0,01-0,05		1	Y
	BDE-184	117948-63-7		0,003-0,02	0,01-0,04		2	N
	BDE-191	446255-30-7		0,003-0,02	0,01-0,06		2	N
	BDE-196	32536-52-0		0,005-0,04	0,01-0,1		2	N
	BDE-197	117964-21-3		0,004-0,04	0,01-0,1		2	Y
	BDE-202	67797-09-5		0,006-0,04	0,02-0,1		2	N
	BDE-206	63387-28-0		0,04-0,1	0,1-0,3		2	Y
	BDE-207	437701-79-6		0,02-0,1	0,07-0,2		2	N
	BDE-209	1163-19-5		0,5-1,2	1,4-3,3		2	Y

Table 8 cont. Method information. Other BFRs.

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
EBF	ATE (TBP-AE)	3278-89-5	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively	0,003-0,03	0,01-0,07	In-house method. Internal standard addition, extraction, GPC and/or H2SO4 cleanup followed by adsorption chromatography. GC/HRMS (autspec)	2	N
	a-TBECH	3322-93-8		0,02-0,2	0,05-0,5		2	N
	b-TBECH	3322-93-8		0,05-0,2	0,04-0,4		2	N
	g/d-TBECH	3322-93-8		0,008-0,09	0,01-0,09		2	N
	BATE	99717-56-3		0,003-0,03	0,01-0,8		2	N
	PBT	87-83-2		0,006-0,06	0,01-0,2		2	N
	PBEB	85-22-3		0,003-0,03	0,008-0,09		2	N
	PBBZ	608-90- 2		0,05-0,5	0,2-2		2	y
	HBB	87-82-1		0,02-0,2	0,04-0,4		2	y
	DPTE	35109-60-5		0,004-0,03	0,01-0,07		2	N
	EHTBB	183658-27-7		0,04-0,06	0,1-0,2		2	y
	BTBPE	37853-59-1		0,008-0,06	0,03-0,2		2	y
	TBPH (BEH /TBP)	26040-51-7		0,06-0,1	0,2-0,4		2	N
	DBDPE	84852-53-9		2,6-28	7,76		2	y

Table 8 cont. Method information. Other BFRs - HBCD.

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
HBCD	a-HBCD	25637-99-4	Method blanks following sample series. LOD/LOQ based on calculation of 3 and 10 stddev respectively	0,005-0,05	0,02-0,1	In-house method. Internal standard addition, extraction, GPC and/or H2SO4 cleanup followed by adsorption chromatography. LC/HRMS	2	Y
	b-HBCD	25637-99-4		0,004-0,04	0,01-0,1		2	y
	g-HBCD	25637-99-4		0,005-0,05	0,02-0,1		2	y

Table 8 cont. Method information. S/MCCPs.

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. SCCP og MCCP 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	4-16	13-51	In-house method. Internal standard addition, exctraction, GPC and/or H2SO4 cleanup followed by adsporption chromatography. GC-qToF 7200 in ECNI	3	13C-hexachlorodecane
	MCCP	85535-85-9		13-51	43-168		3	

Table 8 cont. Method information. Phthalates.

Parameter group	Compound	Cas no	Blank	LOD range (ng/L)	LOQ range (ng/L)	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
Phthalate Water	DEHP	117-81-7	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	10-20	40-60	100mL water is cleaned up on HLB column, extracted with ACN, concentrated and analysed on LCMSMS	2	D4-DEHP
	DINP	28553-12-0		10-20	40-60		2	
	Diisodecyl phthalate (DIDP)	68515-49-1		5-20	20-60		2	
	Dioctyl phthalate	117-84-0		1-5	5-15		2	
	BBzP	85-68-7		1-5	5-15		2	
	DEP	84-66-2	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	30-100	50-200	100mL water is cleaned up on HLB column, extracted with ACN, concentrated and analysed on LCMSMS	2	
	diundecyl phthalate, branched and linear	85507-79-5		5-20	20-60		2	
	DHP	84-75-3		1-3	3-9		2	
	DcHP	84-61-7		1-3	3-9		2	
	DIBP	84-69-5		5-20	20-40		2	
	Diundecyl phthalate	3648-20-2		1-5	5-15		2	
	DBP	84-74-2		2-6	6-12		2	

Table 8 cont. Method information. Phthalates cont.

Parameter group	Compound	Cas no	Blank	LOD range (ng/g)	LOQ range (ng/g)	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
Phthalate Biota	DEHP	117-81-7	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	2-10	10-30	1-2 g of biota was homogenized and added deuterated internal standard and later extracted with acetone three times with vortexing and sonication for 10min. Extract was evaporated and added acetic acid/water and later extracted three times with hexane using vortex and 10min sonication and centrifugation. Extract was evaporated and transferred to analytical glass. Recovery standard added and analysis on LC-MSMS.	2	D4-DEHP
	DINP	28553-12-0		1-3	3-6		2	
	Diisodecyl phthalate (DIDP)	68515-49-1		1-3	3-6		2	
	Dioctyl phthalate	117-84-0		0.5-2	2-5		2	
	BBzP	85-68-7		0.5-2	2-5		2	
	DEP	84-66-2	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	0.5-3	3-9	1-2 g of biota was homogenized and added deuterated internal standard and later extracted with acetone three times with vortexing and sonication for 10min. Extract was evaporated and added acetic acid/water and later extracted three times with hexane using vortex and 10min sonication and centrifugation. Extract was evaporated and transferred to analytical glass. Recovery standard added and analysis on LC-MSMS.	2	
	diundecyl phthalate, branched and linear	85507-79-5		0.5-2	2-5		2	
	DHP	84-75-3		0.1-1	1-3		2	
	DcHP	84-61-7		0.1-1	1-3		2	
	DIBP	84-69-5		0.5-2	2-5		2	
	Diundecyl phthalate	3648-20-2		0.1-1	1-3		2	
	DBP	84-74-2		0.5-2	2-5		2	

Table 8 cont. Method information. Phthalates cont.

Parameter group	Compound	Cas no	Blank	LOD range (ng/g)	LOQ range (ng/g)	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
Phthalate sediment	DEHP	117-81-7	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	5-15	15-30	2-4g sediment/soil was dried in a clean cabinet over night. 1g was taken and extracted with acetone by vortex and sonication for 10 min. Extract was evaporated and redissolved in ACN and centrifuged and portion of extract was analysed on LCMSMS	2	D4-DEHP
	DINP	28553-12-0		3-5	5-15		2	
	Diisodecyl phthalate (DIDP)	68515-49-1		3-5	5-15		2	
	Dioctyl phthalate	117-84-0		0.5-2	2-6		2	
	BBzP	85-68-7		0.3-1	1-3		2	
	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	20-50	2-4g sediment/soil was dried in a clean cabinet over night. 1g was taken and extracted with acetone by vortex and sonication for 10 min. Extract was evaporated and redissolved in ACN and centrifuged and portion	3	
	diundecyl phthalate, branched and linear	85507-79-5		3-5	5-15		2	
	DHP	84-75-3		0.3-1	1-3		2	
	DcHP	84-61-7		0.3-1	1-3		2	
	DIBP	84-69-5		0.5-2	1-3		2	
	Diundecyl phthalate	3648-20-2		0.5-2	2-6		2	
	DBP	84-74-2		0.5-2	1-3		2	

Table 8 cont. Method information. OPFRs.

Parameter group	Name of parameter	Cas no	Blank	LOD range (ng/L)	LOQ range (ng/L)	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
OPFR water	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	0.5-5	5-10	100mL water is cleaned up on HLB column, extracted with ACN, concentrated and analysed on LCMSMS	2	Y
	TCEP	115-96-8		1-2	2-3		2	Y
	TPrP	513-08-6		0.5-1	1-2		2	N
	TCPP	13674-84-5		10-20	20-40		2	Y
	TiBP	126-71-6		0.5-2	2-4		2	N
	DBPhP	2528-36-1		0.5-2	2-4		2	N
	TPP	115-86-6		0.5-2	2-4		2	Y
	TnBP	126-73-8		0.5-2	2-4		2	Y
	BdPhP	2752-95-6		0.5-2	2-4		2	N
	TDCPP	13674-87-8		2-4	4-10		2	Y
	TBOEP	78-51-3		1-3	2-5		2	N
	2-IPPDPP	64532-94-1		1-3	2-5		2	N
	4-IPPDPP	55864-04-5		1-3	2-5		2	N
	TCP	1330-78-5		0.5-2	2-4		2	N
	EHDP	1241-94-7		0.5-2	2-4		2	N
	IDDPP	29761-21-5		1-3	2-5		2	N
	B4IPPPP	55864-07-8		1-3	2-5		2	N
	TXP	25155-23-1		1-3	2-5		2	N
	TIPPP	64532-95-2		1-3	2-5		2	Y
	TEHP	78-42-2		1-3	2-5		2	Y
	TTBPP	78-33-1		1-3	2-5		2	N

Table 8 cont. Method information. OPFRs cont.

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		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 was centrifuged and sample was evaporated and transferred to analytical glass. Recovery standard added and analysis on LC-MSMS.	2	Y
	TCEP	115-96-8			2-3		2	Y
	TPrP	513-08-6			1-2		2	N
	TCPP	13674-84-5			1-2		2	Y
	TiBP	126-71-6			2-3		2	N
	DBPhP	2528-36-1			1-2		2	N
	TPP	115-86-6			1-2		2	Y
	TnBP	126-73-8			2-3		2	Y
	BdPhP	2752-95-6			1-2		2	N
	TDCPP	13674-87-8			1-2		2	Y
	TBOEP	78-51-3			1-2		2	N
	2-IPPDPP	64532-94-1			1-2		2	N
	4-IPPDPP	55864-04-5			1-2		2	N
	TCP	1330-78-5			1-2		2	N
	EHDP	1241-94-7			1-2		2	N
	IDDPP	29761-21-5			1-2		2	N
	B4IPPPP	55864-07-8			1-2		2	N
	TXP	25155-23-1			1-2		2	N
	TIPPP	64532-95-2			1-2		2	Y
	TEHP	78-42-2			1-2		2	Y
	TTBPP	78-33-1			1-2		2	N

Table 8 cont. Method information. OPFRs cont.

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 biota	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	2-5	5-10	1-2 g of biota was homogenized and added deuterated internal standard and later extracted with acetone three times with vortexing and sonication for 10min. Extract was evaporated and added acetic acid/water and vortex and later extracted three times with hexane using vortex and 10min sonication and centrifugation. Extract was evaporated and transferred to analytical glass. Recovery standard added and analysis on LC-MSMS.	2	Y
	TCEP	115-96-8		1-2	2-3		2	Y
	TPrP	513-08-6		0.5-1	1-2		2	N
	TCPP	13674-84-5		0.5-1	1-2		2	Y
	TiBP	126-71-6		1-2	2-3		2	N
	DBPhP	2528-36-1		0.5-1	1-2		2	N
	TPP	115-86-6		0.5-1	1-2		2	Y
	TnBP	126-73-8		1-2	2-3		2	Y
	BdPhP	2752-95-6		0.5-1	1-2		2	N
	TDCPP	13674-87-8		0.5-1	1-2		2	Y
	TBOEP	78-51-3		0.5-1	1-2		2	N
	2-IPPDPP	64532-94-1		0.5-1	1-2		2	N
	4-IPPDPP	55864-04-5		0.5-1	1-2		2	N
	TCP	1330-78-5		0.5-1	1-2		2	N
	EHDP	1241-94-7		0.5-1	1-2		2	N
	IDDPP	29761-21-5		0.5-1	1-2		2	N
	B4IPPPP	55864-07-8		0.5-1	1-2		2	N
	TXP	25155-23-1		0.5-1	1-2		2	N
	TIPPP	64532-95-2		0.5-1	1-2		2	Y
	TEHP	78-42-2		0.5-1	1-2		2	Y
	TTBPP	78-33-1		0.5-1	1-2		2	N

Table 8 cont. Method information. Siloxanes

Parameter group	Name parameter	Cas nr	Blank	LOQ range ng/g or ng/L	Method	Uncertainty category	Stable isotope labeled (SIL) analogue
Siloxanes, biota/sediment/ particles	D4 - octamethylcyclotetrasiloxane	556-67-2	Three blanks per batch. Blank subtraction for each batch based on the blank average. LOQ calculated from 10 x stdev. From blanks	0.255-0.6383	To 1-2 g of sample, ^{13}C D4, D5 and D6 were added as internal standard, followed by addition of acetonitrile and hexane. Ultrasonic bath and shaking before centrifugation. No further cleanup. Recovery standard added to a sub sample before analysis on GC/MSD. As described in previous MILFERSK/Urban fjord reports. For paticles, the sample was filtrated before the particles were extracted according to the sediment method.	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
	D3F - tris-(trifluoropropyl)trimethylcyclotrisiloxane			2-50		2	N
	D4F - tetrakis-(trifluoropropyl)tetramethylcyclotetrasiloxane			3-30		2	N
Siloxanes, water	D4 - octamethylcyclotetrasiloxane	556-67-2	Three blanks pr batch. Blank subtraction for each batch based on the blank average. LOQ calculated from 10 x stdev. From blanks	6.44-14.7	To 100 mL of water, 13C D4, D5 and D6 were added as internal standard, before addition of 40 mL dichloromethane (DCM). The sample was stirred for 1 h before 20 mL was transferred to a vial containing Na$_2$SO4. No further cleanup before analysis.	2	Y
	D5 - decamethylcyclopentasiloxane	541-02-6		12.3-35.0		2	y
	D6 - dodecamethylcyclohexasiloxane	540-97-6		18		2	y
	M3T (Ph)			18		2	N
	L3 - octamethyltrisiloxane	107-51-7		6.75-14.9		2	N
	L4 - decamethyltetrasiloxane	141-62-8		52.8-109		2	N
	L5 - dodecamethylpentasiloxane	141-63-9		166-272		2	N
	D3F - tris-(trifluoropropyl)trimethylcyclotrisiloxane			30-100		2	N
	D4F - tetrakis-(trifluoropropyl)tetramethylcyclotetrasiloxane			25-130		2	N

Comments on siloxanes: D3F and D4F; The sensitivity for these two compounds in the GC/MSD system are up to 100 lower compared to the cyclic volatile methyl siloxanes.

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, biota/sediment	Traseolide	68857-95-4	Siloxane method: three blanks per batch. None of the native musk compounds were detected in blank samples. This could be due to the strict regime during sample preparation (siloxane method). LOQ based on calculation of background in the instrument analysis.	0.132-1.24	Took a subsample of the siloxane extract, used ^{13}D6 as internal standard for quantification. Some samples were upconcentrated and 5 μL sample injected for analysis on a GC/MSD.	3	N
	Phantolide	15323-35-0		0.029-0.28		3	N
	Otne	54464-57-2		0.132-1.24		3	N
	Acetyl cedrene	32388-55-9		0.132-1.24		3	N
	Galaxolide	1222-05-5		0.068-0.64		3	N
	AHMT	21145-77-7		0.132-1.24		3	N
	Celestolide	13171-00-1		0.021-0.18		3	N
	Tonalide	21145-77-7		0.052-0.49		3	N
Musk, water	Traseolide	68857-95-4	Siloxane method: three blanks per batch. None of the native musk compounds were detected in blank samples. This could be due to the strict regime during sample preparation (siloxane method). LOQ based on calculation of background in the instrument analysis.	12,61	Took a subsample of the siloxane extract, used ^{13}D6 as internal standard for quantification. Some samples were upconcentrated and 5 μL sample injected for analysis on a GC/MSD.	3	N
	Phantolide	15323-35-0		3,81		3	N
	Otne	54464-57-2		12,61		3	N
	Acetyl cedrene	32388-55-9		12,61		3	N
	Galaxolide	1222-05-5		6,48		3	N
	AHMT	21145-77-7		12,61		3	N
	Celestolide	13171-00-1		2,48		3	N
	Tonalide	21145-77-7		5,01		3	N

Comments to Musk compounds:
To avoid contamination from regular laboratory air, the same extract used for siloxanes analysis was used for musk analysis. No musk internal standard added (a siloxane, ^{13}D6, was used as internal standard for quantification) since the risk of contamination of native siloxanes was assumed to be too high. Some musk was detected in samples where the solvent extract was up concentrated and 5 µL sample injected. A higher sample amount for biota and sediment is recommended. There is a process to find a more suitable internal standard for the musks.

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 inn 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: δ^{15}N vs length in cod and brown trout, as well as all concentrations in all samples presented in bar plots.

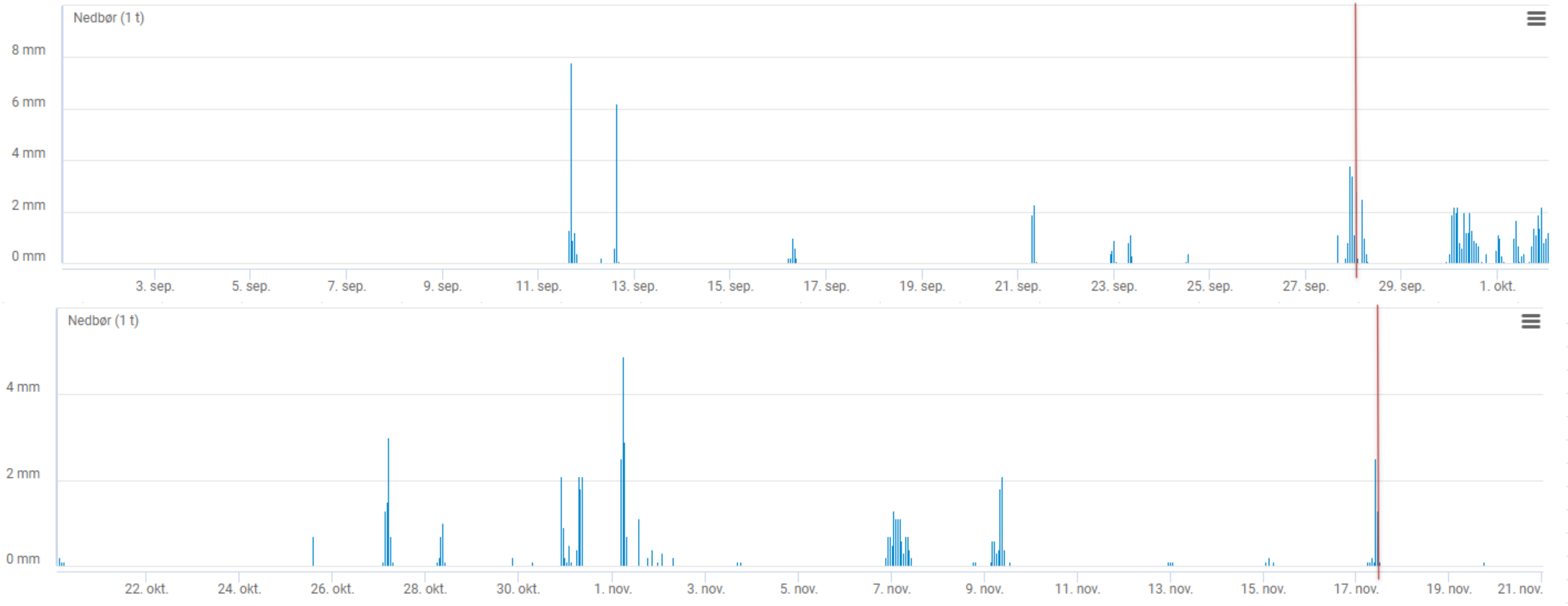

Figure 18. Time of stormwater sampling (|) in relation to precipitation (mm).

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

Substances	**Abbreviation**	**CAS**
Metals		
Mercury	Hg	7440-02-0
Chrome	Cr	7440-47-3
Nickel	Ni	7440-02-0
Copper	Cu	7440-50-8
Zinc	Zn	7440-66-6
Arsenic	As	7440-38-2
Silver	Ag	7440-22-4
Cadmium	Cd	7440-43-9
Lead	Pb	7439-92-1
Antimony	Sb	7440-36-0
Tin	Sn	7440-31-5
Iron	Fe	7439-89-6
Rare earth metals	Sc, Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu	
Siloxanes		
2,2,4,4,6,6,8,8-Octamethyl-1,3,5,7,2,4,6,8-tetroxatetrasilocane	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-pentoxapentasilecane	D5	541-02-6
Dodecamethylcyclohexasiloxane	D6	540-97-6
tris(trimethylsiloxy)phenylsilane	M3T(Ph)	2116-84-9
OCTAMETHYLTRISILOXANE (L3)	L3	107-51-7
Decamethyltetrasiloxane (L4)	L4	141-62-8
Dodecamethylpentasiloxane (L5)	L5	141-63-9
dicyclopentylsilanediol		74-31-7
2,4,6-Trimethyl-2,4,6-tris(3,3,3-trifluoropropyl)cyclotrisiloxane (D3F)	D3F	2374-14-3
2,4,6,8-tetramethyl-2,4,6,8-tetrakis(3,3,3-trifluoropropyl)cyclotetrasiloxane (D4F)	D4F	429-67-4

Polychlorinated biphenyls (PCB)		
2,4,4'-Trichlorobiphenyl 28	PCB-28	7012-37-5
2,2',5,5'-Tetrachlorobiphenyl 52	PCB-52	35693-99-3
2,2',4,5,5'-Pentachlorobiphenyl 101	PCB-101	37680-73-2
2,3',4,4',5-Pentachlorobiphenyl 118	PCB-118	31508-00-6
2,2',3,4,4',5'-Hexachlorobiphenyl 138	PCB-138	35065-28-2
2,2',4,4',5,5'-Hexachlorobiphenyl 153	PCB-153	35065-27-1
2,2',3,4,4',5,5'-Heptachlorobiphenyl 180	PCB-180	35065-29-3
Other congeners	PCB-18, -31, -33, -37, -47, -66, -74, -99, -105, -114, -122, -123, -128, -141, -149, -156, -157, -167, -170, -183, -187, -189, -194, -206, -209	
PBDEs		
2,2',4-Tribromodiphenyl ether	BDE-17	147217-75-2
2,4,4'-Tribromodiphenyl ether	BDE-28	41318-75-6
2,2',4,4'-Tetrabromodiphenyl ether	BDE-47	5436-43-1
2,2',4,5'-Tetrabromodiphenyl ether	BDE-49	123982-82-3
2,3',4,4'-Tetrabromodiphenyl ether	BDE-66	189084-61-5
2,3',4',6-Tetrabromodiphenyl ether	BDE-71	189084-62-6
3,3',4,4'-Tetrabromodiphenyl ether	BDE-77	93703-48-1
2,2',3,4,4'-Pentabromodiphenyl ether	BDE-85	182346-21-0
2,2',4,4',5-Pentabromodiphenyl ether	BDE-99	60348-60-9
2,2',4,4',6-Pentabromodiphenyl ether	BDE-100	189084-64- 8
2,3',4,4',6-Pentabromodiphenyl ether	BDE-119	189084-66-0
3,3',4,4',5-Pentabromodiphenyl ether	BDE-126	366791-32-4
2,2',3,4,4',5'-Hexabromodiphenyl ether	BDE-138	182677-30-1
2,2',4,4',5,5'-Hexabromodiphenyl ether	BDE-153	68631-49-2
2,2',4,4',5,6'-Hexabromodiphenyl ether	BDE-154	207122-15-4
2,3,3',4,4',5-Hexabromodiphenyl ether	BDE-156	405237-85-6
2,2',3,4,4',5',6-Heptabromodiphenyl ether	BDE-183	207122-16-5

2,2',3,4,4',6,6'-Heptabromodiphenyl ether	BDE-184	117948-63-7
2,3,3',4,4',5',6-Heptabromodiphenyl ether	BDE-191	446255-30-7
2,2',3,3',4,4',5',6-Octabromodiphenyl ether	BDE-196	32536-52-0
2,2',3,3',4,4',6,6'-Octabromodiphenyl ether	BDE-197	117964-21-3
2,2',3,3',5,5',6,6'-Octabromodiphenyl ether	BDE-202	67797-09-5
2,2',3,3',4,4',5,5',6-Nonabromodiphenyl ether	BDE-206	63387-28-0
2,2',3,3',4,4',5,6,6'-Nonabromodiphenyl ether	BDE-207	437701-79-6
Decabromodiphenyl ether	BDE-209	1163-19-5
Other BFRs		
2,4,6-tribromophenyl ether	ATE (TBP-AE)	3278-89-5
α-1,2-Dibromo-4-(1,2-di-bromo-ethyl)cyclohexane	α-TBECH	3322-93-8
β-1,2-Dibromo-4-(1,2-di-bromo-ethyl)cyclohexane	β-TBECH	n/a
γ/δ- 1,2-Dibromo-4-(1,2-di-bromo-ethyl)cyclohexane	γ/δ-TBECH	n/a
2-bromoallyl 2,4,6-tribromophenyl ether	BATE	99717-56-3
Pentabromotoluene	PBT	87-83-2
Pentabromoethylbenzene	PBEB	85-22-3
1,2,3,4,5 Pentabromobenzene	PBBZ	608-90-2
Hexabromobenzene	HBB	87-82-1
2,3-dibromopropyl 2,4,6-tribromophenyl ether	DPTE	35109-60-5
2-Ethylhexyl 2,3,4,5-tetrabromobenzoate	EHTBB	183658-27-7
1,2-Bis(2,4,6-tribromophenoxy)ethane	BTBPE	37853-59-1
2,3,4,5-tetrabromophthalate	TBPH (BEH /TBP)	26040-51-7
Decabromodiphenyl ethane	DBDPE	84852-53-9
Organochlorines		
Pentachlorobenzene	PECB	608-93-5
Hexachlorobenzene	HCB	118-74-1
hexachlorobutadiene	HCBD	87-68-3
Organophosphorus Flame Retardants (OPFRs)		
Triethyl phosphate	TEP	78-40-0
Tris(2-chloroethyl) phosphate	TCEP	115-96-8

Tripropyl phosphate	TPP/TPrP	513-08-6
Tris(1-chloropropyl) phosphate	TCPP	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 /TPP	115-86-6
Tri-n-butyl phosphate	TnBP	126-73-8
Tris(1,3-dichloro-2-propyl) phosphate	TDCPP	13674-87-8
Tris(2-butoxyethyl) phosphate	TBOEP/TBEP	78-51-3
Tricresyl phosphate	TCP	1330-78-5
2-Ethylhexyl diphenyl phosphate	EHDP	1241-94-7
Tris(2-ethylhexyl) phosphate	TEHP	78-42-2
Trixylyl phosphate	TXP	25155-23-1
Tris(4-isopropylphenyl) phosphate	TIPPP/T4IPP	26967-76-0
Per- and polyfluoroalkyl substances (PFAS)		
PFCA (perfluorinated carboxylate acids)		
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	422-64-0
Perfluorinated hexanoic acid	PFHxA	307-24-4
Perfluorinated heptanoic acid	PFHpA	335-67-1
Perfluorinated octanoic acid	PFOA	375-95-1
Perfluorinated nonanoic acid	PFNA	335-76-2
Perfluorinated decanoic acid	PFDA	2058-94-8
Perfluorinated undecanoic acid	PFUnDA	307-55-1
Perfluorinated dodecanoic acid	PFDoDA	72629-94-8
Perfluorinated tridecanoic acid	PFTrDA	376-06-7
Perfluorinated tetradecanoic acid	PFTeDA	67905-19-5
Perfluorinated hexadecanoic acid	PFHxDA	16517-11-6
Perfluorinated octadecanoic acid	PFOcDA	16517-11-6

PFSA (Perfluoroalkane sulfonic acids)		
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	17202-41-4
Perfluorinated decane sulfonic acid	PFDS	67906-42-7
Perfluoroundecane sulfonic acid	PFUnS	441296-91-9
Perfluorododecane sulfonic acid	PFDoS	79780-39-5
Perfluorotridecane sulfonic acid	PFTrS	749786-16-1
Perfluorotetradecane sulfonic acid	PFTeS	n/a
nPFAS (polyfluorinated neutral compounds)		
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	meFOSA	31506-32-8
N-Ethyl perfluorooctane sulfonamide	etFOSA	4151-50-2
N-Methyl perfluorooctane sulfonamidoethanol	meFOSE	24448-09-7
N-Ethyl perfluorooctane sulfonamidoethanol	etFOSE	1691-99-2
N-Ethyl perfluorooctane sulfonamidoacetic acid	etFOSAA	2991-50-6
newPFAS		
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-dioxanonanoate	NaDONA	958445-44-8
Cyclohexanesulfonic acid	PFECHS	67584-42-3
Perfluoro(2-ethoxyethane)sulfonate	PFEESA	113507-82-7
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
Perfluoro-3,6-dioxaheptanoic acid (Gen-X)	3,6-OPFHpA (Gen-X)	
Perfluoro-5-oxahexanoic acid (Gen-X)	PF5OHxA (Gen-X)	863090-89-5
UV Chemicals		
Benzophenone-3	BP3	131-57-7
Ethylhexylmethoxycinnamate	EHMC	5466-77-3
Octocrylene	OC	6197-30-4
UV-327	UV-327	3864-99-1
UV-328	UV-328	25973-55-1
UV-329	UV-329	3147-75-9
Homosalate		118-56-9
3-(2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxy-benzenepropanoic acid l	M1-UV328	84268-36-0
Dechloranes		
Dibromo-aldrin	DBA	20389-65-5
Dechlorane 601	Dec-601	3560-90-2
Dechlorane 602	Dec-602	31107-44-5
Dechlorane 603	Dec-603	13560-92-4
Dechlorane 604	Dec-604	34571-16-9
Dechlorane plus syn	syn-DP	135821-03-3
Dechlorane plus anti	anti-DP	135821-74-8
1,5-Dechlorane Plus monoadduct	1,5-DPMA	Not available
1,3-Dechlorane Plus monoadduct	1,3-DPMA	Not available
Chlordene Plus		13560-91-3
Quaternary ammonium compounds		
Dimethyldioctylammonium	DADMAC-C8	3026-69-5

Didecyldimethylammonium	DADMAC-C10	2390-68-3
Didodecyldimethylammonium	DADMAC-C12	3282-73-3
Dimethylditetradecylammonium	DADMAC-C14	68105-02-2
Dihexadecyldimethylammonium	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
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
Pesticides/Fungicides		
Chlorohexidine		55-56-01
Brodifacoum		56073-10-0
Bromodiolone		28772-56-7
Difenacoum		56073-07-5
Difethialone		104653-34-1
Flocumafen		90035-08-8
Chlorpyrifos		2921-88-2
Tebuconazole		107534-96-3
Permethrin		52645-53-1
Triclocarban		101-20-2
Triclosan		3380-34-5

Musks		
Traseolide		68140-48-7
Phantolide		15323-35-0
OTNE		54464-57-2
Acetyl cedrene		32388-55-9
Galaxolide		1222-05-5
AHMT		1506-02-1
Celestolide		13171–00–1
Tonalide		21145–77–7
Benzothiazoles		
Mercaptobenzothiazole	MBT	149-30-4
benzotriazole	BTZ	95-14-7
Benzothiazole	BT	95-16-9
2(3H)-Benzothiazolone	OHBT	934-34-9
metyl-1H-benzotriazole	MeBTZ	29385-43-1
N-cyclohexylbenzothiazole-2-sulfenamide	CBS	95-33-0
5-Chlorobenzotriazole	Cl-BTZ	94-97-3
N-(1,3-Dimethylbutyl)-N'-phenyl-p-phenylenediamine-quinone	66PPDQ	
Phthalates		
Bis(2-ethylhexyl) phthalate	DEHP	117-81-7
Diisononyl phthalate	DINP	28553-12-0
Diisodecyl phthalate	DIDP	68515-49-1
Dioctyl phthalate	DOP	117-84-0
Butylbenzyl phthalate	BBP/BBzP	85-68-7
Diethyl phthalate	DEP	84-66-2
Diundecyl phthalate, branched and linear	DiUnP	85507-79-5
Dihexylphthalate	DHP/DHxP	84-75-3
Dicyclohexyl phthalate	DcHP	84-61-7
Diisobutyl phthalate	DBP/DIBP	84-69-5
Diundecyl phthalate	DiUnP	3648-20-2
Di-n-butyl phthalate	DBP/DNBP	84-74-2

Chlorinated paraffins		
Short-chain chlorinated paraffins (C10-C13)	SCCP	85535-84-8
Medium-chain chlorinated paraffins (C14-C17)	MCCP	85535-85-9
Support parameters		
Stable isotopes δ^{15}N, δ^{13}C		
Lipid content (biota)		
Age determination (fish)		
Length/weight (fish)		
TOC (sediment) and pH		
Grain size distribution (sediment)		

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

Figure 19 shows the 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 1.7 trophic levels higher, assuming an increase in $\delta^{15}N$ between integer trophic levels, $\Delta^{15}N$, of 3.7). There was no significant relationship between $\delta^{15}N$ and fish length for any of the species (see electronic Appendix).

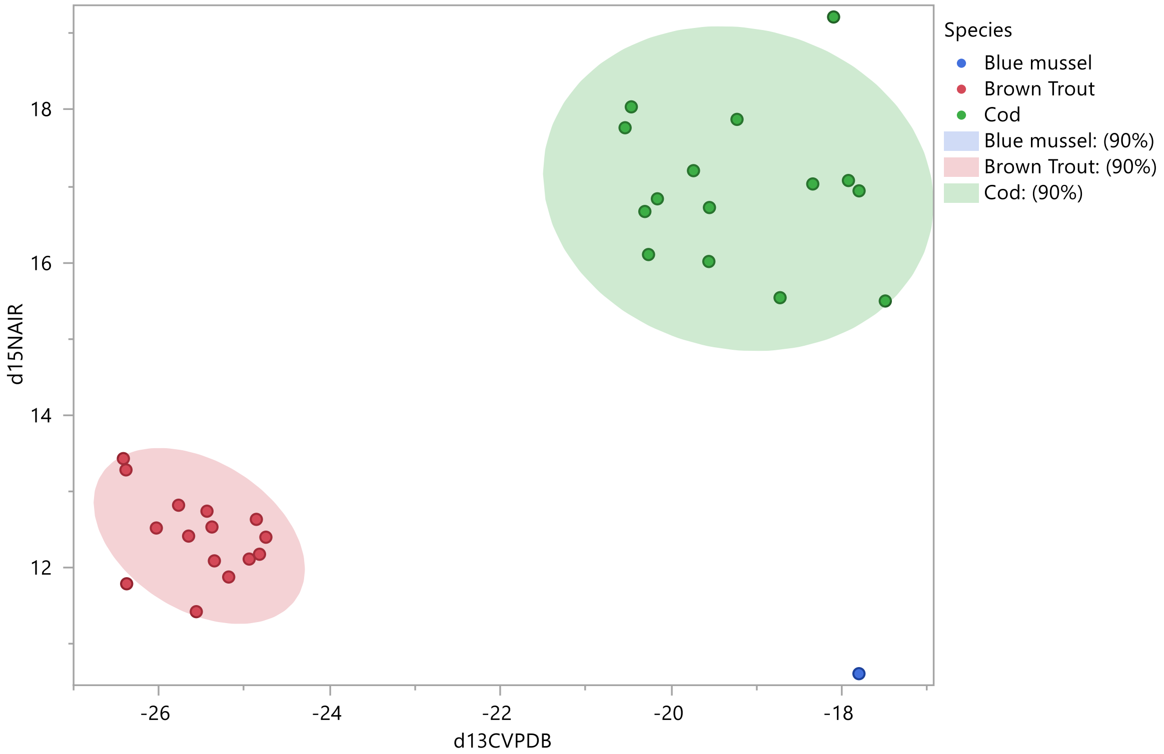

Figure 19. $\delta^{15}N$ plotted against $\delta^{13}C$ in individual samples of cod from the Inner Oslofjord and brown trout from Alna River, as well as in a pooled sample of blue mussel from the Inner Oslofjord. The 90% confidence areas are indicated.

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

A. (Cod)

Ind. No.	$\delta^{13}C$	$\delta^{15}N$	W%C	W%N	Part of pooled sample	Length (cm)	Weight (g)	Sex	Age (Yr)	Trophic Level
1	-17.93	17.07	47.05	14.55	1	41.2	645.2	M	2	3.7
2	-19.56	16.01	47	14.47	1	42.2	688.9	F	2	3.42
3	-18.73	15.54	47.11	15.82	1	40	619.7	M	2	3.3
4	-20.27	16.1	47.28	16.15	1	37.5	531.6	M	2	3.45
5	-17.8	16.94	47.44	13.75	1	41.5	614.3	F	3	3.67
6	-20.47	18.04	45.69	12.6	2	37.2	480.1	F	2	3.96
7	-19.74	17.2	46.34	13.69	2	35.1	421.7	M	2	3.74
8	-18.34	17.03	46.79	13.58	2	36.2	475	F	2	3.69
9	-17.5	15.49	48.27	17.41	2	34.1	430.3	M	2	3.29
10	-18.1	19.22	47.5	13.58	2	37.4	441.9	M	2	4.27
11	-20.31	16.67	46.34	13.17	3	33.1	395.3	F	1	3.59
12	-19.23	17.87	46.76	13.32	3	33.2	359.3	M	2	3.91
13	-20.16	16.83	46.07	13.82	3	33.9	353.2	M	2	3.64
14	-20.54	17.77	51.35	11.96	3	33	348.1	F	3	3.88
15	-19.55	16.72	47.04	13.21	3	31.7	323.3	M	2	3.61

B. (Trout)

Ind. No.	$\delta^{13}C$	$\delta^{15}N$	W%C	W%N	Part of pooled sample	Length (cm)	Weight (g)	Sex	Age (Yr)
A1	-26.38	11.79	51	14.18	1	15.8	47	F	2
A2	-24.75	12.4	48.13	14.54	1	17.7	58	M	2
A3	-25.38	12.53	48.74	14.03	1	15.3	32	F	2
A4	-26.39	13.28	48.5	13.03	1	14.3	32	F	2
A5	-26.42	13.43	49.21	13.03	1	16.5	37	F	2
A6	-25.44	12.74	50.63	14.61	2	19.6	94	M	3
A7	-24.86	12.63	48.35	13.46	2	21	139	M	4
A8	-24.82	12.17	48.49	14.88	2	20.2	106	F	3
A9	-25.35	12.09	50.53	14.27	2	18.8	95	M	3
A10	-25.77	12.82	47.81	12.82	2	19.4	96	M	3
A11	-25.18	11.87	50.52	14.41	3	23.9	219	M	4
A12	-24.94	12.11	49	13.63	3	26.8	257	F	4
A13	-25.65	12.41	50.44	12.31	3	24.2	200	F	4
A14	-25.56	11.42	49.98	12.82	3	27	251	F	4
A15	-26.03	12.52	51.56	13.47	3	31.6	370		5

C. (Blue mussel)

$\delta^{13}C$	$\delta^{15}N$	W%C	W%N	Trophic Level
-17.8	10.61	32.89	5.43	2

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