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Summary

This programme, "Environmental Contaminants in an Urban Fjord" has covered sampling and analysis of sediment and organisms in a marine food web of the Inner Oslofjord, in addition to samples of blood and eggs from herring gull. The programme also included inputs of pollutants via surface water (storm water). The bioaccumulation potential of the contaminants in the Oslo fjord food web was evaluated. The exposure to/accumulation of the contaminants was also assessed in herring gull, as an indicator of an urban fjord inhabitant. A vast number of chemical parameters have been quantified, in addition to some biological effect parameters in cod, and the report serves as valuable documentation of the concentrations of these chemicals in different compartments of the Inner Oslofjord marine ecosystem. Furthermore, this report presents relationships between the contaminant concentrations and various biological variables.

4 emneord

Miljøgifter, urban, næringskjede, bioakkumulering

4 subject words

Contaminants, Urban areas, Food web, Bioaccumulation

Front page photo

Anders Ruus

Foreword

The programme covers sampling and analysis of organisms in a marine food web of the Oslofjord in 2015 in addition to samples of blood and eggs of herring gull. The programme also includes inputs of pollutants via surface water (storm water). Results from other monitoring programmes such as "Contaminants in coastal areas" (MILKYS) and "Riverine inputs and direct discharges to Norwegian coastal waters" (RID), as well as results from other input measurements to the inner Oslofjord, and measurements of contaminants at sewage treatment plants are also considered, when relevant. 2015 represents the third year of the Urban Fjord programme, and some changes/improvements have been made in the design since 2014.

The study was carried out by NIVA, with a majority of the chemical analyses performed by the Norwegian Institute for Air Research, NILU. Collection of herring gulls was done with assistance from the University of Oslo (Morten Helberg, Centre for Ecological and Evolutionary Synthesis).

Besides the authors of this report, several persons are acknowledged for their contribution in sample collection, sample preparation and analysis: Thomas Rundberget, Daniela M. Pampanin, Ingar Johansen, Sigurd Øxnevad, Norman Green, Alfhild Kringstad, Camilla With Fagerli, Katherine Langford, David Eidsvoll, Marthe Torunn Solhau Jenssen, Pawel Rostowski, Mikael Harju, Hilde Uggerud, Marit Vadset, Inger-Christin Steen, Carsten Lome, Katrine Borgå, Ane Haarr, Robin Cristofari and Hilde Karin Midthaug.

Oslo, august 2016

Anders Ruus
Forsker I, Marin Forurensning

Sammendrag

Dette programmet, "Miljøgifter i en Urban Fjord" har omfattet prøvetaking og analyse av sediment og organismer i en marin næringskjede i Indre Oslofjord i 2015, i tillegg til prøver av blod og egg fra gråmåke. Programmet omfattet også undersøkelser av tilførsler av miljøgifter via overvann.

Målet med programmet var å undersøke tilførsler av miljøgifter som er tilstede i et tett befolket område og studere hvordan disse påvirker et fjordsystem. Denne undersøkelsen er ett skritt mot Miljødirektoratets generelle mål om å:

- Anslå graden av bioakkumulering av utvalgte miljøgifter på flere trofiske nivåer i marine næringskjeder.
- Koble eksponeringen av miljøgifter på marine organismer til toksiske effekter på ulike biologiske nivåer, inkludert hormonforstyrrende effekter og interaksjonseffekter ("cocktaileffekter").
- Identifisere kilder og sluk for miljøgifter i fjordsystemer ("skjebnen" til miljøgifter i en fjord), og utforme målrettede tiltak.

Intensjonen er videre at data skal brukes i internasjonale miljøgiftreguleringer, som REACH og Stockholmkonvensjonen. Dessuten skal programmet frembringe data som vil være til hjelp i å gjennomføre kravene i Vanndirektivet ("Vannforskriften") i forbindelse med statlig basisovervåking. 2015 er det tredje året "Miljøgifter i en Urban Fjord" har vært gjennomført og det ble gjort noen forandringer/forbedringer i design/innhold av programmet, siden 2014.

Bioakkumuleringspotensialet til de ulike miljøgiftene i Oslofjord-næringsnettet er undersøkt. Eksponering for/akkumulering av disse stoffene er også undersøkt i gråmåke, som representant som «urban innbygger». Konsentrasjoner av et stort antall kjemiske parametere er kvantifisert i denne undersøkelsen, i tillegg til enkelte biologisk effekt-parametere i torsk. Rapporten fungerer som verdifull dokumentasjon av konsentrasjonene av ulike kjemikalier i ulike deler («compartments») av det marine økosystemet i Indre Oslofjord. Videre presenterer denne rapporten sammenhenger mellom konsentrasjoner av ulike stoffer og forskjellige biologiske variabler.

Noen endringer/forbedringer har blitt gjort i utformingen av programmet siden 2014, og resultatene av stabile isotoper tyder på at dette har vært vellykket, da forskjellene i $\delta^{15}N$ synes å reflektere forventede trofiske relasjoner. Biomagnifiseringspotensialet til stoffene ble evaluert ved beregning av trofiske magnifiseringsfaktorer (TMF) og eldre miljøgifter med kjente biomagnifiserende egenskaper viste positive sammenhenger mellom ($\log_{10}$-) konsentrasjoner og trofisk posisjon.

De følgende biologiske effektparameterne ble målt i torsk: Gonade-histopatologi, vitellogenin i blodplasma, micronucleii (i blodceller), aktivitet av acetylkolinesterase (AChE) i muskel (mikrosomal fraksjon), samt de fysiologiske parameterne leversomatisk indeks (LSI) og gonadosomatisk indeks (GSI). Angående gonade-histopatologi ble det konkludert med at det bare var tre individer med patologiske forandringer i gonadene (granulomatøs inflammasjon), og bare ett av dem viste det på et moderat stadium. Som forventet var konsentrasjoner av VTG høyere i hunner, enn i hanner, og variasjonen var høy. Det var en positiv sammenheng

mellom GSI og VTG hos hunner. Micronucleii ble bare påvist i fire individer av torsk. Videre ble bare en mikronukleus funnet per 2000 undersøkte celler i hver av disse fire individene.

Co- linearitet blant variablene ble ofte funnet, noe som gjorde det vanskelig å konkludere vedrørende sannsynlig kausalitet (årsakssammenheng). For eksempel viste aktiviteten av acetylkolinesterase (AChE) i torskemuskel negative sammenhenger med lengde, vekt og alder av torsk. Kvikksølv (Hg) korrelerte også med lengde og vekt av torsk, og det var (derfor ikke overraskende) også en negativ sammenheng mellom konsentrasjonen av Hg og aktivitet av AChE hos torsk. Andre har tidligere vist en negativ sammenheng mellom kvikksølv og AChE-aktivitet i fisk, men man kan ikke her utelukke en direkte sammenheng mellom fiskestørrelse og AChE-aktvitet.

Som tidligere observert ble en positiv sammenheng funnet mellom eggeskalltykkelse og trofisk posisjon av måkeegg, noe som tyder på at skalltykkelsen av egg ikke ble påvirket negativt av stoffer som øker i konsentrasjon med høyere nivå i næringskjeden.

En potensiell risiko (kumulativ risiko/blandingstoksisitet) for sekundær forgiftning (altså gjennom oralt inntak av bytteorganismer) ble identifisert for fugler som kan beite på blåskjell, børstemark og sild. Basert på foreliggende datagrunnlag ble kvikksølv identifisert som en felles risikodriver blant de ulike bytteorganismene. I tillegg var kadmium en felles risikodriver i blåskjell og børstemark. En potensiell risiko for gråmåke ble identifisert på grunnlag av målte konsentrasjoner i egg og effektdata fra eksponering i egg. De viktigste risikodriverne for effekter i gråmåke var de organiske forbindelsene bisfenol A, 4-nonylfenol og BDE-99. Alle data vedrørende risiko for kombinerte effekter bør tolkes med forsiktighet på grunn av begrenset datamateriale og usikkerhet knyttet til bruk av bioakkumulerte konsentrasjoner.

For en sammenligning av forurensningsnivåer av måker i denne studien med andre undersøkelser av gråmåke, kan følgende bemerkes: PBDE og siloksaner i gråmåkeegg fra Oslofjord-området viste konsentrasjoner som var høyere enn de som nylig ble observert i gråmåkeegg fra mer fjerntliggende marine kolonier i Norge (Sklinna og Røst). På den annen side var konsentrasjoner av de mer klassiske miljøgiftene p,p′-DDE, PCB og kvikksølv i gråmåkeegg fra Oslofjord-området lavere enn de nylig rapporterte konsentrasjonene av disse stoffene i gråmåke fra Sklinna og Røst. Disse resultatene indikerer akkumulering av høyere konsentrasjoner av persistente miljøgifter forbundet med diffus forurensning (ikke urbane aktiviteter) i måker som beiter i større grad på byttedyr i den marine næringskjeden. På den annen side akkumulerer måker fra urbane miljøer høyere konsentrasjoner av PBDE og siloksaner. Det er sannsynlig at avfall fra menneskelig aktivitet kan være en viktig kilde til disse stoffene i urbane måker.

Summary

This programme, “Environmental Contaminants in an Urban Fjord” has covered sampling and analysis of sediment and organisms in a marine food web of the Inner Oslofjord in 2015, in addition to samples of blood and eggs from herring gull. The programme also included inputs of pollutants via surface water (storm water).

The objective of the programme was to monitor the inputs of chemicals present in a densely populated area and to study how this contaminant input affects a fjord system. The present study represents one step towards the Norwegian Environment Agency’s general aim to:

- Estimate the degree of bioaccumulation of selected contaminants at several trophic levels in marine food chains.
- Connect pollutant exposure of marine organisms to toxic effects at different biological levels, including endocrine disruption and contaminant interactions ("cocktail effects").
- Identify sources and sinks (i.e. the fate) of environmental contaminants in fjord systems and design targeted actions.

Furthermore, there is an intention that data will be used in international chemical regulation, such as REACH and the Stockholm Convention. The programme was also meant to provide data from governmental monitoring in Norway to comply with the requirements of Water Framework Directive (The Water Regulation/“Vannforskriften”). 2015 represents the third year of the Urban Fjord programme, and some changes/improvements have been made in the design since 2014.

The bioaccumulation potential of the contaminants in the Oslo fjord food web was evaluated. The exposure to/accumulation of the contaminants was also assessed in herring gull, as an indicator of an urban fjord inhabitant. A vast number of chemical parameters have been quantified, in addition to some biological effect parameters in cod, and the report serves as valuable documentation of the concentrations of these chemicals in different compartments of the Inner Oslofjord marine ecosystem. Furthermore, this report presents relationships between the contaminant concentrations and various biological variables.

Some changes/improvements have been made in the design of the programme since 2014 and the results of the stable isotope analysis suggest that this has been successful, as the differences in $\delta^{15}N$ seem to reflect expected trophic relationships. The biomagnifying potential of contaminants were evaluated by calculation of Trophic Magnification Factors (TMFs) and several legacy contaminants with well-known biomagnifying properties displayed a positive significant relationship between (log_{10}-)concentrations and trophic position.

The following biological effect parameters were measured in cod: Gonad histopathology, vitellogenin (VTG) in blood plasma, micronucleii (in blood cells), acetylcholinesterase (AChE) activity in muscle (microsomal fraction), as well as the physiological parameters liversomatic index (LSI) and gonadosomatic index (GSI). Regarding gonad histopathology, it was concluded that there were only 3 individuals with pathological changes in gonads (granulomatous inflammation), and only one of them had it at a moderate stage. As expected, concentrations of VTG were higher in females, than in males, and variation was high. There was a positive

relationship between GSI and VTG in females. Micronucleii were only detected in four cod individuals. Furthermore, only one micronucleus was detected per 2000 counted cells in each of these four individuals.

Co- linearity among variables was often found, rendering results inconclusive regarding likely causality. For instance, acetylcholinesterase (AChE) activity in the muscle of cod showed negative relationships with length, weight and age of cod. Mercury (Hg) also correlated with length and weight of cod, thus expectedly a statistically significant negative relationship was observed between the concentration of Hg and AChE in cod. Others have previously shown a negative relationship between mercury and AChE activity in fish. However, one cannot here rule out a possible direct relation between fish size and AChE activity.

As previously observed, a positive relationship was found between the eggshell thickness and the trophic position of the herring gull eggs, suggesting that the shell thickness of eggs in the present study was not affected negatively by compounds that increase in concentration with higher trophic position.

A potential risk (cumulative risk/mixture toxicity) of secondary poisoning was identified for birds preying on blue mussels, polychaetes and herring. Based on the current data basis, mercury was identified as a common risk driver among the food sources. In addition, Cd was a common risk driver in blue mussels and polychaetes.

A potential risk to herring gull was identified based on measured concentrations in eggs and effect data from exposure in eggs. The main risk driver for effects in herring gull was the organic compounds bisphenol A, 4-nonylphenol and BDE-99. All data regarding risk of combined effects should be interpreted with caution due to limited data material and uncertainty connected with use of body burden concentrations.

For comparison of the contamination levels of gulls in the present study, the following can be noted: PBDEs and siloxanes in herring gull eggs from the Oslofjord area displayed concentrations that were higher than those recently observed in herring gull eggs from remote marine colonies in Norway (Sklinna and Røst). On the other hand, concentrations of p,p′-DDE, PCBs and mercury in herring gull eggs from the Oslofjord area were lower than those recently reported in herring gull eggs from the remote marine colonies. These results indicate accumulation of higher concentrations of persistent legacy contaminants associated with diffuse pollution (not urban activities) in gulls feeding more exclusively on items of the marine food web. On the other hand, gulls from urban environments accumulate higher concentrations of PBDEs and siloxanes. It is likely that waste and leftovers from human activities are an important source of these compounds in urban gulls.

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1. *Appendix: Support parameters (Tables A1-A6); concentrations in individual samples and composition of (calculated) pooled samples of cod; CAS-no.; report from IRIS on histopathological analysis of gonads in Atlantic cod.*

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. The programme contributes to the Norwegian Environment Agency's ongoing monitoring activity in coastal areas and supplements two other monitoring programmes: "RID - Riverine inputs and direct discharges to Norwegian coastal waters" and "MILKYS - Environmental contaminants in coastal areas".

1.1 Objectives

The environmental monitoring activity in the present programme contributes to the Norwegian Environment Agency's general aim to:

- Estimate the bioaccumulation of selected contaminants at several trophic levels in marine food chains.
- Connect pollutant exposure of marine organisms to toxic effects at different levels of biological organisation, including endocrine disruption and contaminant interactions ("cocktail effects").
- Identify sources and sinks of environmental contaminants in fjord systems ("the fate of the contaminants in a fjord") and designing targeted actions.

The programme will also provide data that will aid to implement the requirements of Water Framework Directive (The Water Regulation/"Vannforskriften") regarding governmental basic monitoring as well as used in international chemical regulation. The present report (2015) represents the third year of the Urban Fjord project, and some changes/improvements have been made in the design since 2014.

2. Material and Methods

2.1 Sample Collection

Polychaetes, zooplankton (krill), prawns, blue mussel, herring and cod were collected as representatives of a food chain in the inner Oslo Fjord. In addition, sediment was collected. The samples were collected in an area within 4.7 km from Steilene (Figure 1), the autumn of 2015. Herring gull (blood and eggs) was also sampled within the programme, as a representative of an urban fjord inhabitant. Table 1 shows the sampling plan of the programme.

2.1.1 Sediment

Sediment was collected at station Cm21 by means of a van Veen grab (0.15 m^2) from RV Trygve Braarud. Three samples of the top layer (0-2 cm in grab samples with undisturbed surface) were prepared[1].

2.1.2 Food web of the Inner Oslofjord

Polychaetes, zooplankton (krill), prawns, blue mussel, herring and cod were collected as representatives of a food chain in the inner Oslo Fjord.

Polychaetes were collected at station Cm21 (Figure 1) using a van Veen grab (0.15 m^2) from RV Trygve Braaarud. When possible (dependent on species and mechanical damage), the worms were held in a container of clean seawater for 6-8 hours prior to cryopreservation and analysis. This was done in order to allow the worms to purge any residual sediment from the gut. Material for three pooled samples was collected. The samples consisted of the species listed in Table 2.

Krill (*Euphausiacea*) were collected as representatives of the zooplankton by Midtmeie, southwest of Steilene (Figure 1). A fry trawl was operated from RV Trygve Braarud for this purpose. Material for three pooled samples was collected.

Prawns (*Pandalus borealis*) were caught with benthic trawl from RV Trygve Braarud in the same area as zooplankton (krill), Midtmeie, southwest of Steilene (Figure 1). Material for three pooled samples (of 75 individuals each; size: 69-102 mm) was collected.

Mussels were collected at Steilene (Figure 1) by standard procedures (as in "Contaminants in coastal areas", MILKYS; handpicked, using rake, or snorkelling).Three pooled samples (each of 22 shells; shell length 52 to 77 mm) was prepared.

Herring (*Clupea harengus*) were caught with trawl from RV Trygve Braarud at Midtmeie, southwest of Steilene (Figure 1). Material for three pooled samples (of 5 individuals in each; length: 26-29 mm, weight: 103-237 g) was collected.

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[1] According to the Norwegian Environment Agency guidelines for risk assessment of contaminated sediment (TA-2802/2011).

Cod (*Gadus morhua*) were caught with trawl from RV Trygve Braarud at Midtmeie, southwest of Steilene (Figure 1). Biometric data for the fish are given in Chapter 3.3.

2.1.3 Herring gull

Herring Gull (*Larus argentatus*) blood samples (from adult breeding individuals trapped at nest) and eggs (15 egg samples and 15 blood samples) were sampled by Morten Helberg (University of Oslo) and provided by the Norwegian Environment Agency. Biometric data for the birds are given in Chapter 3.3. The birds and eggs were sampled at Søndre Skjælholmen (Nesodden municipality; 59.85317 N, 10.7281 E). The blood samples were taken from adult birds trapped by walk-in trap placed at the nest, and the blood samples (~5 ml) were taken from a vein under the wing. For 13 birds, adult female and egg was sampled from the same nest.

2.1.4 Storm water

Storm water samples were collected at one occasion at four specific sampling points (Bryn Ring 3/E6, Breivoll/Alnabru terminal, Breivoll E6, downstream terminal and Hasle snow disposal site; Figure 1). The samples were collected from manholes by filling bottles directly in the storm water. Subsequently, the storm water 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)).

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

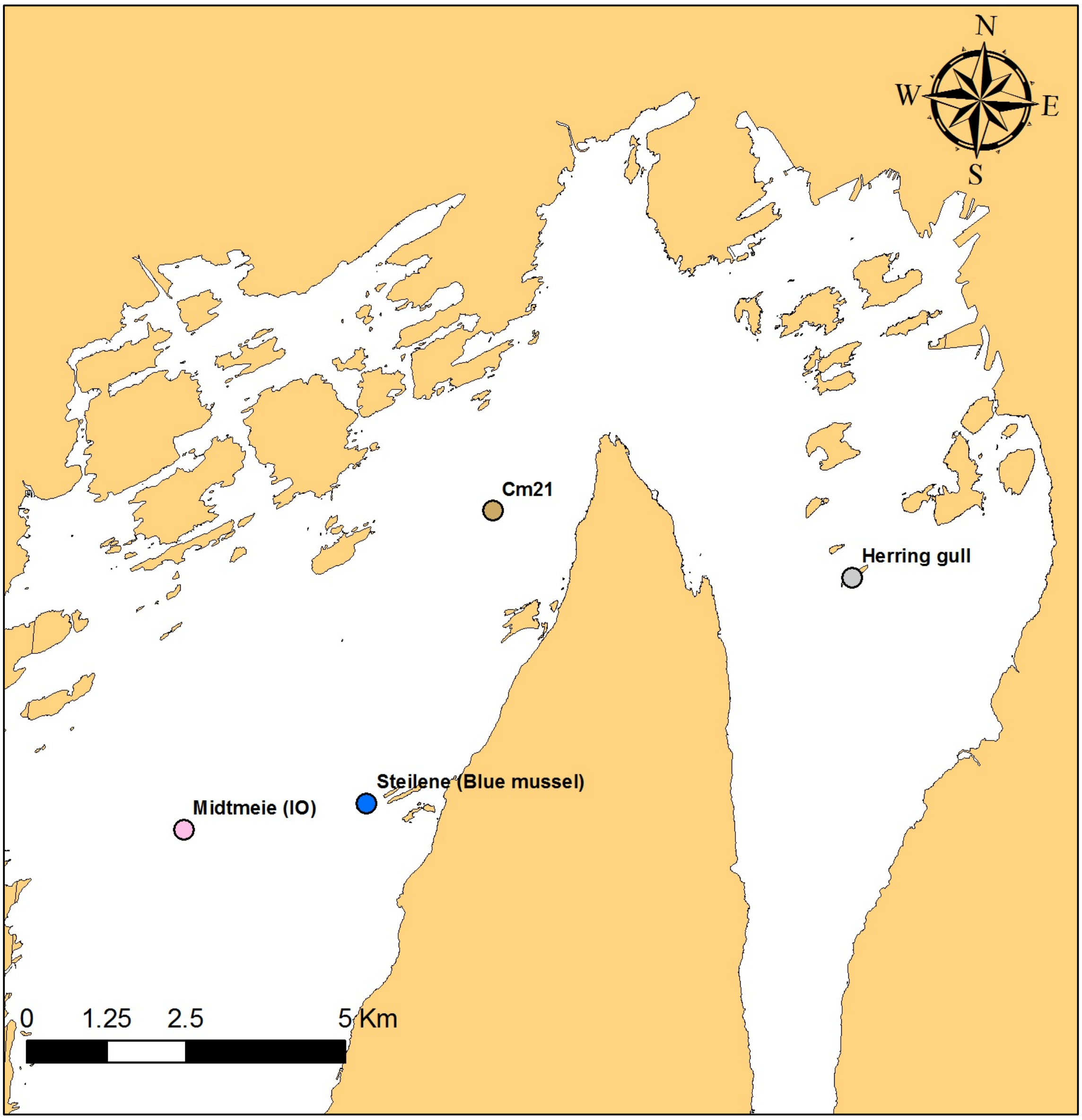
Species/matrix	Locality	Frequency	No. for analysis
Sediment	Cm21	Once per year	1
Polychaetes	Cm21	Once per year	3 pooled samples
Zooplankton	Midtmeie	Once per year	3 pooled samples
Prawns	Midtmeie	Once per year	3 pooled samples
Blue mussel	Steilene	Once per year	3 pooled samples
Herring	Midtmeie	Once per year	3 pooled samples
Cod	Midtmeie	Once per year	15 individuals
Herring gull (blood)	Søndre skjælholmen	Once per year	15 individuals
Herring gull (egg)	Søndre skjælholmen	Once per year	15 eggs
Inputs storm water	See Figure 1	Once per year	4 samples (4 samples of dissolved fraction plus 4 of particulate fraction)

Table 2.
Species constituting polychaete samples (grams of each species).

	Inner Oslofjord (Cm21)		
	Repl. 1	**Repl. 2**	**Repl. 3**
P.crassa	156		
Lumbrineridae			95
Terbellidae		125	
Aphrodita aculeata			96
Misc. *			100
Total (grams)	**156**	**125**	**291**

* *Inter alia*: *Nepthys, Glycera, Goniadidae, Nereididae*

A.



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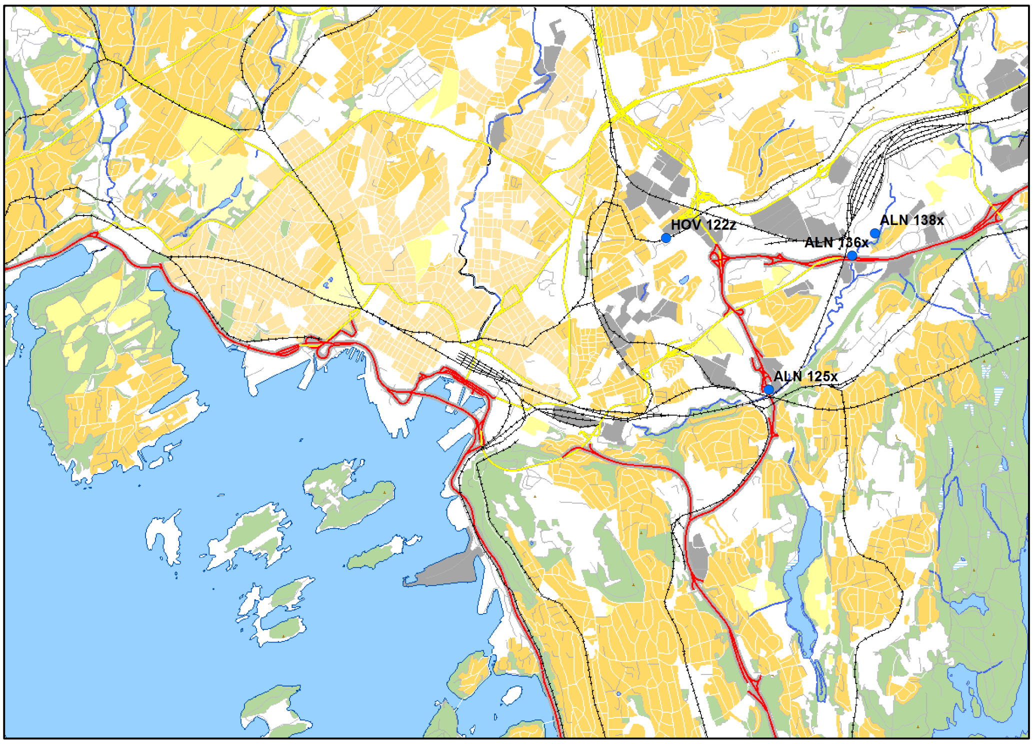

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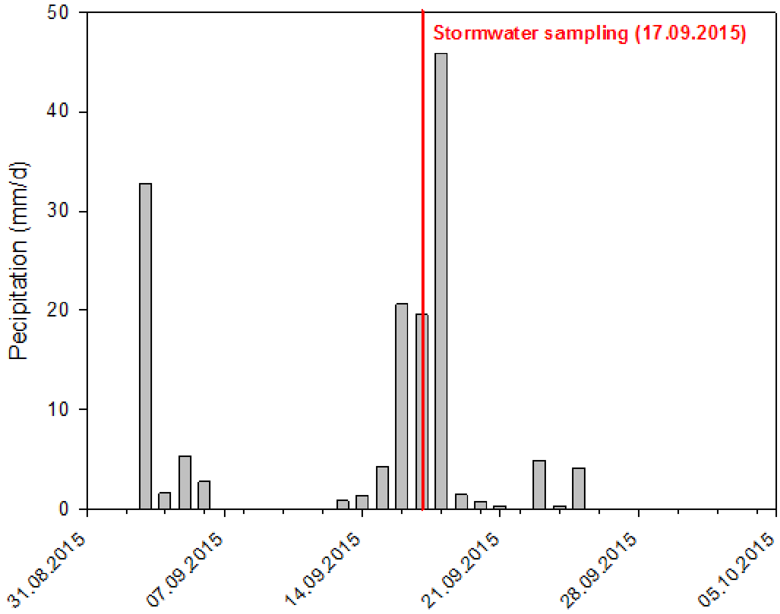


Figure 1. A.: (previous page) Map depicting stations for collection of sediment and polychaetes (Brown dot), blue mussel (blue dot), and krill, prawns, herring and cod (pink dot) in the Inner Oslofjord, as well as collection of herring gull eggs and blood (grey dot). B.: Map depicting sites for collection of storm water/surface water samples. C.: Overview of time of sampling of storm water/surface water in relation to rainfall (mm/d).

2.2 Chemical analysis, support parameters and biological effect parameters

Tables 3-5 provide a detailed overview of the compounds/parameters analysed in the different samples. The samples were analysed at NIVA, NILU and Eurofins. Stable isotopes of carbon and nitrogen were analysed at IFE.

Biological effect parameters (in cod) were also included in the programme (Table 6). These were analysed at NIVA, except for gonad pathology, which was assessed at IRIS.

Table 3.
Overview: analyses in different matrices from the different localities (original programme).

Species/matrix	Locality	Analytes
Sediment	Cm21	Metals, PCB, PFAS, Triclosan, Triclocarban, bisphenols DBDPE, TBBPA, octylphenol, nonylphenol, chloroparafins, UV-chemicals, siloxanes, PFR
Polychaetes	Cm21	Metals, PCB, PFAS, Triclosan, Triclocarban, bisphenols DBDPE, TBBPA, octylphenol, nonylphenol, chloroparafins, UV-chemicals, siloxanes, PFR
Zooplankton	Midtmeie	Metals, PCB, PFAS, Triclosan, Triclocarban, bisphenols DBDPE, TBBPA, octylphenol, nonylphenol, chloroparafins, UV-chemicals, siloxanes, PFR
Prawns	Midtmeie	Metals, PCB, PFAS, Triclosan, Triclocarban, bisphenols DBDPE, TBBPA, octylphenol, nonylphenol, chloroparafins, UV-chemicals, siloxanes, PFR
Blue mussel	Steilene	Metals, PCB, PFAS, Triclosan, Triclocarban, bisphenols DBDPE, TBBPA, octylphenol, nonylphenol, chloroparafins, UV-chemicals, siloxanes, PFR
Herring	Midtmeie	Metals, PCB, PFAS, Triclosan, Triclocarban, bisphenols DBDPE, TBBPA, octylphenol, nonylphenol, chloroparafins, UV-chemicals, siloxanes, PFR
Cod	Midtmeie	Metals, PCB, PFAS, Triclosan, Triclocarban, bisphenols DBDPE, TBBPA, octylphenol, nonylphenol, chloroparafins, UV-chemicals, siloxanes, PFR
Herring gull (blood)	Søndre skjælholmen	Metals, PCB, PFAS, Triclosan, Triclocarban, bisphenols DBDPE, TBBPA, octylphenol, nonylphenol, chloroparafins, UV-chemicals, siloxanes, PFR
Herring gull (eggs)	Søndre skjælholmen	Metals, PCB, PFAS, Triclosan, Triclocarban, bisphenols DBDPE, TBBPA, octylphenol, nonylphenol, chloroparafins, UV-chemicals, DDT, siloxanes, PFR
Inputs storm water	See Figure 1	Metals, PCB, PFAS, Triclosan, Triclocarban, bisphenols DBDPE, TBBPA, chloroparafins, UV-chemicals, PFR

* Dissolved and particulate fractions.

Table 4.
Analytes included in the programme. (See the Appendix for CAS-no.). Additional compounds are indicated.

Parameter	Single compounds
Metals	Hg, Pb, Cd, Ni, Ag, Cu (plus Cr, Zn, Fe, As)
PCB	PCB-28, -52, -101, -118, -138, -153, -180 (plus -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)
PFAS	PFBS, PFHxS, PFOS, PFOSA, 6:2 FTS, 8:2 FTS (plus 4:2 FTS, PFDS, PFDoS, N-EtFOSE, N-MeFOSE, N-EtFOSA, N-MeFOSA, N-MeFOSAA, N-EtFOSAA) Perfluorinated carboxylic acids (6-14 C-atoms): PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnA, PFDoA, PFTrA, PFTeA, PFPeA (plus PFBA, PFPA)
Triclosan and Triclocarban	3380-34-5 and 101-20-2
Brominated flameretardants	Decabromodiphenyl ethane (DBDPE), Tetrabromobisphenol A (TBBPA) (plus 23 polybrominated diphenyl ethers, PBDEs).
Bisphenols	Bisphenol A, bisphenol S, bisphenol F (plus bisphenol AF, AP, B, E, FL, M, Z) (Bisphenol F is also separated in 2,2'- and 4,4'-)
Octyl-/nonylphenol	Octyl-/nonylphenol (isomer-spesifc, i.e. we separate 4- and 4-tert)
UV-chemicals	Octocrylene, benzophenone-3, ethylhexylmethoxycinnamate
Chloroparaffins	SCCP (C10-C13) and MCCP (C14-C17)
ΣDDT	p,p'-DDT, p,p'-DDE, p,p'-DDD (plus o,p'-DDT, o,p'-DDE, o,p'-DDD og α-, β- and γ-HCH)
Siloxanes	Octamethylcyclotetrasiloxane (D4), decamethylcyclopentasiloxane (D5), dodecamethylcyclohexasiloxane (D6)
Phosphorus flame retardants (PFR)	tri-iso-butylphosphate (TIBP), tributylphosphate (TBP), tri(2-chloroethyl)phosphate (TCEP), tri(1-chloro-2-propyl)phosphate (TCPP), tri(1,3-dichloro-2-propyl)phosphate (TDCP), tri(2-butoxyethhyl)phosphate (TBEP), triphenylphosphate (TPhP), 2-ethylhexyl-di-phenylphosphate (EHDPP), dibutylphenylphosphate (DBPhP), butyldiphenylphosphate (BdPhP), tris(2-ethylhexyl)phosphate (TEHP), tris-o-cresylphosphate (ToCrP), tricresylphosphate (TCrP)

Table 5.
Supportparameters included in the programme

Parameter	Specific single parameters	Comment
Stable isotopes	$\delta^{15}N$ and $\delta^{13}C$ (and $\delta^{34}S$ in herring gull)	In biological matrices
Eggshell thickness	Eggshell thickness	In egg
Lipid content (%) in biota		In biological matrices
Weight and length		Fish
Age		Cod
Grain size distribution	Fraction <63 µm	Sediment
TOC		Sediment

Table 6.
Biological effect parameters (in cod)

Parameter	Indicator of
Gonad histopathology	Effects on gonads
Vitellogenin (VTG)	Compounds with oestrogenic (or anti-oestrogenic) effect
Micronucleii	Chromosome break/genotoxicity
Acetylcholin esterase (AChE)	Inhibition by contaminants such as organophosphates
Other relevant physiological parameters: **Liversomatic index** **Gonadosomatic index**	

2.2.1 Analysis of metals

Metal analyses were performed by NILU.

Sample Preparation

Sediment- and biota-samples were added supra pure acid and digested at high pressure and temperature in a microwave- based digestion unit (UltraClave). A minimum of two blanks were included with each digestion. Furthermore, reference material (traceable to NIST) was digested with the samples.

Water samples were preserved in original bottles with 1% (v/v) nitric acid.

Instrumental Analysis

Concentrations of nickel (Ni), cadmium (Cd), mercury (Hg), lead (Pb), silver (Ag) and copper (Cu) were determined using inductively coupled plasma mass spectrometer (ICP-MS). All samples, standards and blanks were added internal standard prior to analysis. In addition, Chromium (Cr), zinc (Zn), iron (Fe) and arsenic (As) were determined.

Limits of Detection

Detection limits (LoD) and Quantification limits (LoQ) were calculated from 3 times and 10 times the standard deviation of blanks, respectively.

2.2.2 Analysis of PCBs, DDT, S/MCCP and DBDPE

Polychlorinated biphenyls (PCBs), DDT, short- and medium chained chloroparaffins (S/MCCP) and decabromodiphenyl ethane (DBDPE) were analysed by NILU. The analysis was extended to include additional PCB- DDT- hexachlorocyclohexane- (HCH) and polybrominated diphenylether- (PBDE) compounds (Table 4).

Extraction

Prior to extraction, the samples were added a mixture of isotope labelled PCBs, and DDT standards, for quantification purposes.

The water-, sediment-and biota-samples were extracted with organic solvents and concentrated under nitrogen flow, followed by a clean-up procedure using concentrated sulphuric acid and a silica column to remove lipids and other interferences prior to analysis.

Analysis

The compounds were quantified on GC-HRMS (Waters Autospec).

Limits of Detection

The limits of detection (LoD) and quantification (LoQ) were calculated for each sample, using the accepted standard method, i.e. the average of blanks plus 3 and 10 times the standard deviation for blanks, for LoD and LoQ, respectively.

Quality assurance and accreditation

NILU's laboratories are accredited by Norwegian Accreditation for ISO/IEC 17025. NILU is accredited for the analysis of PCBs and DDT compounds. For the other compounds, the same quality assurance procedures (as for the accredited compounds) were applied.

2.2.3 Analysis of PFAS

Per- and polyfluorinated substances (PFAS) were analysed by NIVA

Extraction

Prior to extraction, the samples were added a mixture of isotope labelled PFAS, for quantification purposes. Sediment and biota samples were extracted twice with acetonitrile and the extracts were cleaned using active coal if needed. Water samples were concentrated and cleaned up using an SPE column.

Analysis

PFAS compounds were analysed using LC/QToF (ESI negative mode).

Limits of Detection

The limits of detection (LoD) and quantification (LoQ) were calculated for each sample, using the accepted standard method; three times the signal/noise ratio (z/n) and 9 times z/n, respectively.

Quality assurance and accreditation

NIVA's laboratory is accredited by Norwegian Accreditation for ISO/IEC 17025. NIVA is not accredited for these particular compounds, but to the extent possible, documentation, preparation, analysis and calculations are performed in accordance with accredited methods. NIVA has previously participated in intercalibrations, e.g. organized by UNEP-coordinated Global Inter Laboratory Assessment, with good results (z-score<2 for PFOS, PFOSA, PFHxs and PFDS).

Samples were analysed in groups with at least one additive standard sample and a blank control. To ensure repeatability, a random sample from each matrix was selected for duplicate analysis.

2.2.4 Analysis of alkylphenols and bisphenols

Alkylphenols and bisphenols (octylphenol, nonylphenol, bisphenol A, bisphenol S, bisphenol F and tetrabromobisphenol A, TBBPA) were analysed by NILU. The analysis was extended to include additional phenolic compounds (Table 4).

Extraction

Prior to extraction, the samples were added a mixture of isotope labelled bisphenols and alkylphenols for quantification purposes.

The sediment samples were extracted with accelerated solvent extraction (ASE) and to remove interferences further cleaned with SPE column. Biota-samples were extracted with organic solvents and concentrated under nitrogen flow. Then they were further cleaned with liquid-liquid extraction and an SPE column to remove lipids and other interferences prior to analysis. In addition, prior to the extraction and clean-up procedure for biota, liver samples were subjected to an enzyme digestion procedure in order to convert possible Phase II metabolites of phenolic compounds into their respective free forms. Water samples were concentrated and purified on a SPE column. After elution from the SPE column, the water sample extracts were further concentrated under nitrogen and subjected to instrumental analysis.

Analysis
All samples were analysed by LC-QToF (Agilent 65/50).

Limits of Detection
The limits of detection (LoD) and quantification (LoQ) were calculated for each sample, using the accepted standard method, i.e. the average of blanks plus 3 and 10 times the standard deviation for blanks, for LoD and LoQ, respectively. Due to the lack of internal standards relevant to additional bisphenols included in Table 4, the results are semi-quantitative.

Quality assurance and accreditation
NILU's laboratories are accredited by Norwegian Accreditation for ISO/IEC 17025. NILU is not accredited for the analysis of alkylphenols and bisphenols, but as far as possible, the documentation, sample preparation, analysis and calculation procedures were conducted according to the accredited methods.

2.2.5 Analysis of UV-chemicals and anti-bacterial compounds
UV-chemicals (octocrylene, benzophenone and ethylhexylmethoxycinnamate) and anti-bacterial compounds (Triclosan and Triclocarban) were analysed by NIVA

Extraction of UV-chemicals and Triclosan
Blood and egg samples were extracted first with acetonitrile and then with hexane. The rest of the biota samples were extracted with a mix of isopropanol and cyclohexane. All samples except blood samples were cleaned up using gel permeation chromatography (GPC), before analysis. Some of the samples were also purified using PSA (silica) and/or SPE (Fluorisil). Sediment samples were extracted twice with dichloromethane and the water samples were extracted with SPE (HLB).

Analysis of UV-chemicals and Triclosan
UV-chemicals and triclosan were analysed using GC-HRMS (Waters GCT Premier) or GC-MSD EI, SIM mode (Agilent 6890N, 5973N MSD).

Extraction of triclocarban
Prior to extraction, the samples were added a deuterated internal standard, for quantification purposes. Sediment and biota samples were extracted twice with acetonitrile and the extracts were cleaned using active coal if needed. Water samples were concentrated and cleaned up using an SPE column.
Sediment samples were extracted twice with dichloromethane and the water samples were extracted with SPE (HLB).

Analysis of triclocarban
Triclocarban was analysed using LC/QToF (ESI negative mode).

Limits of Detection
The limits of detection (LoD) and quantification (LoQ) were calculated for each sample, using the accepted standard method; three times the signal/noise ratio (z/n) and 9 times z/n, respectively.

Quality assurance and accreditation
Samples were analysed in groups with at least one additive standard sample and a blank control.

2.2.6 Analysis of siloxanes

Siloxanes, i.e. octamethylcyclotetrasiloxane (D4), decamethylcyclopentasiloxane (D5), and dodecamethylcyclohexasiloxane (D6) were analysed by NILU – Norwegian Institute for Air Research.

Extraction
Sediment and biota tissues were extracted using sold-liquid extraction with a biphasic solvent system of acetonitrile and hexane. Extraction of water samples was performed using headspace extraction

Analysis
Collected extracts from sediment and biota tissues were analysed using Concurrent solvent recondensation large volume injection gas chromatography mass spectrometry (CSR-LVI-GCMS; Companioni-Damas et al. 2012). For water analysis, 2 ml of extracted headspace was directly injected onto a GCMS (Sparham et al. 2008).

Limits of Detection
The limits of detection (LoD) and quantification (LoQ) were calculated for each sample using the accepted standard method, i.e. the average of blanks plus 3 and 10 times the standard deviation for blanks, for LoD and LoQ, respectively.

Quality assurance and accreditation
NILU has extensive experience with analysis of siloxanes. The greatest risk in the analysis is background contamination, as these chemicals (D4, D5 and D6) are applied in e.g. skin care products. Using a state-of-the-art cleanroom and clean bench technologies, NILU is capable of performing trace analysis of these compounds in matrices from pristine environments, including the Arctic (Krogseth et al. 2013; Warner et al. 2013).

NILU's laboratories are accredited by Norwegian Accreditation for ISO/IEC 17025. NILU is not accredited for the analysis of siloxanes. However, to the extent possible, documentation, preparation, analysis and calculations were performed in accordance with accredited methods. NILU has previously participated in a laboratory intercalibration of siloxanes (McGoldrick et al. 2011) and has also worked closely with the industry in Artic monitoring programs to develop methods to enhance result accuracy and limit reporting of false positives (Warner et al. 2013).

Samples were extracted and analysed in batches with a minimum of 3 procedural blanks to assess background contamination and calculate LOD and LOQ per extraction batch. As the sample matrix can contribute to the overall background response, procedural blanks were run both before and after samples to ensure results were above detection limits and not an artefact of background variation.

Field blanks were used to assess any potential contamination that occurred during sample collection and preparation. Each field blank consisted of approximately 3 grams of XAD-2 sorbent in filter bags of polypropylene/cellulose. XAD-2 sorbent was cleaned using a 1:1 mixture of hexane:dichloromethane and dried overnight in a clean cabinet equipped with a HEPA- and charcoal filter to prevent contamination from indoor air. Filter bags were cleaned by ultrasonic treatment in hexane for 30 min. Subsequently, hexane was removed and substituted with clean dichloromethane and the field blanks were sonicated once more for 30 min. After ultrasonic treatment, filter bags were placed in a clean cabinet to dry under similar conditions as the XAD-2 sorbent. Once dry, XAD-2 sorbent was transferred to filter bags and sealed in polypropylene containers to be sent for sampling purposes. Several field-blanks were stored at NILU's laboratories (hereafter called reference blanks) and analysed to determine reference concentrations before sampling. The field blanks sent for sampling purposes were exposed and handled in the field during sampling and during preparation of samples. The results from the analysis of the field blanks are presented in Table 7.

Table 7.
Results of the analysis of siloxanes in (field and reference) blanks, consisting of XAD resin in filter bags of polypropylene/cellulose.

Description of sampling/purpose	D4 (ng/g) *	D5 (ng/g)	D6 (ng/g)
Reference blank 1	286.2	6.8	2.4
Reference blank 2	266.1	4.9	1.5
Reference blank 3	214.2	5.1	2.2
Mean (reference blanks)	**255.5**	**5.6**	**2.0**
Standard deviation (reference blanks)	**37.2**	**1.1**	**0.5**
Field blank 1	19.0	1.0	1.2
Field blank 2	43.9	1.0	0.8
Field blank 3	33.8	1.3	1.2
Field blank 1,6,10	23.4	2.5	1.3

* High background of D4 in reference blanks for unknown reasons, but field blanks show no contamination in the field and during sample preparation.

2.2.7 Analysis of PFR

Phosphorus flame retardants (PFRs) were analysed by NILU (except samples of herring gull blood, which were analysed by NIVA).

Extraction
Prior to extraction, the samples were added a mixture of isotope labelled PFR standards, for quantification purposes.

The water-, sediment- and biota-samples were extracted with organic solvents and concentrated under nitrogen flow, followed by a clean-up procedure using a silica column to remove lipids and other interferences prior to analysis.

Analysis
PFR compounds were quantified on a Thermo TSQ Vantage UPLC/MS-MS.

The PFRs in blood analysed by NIVA
Prior to extraction, the samples were added a mixture of isotope labelled PFAS, for quantification purposes and extracted twice with acetonitrile before analysis using LC/QToF (ESI negative mode).

Limits of detection
The limits of detection (LoD) and quantification (LoQ) were calculated for each sample, using the accepted standard method, i.e. the average of blanks plus 3 and 10 times the standard deviation for blanks, for LoD and LoQ, respectively.

Quality assurance and accreditation
NILU's laboratories are accredited by Norwegian Accreditation for ISO/IEC 17025. NILU is not accredited for the analysis of PFRs, but the same quality assurance procedures (as for the accredited compounds) were applied for the analyses of these compounds.

2.2.8 Support parameters

Stable isotopes of nitrogen, carbon and sulphur were analysed by IFE. Analysis of nitrogen and carbon isotopes was done by combustion in an element analyser, reduction of NOx in Cu-oven, separation of N_2 and CO_2 on a GC-column and determination of $\delta^{13}C$ and $\delta^{15}N$ at IRMS (Isotope Ratio Mass Spectrometer). Analysis of sulphur isotopes was done by combustion in an element analyser with V_2O_5 to increase the amount of available oxygen reduction of SOx to SO_2, separation of SO_2 from other products of combustion on a GC-column, and determination of $\delta^{34}S$ at IRMS.

Trophic level was calculated as follows (assuming a 3.8 increase per full trophic level; Hobson and Welch, 1992; and that blue mussel inhabit trophic level 2, filtrating algal particles on trophic level 1):

$$TL_{consumer} = 2 + (\delta^{15}N_{consumer} - \delta^{15}N_{blue\ mussel})/3.8$$

Captive-rearing studies on piscivorous birds indicate that the $\delta^{15}N$ isotopic fractionation factor between bird diet and tissue is less than that derived for the other trophic steps, most likely linked to the fact that birds produce uric acid (Mizutani et al. 1991). According to Mizutani et al (1991) an isotopic fractionation factor of +2.4 ‰ is appropriate. Thus, the following equation was used to calculate the trophic level of herring gulls:

$$TL_{herring\ gull} = 3 + (\delta^{15}N_{herring\ gull} - (\delta^{15}N_{blue\ mussel} + 2.4))/3.8$$

Eggshell thickness (herring gull eggs) was determined according to procedures described by Nygård (1983).

Lipid content in biological samples was determined gravimetrically during extraction for chemical analyses.

Weight and length of fish were determined before dissection.

The age of the cod was read from otoliths. The age was read by counting the number of opaque zones (summer zones) and hyaline zones (winter zones).

Grain size distribution (fraction of particles <63 µm) in sediment was determined according to procedures described by Krumbein and Petttijohn (1938).

Total organic carbon content (TOC) in sediment was determined by catalytic combustion in an element analyser.

2.2.9 Biological effect parameters (cod)

Gonad histopathology

Gonad histopathology was performed by IRIS. Gonads were dissected, put in histocassettes and placed into histological fixative (3.7% formaldehyde) for wax sections. Tissue samples were no thicker than 1 cm to ensure proper fixation. Samples were then stored at 4˚C until embedding. Histological sections (3 µm) were prepared at Stavanger University Hospital (SUS). The tissues were examined for health parameters related to physiological conditions, inflammatory and non-specific pathologies and those associated with pathogen and parasite infections. Gonad abnormalities were scored using the criteria suggested by Benly et al. (2008) and Sensini et al. (2008). Each alteration was scored according to its severity and frequency (0 = absence of alteration, 1 = ≤ 10 % of the histological section showed the alteration, 2 = between 10% and 50% of the histological section showed the alteration, 3 = between 50% and 100% of the histological section showed the alteration). The presence of parasites and non-specific inflammation were scored as absent (0) or present (1). All micrographs were captured using an AxioCam MRc5 (Zeiss) digital camera mounted on a *Zeiss Axioplan 2* light microscope (Göttingen, Germany). The slides were analysed blind. The stage of the gonads was also evaluated.

Vitellogenin in blood plasma

Vitellogenin (VTG) was measured in blood plasma of cod using an enzyme–linked immunosorbent assay (ELISA). Anti-VTG in a polyclonal serum was bound to dissolved VTG in competition with a known amount of VTG bound to the wells (primary antibody). An enzyme conjugated antibody bound to the primary antibody (high affinity) transformed the substrate to a coloured product that was detected spectrophotometrically.

Micronucleii

Blood samples of cod were smeared on microscope slides. The samples were dyed and monted in glycerol before micronuclei were counted under fluorescence microscope (1000× magnification). A minimum of 2000 cells per sample were counted.

Acetylcholinesterase (AChE)

Inhibition of Acetylcholinesterase (AChE) was measured in the microsomal fraction of muscle samples of cod, using methods described by Bocquené and Galgani (1998).

In addition to the above mentioned effect parameters, the following physiological parameters were measured/calculated: liversomatic index (LSI) and gonadosomatic index (GSI). These are measured of liver weight and gonad weight, respectively, relative to body mass:

$$\text{Liversomatic index (LSI)} = \frac{[\text{liver weight (g)} \times 100]}{\text{body mass (g)}}$$

$$\text{Gonadosomatic index (GSI)} = \frac{[\text{gonad weight (g)} \times 100]}{\text{body mass (g)}}$$

2.3 Data treatment

Statistical analysis (linear regressions; general linear models) was performed with the use of Statistica software (Ver 11; Statsoft). A significance level of α = 0.05 was chosen. When appropriate, data were $\log_{10}$-transformed.

When results are below LoD (especially when this occurs in many samples), the value of the information is reduced, and there are challenges regarding presentations and statistical evaluation. For the purpose of calculating mean concentrations, we have assigned these samples/parameters a value of zero. In regression models, we have omitted samples with non-detects from processing ("case-wise deletion").

It has earlier been pointed out (Ruus et al. 2015) that there is a need for a more balanced design, in terms of the number of individual samples from each species in the food web (when possible biomagnification of compounds in the Inner Oslofjord food web is evaluated). Therefore pooled samples of cod (3 samples constituted of 5 individuals each) are constructed mathematically (mean of the 5 individuals) to obtain 3 samples of each species in the food web. The individuals were assigned to the different "pooled" samples according to their length. (See Appendix for composition of "pooled" samples).

When exploring correlations between contaminant concentrations and trophic position, as well as other predictors (such as length, weight, age etc.), concentrations of the following contaminants were expressed on a wet weight basis: Metals, PFASs, PFRs and phenolic compounds. The concentrations of following contaminants were, on the other hand, expressed on a lipid weight basis: PCBs and other organochlorine compounds, chlorinated paraffins, brominated flame retardants, siloxanes, anti-bacterial compounds and UV-filters. When exploring correlations between contaminant concentrations and biochemical response parameters (such as vitellogenin and AChE activity), all concentrations were expressed on a wet weight basis.

Trophic Magnification Factors (TMFs) were calculated from statistically significant relationships: $\text{Log}_{10}[\text{Contaminant}] = a + b(\text{Trophic position})$
as $\text{TMF} = 10^{b}$.

2.3.1 Mixture toxicity / cumulative risk

Based on knowledge on combined effects of chemicals from laboratory and field studies, a conceptual framework for environmental risk assessment of chemical mixtures has been proposed based on an approximation to concentration addition (CA) (Backhaus and Faust, 2012). In the proposed framework, the environmental risk of chemical mixtures is assessed through a tiered approach using available effect data (NOEC and EC50 values) and predicted or measured exposure concentrations (PEC or MEC). In the first tier a risk quotient (RQ) is calculated by summing up the ratios between exposure concentrations (MEC or PEC) and predicted no effect concentrations (PNEC) for all chemicals in the mixture. Backhaus and Faust (2012) showed that summation of PEC/PNEC ratios can serve as a justifiable, conservative, first-tier approach to CA. If the resulting RQ is ≥ 1, there is a potential environmental risk and the next tier should be performed. In tier 2, the environmental risk of the chemical mixture is assessed for each species group (e.g. algae, crustaceans, fish) by summing up the toxic units (TU = MEC/EC50) for all chemicals in the mixture. The RQ is obtained by application of an appropriate assessment factor on the sumSTU, and a value ≥ 1 is indicative of an environmental risk. This or similar approaches has been used in several studies to assess the environemntal risk of chemical mixtures detected in the aquatic environment (Backhaus and Karlsson, 2014; Bundschuh et al., 2014; Finizio et al., 2005; Moschet et al., 2014; Petersen et al., 2013), and in biota (Herzke et al., 2014, 2015).

As a conservative initiative to assess the risk of the mixture of contaminants detected in the biota, an approach based on the conceptual framework for risk assessment of chemical mixtures presented by Backhaus and Faust (2012) and the approach used by Herzke et al., (2014 and 2015) was used. In order to assess whether the mixture of contaminants measured in the organisms pose a risk to their predators, measured concentrations (MEC) in blue mussels, polychaetes and herring and available $PNEC_{pred}$, $PNEC_{oral}$ and EQS_{biota} values (PNEC for secondary poisoning) were used to calculate the sum of $MEC/PNEC_{pred}$ ratios for all possible compounds. An average of three measured concentrations was used as MEC for blue mussels, polychaetes and herring. Available $PNEC_{pred}$ values were obtained from Andersen et al., 2012, $PNEC_{oral}$ values from EU risk assessment documents and EQS_{biota} from the EQS directive (2013). The $MEC/PNEC_{pred}$ ratios were summed and a potential risk was identified by a sum ≥ 1.

In order to assess whether the mixture of contaminants measured in the organisms pose a risk to themselves the concentration of contaminants in gull eggs was compared to available effect data for exposure in eggs (compiled and assessed by Andersen et al., 2014). The median value of 15 egg concentrations was used as MEC. The sum of MEC/effect data for all possible compounds was calculated and a sum ≥1 was indicative of a potential risk to the birds.

As $PNEC_{pred}$ values and effect data were only available for a few of the tested compounds, the mixture risk assessment performed in this study is not considered complete but is thought to give an indication of which food source pose the highest risk for predators and potential risk drivers.

3. Results and Discussion

The results of the chemical analyses (and lipid content of biological samples) are given in the Appendix, where also analyses falling below LoD are indicated together with the values of the LoDs.

3.1 Stable isotopes

The results of the individual stable isotope analysis are given in Appendix (Tables A3-A6).

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. For instance, it is in principle possible to detect differences in the importance of autochthonous (native marine) and allochthonous (watershed/origin on land) carbon sources in the food web, since the $\delta^{13}C$ signature of the land-based energy sources is lower (greater negative number). Also $\delta^{15}N$ (although to a lesser extent than $\delta^{13}C$) may be lower in allochthonous as compared to autochthonous organic matter (Helland et al. 2002), but more important, it increases in organisms with higher trophic level because of a greater retention of the heavier isotope (^{15}N). The relative increase of ^{15}N over ^{14}N) is 3-5‰ per trophic level (Layman et al. 2012; Post 2002), and provides a continuous descriptor of trophic position. It is also the basis for Trophic Magnification Factors (TMFs) that give the factor of increase in concentrations of contaminants, and have been amended to Annex XIII of the European Community Regulation on chemicals and their safe use (REACH) for possible use in weight of evidence assessments of the bioaccumulative potential of chemicals as contaminants of concern.

Stable isotopes of sulphur may also be applied to increase the knowledge of how and to what extent different food items contribute to the bioaccumulation of a compound. It has previously been shown that $\delta^{34}S$ may be used to indicate if a bird forages in the marine environment or in the terrestrial environment, since $\delta^{34}S$ in marine sulphate is generally higher than $\delta^{34}S$ in terrestrial systems (Lott et al. 2003). Furthermore, it is suggested that birds foraging in/near urbanized centres display lower $\delta^{34}S$ ratios (Eulaers et al. 2014).

In the present report, the stable isotope data have been reviewed partly to indicate possible different energy sources for the organisms/individuals in question. Secondly, as organisms (here cod and herring gull) grow, they may feed on larger prey organisms, thus an increase in trophic level is likely to occur, which is then quantified. For compounds with bioaccumulative potential, a consequence may be higher tissue concentrations. Thirdly, trophic level is calculated from $\delta^{15}N$ for the organisms to assess possible biomagnification of the compounds/contaminants in question in the Inner Oslofjord food web.

It has previously been noted (Ruus et al. 2014; Ruus et al. 2015) that Herring gull sampled in the Inner Oslofjord display low $\delta^{15}N$ and low $\delta^{13}C$, relative to the marine species sampled in the programme. This indicates that important food items for the gull are not related to the marine food web sampled. Herring gull is therefore treated separately (not as part of the food web) in the present study.

Since the individual herring gulls (or eggs) display a range of $\delta^{15}N$ values, implicating different feeding behaviour placing individuals in different trophic positions, the bioaccumulative properties of contaminants are also evaluated by analysing relationships between trophic level and contaminant concentrations in herring gull (in isolation; see Chapter 3.2.4). Similar analyses are performed for cod (of which 15 individuals are analysed; see Chapter 3.2.3).

As previously mentioned, after the first programme period (2013 and 2014) of the “Urban fjord” monitoring programme, changes have been made to the programme, to sample a more representative food web. The results of the stable isotope analysis (Figure 2) suggest that this has been successful, as the differences in $\delta^{15}N$ seem to reflect expected trophic relationships; blue mussel (filters particulate organic matter from the water) < zooplankton (herbivore) = polychaetes (different modes of living, largely detritivorous) < herring (pelagic fish feeding on zooplankton) = prawns (some scavenging behaviour) < cod (mesopelagic fish, predator on fish and benthic organisms). The food web spans over 2 to 3 (~2.7) trophic levels with blue mussel defined at trophic level 2 (see Chapter 2.2.8), polychaetes and zooplankton (krill) at trophic level 2.9, prawns and herring at trophic level 3.5 and cod at trophic level 4.7 in average (assuming an increase in $\delta^{15}N$ of 3.8‰ per integer trophic level).

For cod, there were significant linear relationships between $\delta^{15}N$ and length (R^2=0.36; p=0.0183), between $\delta^{15}N$ and weight (R^2=0.38; p=0.0142), between $\delta^{15}N$ and age (R^2=0.39; p=0.0123), and between $\delta^{13}C$ and age (R^2=0.46; p=0.0052). In other words, the cod apparently increase in trophic position with increased size/age. There were no demonstrable relationships between $\delta^{13}C$, $\delta^{15}N$, or $\delta^{34}S$ and the body mass or wing length of herring gull.

When herring gull matrices (blood and eggs) are evaluated (Figure 3), it can be seen that the matrices show similar $\delta^{15}N$. Herring gull would therefore be placed on approximately the same average trophic level regardless of matrix. The $\delta^{13}C$ ratio is, however, higher in blood than in eggs possibly related to different lipid content. It should be noted that samples were not treated to remove carbonates or lipid before stable isotope analysis. The C:N ratio was measured (Appendix, Tables A3-A6) and a C:N ratio of >3.5 implies the presence of lipids, which may somewhat confound $\delta^{13}C$ interpretation, since lipids are ^{13}C -depleted relative to proteins (Sweeting et al. 2006). Eggs showed a higher C:N ratio than blood (Appendix, Tables A3-A6).

There was a good correlation between $\delta^{34}S$ and $\delta^{13}C$ in the bird matrices (Figure 3; R^2=0.61; p=0.0006 for egg; R^2=0.89; p<0.00001 for blood), suggesting that a higher importance of terrestrial carbon (lower $\delta^{13}C$) is equivalent with a stronger urban signal (lower $\delta^{34}S$).

Obviously, the co-linearity between variables (such as $\delta^{13}C$, $\delta^{15}N$ and $\delta^{34}S$ in herring gull, or $\delta^{15}N$ and length, weight and age in cod) makes it difficult to conclude on likely causality with regard to correlations with contaminant concentrations. For instance it is difficult to relate concentrations to foraging on more marine/less urban food items (suggested by $\delta^{34}S$ signature; Lott et al. 2003; Eulaers et al. 2014), when evidence also indicate foraging on higher trophic level, as known to be reflected in higher $\delta^{15}N$ (Layman et al. 2012; Post 2002).

As mentioned, for 13 of the Herring gulls, adult female and egg was sampled from the same nest (e.g. mother and future offspring). Among these, there were no demonstrable relationships between the stable isotope ratios ($\delta^{13}C$, $\delta^{15}N$ or $\delta^{34}S$) in the blood and in the egg sampled from the same nest.

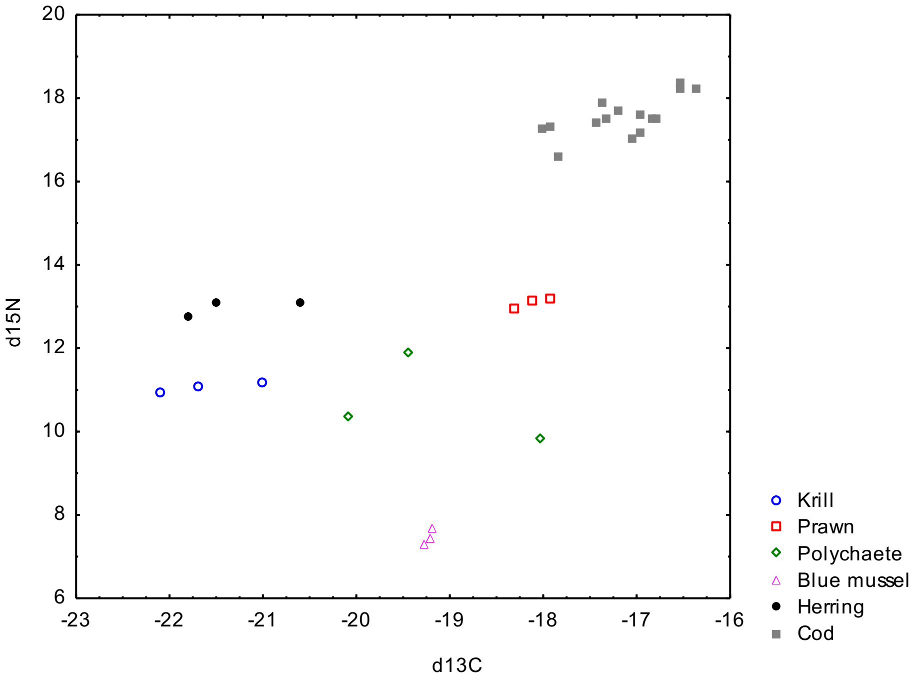


Figure 2. $\delta^{13}C$ plotted against $\delta^{15}N$ in organisms from the inner Oslofjord marine food web.

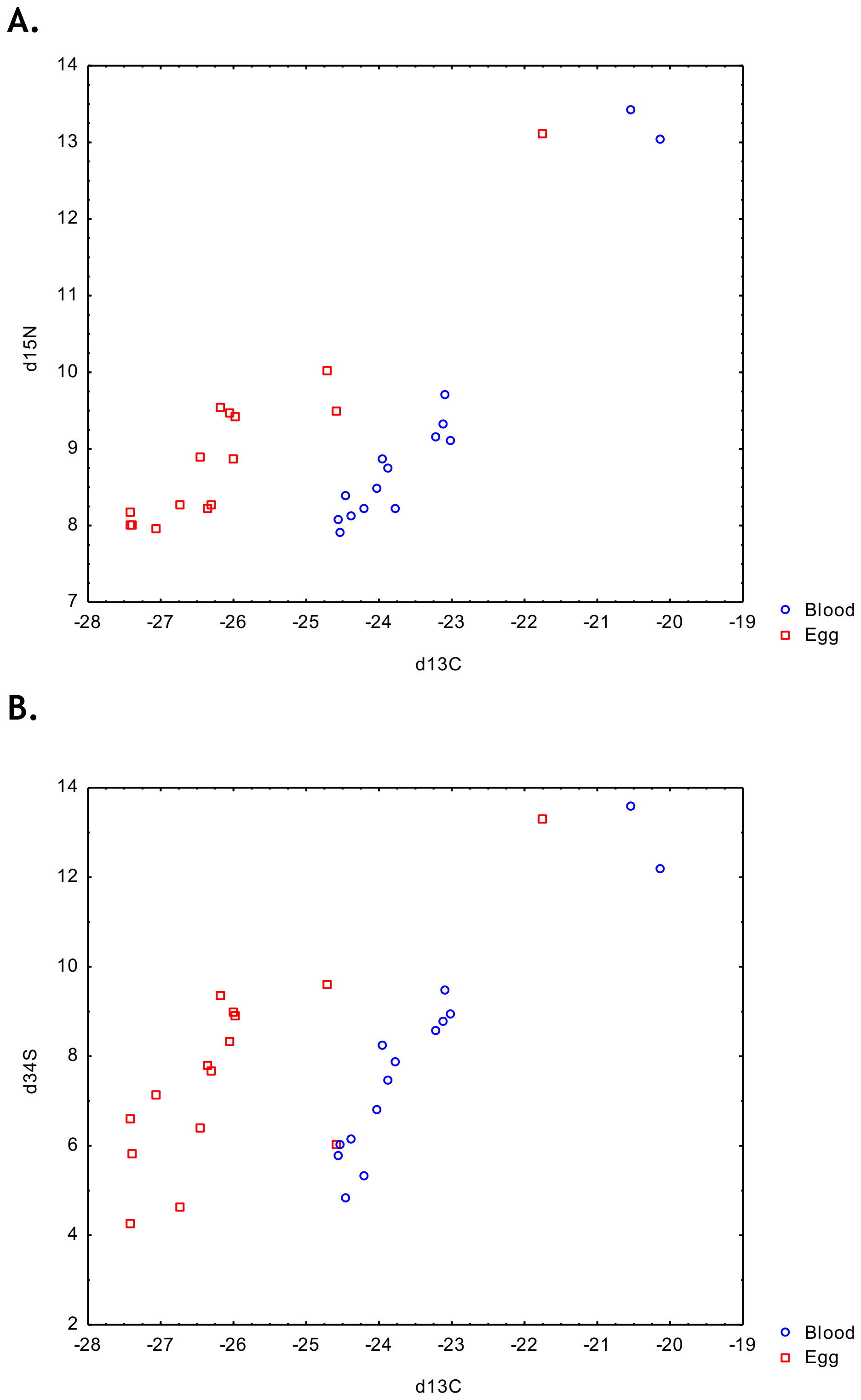


Figure 3. $\delta^{13}C$ plotted against $\delta^{15}N$ (A.) and $\delta^{34}S$ (B.) in Herring gull blood and eggs From the Inner Oslofjord area.

3.2 Environmental contaminants

3.2.1 Sediment

The sediments of the inner Oslofjord is a potential source of environmental contaminants to sediment dwelling organisms and the contaminants may thus enter the food chain. Several of the target compounds of this study were detected in the sediment sample (see Appendix for a detailed overview). Inputs to the fjord via storm water (see Chapter 3.2.5 and Appendix) for several of the compounds is also shown.

For several compounds, environmental quality standards for sediment are given through Norwegian law (The Water Regulation/"Vannforskriften"), according to the requirements of the Water Framework Directive. Furthermore, quality standards are suggested for even more compounds (Arp et al. 2014). For the target compounds of this study of which quality standards exist/are suggested, the sediment concentrations and quality standards are compared in Table 8. Bisphenol A, D5, PCB7, Zn, As, Ni, Hg, PFOS and octylphenol exceeded the quality standards. Regarding inputs to the fjord (apart from the above mentioned storm water; Chapter 3.2.5), according to Skarbøvik et al. (2015), River Alna brought 22.4-25.2 g/yr PCB7 and 232-267 g/yr bisphenol A in 2014. Furthermore, the annual mean concentration of Zn in the river water was 18.5 µg/L. VEAS sewage treatment plant reported a discharge of 49 kg As, 0.37 kg Hg, 306 kg Ni and 2324 kg Zn in 2015 (VEAS 2016). As such, there are currently several known fluxes of these contaminants to the Inner Oslofjord.

Table 8.
Concentrations of contaminants (mg/kg dry wt) of which Norwegian quality standards (from Arp et al. 2014) exist in sediment from the inner Oslofjord. Red numbers indicate excess of the quality standard.

River basin specific compounds	EQS (mg/kg dry wt.)	Sediment conc. (mg/kg dry wt.)
Bisphenol A	0.0011	0.0250
Decamethylcyclopentasiloxane (D5)	0.044	0.077
Medium chained chloroparafins (MCCPs)	4.6	0.001
Copper (Cu)	84	74.9
PCB7	0.0041	0.0169
PFOA	0.071	<0.0005
Zinc (Zn)	139	306
TBBPA	0.11	<0.001
TCEP	0.072	<0.00003
Triclosan	0.009	<0.01
Arsenic (As)	18	54
Chromium (Cr)	620	124
EU priority substances		
Cadmium (Cd)	2.5	0.17
Lead (Pb)	150	95.3
Nickel (Ni)	42	58.6
Mercury (Hg)	0.52	0.94
Brominated diphenyl ethers *	0.062	0.0001
Hexachlorobenzene	0.017	0.0004
C10-13 chloroalkanes **	0.8	0.038
Pentachlorobenzene	0.4	0.0002
Nonylphenol (4-)	0.016	<0.001
Oktylphenol (4-*tert*-)	0.0003	0.9937
PFOS	0.00023	0.00050

* Sum of BDE-28, -47, -99, -100, -153 and -154.
** Short chained chloroparaffins (SCCPs)

3.2.2 Inner Oslofjord Food Web

Several legacy contaminants with well-known biomagnifying properties displayed a positive significant relationship between (log_{10}-)concentrations and trophic position (deduced from the $\delta^{15}N$ isotopic ratio) in the studied Inner Oslofjord marine food web. Of the PCBs, 27 congeners showed significant biomagnification (some presented in Figure 4), with trophic magnification factors ranging from TMF=1.36 (PCB-28) to TMF=12.1 (PCB-189). One of the lesser chlorinated homologues (PCB-33) displayed statistically significant trophic dilution (TMF=0.54). These findings correspond with previous observations from marine systems (Hallanger et al. 2011; Fisk et al. 2001). Thus, PCBs display expected behaviour in the Inner Oslofjord food web, suggesting that the studied food web is appropriate for assessing biomagnifying behaviour of contaminants (where PCBs may serve as "benchmark"). Several PCBs also showed positive relationships with the trophic position of herring gull eggs (see Chapter 3.2.4).

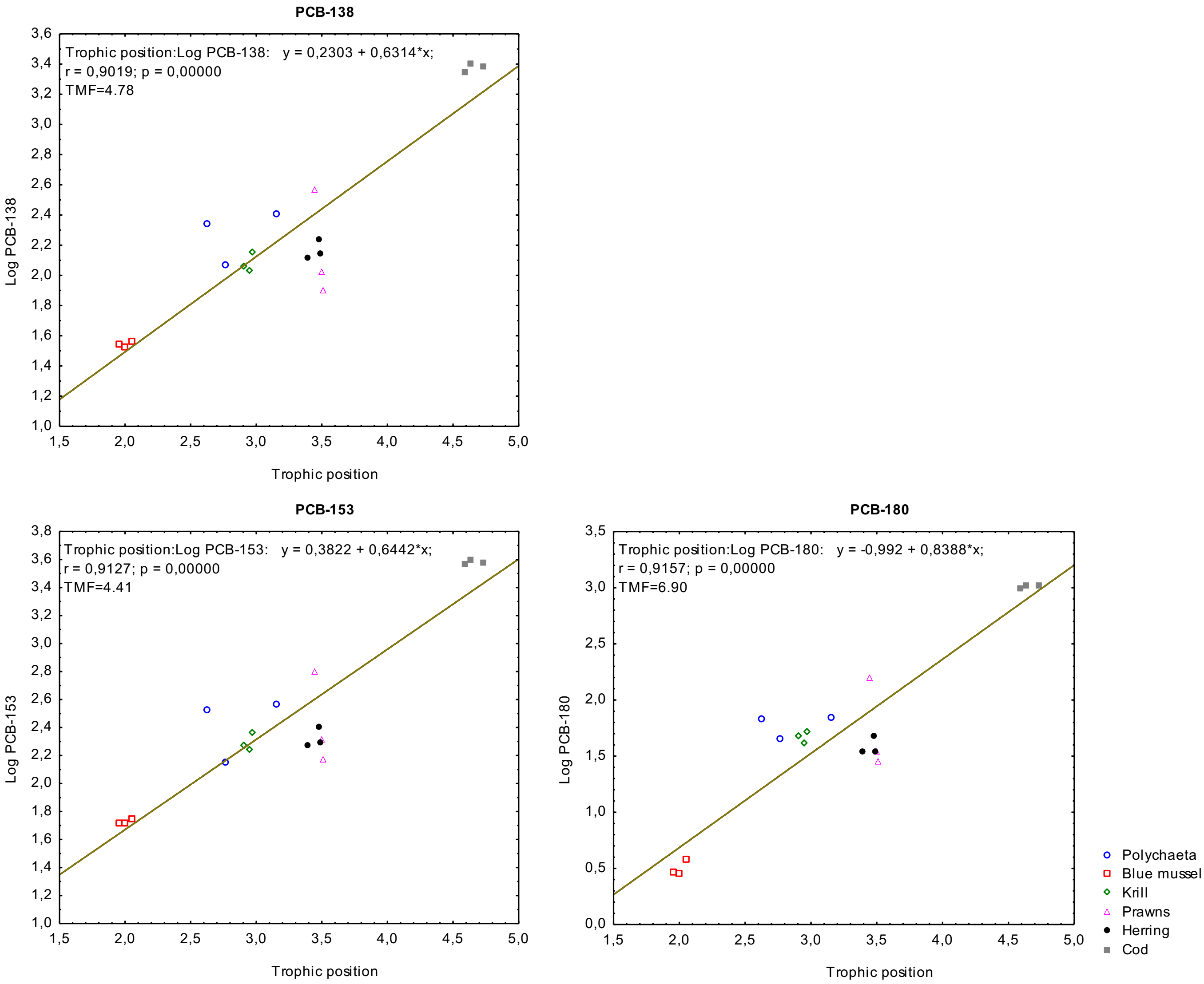


Figure 4. Trophic position against concentrations (ng/g lipid wt.; log-transformed) of PCB-138, PCB-153 and PCB-180 in the studied Inner Oslofjord food web. Note different scales on axes.

Hexachlorobenzene (HCB) was another organochlorine compound that showed statistically significant biomagnification (TMF= 1.75), while SCCPs (R^2=0.22; p=0.0469) and MCCPs (Figure 5) showed trophic dilution (TMF=0.53 and TMF=0.31, respectively). Biomagnification of HCB is previously shown (e.g. Hallanger et al. 2011). In a review of bioaccumulation potential of chlorinated paraffins in the aquatic environment by Thompson and Vaughan (2013), it was concluded that although bioaccumulatiove, TMFs of MCCPs are less than 1.

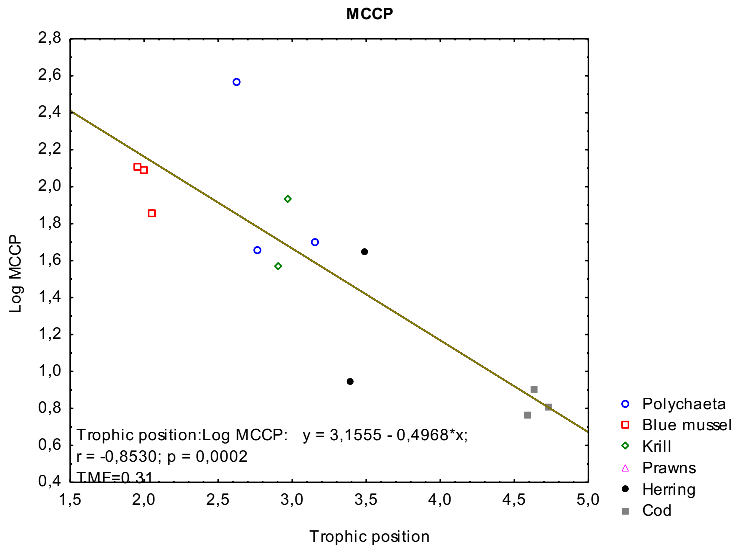


Figure 5. Trophic position against concentrations (ng/g lipid wt.; log-transformed) of MCCP the studied Inner Oslofjord food web.

Among the brominated compounds, some showed statistically significant trophic dilution: TBA (TMF=0.22), BDE-66 (TMF=0.58; several samples with non-detects), BDE-153 (TMF=0.18; several samples with non-detects), and DBDPE (TMF=0.27; Figure 6). Others showed biomagnification: BDE-28 (TMF=2.14), BDE-47 (TMF=2.74; Figure 6), BDE-49 (TMF=2.58), BDE-100 (TMF=3.81; Figure 6), BDE-126 (TMF=2.2; several samples with non-detects), BDE-154 (TMF=2.68) and BDE-202 (TMF=1.28; several samples with non-detects). Biomagnification of PBDEs has previously been shown in marine systems (e.g. Hallanger et al. 2011). It can be mentioned that the concentrations of BDE-47 in blood of herring gull showed a positive relationship with the wing length of the gull, while the concentration of BDE-154 in herring gull blood showed a positive relationship with the trophic position of the gulls (see Chapter 3.2.4), suggesting an increase in concentration with size and trophic position, respectively.

Octamethylcyclotetrasiloxane (D4) showed statistically significant trophic dilution in the Inner Oslofjord food web studied (TMF=0.44; Figure 7). It must be noted, however, that D4 was not detected in blue mussel (thus blue mussel was omitted from the regression). There have previously been some divergences in reports of the biomagnifying properties of siloxanes in different systems (e.g. Borgå et al. 2012 and references therein).

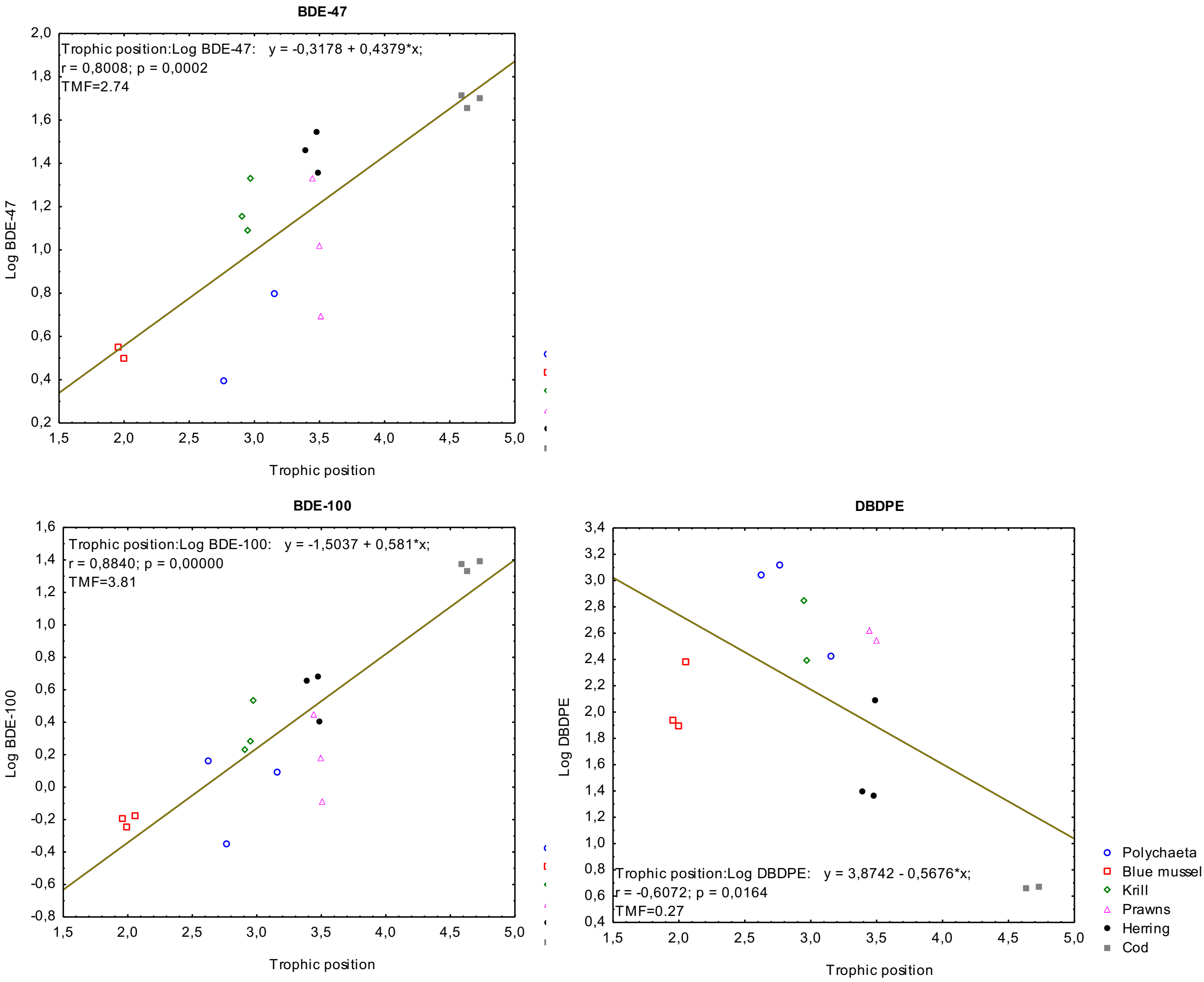


Figure 6. Trophic position against concentrations (ng/g lipid wt.; log-transformed) of BDE-47, BDE-100 and DBDPE in the studied Inner Oslofjord food web. Note different scales on axes.

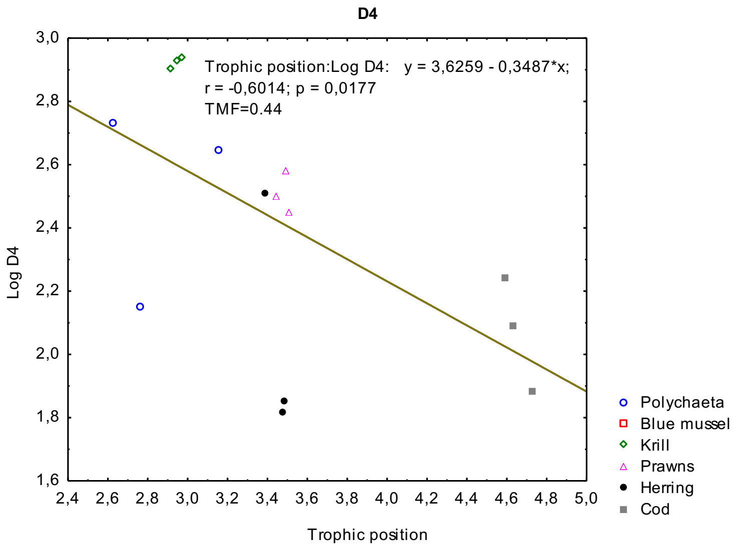


Figure 7. Trophic position against concentrations (ng/g lipid wt.; log-transformed) of D4 in the studied Inner Oslofjord food web. Note that no D4 was detected in blue mussel (omitted from analysis).

The biomagnifying properties of mercury (Hg) are well known (e.g. Jaeger et al. 2009; Ruus et al. 2015), and the (log) concentrations of Hg showed a positive relationship with trophic position in the Inner Oslofjord food web (TMF=3.10; Figure 8).

Arsenic (As) showed a statistically significant positive relationship between (log) concentrations and trophic position (TMF=2.69; Figure 9). It should be mentioned that in this study, total As was measured (not only inorganic As), and most of the arsenic found in fish, and marine animals in general, is present as arsenical arsenobetaine, which is regarded as non-toxic (Amlund, 2005 and references therein). Arsenobetaine is rapidly absorbed over the gastrointestinal tract (Amlund, 2005 and references therein).

Silver (Ag) also showed a statistically significant positive relationship between (log) concentrations and trophic position (TMF=8.03), but it should be noted that Ag was not detected in many samples (two blue mussel samples and all herring samples). Nickel (Ni) and chromium (Cr) on the other hand, displayed statistically significant trophic dilution (TMF=0.34 and TMF=0.22, respectively). There is little evidence of biomagnification of Ag in marine systems, and according to a review by Fisher and Wang (1998), trophic transfer of Ag has been shown to be insignificant in several aquatic animals but more important in others.

Some PFAS compounds displayed statistically significant trophic dilution with TMFs from 0.39 (PFDA and PFTrA; Figure 10) to 0.58 (PFDoA), however, the compounds were not detected in many samples. The regressions for PFOS and PFOSA had positive slopes, but were not statistically significant (p=0.0562 and p=0.0782, respectively).

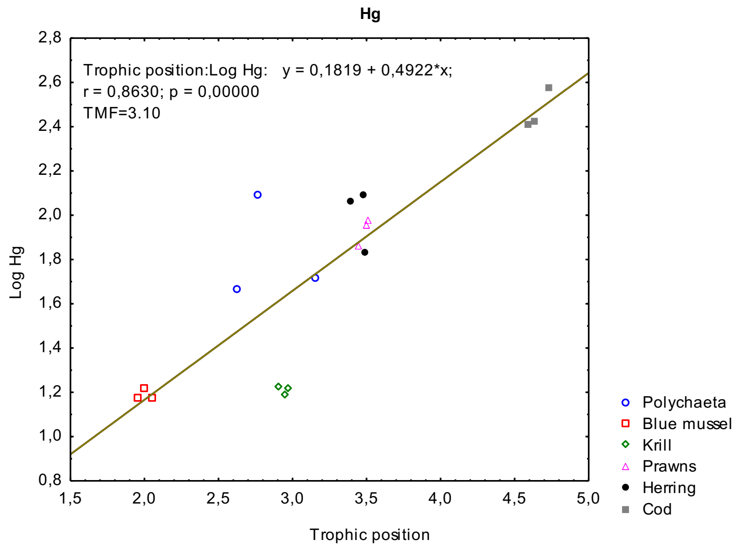


Figure 8. Trophic position against concentrations (ng/g wet wt.; log-transformed) of mercury (Hg) in the studied Inner Oslofjord food web.

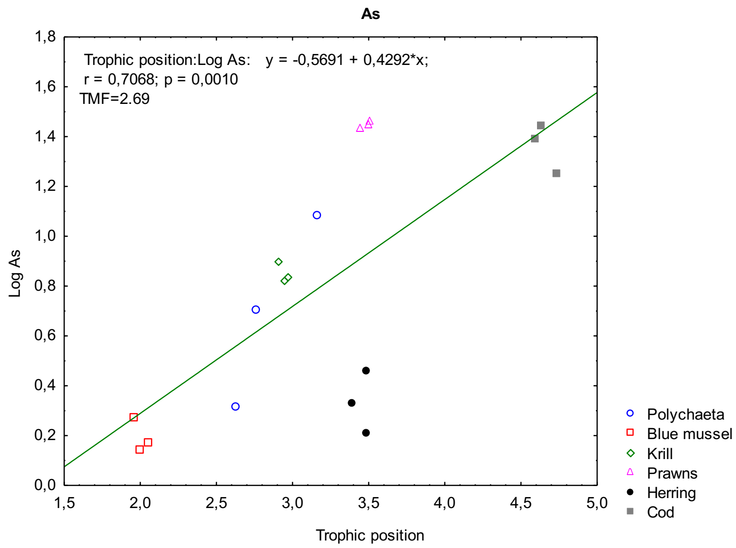


Figure 9. Trophic position against concentrations (µg/g wet wt.; log-transformed) of arsenic (As) in the studied Inner Oslofjord food web.

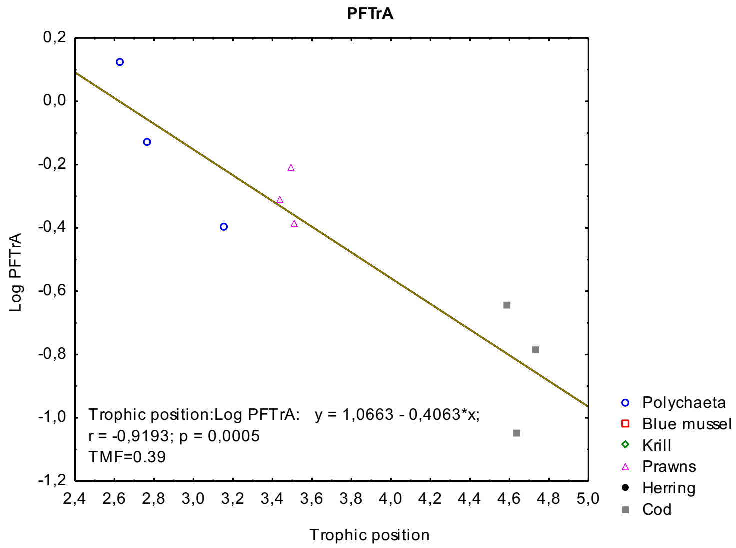
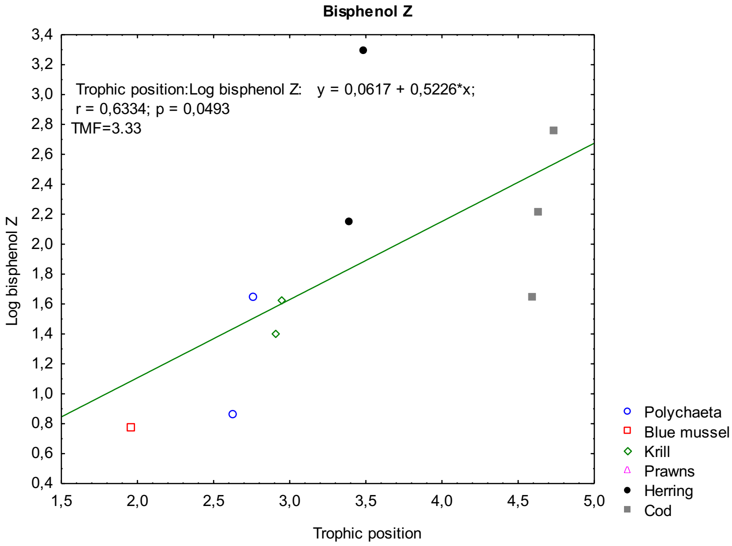


Figure 10. Trophic position against concentrations (ng/g wet wt.; log-transformed) of PFTrA in the studied Inner Oslofjord food web. Note that PFTrA was not detected in blue mussel, krill and herring (omitted from analysis).

Regarding phenolic compounds, concentrations of hexafluorbisphenol A showed a statistically significant negative relationship with trophic position in the food web (R^2=0.34; p=0.0187), because of low concentrations in cod, having a large influence on the regression. Bisphenol BP showed a positive relationship with trophic position (R^2=0.80; p=0.0168), but was only detected in 6 samples (and not detected in cod). 4-octylphenol showed a positive relationship with trophic position (R^2=0.46; p=0.0316), and was detected in 10 samples, with high concentrations in cod, having a large influence on the regression. Bisphenol TMC showed a positive relationship with trophic position (R^2=0.96; p=0.0206), but was only detected in 4 samples (one blue mussel and 3 cod), with higher concentrations in cod.

Concentrations (log) of bisphenol Z and bisphenol AP showed positive and negative relationships, respectively, with trophic position in the Inner Oslofjord food web (R^2=0.40; p=0.0493; TMF=3.33 and R^2=0.69; p=0.0031; TMF=0.22, respectively; Figure 11).



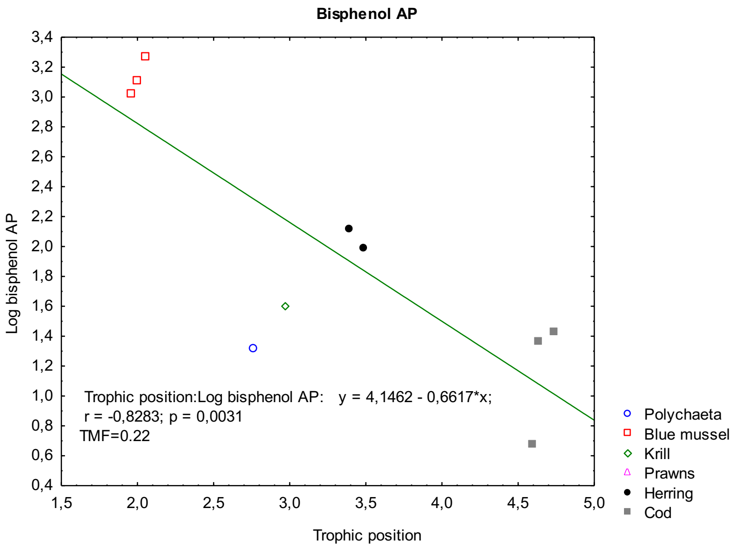


Figure 11. Trophic position against concentrations (ng/g wet wt.; log-transformed) of bisphenol Z and bisphenol AP in the studied Inner Oslofjord food web. Note different scales on axes.

3.2.3 Cod

As mentioned, environmental contaminants were analysed in 15 cod individuals (although pooled samples of cod, 3 samples constituted of 5 individuals each sorted by their length, were constructed mathematically to obtain 3 samples of each species, for evaluation of biomagnifying behaviour in the Inner Oslofjord food web).

Biological effect parameters were also measured in cod, and these are dealt with in Chapter 3.4.

Concentrations (mean and range) for all compounds and elements analysed in cod are presented Table 9, as well as in Appendix.

Table 9.
Lipid content (%) and concentrations of the different analytes in cod from the Inner Oslofjord. Mercury (Hg) is analysed in muscle tissue, while all other parameters are measured in liver. Concentrations are ng/g wet wt., except for concentrations of Ni, Cu, Ag, Cd, Pb, Cr, Fe, Zn and As, which are expressed as µg/g wet wt. Arithmetic mean and range (minimum and maximum) are presented (n=15). In calculations of mean, non-detected components were assigned a value of zero (0).

Analyte	Mean	Min.	Max.
Lipid content (%), liver	40.3	18.9	70.8
PeCB	0.6	0.3	1.3
HCB	5.5	2.5	13.8
PCBs			
PCB-18	0.6	0.3	1.4
PCB-28	5.8	2.4	13.2
PCB-31	0.9	0.1	3.6
PCB-33	0.2	0.1	0.4
PCB-37	0.0	<0.022	0.1
PCB-47	38.7	17.2	71.9
PCB-52	31.2	13.9	78.6
PCB-66	65.7	26.4	166.0
PCB-74	43.1	18.3	102.0
PCB-99	304.8	172.0	550.0
PCB-101	149.5	70.2	312.0
PCB-105	113.0	65.9	217.0
PCB-114	11.2	7.1	17.4
PCB-118	389.5	243.0	696.0
PCB-122	5.2	<0.032	48.3

PCB-123	7.8	4.3	14.6
PCB-128	94.8	54.9	170.0
PCB-138	906.7	576.0	1650.0
PCB-141	22.7	11.5	45.0
PCB-149	45.8	17.4	91.9
PCB-153	1447.1	856.0	2400.0
PCB-156	49.7	33.7	80.7
PCB-157	14.1	9.7	20.7
PCB-167	43.3	27.7	72.6
PCB-170	135.7	90.3	208.0
PCB-180	391.9	255.0	640.0
PCB-183	97.4	66.4	160.0
PCB-187	104.8	47.6	177.0
PCB-189	8.2	5.4	13.1
PCB-194	81.2	42.9	145.0
PCB-206	54.7	23.1	131.0
PCB-209	10.6	3.8	32.1
Sum-PCB_7	3321.9	2084.8	5789.1
Sum-PCB (all 32 congeners)	5436.2	3570.4	9149.6
TBA, PBDEs and DBDPE			
TBA	0.065	<0.02	0.259
BDE-17	0.003	<0.01	0.021
BDE-28	0.563	0.164	1.690
BDE-47	20.379	5.780	59.800
BDE-49	1.804	0.306	8.340
BDE-66	0.164	<0.041	0.457
BDE-71	n.d.	<0.01	<0.01
BDE-77	0.004	<0.01	0.030
BDE-85	n.d.	<0.01	<0.01
BDE-99	0.173	<0.021	0.826
BDE-100	8.799	3.630	18.400
BDE-119	0.085	<0.01	0.232

BDE-126	0.087	0.030	0.208
BDE-138	n.d.	<0.013	<0.015
BDE-153	0.023	<0.012	0.092
BDE-154	2.494	1.270	3.540
BDE-156	n.d.	<0.02	<0.023
BDE-183	n.d.	<0.01	<0.01
BDE-184	0.015	<0.01	0.087
BDE-191	n.d.	<0.012	<0.012
BDE-196	n.d.	<0.017	<0.017
BDE-197	n.d.	<0.015	<0.015
BDE-202	0.085	0.024	0.169
BDE-206	n.d.	<0.017	<0.017
BDE-207	n.d.	<0.016	<0.016
BDE-209	n.d.	<1.01	<1.01
DBDPE	1.218	<1.126	10.942
Chloroparaffins			
SCCP	21.64	3.5	107
MCCP	2.6	0.4	4.3
Siloxanes			
D4	47.8	17.2	82.5
D5	1083.3	390.0	2504.0
D6	135.7	78.2	259.1
Phosphorus flame retardants (PFRs)			
TEP	n.d.	<0.18	<0.18
TCEP	n.d.	<0.08	<0.08
TPrP	n.d.	<0.03	<0.03
TCPP	0.257	<1.8	3.854
TiBP	0.455	<1	4.292
BdPhP	n.d.	<0.03	<0.03
TPP	0.290	<0.1	1.807
DBPhP	n.d.	<0.01	<0.01
TnBP	1.141	<6.2	10.396

TDCPP	n.d.	<0.18	<0.18
TBEP	3.587	<2.1	14.849
TCP	n.d.	<0.01	<0.01
EHDP	n.d.	<0.02	<0.02
TEHP	n.d.	<0.04	<0.04
Phenolic compounds			
Bisphenol A	53	12	195
Tetrabromobisphenol A	n.d.	<2.2	<2.2
4,4-bisphenol F	71	<5	789
2,2-bisphenol F	258	<5	3852
Hexafluorobisphenol A	0	<5	2
Bisphenol BP	n.d.	<10	<10
Bisphenol S	1	<1	10
4-nonylphenol	n.d.	<20	<20
4-octylphenol	n.d.	<25	<25
4-tert-octylphenol	185	<25	2772
Bisphenol B	289	<10	1995
Bisphenol Z	264	<2	2653
Bisphenol AP	18	<2	117
Bisphenol E	407	<4	1839
Bisphenol FL	1	<10	22
Bisphenol P	34	<5	131
Bisphenol M	19	<3	122
Bisphenol G	4578	<3	53448
Bisphenol TMC	828	<3	7145
Metals			
Ni	0.063	0.034	0.162
Cu	7.706	1.491	18.751
Ag	4.318	0.746	6.988
Cd	0.110	0.010	0.443
Hg (in muscle)	299.4	157.8	486.5
Pb	0.071	0.003	0.202

Cr	0.019	<0.011	0.045
Fe	22.311	8.941	45.877
Zn	22.120	8.545	32.036
As	23.442	4.108	40.680
PFAS compounds			
PFPA	n.d.	<1	<1
PFHxA	n.d.	<0.5	<0.5
PFHpA	n.d.	<0.5	<0.5
PFOA	n.d.	<0.5	<0.5
PFNA	n.d.	<0.5	<0.5
PFDA	0.272	<0.5	1.010
PFUdA	0.470	<0.4	0.930
PFDoA	0.321	<0.4	0.740
PFTrA	0.160	<0.4	0.590
PFTeA	n.d.	<0.4	<0.4
PFBS	n.d.	<0.1	<0.1
PFHxS	n.d.	<0.1	<0.1
PFOS	3.225	1.590	6.330
PFDS	0.241	<0.2	0.480
PFDoS	n.d.	<0.2	<0.2
PFOSA	4.581	1.770	12.180
me-PFOSA	n.d.	<0.3	<0.3
et-PFOSA	n.d.	<0.3	<0.3
me-PFOSE	n.d.	<5	<5
et-PFOSE	n.d.	<5	<5
me-FOSAA	n.d.	<0.3	<0.3
et-FOSAA	n.d.	<0.3	<0.3
4:2 FTS	n.d.	<0.3	<0.3
6:2 FTS	n.d.	<0.3	<0.3
8:2 FTS	n.d.	<0.3	<0.3
Triclosan and triclocarban			
TCC	n.d.	<2	<2

Triclosan	n.d.	<3	<10
UV-chemicals			
BP3	n.d.	<5	<20
EHMC	n.d.	<6	<20
OC	n.d.	<5	<20

Looking at cod isolated from the other species in the food web, mercury (Hg) also showed a statistically significant positive relationship between (log) concentration and trophic position (Figure 12). Mercury in cod also showed positive relationships with length and weight of cod, variables that are co-varying, and co-varying with trophic position. As already mentioned, length, weight and age of cod all showed statistically significant positive relationships with $\delta^{15}N$ (see chapter 3.1). The results indicate that as fish grow larger, they occupy a higher trophic level and accumulate more mercury.

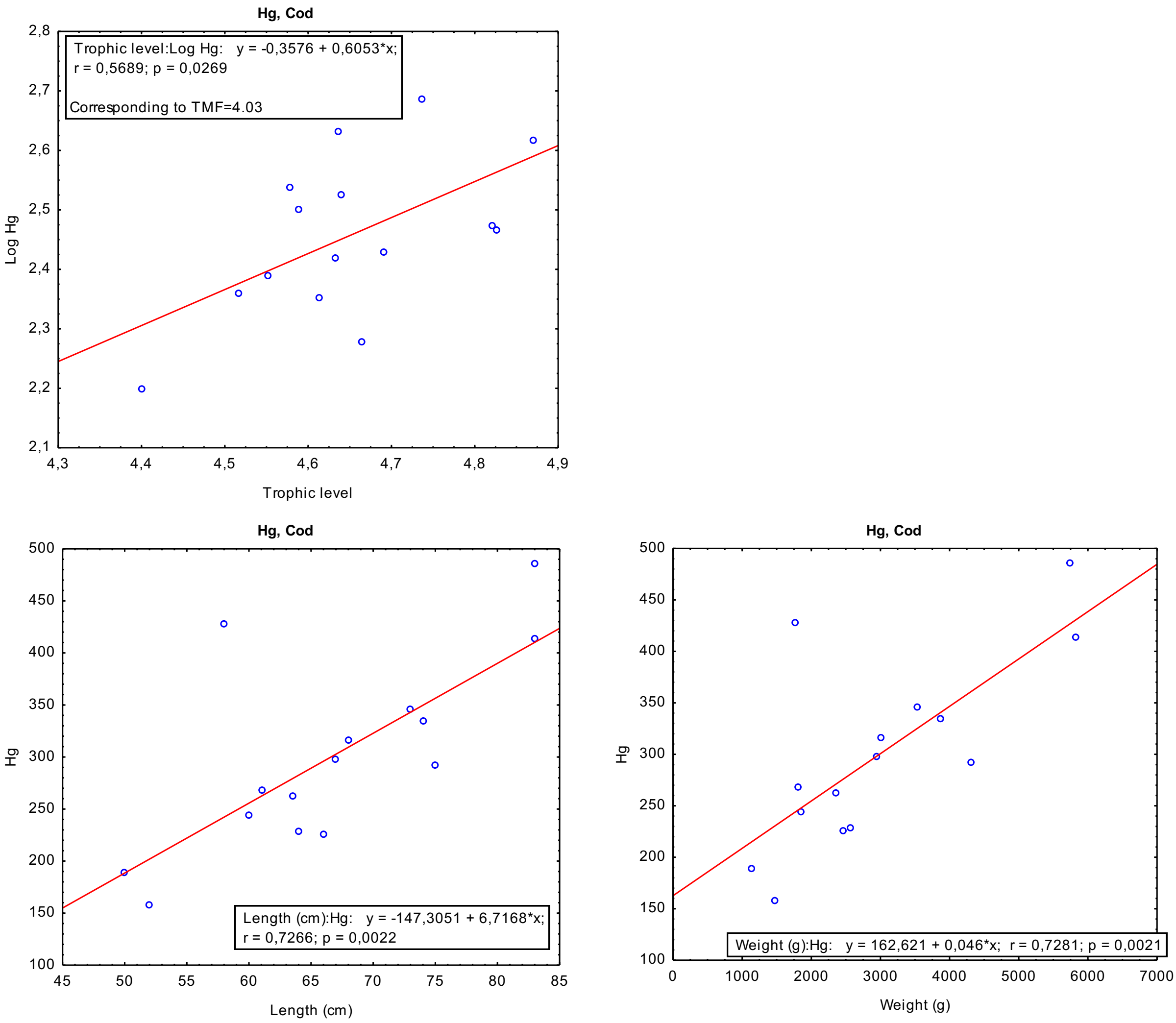


Figure 12. Trophic position against concentrations (ng/g wet wt.; log-transformed) of mercury (Hg) in cod from the Inner Oslofjord, as well as length (cm) and weight (g) of cod against concentrations (ng/g wet wt) of mercury.

Other metals, specifically lead (Pb) and silver (Ag), showed statistically significant negative relationships between concentrations and length (R^2=0.35; p=0.0202 and R^2=0.32; p=0.0282, respectively) and weight (R^2=0.33; p=0.0252 and R^2=0.40; p=0.0117, respectively) of cod.

Among the per- and polyfluorinated substances, PFUdA (log-transformed concentrations) showed a negative relationship with trophic position in cod (corresponding to TMF=0.33), while PFTrA showed a negative relationship with age of cod (R^2=0.84; p=0.0288; note many non-detects).

Some polychlorinated biphenyls showed positive relationships with length (PCB-31: R^2=0.27; p=0.0468), weight (PCB-31: R^2=0.28; p=0.0441), or age (PCB-28: R^2=0.28; p=0.0422, PCB-47: R^2=0.28; p=0.0433; PCB-66: R^2=0.35; p=0.0199, PCB-74: R^2=0.34; p=0.0222, PCB-206: R^2=0.31; p=0.0306, PCB-209: R^2=0.32; p=0.0285). In other words, as cod grow older/larger, they accumulate more PCBs.

Octamethylcyclotetrasiloxane (D4; lipid weight based concentrations) showed statistically significant negative relationships with length and weight of cod (Figure 13). This is supported by findings from Warner et al. (2014), where statistically negative correlations were observed between D4 concentration and length and width within cod from Tromsøysund. Warner et al. (2014) attributed these findings to the possibility of greater capacity for elimination (i.e. growth dilution, increased metabolic activity) compared to uptake processes with increasing size under relatively constant exposure conditions existing near point sources. Mean (± standard deviation) concentrations (lipid weight basis) of D4, D5 and D6 in the liver of Oslofjord cod were 125 (±56), 2635 (±1059) and 368 (±173) ng/g, respectively. Liver of cod caught in the Oslofjord in 2006 contained 244-860 ng/g D4, 5943-9607 ng/g D5, and 328-829 ng/g D6 (lipid weight basis; Schlabach et al. 2007).

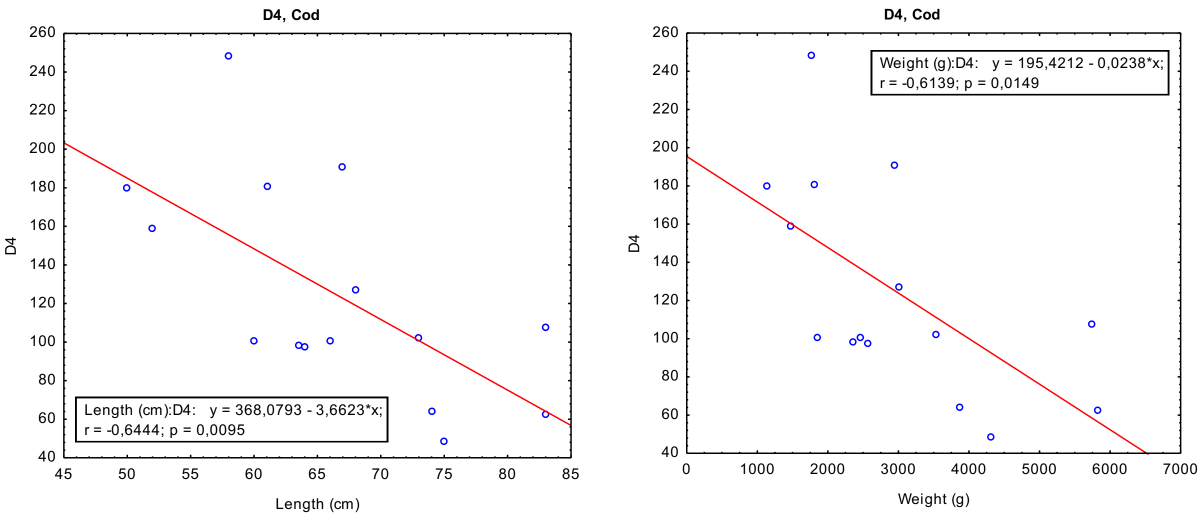


Figure 13. Octamethylcyclotetrasiloxane (D4) concentrations (ng/g lipid wt) against length (cm) and weight (g) of cod from the Inner Oslofjord.

Looking at cod isolated from the other species in the food web, bisphenol P also showed a statistically significant positive relationship between (log) concentration and trophic position (R^2=0.73; p=0.0295). Bisphenol P was, however, only detected in 6 individuals. Bisphenol P in cod also showed positive relationships with length (R^2=0.77; p=0.0214) and weight (R^2=0.79; p=0.0182) of cod, variables that are co-varying, and co-varying with trophic position. As already mentioned, length, weight and age of cod all showed statistically significant positive relationships with δ^{15}N (see chapter 3.1). The results suggest that as fish grow larger, they occupy a higher trophic level and may accumulate more bisphenol P.

Bisphenol E showed a statistically significant negative relationship between concentration and length (R^2=0.88; p=0.0187), and between concentration and weight (R^2=0.86; p=0.0234) of cod, but was only detected in 5 individuals. Bisphenol Z showed a statistically significant positive relationship (R^2=0.61; p=0.0390) between concentration and weight of cod, but was only detected in 7 individuals, and one individual had a large influence on the regression.

3.2.4 Herring gull

Both blood and egg were sampled from herring gull. As mentioned, For 13 of the Herring gulls, adult female and egg was sampled from the same nest (e.g. mother and future offspring).

Concentrations (mean and range) for all compounds and elements analysed in herring gull (blood and egg) are presented Table 10, as well as in Appendix. Concentrations of selected contaminants (PBDEs, siloxanes and PFAS compounds) in herring gull (blood and egg) are also presented in Figure 14 to Figure 16.

Table 10.
Lipid content (%) and concentrations of the different analytes in herring gull blood and egg from the Inner Oslofjord. Concentrations are ng/g wet wt., except for concentrations of Ni, Cu, Ag, Cd, Pb, Cr, Fe, Zn and As, which are expressed as µg/g wet wt, and PFRs in gull blood which are expressed as ng/ml wet wt. Arithmetic mean and range (minimum and maximum) are presented (n=15). In calculations of mean, non-detected components were assigned a value of zero (0).

Analyte	Blood Mean	Blood Min.	Blood Max.	Egg Mean	Egg Min.	Egg Max.
Lipid content (%)	0.42	0.20	1.77	9.51	7.08	17.4
PeCB	0.038	0.017	0.131	0.238	0.058	1.380
HCB	0.485	0.141	2.930	4.504	0.664	27.1
PCBs						
PCB-18	0.000	<0.005	0.007	0.033	<0.003	0.221
PCB-28	0.114	0.022	0.354	1.847	0.299	7.160
PCB-31	0.002	<0.005	0.018	0.049	<0.004	0.206
PCB-33	0.001	<0.005	0.010	0.001	<0.002	0.008
PCB-37	n.d.	<0.005	<0.007	0.001	<0.002	0.004
PCB-47	0.493	0.061	1.620	7.810	1.230	21.6
PCB-52	0.134	<0.04	1.050	3.357	0.163	24.0
PCB-66	1.034	<0.137	3.030	20.1	3.370	65.3
PCB-74	0.523	0.071	1.550	10.4	1.560	34.5
PCB-99	2.284	0.268	7.500	35.0	6.760	82.1
PCB-101	0.082	<0.085	0.472	4.178	0.139	23.7
PCB-105	1.199	0.140	3.660	17.5	4.990	42.7
PCB-114	0.093	<0.005	0.275	1.512	0.390	3.220
PCB-118	3.430	0.402	11.0	47.1	10.4	111
PCB-122	n.d.	<0.005	<0.007	0.776	<0.003	5.480
PCB-123	0.047	<0.005	0.166	0.857	0.223	1.950

PCB-128	0.817	0.103	2.410	10.0	3.030	26.2
PCB-138	5.113	0.609	14.6	68.2	19.8	157
PCB-141	0.017	<0.005	0.116	0.417	0.032	2.290
PCB-149	0.332	<0.048	1.990	4.587	0.703	19.4
PCB-153	7.554	0.855	21.9	104	26.9	243
PCB-156	0.339	0.038	1.020	4.767	1.270	10.7
PCB-157	0.080	<0.005	0.242	1.061	0.267	2.410
PCB-167	0.176	0.019	0.500	2.664	0.737	5.960
PCB-170	0.650	0.077	1.950	6.827	1.410	16.4
PCB-180	1.974	0.208	6.360	23.8	5.170	59.6
PCB-183	0.496	0.051	1.610	6.762	1.790	17.7
PCB-187	1.191	0.142	3.800	17.4	5.410	54.9
PCB-189	0.034	<0.005	0.098	0.440	0.094	1.080
PCB-194	0.239	0.025	0.755	3.459	0.847	8.840
PCB-206	0.089	<0.005	0.271	1.047	0.215	2.890
PCB-209	0.031	<0.005	0.147	0.409	0.124	1.250
Sum-PCB_7	18.3	1.976	55.1	252	63.0	589
Sum-PCB (all 32 congeners)	33.9	3.908	107	443	98.6	1 189
TBA, PBDEs and DBDPE						
TBA	n.d.	<0.01	<0.014	0.003	<0.01	0.021
BDE-17	n.d.	<0.005	<0.007	n.d.	<0.01	<0.01
BDE-28	n.d.	<0.005	<0.007	0.011	<0.01	0.069
BDE-47	0.294	<0.058	1.100	5.828	1.283	24.8
BDE-49	0.002	<0.005	0.019	0.064	<0.01	0.461
BDE-66	0.008	<0.021	0.114	0.055	0.012	0.192
BDE-71	n.d.	<0.005	<0.007	n.d.	<0.01	<0.01
BDE-77	n.d.	<0.005	<0.007	0.002	<0.01	0.012
BDE-85	0.001	<0.005	0.011	0.146	0.015	0.729
BDE-99	0.151	0.030	0.723	5.411	1.062	27.7
BDE-100	0.051	0.007	0.208	1.364	0.257	4.875
BDE-119	0.000	<0.005	0.006	0.031	<0.01	0.254

BDE-126	n.d.	<0.005	<0.007	0.002	<0.01	0.018
BDE-138	n.d.	<0.007	<0.009	0.072	0.011	0.312
BDE-153	0.021	<0.008	0.094	1.043	0.213	4.423
BDE-154	0.012	<0.005	0.069	0.504	0.163	1.341
BDE-156	n.d.	<0.01	<0.014	n.d.	<0.01	<0.027
BDE-183	0.004	<0.005	0.038	0.204	0.046	1.080
BDE-184	n.d.	<0.005	<0.007	0.017	<0.01	0.081
BDE-191	n.d.	<0.006	<0.009	0.002	<0.01	0.015
BDE-196	0.002	<0.009	0.018	0.110	0.018	0.412
BDE-197	0.007	<0.007	0.043	0.300	0.039	1.221
BDE-202	0.001	<0.008	0.010	0.061	0.024	0.164
BDE-206	0.002	<0.009	0.018	0.197	0.025	0.417
BDE-207	0.033	<0.008	0.115	1.160	0.114	4.765
BDE-209	0.319	<0.501	1.660	11.8	0.697	37.6
DBDPE	n.d.	<1.337	<3.034	25.0	<3.531	104
DDT-compounds						
o,p′-DDE	-	-	-	0.035	<0.005	0.403
p,p′-DDE	-	-	-	51.0	4.650	197
o,p′-DDD	-	-	-	0.029	<0.003	0.183
p,p′-DDD	-	-	-	0.394	0.017	2.200
o,p′-DDT	-	-	-	0.059	<0.006	0.474
p,p′-DDT	-	-	-	1.407	0.023	13.0
Sum DDT	-	-	-	52.9	5.067	211
Chloroparaffins						
SCCP	1.19	<0.6	2.50	1 600	6.00	23 700
MCCP	3.57	<0.1	32.0	24.5	3.00	274
Siloxanes						
D4	0.71	<2.26	3.13	2.60	1.35	6.40
D5	4.53	1.77	25.2	88.8	13.2	303
D6	1.95	1.06	3.70	11.2	5.50	28.5
Phosphorus flame retardants (PFRs)						
TEP	-	-	-	n.d.	<0.18	<0.52

TCEP	n.d.	<0.5	<0.5	0.02	<0.08	0.26
TPrP	n.d.	<0.2	<0.2	n.d.	<0.03	<0.05
TCPP	n.d.	<5	<5	n.d.	<1.38	<1.8
TiBP	n.d.	<0.2	<0.2	n.d.	<1	<1.08
BdPhP	n.d.	<0.2	<0.2	n.d.	<0.03	<0.04
TPP	n.d.	<0.2	<0.2	0.03	<0.1	0.18
DBPhP	n.d.	<0.2	<0.2	n.d.	<0.01	<0.07
TnBP	n.d.	<0.2	<0.2	0.29	<3.31	4.41
TDCPP	n.d.	<0.5	<0.5	0.01	<0.18	0.20
TBEP	n.d.	<0.2	<0.2	0.60	<2.1	4.68
TCP	n.d.	<0.2	<0.2	0.03	<0.01	0.27
EHDP	n.d.	<0.2	<0.2	0.13	<0.02	1.66
TEHP	n.d.	<0.2	<0.2	0.01	<0.04	0.16
Phenolic compounds						
Bisphenol A	-	-	-	7.28	<0.55	24.6
Tetrabromobisphenol A	-	-	-	n.d.	<0.5	<1
4,4-bisphenol F	-	-	-	3.12	<1	7.00
2,2-bisphenol F	-	-	-	5.52	<1	8.72
Hexafluorobisphenol A	-	-	-	12.5	<1	16.6
Bisphenol BP	-	-	-	23.2	<1	33.5
Bisphenol S	-	-	-	3.72	<1	14.1
4-nonylphenol	-	-	-	280	<1	4 176
4-octylphenol	-	-	-	4.12	<1	10.1
4-tert-octylphenol	-	-	-	0.36	<1	3.52
Bisphenol B	-	-	-	5.10	<1	13.6
Bisphenol Z	-	-	-	27.0	<1	50.6
Bisphenol AP	-	-	-	0.46	<1	6.95
Bisphenol E	-	-	-	n.d.	<1	<1
Bisphenol FL	-	-	-	n.d.	<1	<1
Bisphenol P	-	-	-	10.1	<1	48.7
Bisphenol M	-	-	-	1.27	<1	19.0
Bisphenol G	-	-	-	1.89	<1	11.6

Bisphenol TMC	-	-	-	46.4	<1	332
Metals						
Ni	-	-	-	0.172	0.012	1.379
Cu	-	-	-	0.727	0.606	0.848
Ag	-	-	-	0.0011	0.0004	0.0039
Cd	-	-	-	0.0002	0.0001	0.0005
Hg	-	-	-	66.2	<21.95	222
Pb	-	-	-	0.045	0.004	0.408
Cr	-	-	-	0.233	0.017	1.773
Fe	-	-	-	27.6	10.9	49.8
Zn	-	-	-	13.3	10.6	19.8
As	-	-	-	0.047	0.008	0.149
PFAS compounds						
PFPA	n.d.	<1	<1	n.d.	<1	<1
PFHxA	n.d.	<0.5	<0.5	n.d.	<0.5	<0.5
PFHpA	n.d.	<0.5	<0.5	n.d.	<0.5	<0.5
PFOA	0.53	<0.5	1.78	0.10	<0.5	0.94
PFNA	0.52	<0.5	1.81	0.28	<0.5	1.73
PFDA	1.43	<0.5	5.61	1.22	<0.5	8.85
PFUdA	1.27	0.49	4.71	0.88	<0.4	4.10
PFDoA	1.12	0.27	3.63	1.32	<0.4	2.94
PFTrA	1.18	0.61	2.83	1.05	<0.4	2.62
PFTeA	0.88	0.42	1.89	0.71	<0.4	2.85
PFBS	n.d.	<0.1	<0.1	n.d.	<0.1	<0.1
PFHxS	0.45	0.14	0.97	0.24	<0.1	0.50
PFOS	21.0	4.35	125	13.0	<0.1	46.5
PFDS	0.35	<0.2	1.25	0.30	<0.2	1.35
PFDoS	n.d.	<0.2	<0.2	n.d.	<0.2	<0.2
PFOSA	0.26	<0.1	3.07	0.03	<0.1	0.20
me-PFOSA	n.d.	<0.3	<0.3	n.d.	<0.3	<0.3
et-PFOSA	n.d.	<0.3	<0.3	n.d.	<0.3	<0.3
me-PFOSE	n.d.	<5	<5	n.d.	<5	<5

et-PFOSE	n.d.	<5	<5	n.d.	<5	<5
me-FOSAA	n.d.	<0.3	<0.3	n.d.	<0.3	<0.3
et-FOSAA	n.d.	<0.3	<0.3	n.d.	<0.3	<0.3
4:2 FTS	n.d.	<0.3	<0.3	n.d.	<0.3	<0.3
6:2 FTS	n.d.	<0.3	<0.3	n.d.	<0.3	<0.3
8:2 FTS	n.d.	<0.3	<0.3	0.02	<0.3	0.35
6:2 diPAP	-	-	-	0.07	<0.3	0.64
Triclosan and triclocarban						
TCC	0.21	<1	3.20	n.d.	<1	<1
Triclosan	n.d.	<3	<3	n.d.	<4	<7
UV-chemicals						
BP3	n.d.	<4	<4	n.d.	<8	<8
EHMC	1.01	<3	8.70	n.d.	<10	<10
OC	2.54	<6	15.4	1.35	<8	10.5

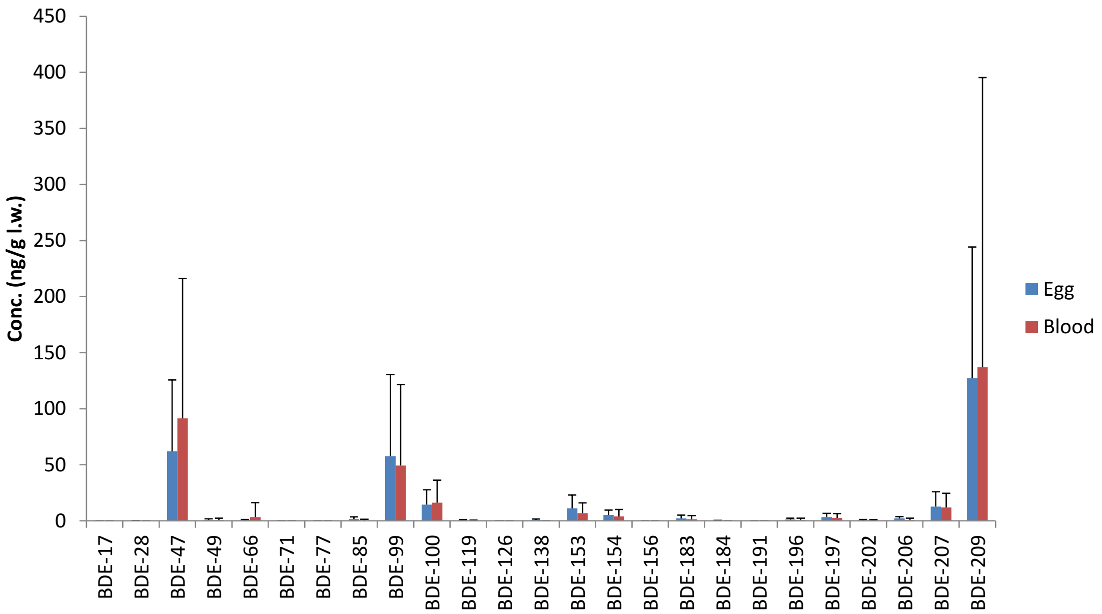


Figure 14. Concentrations of PBDEs (ng/g lipid wt.) in herring gull (eggs and blood) from the Inner Oslofjord (mean and standard deviation; n=15; non-detects are assigned values of zero).

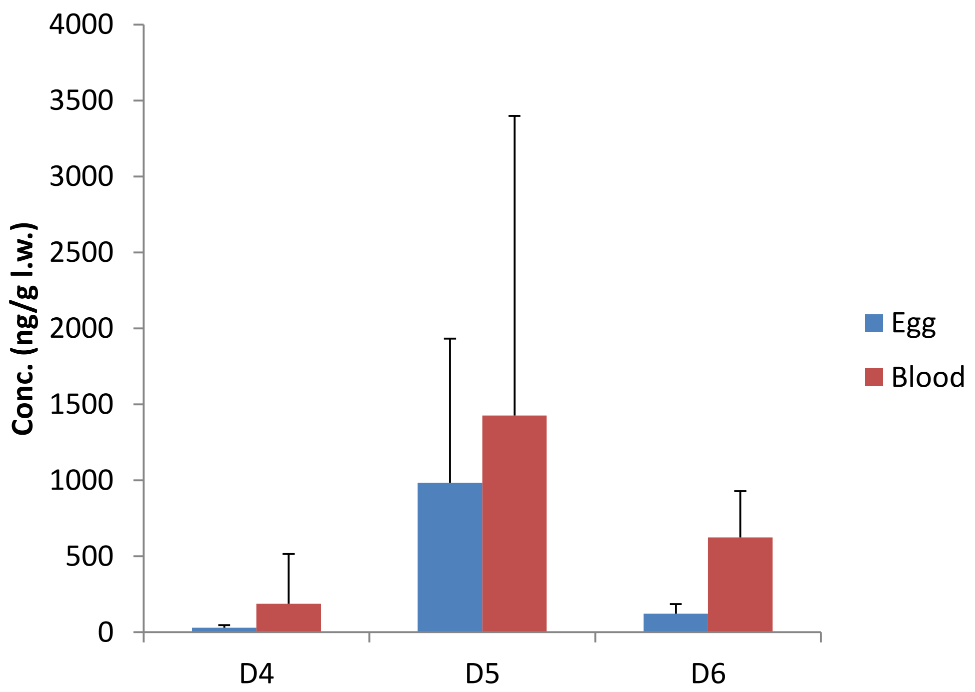


Figure 15. Concentrations of cyclic volatile methylsiloxanes (ng/g lipid wt.) in herring gull (eggs and blood) from the Inner Oslofjord (mean and standard deviation; n=15; non-detects are assigned values of zero, relevant only for D4 in blood, which was not detected in 11 samples).

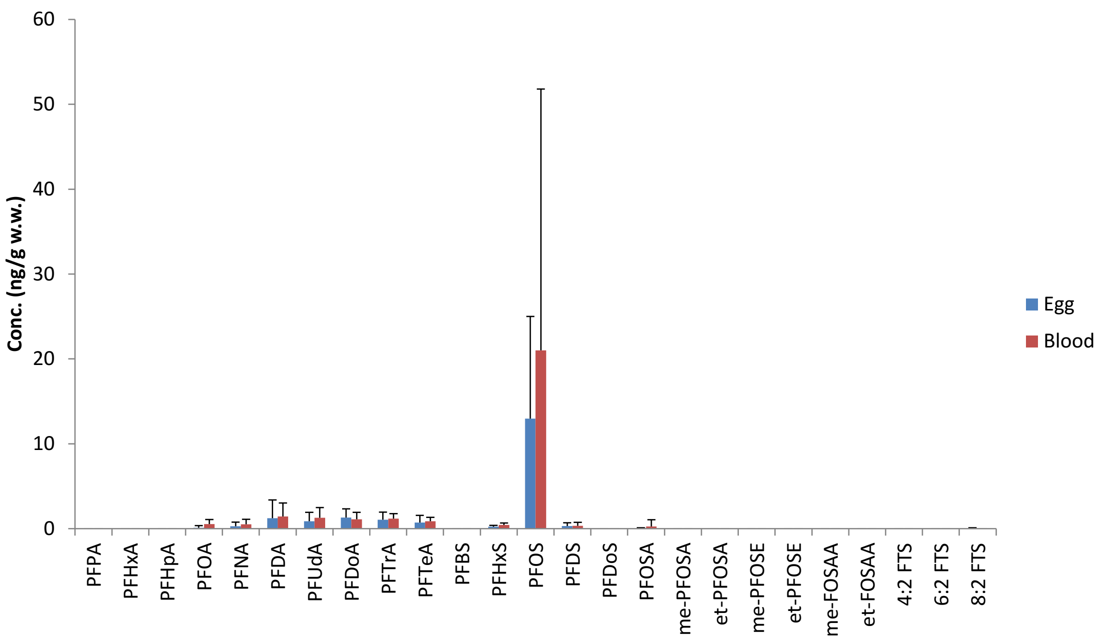


Figure 16. Concentrations (ng/g wet wt.) of PFAS in herring gull (eggs and blood) from the Inner Oslofjord (mean and standard deviation; n=15; non-detects are assigned values of zero).

The PBDE congeners displaying the highest concentrations in herring gull (both blood and eggs) were BDE-209, -47 and -99, although variability was high (Figure 14). This corresponds with previous observations from the Urban fjord programme (Ruus et al. 2015; Ruus et al. 2014). As observed/mentioned earlier (Ruus et al. 2015), the concentrations of PBDEs (e.g. BDE-47 and -209) in herring gull eggs from the present study displayed concentrations that were higher than those recently observed in herring gull eggs from remote colonies in Norway (Sklinna and Røst; Huber et al. 2015), indicating urban influence. It can also be mentioned that according to Gentes et al. (2015), intraspecific forage strategies have strong influence on the PBDE accumulation in gulls, and that foraging on waste management facilities particularly results in higher BDE-209 exposure.

Siloxanes were detected in eggs and blood of herring gull (Figure 15). Decamethylcyclo-pentasiloxane (D5) displayed the highest concentrations and the variability was high. This corresponds with previous observations from the Urban fjord programme (Ruus et al. 2015; Ruus et al. 2014). Mean D5 concentration in eggs from the Oslofjord area (present study) was a factor of ~60 higher than those recently observed in herring gull eggs from remote colonies in Norway (Sklinna and Røst; Huber et al. 2015), indicating urban influence.

PFAS compounds were also detected in eggs and blood of herring gull (Figure 16). PFOS constituted, by far, the highest concentrations in both matrices. The variability was high. This corresponds with previous observations from the Urban fjord programme (Ruus et al. 2015; Ruus et al. 2014).

Egg

As for cod, mercury in herring gull eggs showed a statistically significant positive relationship between (log) concentration and trophic position (Figure 17; corresponding TMF=3.8). One individual egg had large influence on the regression. Mercury in herring gull eggs also showed a positive relationship with $\delta^{34}S$ (R^2=0.51; p=0.0042), shown to co-vary with trophic position (or $\delta^{15}N$) and $\delta^{13}C$ (see chapter 3.1).

The following compounds or elements also showed statistically significant positive relationships between (log) concentrations and trophic position in herring gull eggs, however with one individual egg influencing largely on the regression: PFDA, PFUdA, Cu, Cr and As (wet wt. basis), and PCB-18, -28, -31, -52, -101, -105, -118, -128, -141, and -149 (corresponding TMFs were 4.3, 3.1, 1.2, 8.0, 4.8 for PFDA, PFUdA, Cu, Cr and As, respectively, and 10.6, 3.8, 5.4, 19.2, 19.9, 2.8, 2,8, 2.9, 11.5 and 7.3 for PCB-18, -28, -31, -52, -101, -105, -118, -128, -141, and -149, respectively).

The (log) concentrations (lipid wt. basis) of these PCBs (PCB-18, -28, -31, -52, -101, -105, -118, -128, -141, and -149) also showed statistically significant relationships with $\delta^{34}S$. Furthermore, the (log) concentrations (lipid wt. basis) of D4 and D5 showed statistically significant relationships with $\delta^{34}S$ (Figure 18), and so did the (log) concentrations (wet wt. basis) of As.

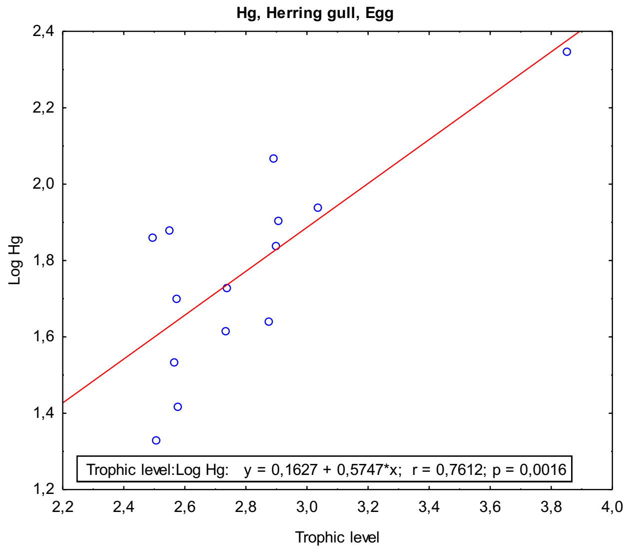


Figure 17. Trophic position against concentrations (ng/g wet wt.; log-transformed) of mercury (Hg) in Herring gull eggs.

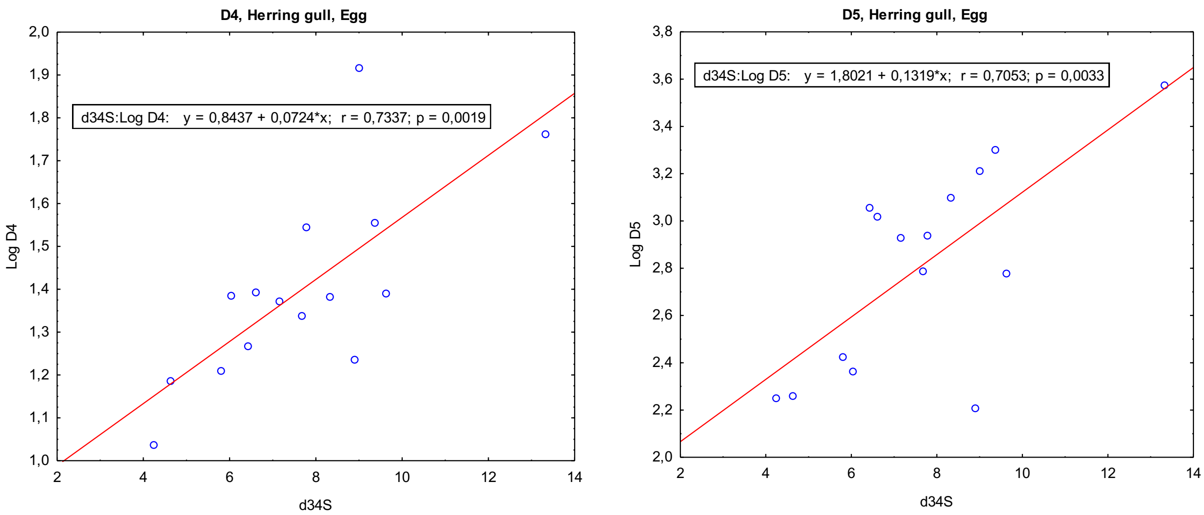


Figure 18. Octamethylcyclotetrasiloxane (D4) and decamethylcyclopentasiloxane (D5) concentrations (ng/g lipid wt.; log-transformed) against $\delta^{34}S$ in herring gull eggs.

As mentioned, it is earlier shown that $\delta^{34}S$ may be used to indicate if a bird forages in the marine environment or in the terrestrial environment, since $\delta^{34}S$ in marine sulphate is generally higher than $\delta^{34}S$ in terrestrial systems (Lott et al. 2003). Furthermore, it is suggested that birds foraging in/near urbanized centres display lower $\delta^{34}S$ ratios (Eulaers et al. 2014). The results presented in Figure 18 would then suggest higher siloxane accumulation in gull individuals that forage more marine and less terrestrial/urban. This is contradictory to the expectation that gulls living more in proximity of urban centres and human products and waste would experience higher siloxane exposure. The Herring gull eggs from the Oslofjord area (this study) did show concentrations of D5 (mean 88.8 ng/g, range 13.1-303 ng/g wet wt.) that were substantially higher than in herring gull eggs from more remote Norwegian marine locations (<0.9 ng/g at Sklinna and <0.9-1.5 ng/g at Røst; Huber et al. 2015). It may therefore be more likely that the relationships presented in Figure 18 may be attributed to the above mentioned co-variation between $\delta^{15}N$, $\delta^{13}C$, and $\delta^{34}S$. Previously, a positive relationship was shown between the concentration of D5 and trophic position (deduced from $\delta^{15}N$) in herring gull eggs (Ruus et al. 2014).

Blood

For herring gull blood, (log) concentrations (ng/g wet wt.) of some PFAS compounds showed statistically significant positive relationships with trophic position: PFNA, PFDA, PFUdA, PFTrA, PFOS and PFDS (corresponding TMFs=1.6, 3.6, 3.3, 1.8, 4.4 and 2.8, respectively). However, two individual gulls (with high $\delta^{15}N$ ratio) had a large influence on the regression. Four of these compounds (PFDA, PFUdA, PFOS and PFDS) also showed a significant positive relationship with $\delta^{34}S$ (still two individual gulls, with high $\delta^{34}S$ ratio, having a large influence on the regression).

The (log) concentration of BDE-154 (ng/g lipid wt.) also showed a statistically significant positive relationship with trophic position in herring gull blood (R^2=0.51; p=0.0313; corresponding TMF=247).

The siloxanes D5 and D6 displayed a statistically significant positive (log-log) relationship between blood concentrations (ng/g lipid wt.) and body mass of herring gulls, again with two individual large gulls having a large influence on the regression. D5 also showed a statistically significant positive (log-log) relationship between blood concentrations (ng/g lipid wt.) and wing length of herring gulls (Figure 19). So did BDE-47 (R^2=0.36; p=0.0497). This suggests that concentrations of D5, D6 and BDE-47 may increase with the size of the birds.

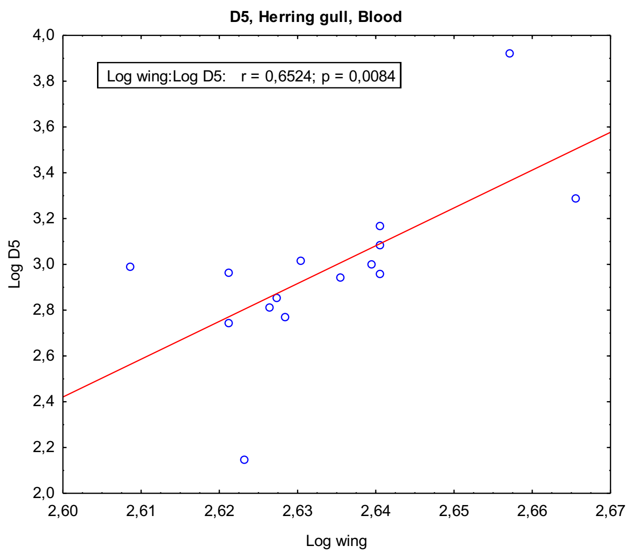


Figure 19. Decamethylcyclopentasiloxane (D5) concentrations (ng/g lipid wt.; log-transformed) in herring gull blood against Wing length (mm; log-transformed).

Egg versus blood

As mentioned, for 13 of the herring gulls, adult female and egg was sampled from the same nest (e.g. mother and future offspring), however, among these there were no demonstrable relationships between the stable isotope ratios ($\delta^{13}C$, $\delta^{15}N$ or $\delta^{34}S$) in the blood and in the egg. Despite that, statistically significant positive (log-log) relationships between egg and blood concentrations could be shown for some halogenated compounds (concentration on lipid wt. basis): PeCB, HCB, PCB-209, BDE-47, BDE-99 (Figure 20), BDE-100, BDE-153, BDE-154 and BDE-197. PCB-123 showed a negative relationship between concentrations in egg and blood.

Verboven et al. (2009) found that Glaucous gull (*Larus hyperboreus*) eggs reflect maternal contaminant patterns (as far as proportions of major contaminant classes are concerned), but emphasized that extrapolation of the POP concentrations in eggs to a value for female body burden should be performed with caution, taking into account contaminant-related differences in egg size and lipid content.

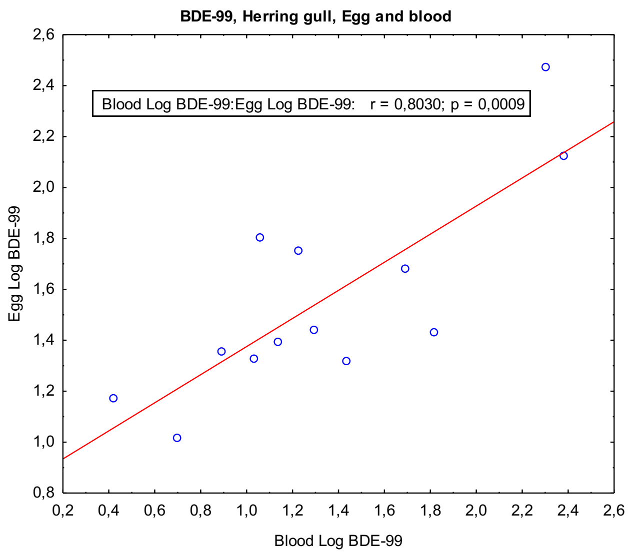


Figure 20. Concentrations (ng/g lipid wt; log-transfromed) of BDE-99 in Blood versus egg of herring gull.

3.2.5 Storm water

The results of the chemical analysis of storm water can be found in the Appendix. Several of the PFAS compounds were not detected in storm water, or only detected in the dissolved fraction (none detected in the particular fraction). Regarding the UV-filters, EHMCwas detected in one sample of the dissolved fraction and 2 samples of the particulate fraction. OC was detected in one sample of the dissolved fraction and 3 samples of the particulate fraction. PCB-concentrations were, as expected, generally higher in the particulate fraction, than in the dissolved fraction. Given the hydrophobic nature of these compounds, they have a high affinity for the particulate phase and are usually associated with particles.

For several compounds, environmental quality standards for water are given through Norwegian law (The Water Regulation/“Vannforskriften”), according to the requirements of the Water Framework Directive. Furthermore, quality standards are suggested for even more compounds (Arp et al. 2014). For the target compounds of this study of which quality standards exist/are suggested, the water concentrations (dissolved fraction) and quality standards are compared in Table 11 (quality standards for coastal water used, to elucidate the potential of surface water as source of contaminants to parts of the fjord).

Concentrations of copper, zinc, arsenic, PBDEs and PFOS exceeded the quality standards, reflecting runoff from the surrounding (urban) area. It should be mentioned that the proposed quality standard for arsenic is low (based on an EC10/NOEC for *Strongylocentrotus purpuratus* of 6 µg/L and an assessment factor of 10; i.e. 0.6 µg/L; Arp et al. 2014). According to Donat and Bruland (1995) common concentrations in sea water lies between 1.5 and 1.8 µg/L (20 – 24 µM). Zinc and arsenic also exceeded the quality standards for sediment out at station Cm21 (see chapter 3.2.1).

Table 11.
Concentrations of contaminants (µg/L) of which Norwegian quality standards (from Arp et al. 2014) exist in coastal water in Stormwater (dissolved fraction). Red numbers indicate excess of the quality standard.

River basin specific compounds	EQS (µg/L)	Stormwater conc. (dissolved; µg/L)
Bisphenol A	0.15	0.0055
Decamethylcyclopentasiloxane (D5)	0.17	n.a.
Medium chained chloroparafins (MCCPs)	0.05	0.0081
Copper (Cu)	2.6	6.52
PFOA	9.1	0.0054
Zinc (Zn)	3.4	29.68
TBBPA	0.25	<0.001
TCEP	65	0.15
Triclosan	0.1	n.a.
Arsenic (As)	0.6	0.91
Chromium (Cr)	3.4	1.60
EU priority substances		
Cadmium (Cd)	0.2	0.044
Lead (Pb)	1.3	0.27
Nickel (Ni)	8.6	1.25
Mercury (Hg)	0.047	0.0064
Brominated diphenyl ethers *	2.4×10^{-09}	6.5×10^{-05}
Hexachlorobenzene	0.013	0.0002
C10-13 chloroalkanes **	0.4	0.066
Pentachlorobenzene	0.0007	0.0001
Nonylphenol (4-)	0.3	<0.001
Oktylphenol (4-*tert*-)	0.01	<0.001
PFOS	0.00013	0.0098

* Sum of BDE-28, -47, -99, -100, -153 and -154.
** Short chained chloroparaffins (SCCPs)

3.3 Support parameters

Miscellaneous support parameters were measured for the different matrices/samples/organisms: Particle fraction <63 µm (% dry wt.) and TOC (µg/mg dry wt.) in sediment, SDM (mg/L) and NPOC/DC (mg C/L) in storm water, $\delta^{34}S$, $\delta^{13}C$, $\delta^{15}N$, C:N (W%), trophic position (deduced from $\delta^{15}N$,) weight of egg (g) and eggshell thickness (mm) for herring gull eggs, $\delta^{34}S$, $\delta^{13}C$, $\delta^{15}N$, C:N (W%), trophic position (deduced from $\delta^{15}N$), wing length (mm), head length (mm) and body mass (g) for herring gull (blood), $\delta^{13}C$, $\delta^{15}N$, C:N (W%), trophic position (deduced from $\delta^{15}N$), age (yr), body length (cm), body mass (g), liver weight (g), gonad weight (g) and sex of cod, and $\delta^{13}C$, $\delta^{15}N$, C:N (W%) and trophic position (deduced from $\delta^{15}N$) of the organisms of the Inner Oslofjord food web. Some of these were included in different statistical analyses referred to above. The measurements of these support parameters are presented in Tables A1-A6 in the Appendix. The lipid content of all biological samples is given in the Appendix.

3.4 Biological effect parameters

The following biological effect parameters were measured in cod: Gonad histopathology, vitellogenin (VTG) in blood plasma, micronucleii (in blood cells), acetylcholinesterase (AChE) activity in muscle (microsomal fraction), as well as the physiological parameters liversomatic index (LSI) and gonadosomatic index (GSI).

The purpose of the gonad histopathology was to assess the histological status of gonads, including histopathological conditions. Histological parameters are commonly used as markers of health status in various fish species. The identification of pathologies and diseases are increasingly being used as indicators of environmental stress since they provide a definite and ecologically-relevant end-point for chronic/sub-chronic contaminant exposure. Histopathological alterations illustrate a definitive endpoint of historical exposure, intermediate between initial biochemical changes and reproductive capability and growth.

Vitellogenin is a parameter of which the response is well characterized and limited to substances with estrogenic (or anti estrogenic) activity. Synthesis of VTG is regulated by the hormone estradiol. High levels of estradiol mean high production of VTG in the liver and thus higher levels in blood plasma.

Micronucleus formation (MN) is one of the most widely used methods to investigate chromosomal aberrations resulting in the formation of satellite DNA. Micronucleus formation can be used as a measure of chemical induced genotoxicity.

In vertebrates acetylcholine (ACh) acts as an excitatory transmitter in the somatic nervous system. ACh also serves as both a pre ganglionic and a post ganglionic transmitter in the parasympathetic nervous system. Cholinesterase enzymes (ChE) are responsible for the removal of ACh from the synaptic cleft by hydroxylation. Acetylcholinesterase (AChE) may be inhibited by various substances/contaminants in the aquatic environment, such as organophosphates (Burgeot et al., 2012; Assis et al. 2010; Di Tuoro et al., 2011).

Gonad histopathology was performed by IRIS and the results are reported in the Appendix. Some quantitative measures from the histopathology are also presented in Table 12, together with results from the other effect parameter analyses. It was concluded that there were only 3 individuals with pathological changes in gonads, i.e. granulomatous inflammation, and only one of them had it at a moderate stage. It is difficult to relate this to any contaminant concentrations pointing out as extraordinary (only the male individual characterized by mild degree of granulomatous inflammation and MMC presence, in addition to being affected by a parasite, showed concentrations of PCBs in the higher range; see Appendix).

Vitellogenin was measured in blood plasma of cod using an enzyme–linked immunosorbent assay (ELISA). As expected, concentrations were higher in females, than in males, and variation was high (Figure 21). The three individual females with the markedly highest VTG concentrations were also the ones with the highest gonadosomatic index (GSI; Table 12). There was a statistically significant positive relationship (log-log) between GSI and VTG in females (R^2=0.63; p=0.0191). There were some statistically significant relationships (log-log) between the concentrations of contaminants and VTG in females, with the three individuals with the markedly high VTG concentrations having a large influence on the regression (i.e. large females may naturally have higher VTG levels as well as higher contaminant levels as a consequence of higher age or trophic level), thus a likely causality cannot be shown to. The following compounds showed a positive relationship with VTG: PeCB, HCB, PCB-18, -28, -31, -33, -47, -52 and -149, BDE-28, -47, and -49, SCCP, and bisphenol TMC (only detected in 4 individual females). Lead (Pb) and zinc (Zn) showed negative relationship with VTG. In males, only one compound (PFOS) showed a statistically significant relationship (log-log) with the VTG concentrations in blood, and this relationship was positive. Vitellogenin was, however, only measured together with contaminants in 4 male individuals, thus a likely causality cannot be shown to.

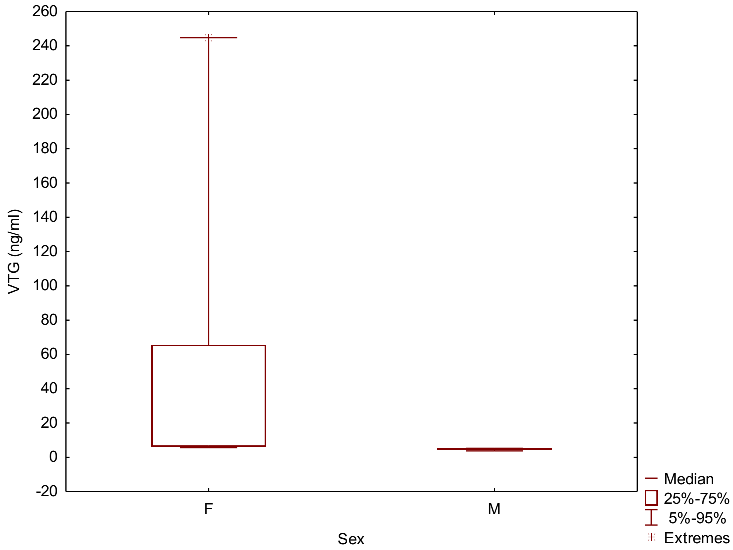


Figure 21. Box plot (median and percentiles) of vitellogenin concentrations (ng/ml) in blood plasma of cod (female, n=8, and male, n=7, respectively) from the Inner Oslofjord.

Table 12.
Biological effect parameters measured for Cod from the Inner Oslofjord.

							Histological analysis, Gonads (see full report in Appendix)						
Sample no. (fish no.)	**Sex**	**VTG ***	**AChE ****	**MN *****	**GSI**	**LSI**	**Stage**	**Increased vascular or interstitial proteinaceous fluid**	**Granulomatous inflammation**	**Parasite**	**Postovulatory follicles**	**Atretic follicles**	**mmc**
1 (1)	F	18.46	15.23	0.0	0.95	2.31	5		2		2		2
2 (10)	F	5.81	26.18		0.38	2.38	6						
3 (12)	F	244.73	5.60	0.0	0.94	4.01	6						
4 (13)	F	112.77	13.19	0.5	1.02	2.85	6						
5 (14)	M	4.61	14.33		0.08	1.88	6						
6 (16)	F		18.25		0.90	2.94	5		2		2	2	2
7 (17)	F		12.11		0.60	1.70	5	1			2		3
8 (18)	F		8.14	0.0	0.88	2.23	5	1	1		2		
9 (19)	M	5.24	15.07	0.0	0.14	2.09	6						
10 (20)	F	5.59	10.15	0.0	0.54	3.01	6						1
11(23)	M	3.70	20.74	0.0	0.25	3.01	6	2					
12 (25)	F	6.23	12.27	0.5	0.33	1.16	6						
13 (26)	F	6.61	15.67	0.0	0.34	2.42	6					1	1
14 (27)	F	6.74	11.00	0.0	0.60	2.35	5				1		1
15 (28)	M	5.32	11.54	0.0	0.35	3.76	6		1	1			2

***Vitellogenin (ng/ml); **Acetylcholin esterase activity (nmol ATC/min/mg protein); ***Micronucleii (MN/1000 cells).**

Table 12 cont.
Effect parameters measured for Cod from the Inner Oslofjord (extra specimens of which some effect parameters were measured).

							Histological analysis, Gonads						
Sample no. (fish no.)	Sex	VTG *	AChE **	MN ***	GSI	LSI	Stage	Increased vascular or interstitial proteinaceous fluid	Granulomatous inflammation	Parasite	Postovulatory follicles	Atretic follicles	mmc
X1 (3)	M	4.90			0.28	1.41							
X2 (6)	F			0.0	1.07	2.30							
X3 (7)	F			0.0	0.44	1.60							
X4 (8)	F			0.5	1.09	2.34							
X5 (9)	F			0.5	0.29	1.21							
X6 (15)	M	3.97			0.23	0.86							
X7 (21)	M	5.64			0.06	1.28							
X8 (22)	F			0.0	0.71	0.91							
X9 (24)	F			0.0	0.86	1.97							

***Vitellogenin (ng/ml); **Acetylcholin esterase activity (nmol ATC/min/mg protein); ***Micronucleii (MN/1000 cells).**

Micronucleii were only detected in four cod individuals. Furthermore, only one micronucleus was detected per 2000 counted cells in each if these individuals (Table 12).

Acetylcholinesterase (AChE) activity in the muscle of cod showed statistically significant negative relationships with length, weight and age of cod (Figure 22). As mentioned, mercury (Hg) was shown to correlate with length and weight of cod (see chapter 3.2.3), thus expectedly a statistically significant negative relationship (log-log) was observed between the concentration of Hg and AChE in cod (Figure 23).

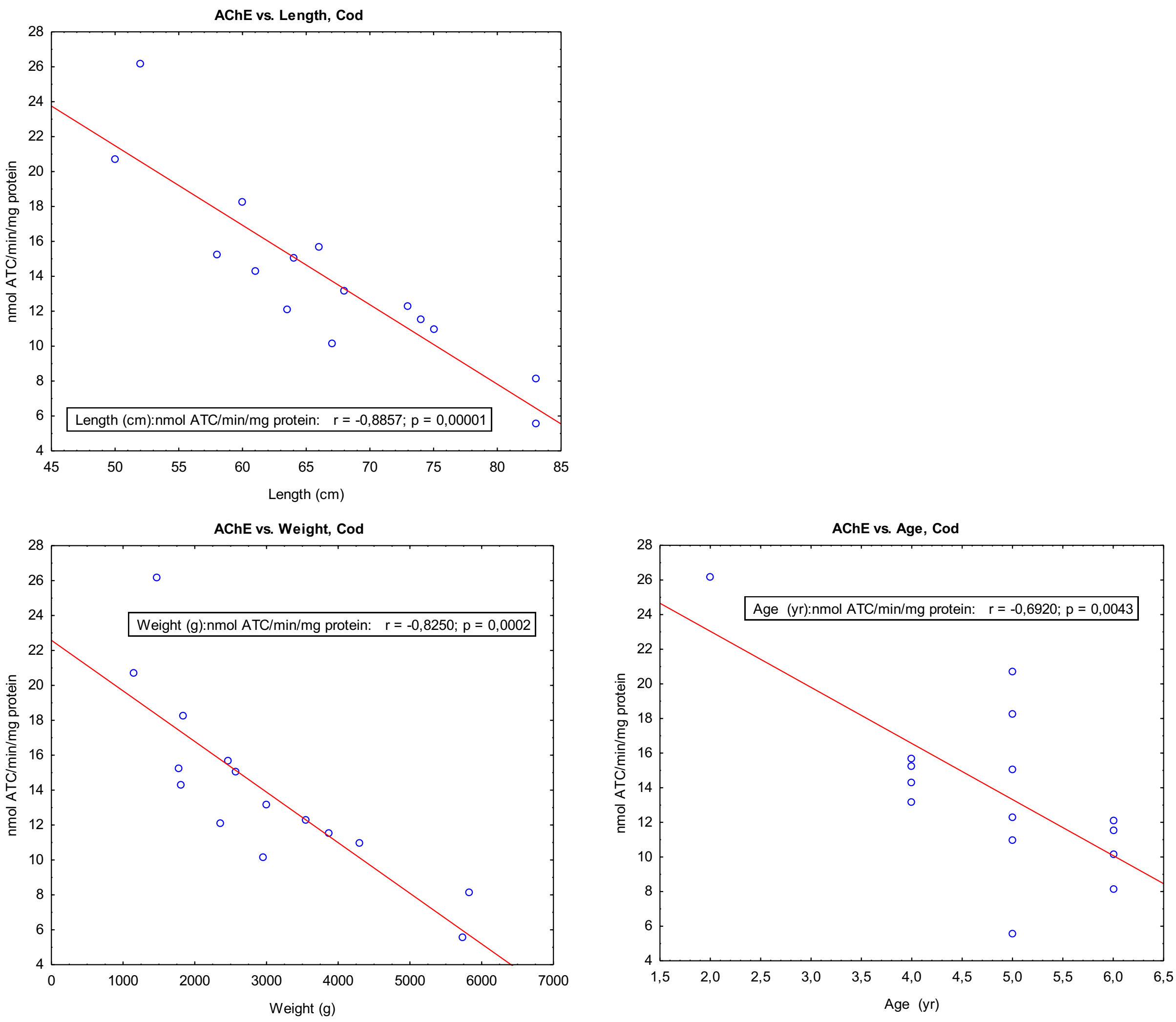


Figure 22. Acetylcholinesterase (AchE) activity in muscle of cod from the Inner Oslofjord against length (cm), weight (g) and age (yr) of cod respectively.

Because of the co- linearity among several variables results are inconclusive regarding likely causality, i.e. it is difficult to know if it is the size of the fish or the concentration of mercury that cause lower AChE activity. Inhibition of AChE is a known marker of exposure to organophosphate pesticides, but the role of Hg as an anticholinesterase agent is not as well established. Shaw and Panigrahi (1990) did however show a significant negative correlation between brain residual Hg levels and AChE activity in fish. They suggested that Hg might be exerting its influence by combining with the SH-group of the enzyme leading to conformational changes and thus inactivation. Vieira et al. (2009) also found that mercury inhibited AChE activity in the head of the common goby (*Pomatoschistus microps*), also leading to decreased swimming performance.

Concentrations of bisphenol P also showed a negative relationship (log-log) with AChE activity in cod (bisphenol P only detected in 6 individuals; R^2=0.85; p=0.0090). As mentioned, concentrations of bisphenol P were also correlated with trophic position, length and weight of cod (see chapter 3.2.3).

Acetylcholinesterase (AChE) activity in the muscle of cod also showed statistically significant negative relationships (log-log) with the concentrations of PeCB, HCB, PCB-28, -31, and -33, BDE-49 and -119. It showed positive relationships with the concentrations of lead (Pb) and bisphenol E (only detected in 5 individuals, with one individual having a large influence on the regression). It is likely that these observations are a consequence of the above mentioned co-linearity with the size of the fish, as concentrations of PCB-31 showed a positive relationship with both length and weight of cod, while Pb showed a negative relationship with both length and weight of cod (see chapter 3.2.3).

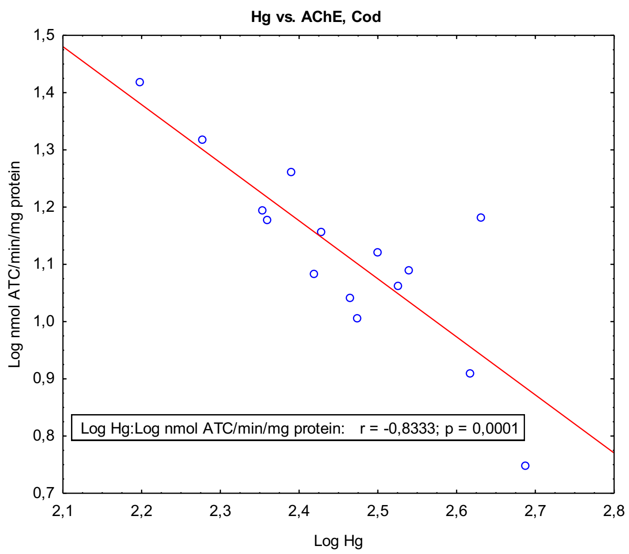


Figure 23. The activity of Acetylcholin esterase (nmol ATC/min/mg protein; log-transformed) against the concentrations of mercury (Hg; ng/g wet wt.; log-transformed) in muscle of cod from the Inner Oslofjord.

3.5 Eggshell thickness

As previously observed (Ruus et al. 2015), a statistically significant positive relationship was found between the eggshell thickness and the trophic position of the eggs (determined from the fraction of stable nitrogen isotopes, $\delta^{15}N$; Figure 24). This suggests that the shell thickness of eggs in the present study was not affected negatively by compounds that increase in concentration with higher trophic position. As mentioned, co-variation was found between $\delta^{15}N$, $\delta^{13}C$, and $\delta^{34}S$. Not unexpectedly, a significant relationship was therefore also found between eggshell thickness and $\delta^{34}S$ (Figure 24) in the eggs.

For 13 of the 15 herring gulls sampled, adult female and egg was sampled from the same nest (e.g. mother and future offspring). There were no statistically significant relationship between the trophic position of the gull (mother) and the thickness of eggshells from the same nests, or between $\delta^{34}S$ of the gull (mother) and the thickness of eggshells from the same nests.

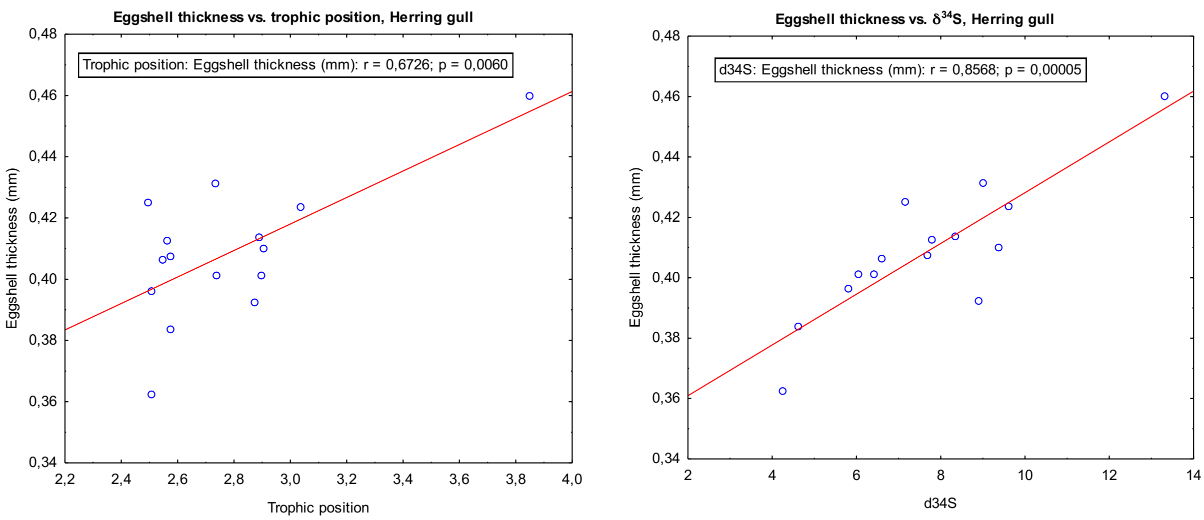


Figure 24. Eggshell thickness (mm) against Trophic position (determined from the fraction of stable nitrogen isotopes, $\delta^{15}N$) and $\delta^{34}S$, respectively, in eggs of herring gull from the Oslofjord area.

Given these relationships, not unexpectedly statistically significant positive relationships (log-log) were found between eggshell thickness and egg concentrations of several compounds:, such as Cu, Hg ,PCB-28, -47, -52, -66, -74, -99, -101, -105, -118, -123, -128, -141, -149, p,p′-DDD, D4 (Figure 25), D5 (Figure 25) and D6 (Figure 25).

Concentrations of Zinc (Zn) in the eggs showed a negative relationship (log-log) with the eggshell thickness (Figure 26). This appears contradictory to findings that (organic forms of) Zn in the diet of egg laying hens improves eggshell qualities (Gheisari et al. 2011).

There were few statistically significant relationships that could be shown between the concentrations of compounds in the blood of birds and the eggshell thickness of eggs from the same nest. Negative relationships were found for PFDA (R^2=0.47; p=0.0142) and PFUdA (R^2=0.31; p=0.049). However, one individual had a strong influence on the regressions. Future studies could indicate if these correlations were a random observation, or if such relationships may be reproduced. However, apparently it has been shown difficult to relate contaminants to decreased reproductive success in herring gulls (Weseloh et al. 1994).

In 2013, significant relationships were found between eggshell thickness and (egg-) concentrations of β-HCH and bisphenol A (BPA), with reasons unknown (Ruus et al. 2014). It was noted that BPA is known for its estrogenic-like effects, however that it is difficult to relate oestrogenic effects to a decrease in avian eggshell thickness. Furthermore, no such relationship could be shown in 2014 (Ruus et al. 2015) or 2015 (present study). In 2014 (Ruus et al. 2015) no significant relationships could be observed between eggshell thickness and egg-concentrations of any compounds. However, a significant positive relationship was observed between eggshell thickness and the trophic position (derived from $\delta^{15}N$), as in the present study.

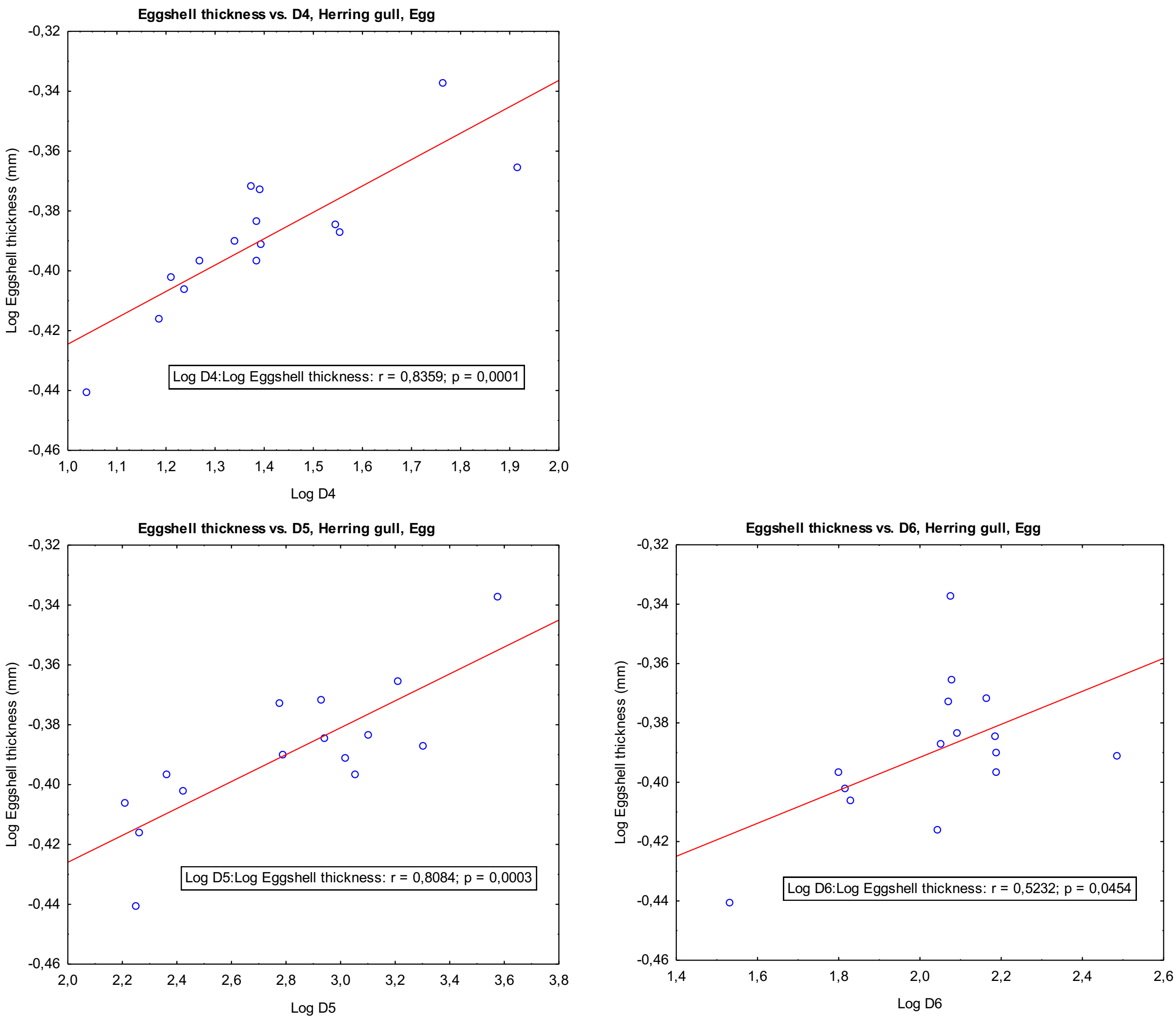


Figure 25. Eggshell thickness (mm; log-transformed) against the concentrations (ng/g lipid wt.; log-transformed) of D4, D5 and D6, respectively, in eggs of herring gull from the Oslofjord area.

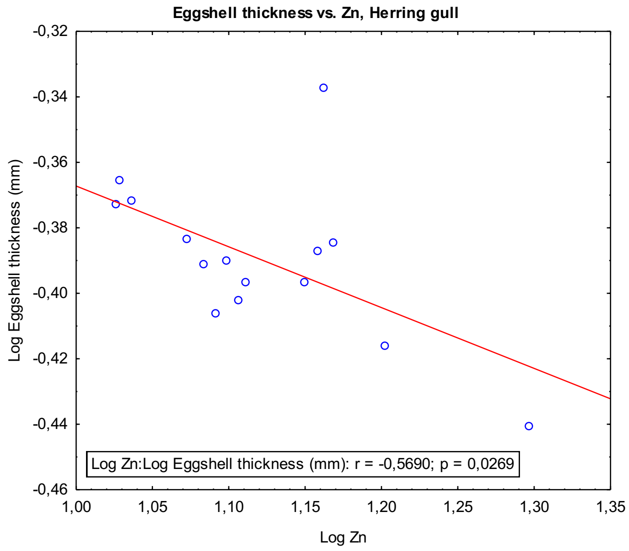


Figure 26. Eggshell thickness (mm; log-transformed) against the concentrations (µg/g wet wt.; log-transformed) of zinc (Zn) in eggs of herring gull from the Oslofjord area.

3.6 Mixture toxicity / cumulative risk

Of the measured contaminants, $PNEC_{pred}$, $PNEC_{oral}$ and/or EQS_{biota} values were only found for 19 compounds or compound groups (Table 13). The values were obtained from Andersen et al. (2012), EU risk assessment reports and the EQS directive (2013). All values ($PNEC_{pred}$, $PNEC_{oral}$ and EQS_{biota}) are hereby referred to as $PNEC_{pred}$ and refer to secondary poisoning of terrestrial organisms from eating contaminated prey. The risk of secondary poisoning of seabirds feeding on blue mussels, polychaetes or herring was calculated by summing up the $MEC/PNEC_{pred}$ values as described earlier and is presented in the following subchapters.

Table 13.
Available PNEC values for the analysed contaminants (µg/kg).

Compound	$PNEC_{pred}$[a]	$PNEC_{oral}$	EQS_{biota}[b]
Bisphenol A	2670		
Cadmium (Cd)		160[c]	
Decamethylcyclopentasiloxane (D5)	13000		
Hexachlorobenzene (HCB)			10
Dodecamethylcyclohexasiloxane (D6)		667000[g]	
Medium chained chloroparafins (MCCP)	10000		
Mercury (Hg)			20
Nickel (Ni)		8500[b]	
Nonylphenol (4-)	10000		
OctaBDE (BDE183, 184, 191, 196, 197, 202, 206, 207)	6700		
Octamethylcyclotetrasiloxane (D4)		1700[f]	
Octylphenols (octylphenol and 4-tert-octylphenol)	10000		
PentaBDE (BDE 99 + BDE 100)	1000		
PFOS	13		
Short chained chloroparafins (SCCP)	5500		
TCP	1700		
TCPP	11600		
tetrabromobisphenol A	667000		
Triclosan		1670[e]	
[a]Obtained from Andersen et al. (2012) [b] EQS directive 2013/39/EU [c]EU RAR Cd 2007 [d]EU RAR Ni 2008 [e]ECHA 2015, [f]Brooke et al., 2009b. [g]Brooke et al., 2009a			

3.6.1 Risk of secondary poisoning for predators of blue mussels

The sum of $MEC/PNEC_{pred}$ values based on measured concentrations in blue mussels was 1.86 which is indicative of a risk to predators of these organisms. The individual $MEC/PNEC_{pred}$ ratios are presented in Table 14. Cadmium was the only compound with a $MEC/PNEC_{pred}$ ratio above 1, indicating that there is a potential risk of secondary poisoning by this compound alone. The main risk drivers for secondary poisoning of seabirds feeding on blue mussels are the metals Cd ($MEC/PNEC_{pred}$ = 1.01) and Hg ($MEC/PNEC_{pred}$ =0.77), constituting 96% of the total sum of $MEC/PNEC_{pred}$ (Figure 27).

Table 14.
Calculation of MEC/PNECpred ratios for blue mussels.

Compound	MEC (µg/kg)	MEC/PNEC
Bisphenol A	<LOD	0.00
Cadmium (Cd)	161.58	1.01
Decamethylcyclopentasiloxane (D5)	20.54	0.00
Dodecamethylcyclohexasiloxane (D6)	<LOD	0.00
Hexachlorobenzene (HCB)	0.02	0.00
Medium chained chloroparafins (MCCP)	0.97	0.00
Mercury (Hg)	15.47	0.77
Nickel (Ni)	400.92	0.05
Nonylphenol (4-)	14.38	0.00
OctaBDE (BDE183, 184, 191, 196, 197, 202, 206, 207)	<LOD	0.00
Octamethylcyclotetrasiloxane (D4)	<LOD	0.00
Octylphenols (octylphenol and 4-tert-octylphenol)	257.65	0.03
PentaBDE (BDE 99 + BDE 100)	0.01	0.00
PFOS	<LOD	0.00
Short chained chloroparafins (SCCP)	1.50	0.00
TCP	<LOD	0.00
TCPP	0.40	0.00
Tetrabromobisphenol A	<LOD	0.00
Triclosan	<LOD	0.00
Sum MEC/PNEC		1.86

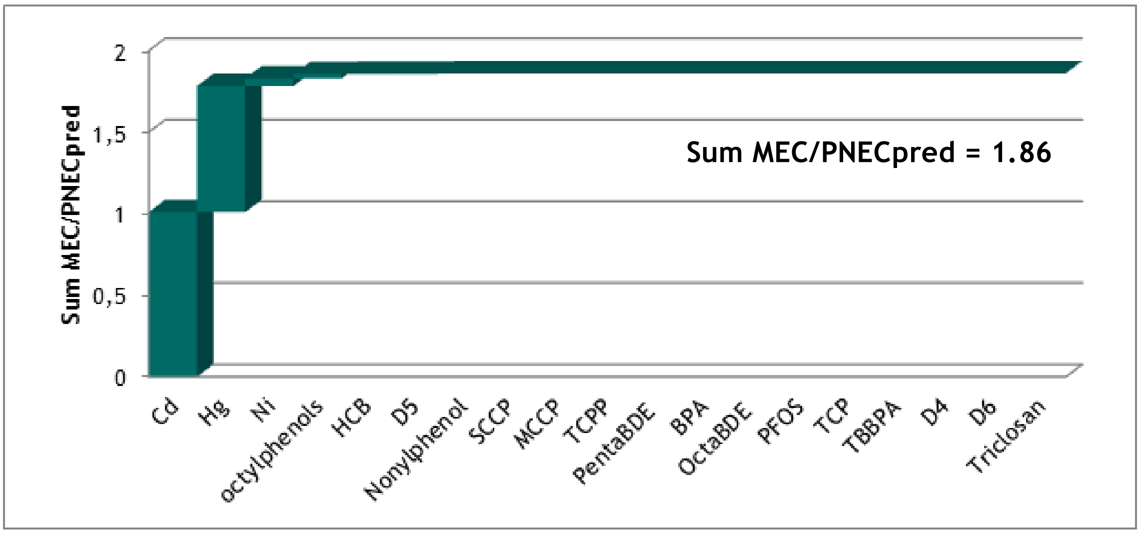


Figure 27. Contribution plot of MEC/PNEC$_{pred}$ summation for values measured in blue mussels.

3.6.2 Risk of secondary poisoning for predators of polychaetes

The sum of MEC/PNEC$_{pred}$ values based on measured concentrations in polychaetes was 5.48 which is indicative of a risk to predators of these organisms. The individual MEC/PNEC$_{pred}$ ratios are presented in Table 15. Mercury and Cd had MEC/PNEC$_{pred}$ ratios above 1, indicating a potential risk of secondary poisoning by these compounds individually. The main risk drivers for secondary poisoning of seabirds feeding on polychaetes are the metals Hg (MEC/PNEC$_{pred}$ = 3.71) and Cd (MEC/PNEC$_{pred}$ = 1.15), constituting 89% of the total sum of MEC/PNEC$_{pred}$ (Figure 28).

Table 15.
Calculation of MEC/PNECpred ratios for polychaetes

Compound	MEC (µg/kg)	MEC/PNEC
Bisphenol A	174.51	0.07
Cadmium (Cd)	183.32	1.15
Decamethylcyclopentasiloxane (D5)	132.33	0.01
Dodecamethylcyclohexasiloxane (D6)	7.05	0.00
Hexachlorobenzene (HCB)	0.20	0.02
Medium chained chloroparafins (MCCP)	1.27	0.00
Mercury (Hg)	74.13	3.71
Nickel (Ni)	2443.40	0.29
Nonylphenol (4-)	21.93	0.00
OctaBDE (BDE183, 184, 191, 196, 197, 202, 206, 207)	0.00	0.00
Octylphenols (octylphenol and 4-tert-octylphenol)	272.94	0.03
Octamethylcyclotetrasiloxane (D4)	4.09	0.00
PentaBDE (BDE 99 + BDE 100)	0.04	0.00
PFOS	1.87	0.14
Short chained chloroparafins (SCCP)	1.33	0.00
TCP	0.09	0.00
TCPP	14.14	0.00
Tetrabromobisphenol A	45172.09*	0.07
Triclosan	<LOD	0.00
Sum MEC/PNEC		5.48

* TBBPA only detected in quantifiable amounts in one of the three samples, high concentration in this sample.

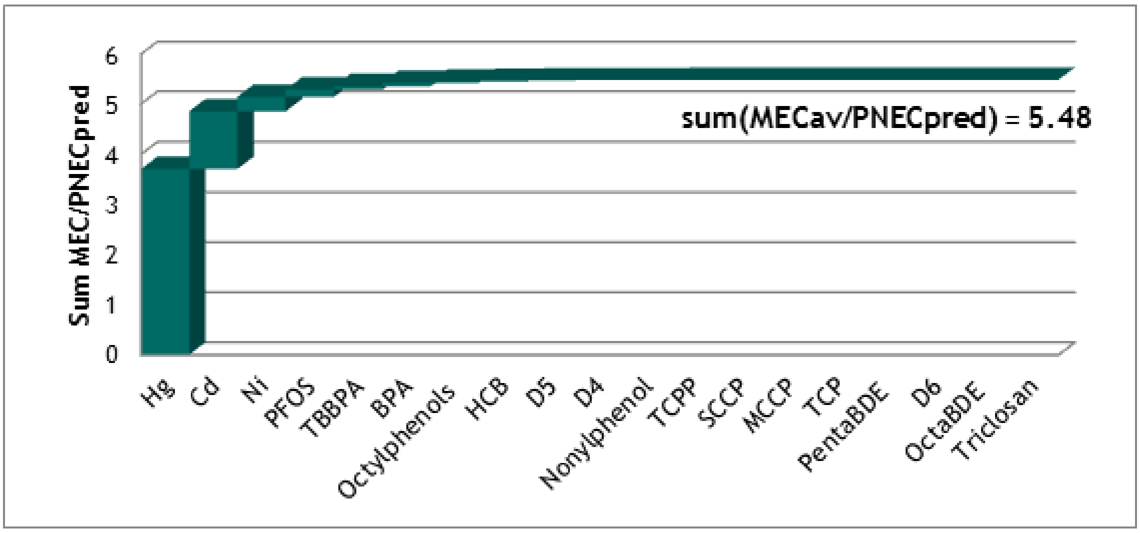


Figure 28. Contribution plot of MEC/PNEC$_{pred}$ summation for values measured in polychaetes.

3.6.3 Risk of secondary poisoning for predators of herring

The sum of MEC/PNEC$_{pred}$ values based on measured concentrations in herring was 5.33 which is indicative of a risk to predators of these organisms. The individual MEC/PNEC$_{pred}$ ratios are presented in Table 16. Mercury is the only compound with an individual MEC/PNEC$_{pred}$ ratio above 1, indicating a potential risk of secondary poisoning by Hg alone. The main risk driver for secondary poisoning of seabirds feeding on herring is Hg (MEC/PNEC$_{pred}$ = 5.14), constituting 96% of the total sum of MEC/PNEC$_{pred}$ (Figure 29).

For all food sources, Hg appears to be the main risk driver. The PNEC$_{pred}$ value used for Hg was obtained from the EQS directive (20 µg/kg) and is lower than the PNEC$_{pred}$ value used by Herzke et al. (2015) (0.4 mg/kg = 400 µg/kg). Thus, the data source from which the PNEC$_{pred}$ is based is of importance and should in the future be more standardised in order to compare calculations between studies. Another aspect adding uncertainty to the performed assessment is that the proposed framework is based on exposure concentrations in water and PNEC values for the aquatic environment. In this study, measured concentrations in prey were used as exposure concentrations and PNECs for secondary poisoning were used as limit values. However, more effect data for the aquatic environment are present based on water concentrations and PNEC values or EQS values based on concentrations in water are calculated for more compounds than the PNEC$_{pred}$, PNEC$_{oral}$ and EQS$_{biota}$ values. Thus, environmental risk assessment of mixtures based on measured concentrations in water and use of PNEC and EQS values for the aquatic environment might lower the uncertainty of the first-tier assessment. Other knowledge gaps in the present study are that PNEC$_{pred}$ values were only found for a limited number of compounds and compound groups.

Table 16.
Calculation of MEC/PNECpred ratios for herring

Compound	MEC (µg/kg)	MEC/PNEC
Bisphenol A	10.95	0.00
Cadmium (Cd)	<LOD	0.00
Decamethylcyclopentasiloxane (D5)	520.70	0.04
Dodecamethylcyclohexasiloxane (D6)	18.59	0.00
Hexachlorobenzene (HCB)	0.90	0.09
Medium chained chloroparafins (MCCP)	1.05	0.00
Mercury (Hg)	102.83	5.14
Nickel (Ni)	57.72	0.01
Nonylphenol (4-)	2.52	0.00
OctaBDE (BDE183, 184, 191, 196, 197, 202, 206, 207)	0.02	0.00
Octylphenols (octylphenol and 4-tert-octylphenol)	292.11	0.03
Octamethylcyclotetrasiloxane (D4)	8.28	0.00
PentaBDE (BDE 99 + BDE 100)	0.40	0.00
PFOS	0.21	0.02
Short chained chloroparafins (SCCP)	5.27	0.00
TCP	<LOD	0.00
TCPP	0.38	0.00
Tetrabromobisphenol A	<LOD	0.00
Triclosan	<LOD	0.00
Sum MEC/PNEC		5.33

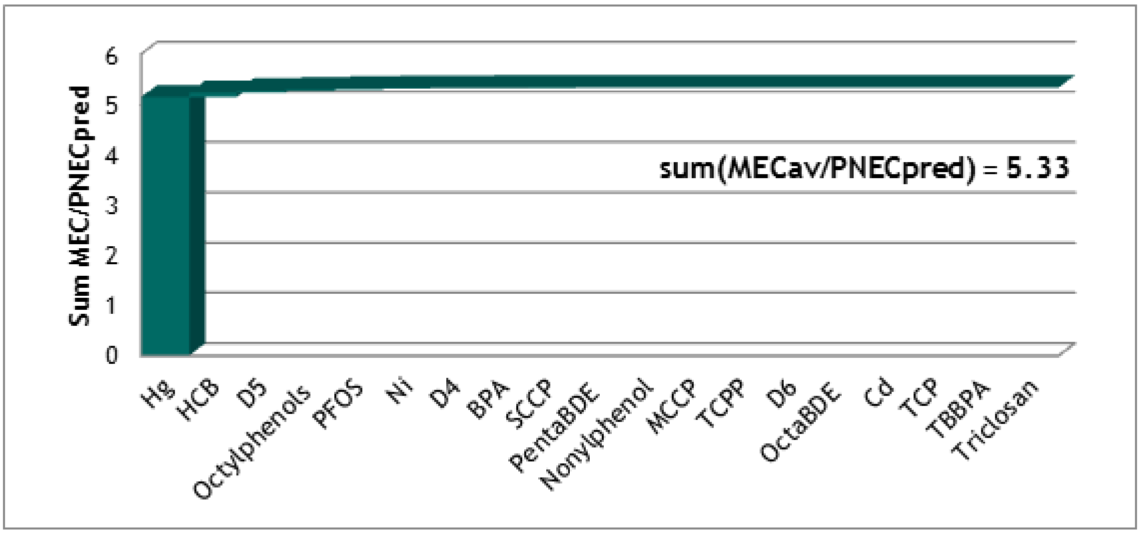


Figure 29. Contribution plot of MEC/PNEC$_{pred}$ summation for values measured in herring.

3.6.4 Risk for effects on herring gull from exposure in eggs

The approach of summing up $MEC/PNEC_{pred}$ values is considered a conservative first-tier approach in order to filter out scenarios with low environmental risk. The calculated sum of $MEC/PNEC_{pred}$ based on blue mussels, polychaetes or herring as food source all indicated a risk of secondary poisoning, mainly by the risk drivers Hg and Cd. In order to evaluate the risk for birds based on the measured concentrations, relevant toxicity data for the same species group with the same exposure concentration denomination (e.g. ng/g egg) as the measured concentrations is required.

In a recent study from the Norwegian Environment Agency (Andersen et al. 2014), the combined risk of effects in sea bird eggs were calculated by comparing MEC in eggs with effect data from exposure in eggs compiled from literature. These effect data were adopted in this study in order to evaluate the combined risk for effects on Herring gull eggs. As the effect data does not separate between type of effect (e.g. mortality, reduced number of eggs) or effect level (e.g. LOEC, EC(D)10, EC(D)50), and assessment factors are not used in this study, the applied approach is considered as an approximation to the environmental risk assessment of chemical mixtures, tier-two. The results should therefore be interpreted with caution. The risk of combined effects of the compounds was calculated based on average (MECa) and median (MECm) values of the measured egg concentrations in 15 eggs. As seen from Table 17, using average measured concentrations led to a higher sum of MEC/Effect ratios than when using median measured concentrations. There was a large difference in the average and median concentration of 4-nonylphenol. 4-nonylphenol was only detected in quantifiable amounts in four of the 15 eggs, and in one egg the concentration was considerably higher (4176 ng/g) than the other three. In both cases (average and median values) the sum was higher than 1, indicating a risk for effect on the eggs of the mixture of contaminants.

Bisphenol A had MEC/effect ratios above 1 in both approaches (using average or median concentration), showing that there is a risk of effects of bisphenol alone. The main contributors to the sum of MECm/effect in addition to bisphenol A was BDE-99 and 4-nonylphenol (Figure 30). These findings are similar to that observed by Herzke et al. (2015) where a sum MEC/effect for compounds measured in sparrowhawk eggs were higher than 1. Bisphenol A and 4-nonylphenol were not included in the assessment of sparrowhawk, but BDE-99 (which was also one of the main contributors in this study), had the highest MEC/effect ratio (Herzke et al. 2015).

Table 17.
Calculation of MEC/effect ratios for Herring gull eggs

Compound	MECa (ng/g egg)	MECm (ng/g egg)	Effect value (ng/g egg)*	MECa/effect	MECm/effect
PeCB	0.24	0.14	400	0.00	0.00
BDE-85	0.15	0.08	10	0.01	0.01
BDE-99	5.41	4.41	10	0.54	0.44
BDE-100	1.36	0.91	10	0.14	0.09
BDE-119	0.05	0.02	10	0.01	0.00
BDE-126	0.01	0.01	10	0.00	0.00
p,p'-DDE	51.02	24.40	3000	0.02	0.01
EHDP	0.94	0.94	1100	0.00	0.00
bisphenol A	18.19	17.27	2	9.10	8.63
4-nonylphenol	1048.27	7.46	20	52.41	0.37
Ni	0.17	0.04	1000	0.00	0.00
Cu	0.73	0.73	1160	0.00	0.00
Cd	0.00	0.00	100	0.00	0.00
Hg	70.94	61.33	400	0.18	0.15
PFOS	13.89	10.77	100	0.14	0.11
Sum				62.54	9.82

*Effect values were obtained from Andersen et al. (2014)

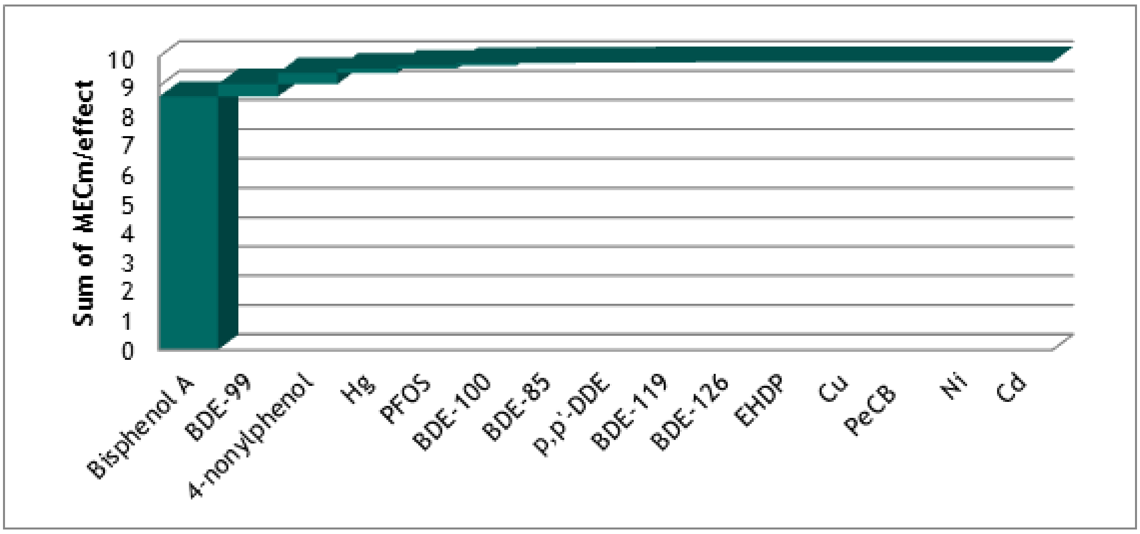


Figure 30. Contribution plot of MEC/PNEC$_{pred}$ summation for values measured in herring gull eggs.

Based on the measured concentrations of pollutants in Herring gull and effect data compiled by Andersen et al. (2014), there is a risk for effects of combined effects, mainly driven by the organic compounds bisphenol A, 4-nonylphenol and BDE-99. However, the results should be interpreted with caution due to the nature of the effect data. The effect data do not correspond to the same endpoint, the same species or the same effect level, adding uncertainty to the performed assessment.

3.7 Concluding remarks and recommendations

In this programme, a large number of chemical parameters have been quantified, in addition to biological effect parameters and support parameters, and concentrations of different chemicals in different compartments of the Inner Oslofjord marine ecosystem are documented. Furthermore, this report presents relationships between the contaminant concentrations and various biological variables.

Some changes/improvements have been made in the design of the programme since 2014. The results of the stable isotope analysis suggest that this has been successful, as the differences in $\delta^{15}N$ seem to reflect expected trophic relationships; blue mussel (filters particulate organic matter from the water) < zooplankton (herbivore) = polychaetes (different modes of living, largely detritivorous) < herring (pelagic fish feeding on zooplankton) = prawns (some scavenging behaviour) < cod (mesopelagic fish, predator on fish and benthic organisms). Thus, the programme would benefit from sampling these organisms in future campaign for documentation of time trends and reproducibility of results.

The biomagnifying potential of contaminants were evaluated by calculation of Trophic Magnification Factors (TMFs) and several legacy contaminants with well-known biomagnifying properties displayed a positive significant relationship between ($\log_{10}$-)concentrations and trophic position (deduced from the $\delta^{15}N$ isotopic ratio) in the studied Inner Oslofjord marine food web.

UV-chemicals (octocrylene, benzophenone and ethylhexylmethoxycinnamate) and anti-bacterial compounds (Triclosan and Triclocarban) were introduced in the programme in 2015. Results showed that these compounds were not detected in many samples/matrices (see Appendix).

Alkylphenols and bisphenols has been shown challenging to analyse in liver of cod (matrix problems) resulting in elevated limits of detection. Consequently, several phenolic compounds were difficult to detect in cod liver (although liver samples were subjected to an enzyme digestion procedure in order to convert possible Phase II metabolites of phenolic compounds into their respective free forms). It the future one could consider other possible analytical matrices (e.g. bile) with regard to phenolic compounds in cod.

Regarding biological effect parameters in cod (gonad histopathology, vitellogenin in blood plasma, micronucleii in blood cells, acetylcholinesterase activity in muscle, as well as the physiological parameters liversomatic index and gonadosomatic index), the following was noted: Only 3 individuals showed pathological changes in gonads (granulomatous inflammation), and only one of them had it at a moderate stage. As expected, concentrations of VTG were higher in females, than in males, and variation was high. There was a positive relationship between GSI and VTG in females. Micronucleii were only detected in four cod individuals (and one micronucleus was detected per 2000 counted cells in each of the individuals). If similarly low prevalence of micronuclei is observed in 2016, it can be considered whether this parameter should be included in future campaigns, as this is a resource demanding parameter that apparently offers limited information for cod in the Inner Oslofjord.

Co-linearity among variables was often found. For example, the length of cod was (as can be expected) correlated with age (R^2=0.27; p=0.0458), weight (R^2=0.94; p=0.00000) and trophic position (R^2=0.36; p=0.0183), since as it grows older and larger it feeds on larger prey organisms. However, sometimes co-linearity rendered results inconclusive regarding likely causality. For instance, acetylcholinesterase (AChE) activity in the muscle of cod showed negative relationships with length, weight and age of cod. Mercury (Hg) also correlated with length and weight of cod, due to lifelong age accumulation. Therefore, a statistically significant negative relationship was observed between the concentration of Hg and the AChE activity in the muscle of cod. It is difficult to conclude on a causal relationship between Hg concentration and AChE activity, since the direct effect of length/weight/age is unknown. It has, however, been suggested that Hg might have an effect on AChE by combining with the SH-group of the enzyme leading to conformational changes and thus inactivation.

As previously observed, a positive relationship was found between the eggshell thickness and the trophic position of the eggs (determined from the fraction of stable nitrogen isotopes, $\delta^{15}N$), suggesting that the shell thickness of eggs in the present study was not affected negatively by compounds that increase in concentration with higher trophic position of the egg. There were few statistically significant relationships that could be shown between the concentrations of compounds in blood of birds and the eggshell thickness of eggs from the same nest. Negative relationships were found for PFDA and PFUdA (however, one individual had a strong influence on the regressions). Future studies could indicate if these correlations were a random observation, or if such relationships may be reproduced. However, apparently it has been shown difficult to relate contaminants to decreased reproductive success in herring gulls.

A potential risk (cumulative risk/mixture toxicity) of secondary poisoning was identified for birds preying on blue mussels, polychaetes and herring. Based on the current data basis, mercury was identified as a common risk driver among the food sources. In addition, Cd was a common risk driver in blue mussels and polychaetes. Furthermore, a potential risk to herring gull was identified based on measured concentrations in eggs and effect data from exposure in eggs. The main risk driver for effects in herring gull was the organic compounds bisphenol A, 4-nonylphenol and BDE-99. All data regarding risk of combined effects should be interpreted with caution due to limited data material and uncertainty connected with use of body burden concentrations.

For comparison of the contamination levels of gulls in the present study, the following can be noted: PBDEs (e.g. BDE-47 and -209) in herring gull eggs from the present study displayed concentrations that were factors 10-30 higher than those recently observed in herring gull eggs from remote colonies in Norway (Sklinna and Røst). Furthermore, while decamethylcyclopentasiloxane (D5) was only detected (LoD = 0.9 ng/g wet wt.) in one sample at Røst at a concentration of 1.5 ng/g wet wt.), mean D5 concentration in eggs from the Oslofjord area (present study) was a factor of ~60 higher (88.8 ng/g wet wt.). On the other hand, mean concentration of p,p′-DDE in herring gull eggs of the present study was in fact 6-8 times lower than recently reported in herring gull eggs from the remote marine colonies (Sklinna and Røst). Concentrations of PCBs and mercury (Hg) in eggs from the Oslofjord were approximately half of those in the remote marine colonies.These results indicate accumulation of higher concentrations of persistent legacy contaminants associated with diffuse pollution (not urban activities) in gulls feeding more exclusively on items of the marine food web. On the other hand, gulls from urban environments accumulate higher concentrations of PBDEs and siloxanes.

Herring gull is a partial migratory bird, i.e. some migrate while others are quite stationary. In an extension of this work, it could be very interesting to track the birds that are sampled, using GPS-trackers. Exact knowledge regarding their whereabouts would provide valuable additional information in relation to exposure.

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Appendix

Table A1.
Support parameters measured for sediment from the inner Oslofjord (station Cm21).

Area	<63 µm (% dry wt.)	TOC (µg/mg dry wt.)
Inner Oslofjord (station Cm21)	76	32.4

Table A2.
Support parameters measured for storm water samples.

Sample sub no.	Sample area details	SDM (mg/L)	NPOC/DC (mg C/L)
1	Breivoll E6, Downstream Term. (Aln 136x).	66	7.2
2	Bryn Ring3/E6 (Aln 125x).	62	4.6
3	Breivoll/Alnabru Teminal (Aln 138x).	20	2.5
4	Hasle, Snow disposal site (Hov 122z)	31	3.2

Table A3.
Support parameters measured for Herring gull eggs from the Oslofjord area.

Sample no.	Specimen/ nest	$\delta^{34}S$	$\delta^{13}C$	$\delta^{15}N$	C:N (W%)	Trophic position	Weight, egg (g)	Eggshell thickness (mm)
1	JAM63	4.24	-27.41	8.01	4.24	2.51	35.3	0.36
2	JCL10	6.42	-26.46	8.89	6.42	2.74	77.4	0.40
3	JCL11	7.16	-27.06	7.96	7.16	2.49	81.8	0.43
4	jcl21	4.62	-26.74	8.27	4.62	2.58	71.1	0.38
5	jam 64	13.32	-21.77	13.12	13.32	3.85	79	0.46
6	JCl20	5.81	-27.39	8.01	5.81	2.51	76.9	0.40
7	JCL22	9.37	-26.17	9.53	9.37	2.91	71.1	0.41
8	JCL18	8.33	-26.04	9.47	8.33	2.89	74	0.41
9	J4157	6.61	-27.41	8.17	6.61	2.55	80.8	0.41
10	JCL23	7.79	-26.35	8.23	7.79	2.56	76	0.41
11	JAM72	8.89	-25.98	9.41	8.89	2.87	67.3	0.39
12	JAM74	6.04	-24.59	9.49	6.04	2.90	81.2	0.40
13	JAM70	9.01	-25.99	8.88	9.01	2.73	80.4	0.43
14		7.68	-26.31	8.27	7.68	2.57	72.6	0.41
15		9.62	-24.71	10.03	9.62	3.04	89.5	0.42

Table A4.
Support parameters measured for Herring gull blood from the Inner Oslofjord.

Sample no.	Specimen/ nest	$\delta^{34}S$	$\delta^{13}C$	$\delta^{15}N$	C:N (W%)	Trophic position	Wing (mm)	Head (mm)	Weight (g)
1	JAM63	12.19	-20.15	13.05	3.69	3.83	406	115.6	860
2	JCL10	8.56	-23.23	9.15	3.68	2.81	424	117.6	830
3	JCL11	8.25	-23.95	8.86	3.71	2.73	436	118.6	950
4	JCL21	6.05	-24.53	7.90	3.61	2.48	420	119.2	850
5	JAM64	6.82	-24.03	8.50	3.65	2.63	437	112.1	960
6	JCl20	5.79	-24.57	8.08	3.66	2.52	423	118.1	970
7	JCL22	9.50	-23.09	9.71	3.60	2.95	425	115.4	810
8	JCL18	7.47	-23.88	8.75	3.65	2.70	437	118.7	940
9	J4157	8.78	-23.13	9.34	3.60	2.86	427	116.8	910
10	JCL23	6.14	-24.39	8.14	3.82	2.54	418	119.6	870
11	JAM72	8.96	-23.02	9.11	3.68	2.79	437	119.9	920
12	JAM74	4.84	-24.46	8.38	3.68	2.60	432	117.3	920
13	JAM70	7.87	-23.78	8.23	3.57	2.56	418	117.3	810
14	J8195	13.59	-20.55	13.42	3.70	3.93	463	131.8	1220
15	J4438	5.31	-24.21	8.23	3.68	2.56	454	129.7	1210

Table A5.
Support parameters measured for Cod from the Inner Oslofjord (including some extra specimens of which some effect parameters were measured).

Sample no. (fish no.)	$\delta^{13}C$	$\delta^{15}N$	C:N (W%)	Trophic position	Age (yr)	Length (cm)	Weight (g)	Liver weight (g)	Gonad weight (g)	Sex
1 (1)	-17.32	17.50	3.35	4.64	4	58	1770	40.9	16.8	F
2 (10)	-17.84	16.61	3.40	4.40	2	52	1470	35	5.6	F
3 (12)	-17.38	17.88	3.38	4.74	5	83	5730	230	54	F
4 (13)	-17.93	17.32	3.33	4.59	4	68	3000	85.5	30.6	F
5 (14)	-17.21	17.71	3.39	4.69	4	61	1800	33.9	1.4	M
6 (16)	-16.96	17.18	3.40	4.55	5	60	1840	54.1	16.6	F
7 (17)	-16.84	17.49	3.35	4.63	6	63.5	2350	40	14.2	F
8 (18)	-16.53	18.40	3.39	4.87	6	83	5820	129.5	51.2	F
9 (19)	-17.05	17.05	3.36	4.52	5	64	2560	53.4	3.5	M
10 (20)	-16.54	18.21	3.39	4.82	6	67	2950	88.7	15.9	F
11(23)	-16.97	17.61	3.42	4.66	5	50	1140	34.3	2.9	M
12 (25)	-18.01	17.28	3.35	4.58	5	73	3540	41	11.7	F
13 (26)	-17.44	17.42	3.38	4.61	4	66	2460	59.5	8.3	F
14 (27)	-16.37	18.23	3.30	4.83	5	75	4300	101	26	F
15 (28)	-16.79	17.52	3.38	4.64	6	74	3860	145	13.5	M
X1 (3)						47	980	13.8	2.7	M
X2 (6)						49.5	1040	23.9	11.1	F
X3 (7)						56	1620	26	7.1	F
X4 (8)						47	1040	24.3	11.3	F
X5 (9)						50	1400	16.9	4	F
X6 (15)						57	1650	14.2	3.8	M
X7 (21)						54	1570	20.1	1	M
X8 (22)						52	1260	11.5	8.9	F
X9 (24)						53	1270	25	10.9	F

Table A6.
Support parameters measured for compartments of the Inner Oslofjord marine food web; polychaetes, blue mussel, krill, prawns, herring, cod (mathematically derived pooled samples).

Species	Sample sub no.	$\delta^{13}C$	$\delta^{15}N$	C:N (W%)	Trophic position
Polychaeta	1	-18.02	9.86	3.73	2.62
Polychaeta	2	-20.09	10.38	4.94	2.76
Polychaeta	3	-19.44	11.88	4.20	3.16
Blue mussel	1	-19.19	7.69	4.74	2.05
Blue mussel	2	-19.27	7.32	4.86	1.96
Blue mussel	3	-19.21	7.46	4.93	1.99
Krill	1	-22.11	10.94	4.74	2.91
Krill	2	-21.68	11.09	4.46	2.95
Krill	3	-21.01	11.17	4.23	2.97
Prawns	1	-18.32	12.96	3.68	3.44
Prawns	2	-17.93	13.21	3.62	3.51
Prawns	3	-18.11	13.17	3.58	3.49
Herring	1	-20.60	13.12	4.25	3.48
Herring	2	-21.49	13.11	4.86	3.48
Herring	3	-21.81	12.76	4.74	3.39
Cod (pool 1)	1	-17.26	17.32	3.39	4.59
Cod (pool 2)	2	-17.16	17.50	3.36	4.63
Cod (pool 3)	3	-17.02	17.86	3.36	4.73

NILU-no.	NIVA-no.	Compartment	Comp. spec.	Note	Species	Tissue
15/1756	2015-11954	Organism	Polychaetes	1. P. crassa	Polychaetes	Pooled wb
15/1757	2015-11955	Organism	Polychaetes	2. Terebellidae	Polychaetes	Pooled wb
15/1758	2015-11956	Organism	Polychaetes	3. Misc.	Polychaetes	Pooled wb
15/1816	2015-11951	Organism	Mussel	Repl. 1	Mussel	Pooled soft tissue
15/1817	2015-11952	Organism	Mussel	Repl. 2	Mussel	Pooled soft tissue
15/1818	2015-11953	Organism	Mussel	Repl. 3	Mussel	Pooled soft tissue
15/1750	2015-11195	Organism	Plankton	Repl. 1	Krill	Pooled wb
15/1751	2015-11196	Organism	Plankton	Repl. 2	Krill	Pooled wb
15/1752	2015-11197	Organism	Plankton	Repl. 3	Krill	Pooled wb
15/1753	2015-11201	Organism	Prawns	Repl. 1	Prawns	Pooled tail soft tissue
15/1754	2015-11202	Organism	Prawns	Repl. 2	Prawns	Pooled tail soft tissue
15/1755	2015-11203	Organism	Prawns	Repl. 3	Prawns	Pooled tail soft tissue
15/1812	2015-11198	Organism	Herring	Repl. 1	Herring	Pooled muscle
15/1813	2015-11199	Organism	Herring	Repl. 2	Herring	Pooled muscle
15/1814	2015-11200	Organism	Herring	Repl. 3	Herring	Pooled muscle
		Organism	Cod pool 1	Fish no. 1, 10, 14, 16, 23	Cod	Liver (muscle for Hg)
		Organism	Cod pool 2	Fish no. 13, 17, 19, 20, 26	Cod	Liver (muscle for Hg)
		Organism	Cod pool 3	Fish no. 12, 18, 25, 27, 28	Cod	Liver (muscle for Hg)

NILU-no.	NIVA-no.	Compartment	Comp. spec.	Note	Species	Tissue
15/1759	2015-11180	Organism	Cod	Fish no. 1	Cod	Liver (muscle for Hg)
15/1760	2015-11181	Organism	Cod	Fish no. 10	Cod	Liver (muscle for Hg)
15/1761	2015-11182	Organism	Cod	Fish no. 12	Cod	Liver (muscle for Hg)
15/1762	2015-11183	Organism	Cod	Fish no. 13	Cod	Liver (muscle for Hg)
15/1763	2015-11184	Organism	Cod	Fish no. 14	Cod	Liver (muscle for Hg)
15/1764	2015-11185	Organism	Cod	Fish no. 16	Cod	Liver (muscle for Hg)
15/1765	2015-11186	Organism	Cod	Fish no. 17	Cod	Liver (muscle for Hg)
15/1766	2015-11187	Organism	Cod	Fish no. 18	Cod	Liver (muscle for Hg)
15/1767	2015-11188	Organism	Cod	Fish no. 19	Cod	Liver (muscle for Hg)
15/1768	2015-11189	Organism	Cod	Fish no. 20	Cod	Liver (muscle for Hg)
15/1769	2015-11190	Organism	Cod	Fish no. 23	Cod	Liver (muscle for Hg)
15/1770	2015-11191	Organism	Cod	Fish no. 25	Cod	Liver (muscle for Hg)
15/1771	2015-11192	Organism	Cod	Fish no. 26	Cod	Liver (muscle for Hg)
15/1772	2015-11193	Organism	Cod	Fish no. 27	Cod	Liver (muscle for Hg)
15/1773	2015-11194	Organism	Cod	Fish no. 28	Cod	Liver (muscle for Hg)

Comp. spec.	Note	Lipid% (%)	PeCB ng/g (w.w.)	HCB ng/g (w.w.)	PCB-18 ng/g (w.w.)	PCB-28 ng/g (w.w.)	PCB-31 ng/g (w.w.)	PCB-33 ng/g (w.w.)
Polychaetes	1. P. crassa	0,60	0,013	0,082	0,019	0,088	0,040	0,018
Polychaetes	2. Terebellidae	2,00	0,079	0,454	0,078	0,326	0,170	0,048
Polychaetes	3. Misc.	1,40	0,015	0,056	0,023	0,139	0,047	0,017
Mussel	Repl. 1	0,70	<0,005	0,015	0,011	0,031	0,023	0,010
Mussel	Repl. 2	0,94	0,007	0,018	0,013	0,046	0,030	0,012
Mussel	Repl. 3	0,97	0,006	0,016	0,013	0,040	0,028	0,012
Plankton	Repl. 1	0,80	0,014	0,111	0,018	0,078	0,072	0,015
Plankton	Repl. 2	0,90	0,013	0,113	0,020	0,081	0,075	0,015
Plankton	Repl. 3	0,70	0,014	0,118	0,019	0,082	0,075	0,017
Prawns	Repl. 1	0,89	0,018	0,075	0,004	0,062	0,025	<0,002
Prawns	Repl. 2	0,80	0,015	0,052	<0,003	0,030	0,018	<0,003
Prawns	Repl. 3	0,70	0,012	0,060	<0,005	0,041	0,015	<0,004
Herring	Repl. 1	3,60	0,070	0,652	0,084	0,585	0,374	0,030
Herring	Repl. 2	6,00	0,093	0,831	0,116	0,871	0,542	0,052
Herring	Repl. 3	5,70	0,103	1,220	0,080	0,699	0,399	0,028
Cod pool 1	Fish no. 1, 10, 14, 16, 23	33,6	0,495	4,264	0,500	4,460	0,435	0,116
Cod pool 2	Fish no. 13, 17, 19, 20, 26	37,4	0,548	4,450	0,504	4,894	0,745	0,122
Cod pool 3	Fish no. 12, 18, 25, 27, 28	50,0	0,802	7,724	0,860	8,142	1,535	0,241

Comp. spec.	Note	Lipid% (%)	PeCB ng/g (w.w.)	HCB ng/g (w.w.)	PCB-18 ng/g (w.w.)	PCB-28 ng/g (w.w.)	PCB-31 ng/g (w.w.)	PCB-33 ng/g (w.w.)
Cod	Fish no. 1	33,2	0,508	4,730	0,528	3,930	0,309	0,117
Cod	Fish no. 10	41,1	0,546	4,400	0,440	4,580	0,585	0,097
Cod	Fish no. 12	70,8	1,260	13,8	1,430	13,2	3,590	0,435
Cod	Fish no. 13	44,8	0,659	5,090	0,586	5,220	1,420	0,145
Cod	Fish no. 14	18,9	0,293	2,500	0,262	2,360	0,129	0,062
Cod	Fish no. 16	40,5	0,662	5,810	0,887	7,740	0,846	0,215
Cod	Fish no. 17	37,3	0,600	5,350	0,628	6,740	1,200	0,180
Cod	Fish no. 18	47,2	0,711	6,510	0,667	6,230	0,540	0,150
Cod	Fish no. 19	28,6	0,449	3,520	0,438	3,700	0,268	0,085
Cod	Fish no. 20	40,4	0,520	4,320	0,408	5,370	0,520	0,102
Cod	Fish no. 23	34,2	0,464	3,880	0,383	3,690	0,307	0,090
Cod	Fish no. 25	34,6	0,511	4,390	0,491	3,910	0,562	0,100
Cod	Fish no. 26	36,1	0,514	3,970	0,460	3,440	0,317	0,096
Cod	Fish no. 27	35,7	0,500	4,160	0,413	4,870	0,845	0,093
Cod	Fish no. 28	61,8	1,030	9,760	1,300	12,5	2,140	0,428

Comp. spec.	Note	PCB-37 ng/g (w.w.)	PCB-47 ng/g (w.w.)	PCB-52 ng/g (w.w.)	PCB-66 ng/g (w.w.)	PCB-74 ng/g (w.w.)	PCB-99 ng/g (w.w.)
Polychaetes	1. P. crassa	0,014	0,249	0,457	0,387	0,225	0,702
Polychaetes	2. Terebellidae	0,030	0,739	0,760	0,800	0,551	1,560
Polychaetes	3. Misc.	0,009	0,458	0,423	0,552	0,314	1,530
Mussel	Repl. 1	0,006	0,072	0,131	0,189	0,079	0,164
Mussel	Repl. 2	0,009	0,102	0,180	0,238	0,102	0,200
Mussel	Repl. 3	0,008	0,097	0,171	0,235	0,097	0,203
Plankton	Repl. 1	9,170	0,261	0,406	0,433	0,222	0,645
Plankton	Repl. 2	<0,004	0,279	0,436	0,455	0,242	0,689
Plankton	Repl. 3	0,012	0,285	0,448	0,471	0,254	0,741
Prawns	Repl. 1	<0,003	0,242	0,275	0,507	0,319	1,430
Prawns	Repl. 2	<0,005	0,099	0,124	0,189	0,110	0,410
Prawns	Repl. 3	<0,007	0,110	0,118	0,199	0,112	0,477
Herring	Repl. 1	<0,006	1,280	2,930	2,640	1,540	3,490
Herring	Repl. 2	<0,006	2,490	4,870	4,760	2,680	7,370
Herring	Repl. 3	<0,005	1,560	3,350	2,990	1,800	4,700
Cod pool 1	Fish no. 1, 10, 14, 16, 23	0,019	33,7	26,3	53,0	36,1	260
Cod pool 2	Fish no. 13, 17, 19, 20, 26	0,045	35,9	23,7	60,5	39,0	293
Cod pool 3	Fish no. 12, 18, 25, 27, 28	0,049	46,6	43,7	83,6	54,2	361

Comp. spec.	Note	PCB-37 ng/g (w.w.)	PCB-47 ng/g (w.w.)	PCB-52 ng/g (w.w.)	PCB-66 ng/g (w.w.)	PCB-74 ng/g (w.w.)	PCB-99 ng/g (w.w.)
Cod	Fish no. 1	0,055	34,0	31,3	54,7	33,8	217
Cod	Fish no. 10	<0,039	30,4	18,7	43,3	33,0	254
Cod	Fish no. 12	0,050	49,9	69,2	87,6	52,5	259
Cod	Fish no. 13	0,042	33,8	24,8	49,2	31,3	227
Cod	Fish no. 14	<0,022	17,2	13,9	26,4	18,3	172
Cod	Fish no. 16	<0,031	46,6	37,5	81,5	52,4	363
Cod	Fish no. 17	0,080	46,5	37,2	79,3	51,5	368
Cod	Fish no. 18	0,037	49,9	29,4	77,6	52,7	397
Cod	Fish no. 19	0,028	36,1	16,5	67,5	43,3	357
Cod	Fish no. 20	0,047	34,6	20,5	64,5	43,3	293
Cod	Fish no. 23	0,041	40,1	30,0	59,0	42,8	294
Cod	Fish no. 25	0,028	30,5	20,8	40,9	31,4	322
Cod	Fish no. 26	0,029	28,5	19,4	42,1	25,4	220
Cod	Fish no. 27	0,016	30,9	20,5	46,0	32,4	279
Cod	Fish no. 28	0,113	71,9	78,6	166	102	550

Comp. spec.	Note	PCB-101 ng/g (w.w.)	PCB-105 ng/g (w.w.)	PCB-114 ng/g (w.w.)	PCB-118 ng/g (w.w.)	PCB-122 ng/g (w.w.)	PCB-123 ng/g (w.w.)
Polychaetes	1. P. crassa	0,908	0,311	0,013	1,070	<0,005	0,026
Polychaetes	2. Terebellidae	1,580	0,536	0,039	1,390	0,024	0,044
Polychaetes	3. Misc.	1,240	0,529	0,055	1,490	<0,007	0,050
Mussel	Repl. 1	0,238	0,093	0,006	0,236	<0,002	<0,002
Mussel	Repl. 2	0,308	0,123	0,009	0,304	<0,002	0,029
Mussel	Repl. 3	0,291	0,125	<0,003	0,299	<0,003	0,009
Plankton	Repl. 1	0,885	0,276	0,034	0,755	0,011	0,020
Plankton	Repl. 2	0,932	0,313	0,035	0,805	0,011	0,020
Plankton	Repl. 3	0,973	0,314	0,035	0,860	0,010	0,023
Prawns	Repl. 1	0,973	0,653	0,053	2,000	<0,004	0,040
Prawns	Repl. 2	0,364	0,200	<0,004	0,578	<0,004	0,014
Prawns	Repl. 3	0,417	0,235	<0,013	0,712	<0,013	<0,013
Herring	Repl. 1	4,950	1,800	0,151	4,520	<0,011	0,064
Herring	Repl. 2	9,760	3,490	0,306	9,080	0,032	0,132
Herring	Repl. 3	6,390	2,270	0,200	5,990	0,016	0,065
Cod pool 1	Fish no. 1, 10, 14, 16, 23	126	97,1	9,924	341		7,246
Cod pool 2	Fish no. 13, 17, 19, 20, 26	133	107	10,4	364	5,947	7,660
Cod pool 3	Fish no. 12, 18, 25, 27, 28	190	135	13,4	463	9,762	8,562

Comp. spec.	Note	PCB-101 ng/g (w.w.)	PCB-105 ng/g (w.w.)	PCB-114 ng/g (w.w.)	PCB-118 ng/g (w.w.)	PCB-122 ng/g (w.w.)	PCB-123 ng/g (w.w.)
Cod	Fish no. 1	134	88,4	10,3	278	<0,06	5,790
Cod	Fish no. 10	98,6	79,0	8,460	329	<0,091	6,950
Cod	Fish no. 12	203	112	10,1	337	0,316	5,660
Cod	Fish no. 13	130	83,7	9,730	270	<0,052	4,990
Cod	Fish no. 14	70,2	65,9	7,060	243	<0,039	4,250
Cod	Fish no. 16	168	138	12,3	493	<0,085	10,9
Cod	Fish no. 17	194	139	15,0	476	0,197	11,2
Cod	Fish no. 18	146	154	14,7	538	<0,054	10,2
Cod	Fish no. 19	113	126	9,700	447	<0,032	9,520
Cod	Fish no. 20	107	104	8,390	373	0,036	7,730
Cod	Fish no. 23	160	114	11,5	362	<0,036	8,340
Cod	Fish no. 25	166	105	14,8	405	48,3	6,660
Cod	Fish no. 26	119	81,5	9,030	255	29,5	4,860
Cod	Fish no. 27	122	86,8	10,2	341	0,028	5,690
Cod	Fish no. 28	312	217	17,4	696	0,165	14,6

Comp. spec.	Note	PCB-128 ng/g (w.w.)	PCB-138 ng/g (w.w.)	PCB-141 ng/g (w.w.)	PCB-149 ng/g (w.w.)	PCB-153 ng/g (w.w.)	PCB-156 ng/g (w.w.)
Polychaetes	1. P. crassa	0,253	1,330	0,102	1,070	2,010	0,086
Polychaetes	2. Terebellidae	0,459	2,370	0,122	1,250	2,830	0,165
Polychaetes	3. Misc.	0,633	3,600	0,151	1,910	5,140	0,179
Mussel	Repl. 1	0,044	0,254	0,006	0,159	0,395	0,012
Mussel	Repl. 2	0,056	0,327	<0,002	0,191	0,493	0,017
Mussel	Repl. 3	0,057	0,326	<0,002	0,192	0,503	0,017
Plankton	Repl. 1	0,163	0,915	0,091	1,210	1,490	0,060
Plankton	Repl. 2	0,180	0,968	0,096	1,270	1,590	0,058
Plankton	Repl. 3	0,188	0,999	0,096	1,270	1,640	0,058
Prawns	Repl. 1	0,467	3,320	0,122	0,481	5,610	0,209
Prawns	Repl. 2	0,124	0,640	0,036	0,259	1,200	0,050
Prawns	Repl. 3	0,171	0,733	<0,005	0,277	1,430	0,042
Herring	Repl. 1	0,883	5,070	0,513	3,880	7,150	0,310
Herring	Repl. 2	1,930	10,5	1,020	8,920	15,1	0,614
Herring	Repl. 3	1,310	7,440	0,708	5,360	10,6	0,429
Cod pool 1	Fish no. 1, 10, 14, 16, 23	80,4	717	19,5	40,3	1 178	42,2
Cod pool 2	Fish no. 13, 17, 19, 20, 26	92,8	882	19,6	37,0	1 419	46,7
Cod pool 3	Fish no. 12, 18, 25, 27, 28	111	1 121	28,9	60,3	1 744	60,0

Comp. spec.	Note	PCB-128 ng/g (w.w.)	PCB-138 ng/g (w.w.)	PCB-141 ng/g (w.w.)	PCB-149 ng/g (w.w.)	PCB-153 ng/g (w.w.)	PCB-156 ng/g (w.w.)
Cod	Fish no. 1	69,1	602	22,4	61,0	912	35,1
Cod	Fish no. 10	54,9	683	14,0	21,5	1 120	38,4
Cod	Fish no. 12	95,3	685	26,3	91,9	1 100	39,3
Cod	Fish no. 13	66,0	579	19,0	50,0	959	33,7
Cod	Fish no. 14	64,5	576	11,5	17,4	1 010	35,5
Cod	Fish no. 16	116	967	28,0	59,9	1 520	61,2
Cod	Fish no. 17	118	979	27,1	50,1	1 650	58,3
Cod	Fish no. 18	130	1 060	25,4	52,6	1 810	69,1
Cod	Fish no. 19	108	1 400	17,5	18,4	2 080	57,2
Cod	Fish no. 20	92,9	876	17,0	22,3	1 550	50,5
Cod	Fish no. 23	97,7	757	21,6	41,6	1 330	40,9
Cod	Fish no. 25	85,3	1 330	30,0	40,0	1 820	62,6
Cod	Fish no. 26	79,3	577	17,4	44,1	856	34,0
Cod	Fish no. 27	74,4	880	18,0	26,4	1 590	48,5
Cod	Fish no. 28	170	1 650	45,0	90,4	2 400	80,7

Comp. spec.	Note	PCB-157 ng/g (w.w.)	PCB-167 ng/g (w.w.)	PCB-170 ng/g (w.w.)	PCB-180 ng/g (w.w.)	PCB-183 ng/g (w.w.)	PCB-187 ng/g (w.w.)
Polychaetes	1. P. crassa	0,024	0,079	0,160	0,407	0,129	0,419
Polychaetes	2. Terebellidae	0,062	0,121	0,302	0,918	0,200	0,430
Polychaetes	3. Misc.	0,050	0,155	0,534	0,992	0,330	1,630
Mussel	Repl. 1	<0,002	0,013	0,005	0,027	0,025	0,076
Mussel	Repl. 2	0,005	0,016	<0,002	0,028	0,030	0,096
Mussel	Repl. 3	<0,002	0,018	<0,002	0,028	0,031	0,101
Plankton	Repl. 1	0,015	0,048	0,099	0,387	0,092	0,736
Plankton	Repl. 2	0,024	0,051	0,097	0,377	0,091	0,726
Plankton	Repl. 3	0,014	0,052	0,096	0,371	0,095	0,738
Prawns	Repl. 1	0,051	0,171	0,500	1,400	0,337	0,343
Prawns	Repl. 2	0,017	0,036	0,097	0,229	0,059	0,113
Prawns	Repl. 3	0,020	0,042	0,123	0,245	0,074	0,113
Herring	Repl. 1	0,081	0,164	0,459	1,270	0,356	1,390
Herring	Repl. 2	0,149	0,339	1,010	2,880	0,784	3,360
Herring	Repl. 3	0,101	0,238	0,713	1,980	0,544	2,290
Cod pool 1	Fish no. 1, 10, 14, 16, 23	12,2	37,5	113	316	78,6	79,8
Cod pool 2	Fish no. 13, 17, 19, 20, 26	13,4	42,2	131	382	96,0	98,2
Cod pool 3	Fish no. 12, 18, 25, 27, 28	16,7	50,1	163	478	118	136

Comp. spec.	Note	PCB-157 ng/g (w.w.)	PCB-167 ng/g (w.w.)	PCB-170 ng/g (w.w.)	PCB-180 ng/g (w.w.)	PCB-183 ng/g (w.w.)	PCB-187 ng/g (w.w.)
Cod	Fish no. 1	10,5	27,7	94,8	257	68,0	111
Cod	Fish no. 10	11,4	35,2	104	291	76,5	55,6
Cod	Fish no. 12	10,7	28,4	110	309	77,9	96,8
Cod	Fish no. 13	10,0	28,5	98,1	277	66,4	115
Cod	Fish no. 14	10,2	31,1	106	280	71,7	47,6
Cod	Fish no. 16	16,0	53,4	158	462	107	85,5
Cod	Fish no. 17	17,9	54,1	164	465	116	137
Cod	Fish no. 18	20,1	59,7	188	530	141	166
Cod	Fish no. 19	15,4	50,4	150	454	109	57,7
Cod	Fish no. 20	13,9	49,0	151	458	119	73,4
Cod	Fish no. 23	12,7	40,3	102	288	69,9	99,3
Cod	Fish no. 25	17,7	49,2	170	510	116	177
Cod	Fish no. 26	9,730	29,2	90,3	255	69,7	108
Cod	Fish no. 27	14,1	40,7	141	403	93,1	115
Cod	Fish no. 28	20,7	72,6	208	640	160	127

Comp. spec.	Note	PCB-189 ng/g (w.w.)	PCB-194 ng/g (w.w.)	PCB-206 ng/g (w.w.)	PCB-209 ng/g (w.w.)	Sum PCB7 ng/g (w.w.)	Sum PCB ng/g (w.w.)
Polychaetes	1. P. crassa	<0,004	0,050	0,035	<0,003	6,270	17,6
Polychaetes	2. Terebellidae	<0,004	0,153	0,082	0,034	10,2	27,6
Polychaetes	3. Misc.	<0,004	0,294	0,297	0,072	13,0	35,5
Mussel	Repl. 1	<0,002	<0,002	<0,002	<0,002	1,312	3,471
Mussel	Repl. 2	<0,002	<0,002	<0,002	<0,002	1,686	4,552
Mussel	Repl. 3	<0,002	<0,002	<0,002	<0,002	1,658	4,493
Plankton	Repl. 1	<0,003	0,032	0,020	0,012	4,916	16,6
Plankton	Repl. 2	<0,003	0,039	0,020	0,011	5,189	17,6
Plankton	Repl. 3	<0,003	0,040	0,021	0,009	5,373	18,2
Prawns	Repl. 1	0,027	0,297	0,207	0,024	13,6	25,5
Prawns	Repl. 2	<0,003	0,034	<0,003	<0,003	3,165	6,849
Prawns	Repl. 3	<0,005	0,046	<0,006	<0,003	3,696	7,098
Herring	Repl. 1	0,021	0,115	0,053	0,014	26,5	78,7
Herring	Repl. 2	0,043	0,243	0,134	0,047	53,1	165
Herring	Repl. 3	<0,004	0,174	0,082	0,028	36,4	105
Cod pool 1	Fish no. 1, 10, 14, 16, 23	6,532	58,0	34,8	5,972	2 709	4 538
Cod pool 2	Fish no. 13, 17, 19, 20, 26	8,098	85,1	63,3	13,2	3 208	5 255
Cod pool 3	Fish no. 12, 18, 25, 27, 28	10,0	101	65,9	12,6	4 048	6 516

Comp. spec.	Note	PCB-189 ng/g (w.w.)	PCB-194 ng/g (w.w.)	PCB-206 ng/g (w.w.)	PCB-209 ng/g (w.w.)	Sum PCB7 ng/g (w.w.)	Sum PCB ng/g (w.w.)
Cod	Fish no. 1	5,400	42,9	23,1	3,840	2 218	3 955
Cod	Fish no. 10	5,910	51,4	33,6	6,310	2 545	3 970
Cod	Fish no. 12	5,940	54,0	31,7	6,510	2 716	4 764
Cod	Fish no. 13	5,690	51,0	31,5	5,170	2 245	4 267
Cod	Fish no. 14	6,050	55,9	31,1	4,820	2 195	3 570
Cod	Fish no. 16	9,210	90,5	59,5	10,2	3 655	6 375
Cod	Fish no. 17	9,700	95,9	58,5	11,6	3 808	6 813
Cod	Fish no. 18	12,1	117	82,6	16,6	4 120	7 423
Cod	Fish no. 19	9,580	98,7	66,4	12,0	4 514	5 434
Cod	Fish no. 20	9,920	127	131	32,1	3 390	5 715
Cod	Fish no. 23	6,090	49,3	26,8	4,690	2 931	4 817
Cod	Fish no. 25	10,3	98,0	48,6	7,880	4 256	6 139
Cod	Fish no. 26	5,600	53,1	28,9	4,900	2 085	4 048
Cod	Fish no. 27	8,760	88,5	57,7	10,9	3 361	5 104
Cod	Fish no. 28	13,1	145	109	21,3	5 789	9 150

Comp. spec.	Note	TBA ng/g (w.w.)	BDE-17 ng/g (w.w.)	BDE-28 ng/g (w.w.)	BDE-47 ng/g (w.w.)	BDE-49 ng/g (w.w.)	BDE-66 ng/g (w.w.)
Polychaetes	1. P. crassa	<0,007	<0,003	<0,003	<0,039	0,009	<0,014
Polychaetes	2. Terebellidae	0,009	<0,003	<0,003	0,050	0,013	<0,014
Polychaetes	3. Misc.	<0,007	<0,003	<0,003	0,088	0,015	0,015
Mussel	Repl. 1	0,067	<0,002	<0,002	<0,023	0,003	<0,008
Mussel	Repl. 2	0,091	<0,002	<0,002	0,034	0,003	<0,008
Mussel	Repl. 3	0,091	<0,002	<0,002	0,031	0,003	<0,008
Plankton	Repl. 1	<0,005	<0,002	<0,002	0,114	0,005	<0,01
Plankton	Repl. 2	<0,005	<0,002	<0,002	0,111	0,007	<0,01
Plankton	Repl. 3	0,006	<0,002	0,003	0,151	0,016	<0,01
Prawns	Repl. 1	<0,005	<0,002	0,003	0,190	0,025	<0,01
Prawns	Repl. 2	<0,005	<0,002	<0,002	0,040	0,006	<0,01
Prawns	Repl. 3	<0,005	<0,002	<0,002	0,073	0,012	<0,01
Herring	Repl. 1	0,024	<0,003	0,018	0,824	0,287	0,018
Herring	Repl. 2	0,030	<0,003	0,038	2,100	0,714	0,045
Herring	Repl. 3	0,075	<0,003	0,033	1,650	0,543	0,035
Cod pool 1	Fish no. 1, 10, 14, 16, 23	0,030	0,003	0,413	16,4	0,980	0,167
Cod pool 2	Fish no. 13, 17, 19, 20, 26	0,037		0,545	16,6	0,939	0,140
Cod pool 3	Fish no. 12, 18, 25, 27, 28	0,128	0,007	0,731	28,2	3,494	0,185

Comp. spec.	Note	TBA ng/g (w.w.)	BDE-17 ng/g (w.w.)	BDE-28 ng/g (w.w.)	BDE-47 ng/g (w.w.)	BDE-49 ng/g (w.w.)	BDE-66 ng/g (w.w.)
Cod	Fish no. 1	0,027	<0,01	0,662	19,3	2,050	0,457
Cod	Fish no. 10	0,031	<0,01	0,164	8,300	0,668	0,115
Cod	Fish no. 12	0,247	0,021	1,690	43,5	8,340	0,361
Cod	Fish no. 13	0,044	<0,01	0,921	15,3	1,610	0,346
Cod	Fish no. 14	0,024	<0,01	0,282	12,7	0,552	<0,041
Cod	Fish no. 16	0,034	0,013	0,346	15,6	1,100	0,119
Cod	Fish no. 17	0,032	<0,01	0,325	23,8	1,350	0,069
Cod	Fish no. 18	0,041	<0,01	0,442	17,7	0,858	0,118
Cod	Fish no. 19	0,057	<0,01	0,326	14,9	0,443	0,142
Cod	Fish no. 20	0,051	<0,01	0,241	11,1	0,986	0,144
Cod	Fish no. 23	0,035	<0,01	0,613	26,1	0,531	0,144
Cod	Fish no. 25	0,055	<0,01	0,422	14,1	0,644	0,051
Cod	Fish no. 26	<0,02	<0,01	0,912	17,7	0,306	<0,041
Cod	Fish no. 27	0,039	<0,01	0,245	5,780	0,739	<0,041
Cod	Fish no. 28	0,259	0,014	0,856	59,8	6,890	0,395

Comp. spec.	Note	BDE-71 ng/g (w.w.)	BDE-77 ng/g (w.w.)	BDE-85 ng/g (w.w.)	BDE-99 ng/g (w.w.)	BDE-100 ng/g (w.w.)	BDE-119 ng/g (w.w.)
Polychaetes	1. P. crassa	<0,003	<0,003	<0,003	0,020	0,009	<0,003
Polychaetes	2. Terebellidae	<0,003	<0,003	<0,003	0,023	0,009	<0,003
Polychaetes	3. Misc.	<0,003	<0,003	0,025	0,039	0,017	<0,003
Mussel	Repl. 1	<0,002	<0,002	<0,002	0,008	0,005	<0,002
Mussel	Repl. 2	<0,002	<0,002	<0,002	0,011	0,006	<0,002
Mussel	Repl. 3	<0,002	<0,002	<0,002	0,009	0,005	<0,002
Plankton	Repl. 1	<0,002	<0,002	<0,002	0,086	0,014	<0,002
Plankton	Repl. 2	<0,002	<0,002	<0,002	0,080	0,017	<0,002
Plankton	Repl. 3	<0,002	<0,002	0,044	0,290	0,024	<0,002
Prawns	Repl. 1	<0,002	<0,002	<0,002	<0,005	0,025	<0,002
Prawns	Repl. 2	<0,002	<0,002	<0,002	<0,005	0,007	<0,002
Prawns	Repl. 3	<0,002	<0,002	<0,002	<0,005	0,011	<0,002
Herring	Repl. 1	<0,003	<0,003	<0,003	0,106	0,091	0,005
Herring	Repl. 2	<0,003	<0,003	<0,003	0,240	0,286	0,009
Herring	Repl. 3	<0,003	0,003	<0,003	0,223	0,256	0,012
Cod pool 1	Fish no. 1, 10, 14, 16, 23				0,144	7,238	0,081
Cod pool 2	Fish no. 13, 17, 19, 20, 26				0,047	7,936	0,063
Cod pool 3	Fish no. 12, 18, 25, 27, 28		0,012		0,329	11,2	0,110

Comp. spec.	Note	BDE-71 ng/g (w.w.)	BDE-77 ng/g (w.w.)	BDE-85 ng/g (w.w.)	BDE-99 ng/g (w.w.)	BDE-100 ng/g (w.w.)	BDE-119 ng/g (w.w.)
Cod	Fish no. 1	<0,01	<0,01	<0,01	0,402	9,460	0,143
Cod	Fish no. 10	<0,01	<0,01	<0,01	0,081	7,410	0,081
Cod	Fish no. 12	<0,01	0,030	<0,01	0,682	11,2	0,232
Cod	Fish no. 13	<0,01	<0,01	<0,01	0,078	8,250	0,098
Cod	Fish no. 14	<0,01	<0,01	<0,01	0,074	7,240	0,057
Cod	Fish no. 16	<0,01	<0,01	<0,01	0,088	5,170	0,063
Cod	Fish no. 17	<0,01	<0,01	<0,01	0,061	9,540	0,112
Cod	Fish no. 18	<0,01	<0,01	<0,01	0,097	8,440	0,090
Cod	Fish no. 19	<0,01	<0,01	<0,01	0,042	5,360	0,063
Cod	Fish no. 20	<0,01	<0,01	<0,01	0,030	3,630	<0,01
Cod	Fish no. 23	<0,01	<0,01	<0,01	0,072	6,910	0,061
Cod	Fish no. 25	<0,01	<0,01	<0,01	0,038	18,4	<0,01
Cod	Fish no. 26	<0,01	<0,01	<0,01	0,027	12,9	0,043
Cod	Fish no. 27	<0,01	<0,01	<0,01	<0,021	5,870	<0,01
Cod	Fish no. 28	<0,01	0,030	<0,01	0,826	12,2	0,229

Comp. spec.	Note	BDE-126 ng/g (w.w.)	BDE-138 ng/g (w.w.)	BDE-153 ng/g (w.w.)	BDE-154 ng/g (w.w.)	BDE-156 ng/g (w.w.)	BDE-183 ng/g (w.w.)
Polychaetes	1. P. crassa	<0,003	<0,004	<0,004	0,005	<0,007	0,004
Polychaetes	2. Terebellidae	<0,003	<0,004	0,005	0,008	<0,007	<0,003
Polychaetes	3. Misc.	<0,003	<0,004	0,007	0,020	<0,007	<0,003
Mussel	Repl. 1	<0,002	<0,003	<0,002	<0,002	<0,004	<0,002
Mussel	Repl. 2	<0,002	<0,003	<0,002	<0,002	<0,004	<0,002
Mussel	Repl. 3	<0,002	<0,003	<0,002	<0,002	<0,004	<0,002
Plankton	Repl. 1	<0,002	<0,003	0,008	0,010	<0,005	<0,003
Plankton	Repl. 2	<0,002	<0,003	0,007	0,009	<0,005	<0,003
Plankton	Repl. 3	<0,002	0,005	0,062	0,053	<0,005	<0,003
Prawns	Repl. 1	<0,002	<0,003	<0,003	0,009	<0,005	<0,003
Prawns	Repl. 2	<0,002	<0,003	<0,003	<0,003	<0,005	<0,003
Prawns	Repl. 3	<0,002	<0,003	<0,003	0,004	<0,005	<0,003
Herring	Repl. 1	<0,003	<0,004	0,012	0,040	<0,007	<0,003
Herring	Repl. 2	<0,003	<0,004	0,027	0,080	<0,007	<0,003
Herring	Repl. 3	<0,003	<0,004	0,029	0,098	<0,007	0,006
Cod pool 1	Fish no. 1, 10, 14, 16, 23	0,064		0,022	2,416		
Cod pool 2	Fish no. 13, 17, 19, 20, 26	0,081		0,011	2,260		
Cod pool 3	Fish no. 12, 18, 25, 27, 28	0,117		0,037	2,806		

Comp. spec.	Note	BDE-126 ng/g (w.w.)	BDE-138 ng/g (w.w.)	BDE-153 ng/g (w.w.)	BDE-154 ng/g (w.w.)	BDE-156 ng/g (w.w.)	BDE-183 ng/g (w.w.)
Cod	Fish no. 1	0,050	<0,013	0,041	2,870	<0,02	<0,01
Cod	Fish no. 10	0,030	<0,015	0,019	2,780	<0,023	<0,01
Cod	Fish no. 12	0,112	<0,013	0,092	3,330	<0,02	<0,01
Cod	Fish no. 13	0,062	<0,013	0,022	3,180	<0,02	<0,01
Cod	Fish no. 14	0,062	<0,013	0,014	2,800	<0,02	<0,01
Cod	Fish no. 16	0,060	<0,013	0,013	1,580	<0,02	<0,01
Cod	Fish no. 17	0,111	<0,013	0,017	3,520	<0,02	<0,01
Cod	Fish no. 18	0,103	<0,013	<0,012	2,850	<0,02	<0,01
Cod	Fish no. 19	0,047	<0,013	<0,012	1,490	<0,02	<0,01
Cod	Fish no. 20	0,082	<0,013	0,015	1,270	<0,02	<0,01
Cod	Fish no. 23	0,119	<0,013	0,021	2,050	<0,02	<0,01
Cod	Fish no. 25	0,100	<0,013	<0,012	3,540	<0,02	<0,01
Cod	Fish no. 26	0,102	<0,013	<0,012	1,840	<0,02	<0,01
Cod	Fish no. 27	0,061	<0,013	<0,012	2,170	<0,02	<0,01
Cod	Fish no. 28	0,208	<0,013	0,091	2,140	<0,02	<0,01

Comp. spec.	Note	BDE-184 ng/g (w.w.)	BDE-191 ng/g (w.w.)	BDE-196 ng/g (w.w.)	BDE-197 ng/g (w.w.)	BDE-202 ng/g (w.w.)	BDE-206 ng/g (w.w.)
Polychaetes	1. P. crassa	<0,003	<0,004	<0,006	<0,005	<0,005	<0,006
Polychaetes	2. Terebellidae	<0,003	<0,004	<0,006	<0,005	<0,005	<0,006
Polychaetes	3. Misc.	<0,003	<0,004	<0,006	<0,005	<0,005	<0,006
Mussel	Repl. 1	<0,002	<0,002	<0,003	<0,003	<0,003	<0,003
Mussel	Repl. 2	<0,002	<0,002	<0,003	<0,003	<0,003	<0,003
Mussel	Repl. 3	<0,002	<0,002	<0,003	<0,003	<0,003	<0,003
Plankton	Repl. 1	<0,002	<0,003	<0,004	<0,004	<0,004	<0,004
Plankton	Repl. 2	<0,002	<0,003	<0,004	<0,004	<0,004	<0,004
Plankton	Repl. 3	<0,002	<0,003	<0,004	<0,004	<0,004	<0,004
Prawns	Repl. 1	<0,002	<0,003	<0,004	<0,004	<0,004	<0,004
Prawns	Repl. 2	<0,002	<0,003	<0,005	<0,004	<0,004	<0,005
Prawns	Repl. 3	<0,002	<0,003	<0,004	<0,004	<0,004	<0,004
Herring	Repl. 1	<0,003	<0,004	<0,006	<0,005	<0,005	<0,006
Herring	Repl. 2	<0,003	<0,004	<0,006	<0,005	<0,005	<0,006
Herring	Repl. 3	<0,003	<0,004	<0,006	<0,005	0,009	<0,006
Cod pool 1	Fish no. 1, 10, 14, 16, 23	0,010				0,064	
Cod pool 2	Fish no. 13, 17, 19, 20, 26	0,026				0,086	
Cod pool 3	Fish no. 12, 18, 25, 27, 28	0,009				0,105	

Comp. spec.	Note	BDE-184 ng/g (w.w.)	BDE-191 ng/g (w.w.)	BDE-196 ng/g (w.w.)	BDE-197 ng/g (w.w.)	BDE-202 ng/g (w.w.)	BDE-206 ng/g (w.w.)
Cod	Fish no. 1	<0,01	<0,012	<0,017	<0,015	0,054	<0,017
Cod	Fish no. 10	0,011	<0,012	<0,017	<0,015	0,074	<0,017
Cod	Fish no. 12	0,016	<0,012	<0,017	<0,015	0,105	<0,017
Cod	Fish no. 13	<0,01	<0,012	<0,017	<0,015	0,081	<0,017
Cod	Fish no. 14	0,018	<0,012	<0,017	<0,015	0,053	<0,017
Cod	Fish no. 16	0,011	<0,012	<0,017	<0,015	0,069	<0,017
Cod	Fish no. 17	0,024	<0,012	<0,017	<0,015	0,169	<0,017
Cod	Fish no. 18	0,013	<0,012	<0,017	<0,015	0,142	<0,017
Cod	Fish no. 19	<0,01	<0,012	<0,017	<0,015	0,024	<0,017
Cod	Fish no. 20	0,020	<0,012	<0,017	<0,015	0,114	<0,017
Cod	Fish no. 23	0,010	<0,012	<0,017	<0,015	0,068	<0,017
Cod	Fish no. 25	<0,01	<0,012	<0,017	<0,015	0,109	<0,017
Cod	Fish no. 26	0,087	<0,012	<0,017	<0,015	0,041	<0,017
Cod	Fish no. 27	<0,01	<0,012	<0,017	<0,015	0,068	<0,017
Cod	Fish no. 28	0,018	<0,012	<0,017	<0,015	0,103	<0,017

Comp. spec.	Note	BDE-207 ng/g (w.w.)	BDE-209 ng/g (w.w.)	DBDPE ng/g (w.w.)	o,p'-DDE ng/g (w.w.)	p,p'-DDE ng/g (w.w.)	o,p'-DDD ng/g (w.w.)
Polychaetes	1. P. crassa	<0,005	<0,337	6,600			
Polychaetes	2. Terebellidae	<0,005	<0,337	26,4			
Polychaetes	3. Misc.	<0,005	<0,337	3,707			
Mussel	Repl. 1	<0,003	<0,202	1,689			
Mussel	Repl. 2	<0,003	<0,202	0,816			
Mussel	Repl. 3	<0,003	<0,202	0,759			
Plankton	Repl. 1	<0,004	<0,253	<0,847			
Plankton	Repl. 2	<0,004	<0,253	6,300			
Plankton	Repl. 3	<0,004	<0,253	1,712			
Prawns	Repl. 1	<0,004	<0,253	3,723			
Prawns	Repl. 2	<0,005	<0,253	<1,316			
Prawns	Repl. 3	0,005	<0,253	2,429			
Herring	Repl. 1	<0,005	<0,337	4,391			
Herring	Repl. 2	<0,005	<0,337	1,374			
Herring	Repl. 3	0,007	<0,337	1,432			
Cod pool 1	Fish no. 1, 10, 14, 16, 23						
Cod pool 2	Fish no. 13, 17, 19, 20, 26			1,467			
Cod pool 3	Fish no. 12, 18, 25, 27, 28			2,188			

Comp. spec.	Note	BDE-207 ng/g (w.w.)	BDE-209 ng/g (w.w.)	DBDPE ng/g (w.w.)	o,p'-DDE ng/g (w.w.)	p,p'-DDE ng/g (w.w.)	o,p'-DDD ng/g (w.w.)
Cod	Fish no. 1	<0,016	<1,01	<2,613			
Cod	Fish no. 10	<0,016	<1,01	<4,301			
Cod	Fish no. 12	<0,016	<1,01	<1,783			
Cod	Fish no. 13	<0,016	<1,01	<2,43			
Cod	Fish no. 14	<0,016	<1,01	<2,377			
Cod	Fish no. 16	<0,016	<1,01	<3,371			
Cod	Fish no. 17	<0,016	<1,01	<2,76			
Cod	Fish no. 18	<0,016	<1,01	10,9			
Cod	Fish no. 19	<0,016	<1,01	4,896			
Cod	Fish no. 20	<0,016	<1,01	2,437			
Cod	Fish no. 23	<0,016	<1,01	<1,141			
Cod	Fish no. 25	<0,016	<1,01	<1,126			
Cod	Fish no. 26	<0,016	<1,01	<32,542			
Cod	Fish no. 27	<0,016	<1,01	<0,578			
Cod	Fish no. 28	<0,016	<1,01	<0,837			

Comp. spec.	Note	p,p'-DDD ng/g (w.w.)	o,p'-DDT ng/g (w.w.)	p,p'-DDT ng/g (w.w.)	Sum DDT ng/g (w.w.)	SCCP ng/g (w.w.)	MCCP ng/g (w.w.)
Polychaetes	1. P. crassa					1,00	2,20
Polychaetes	2. Terebellidae					1,20	0,90
Polychaetes	3. Misc.					1,80	0,70
Mussel	Repl. 1					1,60	0,50
Mussel	Repl. 2					1,80	1,20
Mussel	Repl. 3					1,10	1,20
Plankton	Repl. 1					7,70	0,30
Plankton	Repl. 2					9,70	<0,1
Plankton	Repl. 3					14,0	0,60
Prawns	Repl. 1					1,10	<0,1
Prawns	Repl. 2					0,60	<0,1
Prawns	Repl. 3					1,00	<0,1
Herring	Repl. 1					4,50	1,60
Herring	Repl. 2					6,80	<0,1
Herring	Repl. 3					4,50	0,50
Cod pool 1	Fish no. 1, 10, 14, 16, 23					17,2	1,86
Cod pool 2	Fish no. 13, 17, 19, 20, 26					8,66	2,92
Cod pool 3	Fish no. 12, 18, 25, 27, 28					39,0	3,02

Comp. spec.	Note	p,p'-DDD ng/g (w.w.)	o,p'-DDT ng/g (w.w.)	p,p'-DDT ng/g (w.w.)	Sum DDT ng/g (w.w.)	SCCP ng/g (w.w.)	MCCP ng/g (w.w.)
Cod	Fish no. 1					36,0	3,20
Cod	Fish no. 10					9,20	1,10
Cod	Fish no. 12					69,0	2,70
Cod	Fish no. 13					12,0	3,00
Cod	Fish no. 14					23,0	1,20
Cod	Fish no. 16					11,0	2,20
Cod	Fish no. 17					6,50	3,10
Cod	Fish no. 18					8,70	4,30
Cod	Fish no. 19					6,70	2,60
Cod	Fish no. 20					6,10	2,50
Cod	Fish no. 23					7,00	1,60
Cod	Fish no. 25					6,90	4,20
Cod	Fish no. 26					12,0	3,40
Cod	Fish no. 27					3,50	0,40
Cod	Fish no. 28					107	3,50

Comp. spec.	Note	Relative distributions of formula groups C-10 to C-13 and Cl-5 to Cl-10							
		(%) 10,5 (%)	(%) 10,6 (%)	(%) 10,7 (%)	(%) 10,8 (%)	(%) 10,9 (%)	(%) 10,10 (%)	(%) 11,5 (%)	(%) 11,6 (%)
Polychaetes	1. P. crassa	0,00	9,32	0,00	0,00	5,76	0,00	43,4	0,00
Polychaetes	2. Terebellidae	0,00	6,45	0,00	0,00	5,79	0,00	31,4	0,00
Polychaetes	3. Misc.	0,00	16,3	0,00	0,00	2,33	0,00	43,3	0,00
Mussel	Repl. 1	0,00	24,3	0,00	0,00	2,04	0,00	37,7	0,00
Mussel	Repl. 2	0,00	24,8	0,00	0,00	2,43	0,00	36,6	0,00
Mussel	Repl. 3	0,00	11,6	0,00	0,00	0,00	0,00	38,0	0,00
Plankton	Repl. 1	1,29	11,0	0,00	0,00	1,84	0,00	1,48	0,00
Plankton	Repl. 2	0,19	5,27	0,00	2,65	1,64	0,39	2,69	0,00
Plankton	Repl. 3	0,00	0,00	0,00	1,94	1,33	0,00	0,00	0,00
Prawns	Repl. 1	6,11	57,0	0,00	0,00	0,00	0,00	15,4	0,00
Prawns	Repl. 2	0,00	49,4	0,00	0,00	0,00	0,00	14,7	0,00
Prawns	Repl. 3	0,00	54,7	0,00	0,00	0,00	0,00	19,1	0,00
Herring	Repl. 1	0,00	0,00	0,00	0,00	0,00	0,00	15,6	0,00
Herring	Repl. 2	0,00	0,00	0,00	0,00	4,84	0,00	7,41	0,00
Herring	Repl. 3	0,00	0,00	0,00	0,00	0,00	0,00	19,4	0,00
Cod pool 1	Fish no. 1, 10, 14, 16, 23	1,91	47,7	0,00	0,00	0,49	1,63	4,66	0,00
Cod pool 2	Fish no. 13, 17, 19, 20, 26	0,00	51,5	0,00	0,00	0,00	1,89	4,23	0,00
Cod pool 3	Fish no. 12, 18, 25, 27, 28	0,00	37,5	0,00	0,00	0,72	1,13	7,41	0,00

Comp. spec.	Note	Relative distributions of formula groups C-10 to C-13 and Cl-5 to Cl-10							
		(%) 10,5 (%)	(%) 10,6 (%)	(%) 10,7 (%)	(%) 10,8 (%)	(%) 10,9 (%)	(%) 10,10 (%)	(%) 11,5 (%)	(%) 11,6 (%)
Cod	Fish no. 1	0,00	22,8	0,00	0,00	2,43	0,00	5,06	0,00
Cod	Fish no. 10	0,00	54,4	0,00	0,00	0,00	2,07	7,19	0,00
Cod	Fish no. 12	0,00	13,9	0,00	0,00	0,00	3,12	0,85	0,00
Cod	Fish no. 13	0,00	49,0	0,00	0,00	0,00	2,64	0,00	0,00
Cod	Fish no. 14	9,57	79,7	0,00	0,00	0,00	0,00	5,59	0,00
Cod	Fish no. 16	0,00	30,0	0,00	0,00	0,00	3,88	0,00	0,00
Cod	Fish no. 17	0,00	62,0	0,00	0,00	0,00	4,42	0,00	0,00
Cod	Fish no. 18	0,00	50,5	0,00	0,00	0,00	0,00	6,11	0,00
Cod	Fish no. 19	0,00	54,2	0,00	0,00	0,00	0,00	7,00	0,00
Cod	Fish no. 20	0,00	62,2	0,00	0,00	0,00	0,00	10,9	0,00
Cod	Fish no. 23	0,00	51,8	0,00	0,00	0,00	2,21	5,45	0,00
Cod	Fish no. 25	0,00	45,7	0,00	0,00	0,00	0,00	14,0	0,00
Cod	Fish no. 26	0,00	30,0	0,00	0,00	0,00	2,37	3,27	0,00
Cod	Fish no. 27	0,00	69,6	0,00	0,00	0,00	0,00	14,3	0,00
Cod	Fish no. 28	0,00	7,89	0,00	0,00	3,58	2,55	1,82	0,00

Comp. spec.	Note	(%) 11,7 (%)	(%) 11,8 (%)	(%) 11,9 (%)	(%) 11,10 (%)	(%) 12,6 (%)	(%) 12,7 (%)	(%) 12,8 (%)	(%) 12,9 (%)
Polychaetes	1. P. crassa	0,00	12,3	0,00	3,62	0,00	0,00	13,5	0,00
Polychaetes	2. Terebellidae	0,00	11,6	12,0	4,28	0,00	0,00	14,2	12,3
Polychaetes	3. Misc.	23,3	7,06	0,00	0,00	0,00	0,00	7,75	0,00
Mussel	Repl. 1	12,2	6,25	6,19	0,00	0,00	0,00	8,62	2,67
Mussel	Repl. 2	16,9	7,91	0,00	0,00	0,00	0,00	7,29	0,00
Mussel	Repl. 3	19,0	13,0	0,00	0,00	0,00	0,00	15,7	0,00
Plankton	Repl. 1	0,00	15,7	9,03	1,06	0,00	0,00	18,1	15,7
Plankton	Repl. 2	9,90	12,9	8,38	1,21	0,00	0,00	16,1	15,0
Plankton	Repl. 3	0,00	12,7	9,82	0,15	0,00	0,00	29,7	16,9
Prawns	Repl. 1	0,00	5,94	5,01	0,00	0,00	0,00	4,88	3,54
Prawns	Repl. 2	0,00	14,9	0,00	0,00	0,00	0,00	21,0	0,00
Prawns	Repl. 3	0,00	11,4	0,00	0,00	0,00	0,00	11,6	0,00
Herring	Repl. 1	0,00	22,9	22,9	1,47	0,00	0,00	19,6	13,1
Herring	Repl. 2	0,00	22,1	20,4	1,09	0,00	0,00	18,7	11,8
Herring	Repl. 3	69,9	7,94	0,00	0,00	0,00	0,00	2,83	0,00
Cod pool 1	Fish no. 1, 10, 14, 16, 23	0,00	0,00	6,02	2,83	0,00	0,00	9,98	11,7
Cod pool 2	Fish no. 13, 17, 19, 20, 26	0,00	0,00	0,00	2,74	0,00	0,00	12,6	11,9
Cod pool 3	Fish no. 12, 18, 25, 27, 28	0,00	2,55	12,2	4,22	0,00	0,00	7,42	11,5

Comp. spec.	Note	(%) 11,7 (%)	(%) 11,8 (%)	(%) 11,9 (%)	(%) 11,10 (%)	(%) 12,6 (%)	(%) 12,7 (%)	(%) 12,8 (%)	(%) 12,9 (%)
Cod	Fish no. 1	0,00	0,00	30,1	8,60	0,00	0,00	8,22	10,3
Cod	Fish no. 10	0,00	0,00	0,00	5,56	0,00	0,00	9,11	12,0
Cod	Fish no. 12	0,00	0,00	27,9	9,61	0,00	0,00	10,5	17,8
Cod	Fish no. 13	0,00	0,00	0,00	0,00	0,00	0,00	14,7	17,5
Cod	Fish no. 14	0,00	0,00	0,00	0,00	0,00	0,00	2,00	1,59
Cod	Fish no. 16	0,00	0,00	0,00	0,00	0,00	0,00	17,0	22,8
Cod	Fish no. 17	0,00	0,00	0,00	0,00	0,00	0,00	14,7	10,1
Cod	Fish no. 18	0,00	0,00	0,00	0,00	0,00	0,00	8,78	13,4
Cod	Fish no. 19	0,00	0,00	0,00	0,00	0,00	0,00	13,9	13,5
Cod	Fish no. 20	0,00	0,00	0,00	0,00	0,00	0,00	9,42	0,00
Cod	Fish no. 23	0,00	0,00	0,00	0,00	0,00	0,00	13,6	11,8
Cod	Fish no. 25	0,00	0,00	0,00	0,00	0,00	0,00	11,1	16,5
Cod	Fish no. 26	0,00	0,00	0,00	13,7	0,00	0,00	10,5	18,6
Cod	Fish no. 27	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Cod	Fish no. 28	0,00	12,7	32,9	11,5	0,00	0,00	6,69	10,0

Comp. spec.	Note	(%) 12,10 (%)	(%) 13,7 (%)	(%) 13,8 (%)	(%) 13,9 (%)	D4 ng/g (w.w.)	D5 ng/g (w.w.)	D6 ng/g (w.w.)
Polychaetes	1. P. crassa	1,96	0,00	10,1	0,00	3,25	158	7,20
Polychaetes	2. Terebellidae	1,95	0,00	0,00	0,00	2,82	134	7,21
Polychaetes	3. Misc.	0,00	0,00	0,00	0,00	6,20	105	6,73
Mussel	Repl. 1	0,00	0,00	0,00	0,00	<1,2	25,8	<0,9
Mussel	Repl. 2	0,00	0,00	4,07	0,00	<1,2	22,2	<0,9
Mussel	Repl. 3	0,00	0,00	0,00	2,67	<1,2	13,6	<0,9
Plankton	Repl. 1	1,47	0,00	14,0	9,31	6,38	229	6,98
Plankton	Repl. 2	1,48	0,00	13,5	8,71	7,67	285	8,57
Plankton	Repl. 3	0,27	0,00	20,5	6,77	6,07	224	7,74
Prawns	Repl. 1	0,00	0,00	0,00	2,16	2,80	32,8	2,89
Prawns	Repl. 2	0,00	0,00	0,00	0,00	2,25	22,6	2,02
Prawns	Repl. 3	0,00	0,00	0,00	3,23	2,65	29,2	2,60
Herring	Repl. 1	0,84	0,00	3,53	0,00	2,57	128	4,36
Herring	Repl. 2	0,00	0,00	11,3	2,36	3,93	421	10,6
Herring	Repl. 3	0,00	0,00	0,00	0,00	18,4	1 013	40,9
Cod pool 1	Fish no. 1, 10, 14, 16, 23	3,07	0,00	4,57	5,42	56,9	958	131
Cod pool 2	Fish no. 13, 17, 19, 20, 26	0,86	0,00	6,19	8,01	47,0	925	152
Cod pool 3	Fish no. 12, 18, 25, 27, 28	3,18	0,00	6,27	5,88	39,6	1 366	124

Comp. spec.	Note	(%) 12,10 (%)	(%) 13,7 (%)	(%) 13,8 (%)	(%) 13,9 (%)	D4 ng/g (w.w.)	D5 ng/g (w.w.)	D6 ng/g (w.w.)
Cod	Fish no. 1	3,03	0,00	4,77	4,73	82,5	1 814	144
Cod	Fish no. 10	3,89	0,00	0,00	5,74	65,3	867	183
Cod	Fish no. 12	3,80	0,00	7,35	5,18	76,5	1 948	134
Cod	Fish no. 13	0,39	0,00	9,00	6,78	56,9	1 393	154
Cod	Fish no. 14	0,74	0,00	0,00	0,82	34,1	560	148
Cod	Fish no. 16	7,68	0,00	9,51	9,20	40,9	838	78,2
Cod	Fish no. 17	0,00	0,00	0,00	8,72	36,7	838	259
Cod	Fish no. 18	9,19	0,00	3,99	8,04	29,4	949	118
Cod	Fish no. 19	0,00	0,00	4,70	6,75	27,9	390	118
Cod	Fish no. 20	0,00	0,00	8,23	9,26	77,2	1 195	126
Cod	Fish no. 23	0,00	0,00	8,59	6,63	61,6	712	99,6
Cod	Fish no. 25	0,00	0,00	7,08	5,60	35,2	993	145
Cod	Fish no. 26	3,91	0,00	9,04	8,56	36,3	810	104
Cod	Fish no. 27	0,00	0,00	8,98	7,18	17,2	438	90,7
Cod	Fish no. 28	2,91	0,00	3,97	3,42	39,4	2 504	134

Comp. spec.	Note	TEP ng/g (w.w.)	TCEP ng/g (w.w.)	TPrP ng/g (w.w.)	TCPP ng/g (w.w.)	TiBP ng/g (w.w.)	BdPhP ng/g (w.w.)
Polychaetes	1. P. crassa	0,10	<0,2	<0,01	0,72	<0,5	<0,01
Polychaetes	2. Terebellidae	< 0,1	1,86	<0,01	39,6	0,60	<0,01
Polychaetes	3. Misc.	< 0,1	0,38	<0,01	2,13	<0,5	<0,01
Mussel	Repl. 1	0,22	<0,2	<0,01	0,39	<0,5	<0,01
Mussel	Repl. 2	0,25	<0,2	<0,01	0,51	<0,5	<0,01
Mussel	Repl. 3	0,53	<0,2	<0,01	0,30	<0,5	<0,01
Plankton	Repl. 1	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Plankton	Repl. 2	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Plankton	Repl. 3	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Prawns	Repl. 1	<0,18	0,30	<0,03	<1,8	5,26	<0,03
Prawns	Repl. 2	<0,18	0,24	<0,03	2,15	<1	<0,03
Prawns	Repl. 3	<0,18	0,21	<0,03	<1,8	<1	<0,03
Herring	Repl. 1	0,16	<0,2	<0,01	0,33	<0,5	<0,01
Herring	Repl. 2	<0,1	0,95	<0,01	0,50	< 0,5	< 0,01
Herring	Repl. 3	0,23	0,63	<0,01	0,31	<0,5	<0,01
Cod pool 1	Fish no. 1, 10, 14, 16, 23					0,86	
Cod pool 2	Fish no. 13, 17, 19, 20, 26				0,77		
Cod pool 3	Fish no. 12, 18, 25, 27, 28					0,51	

Comp. spec.	Note	TEP ng/g (w.w.)	TCEP ng/g (w.w.)	TPrP ng/g (w.w.)	TCPP ng/g (w.w.)	TiBP ng/g (w.w.)	BdPhP ng/g (w.w.)
Cod	Fish no. 1	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Cod	Fish no. 10	<0,18	<0,08	<0,03	<1,8	4,29	<0,03
Cod	Fish no. 12	<0,18	<0,08	<0,03	<1,8	2,53	<0,03
Cod	Fish no. 13	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Cod	Fish no. 14	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Cod	Fish no. 16	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Cod	Fish no. 17	<0,18	<0,08	<0,03	3,85	<1	<0,03
Cod	Fish no. 18	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Cod	Fish no. 19	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Cod	Fish no. 20	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Cod	Fish no. 23	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Cod	Fish no. 25	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Cod	Fish no. 26	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Cod	Fish no. 27	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Cod	Fish no. 28	<0,18	<0,08	<0,03	<1,8	<1	<0,03

Comp. spec.	Note	TPP ng/g (w.w.)	DBPhP ng/g (w.w.)	TnBP ng/g (w.w.)	TDCPP ng/g (w.w.)	TBEP ng/g (w.w.)	TCP ng/g (w.w.)
Polychaetes	1. P. crassa	0,26	<0,01	<0,2	<0,1	0,32	0,03
Polychaetes	2. Terebellidae	0,43	<0,01	1,37	2,49	0,59	0,15
Polychaetes	3. Misc.	0,34	<0,01	<0,2	0,23	3,06	<0,01
Mussel	Repl. 1	0,17	<0,01	<0,2	<0,1	0,31	<0,01
Mussel	Repl. 2	0,24	<0,01	<0,2	<0,1	0,50	<0,01
Mussel	Repl. 3	0,25	<0,01	<0,2	<0,1	0,79	<0,01
Plankton	Repl. 1	<0,2	<0,07	<3,31	<0,33	<3,13	<0,07
Plankton	Repl. 2	<0,2	<0,07	<3,31	<0,33	<3,13	<0,07
Plankton	Repl. 3	<0,2	<0,07	<3,31	<0,33	<3,13	<0,07
Prawns	Repl. 1	<0,1	<0,01	13,9	<0,18	3,69	<0,01
Prawns	Repl. 2	<0,1	<0,01	<6,2	<0,18	<2,1	<0,01
Prawns	Repl. 3	<0,1	<0,01	<6,2	<0,18	<2,1	<0,01
Herring	Repl. 1	<0,03	<0,01	<0,2	<0,1	0,74	<0,01
Herring	Repl. 2	< 0,03	<0,01	< 0,2	< 0,1	0,26	<0,01
Herring	Repl. 3	<0,03	<0,01	<0,2	<0,1	0,26	<0,01
Cod pool 1	Fish no. 1, 10, 14, 16, 23	0,16		1,34		3,44	
Cod pool 2	Fish no. 13, 17, 19, 20, 26	0,36		2,08		6,71	
Cod pool 3	Fish no. 12, 18, 25, 27, 28	0,35				0,61	

Comp. spec.	Note	TPP ng/g (w.w.)	DBPhP ng/g (w.w.)	TnBP ng/g (w.w.)	TDCPP ng/g (w.w.)	TBEP ng/g (w.w.)	TCP ng/g (w.w.)
Cod	Fish no. 1	<0,1	<0,01	<6,2	<0,18	5,76	<0,01
Cod	Fish no. 10	0,81	<0,01	6,72	<0,18	3,60	<0,01
Cod	Fish no. 12	<0,1	<0,01	<6,2	<0,18	<2,1	<0,01
Cod	Fish no. 13	<0,1	<0,01	<6,2	<0,18	3,27	<0,01
Cod	Fish no. 14	<0,1	<0,01	<6,2	<0,18	5,59	<0,01
Cod	Fish no. 16	<0,1	<0,01	<6,2	<0,18	2,23	<0,01
Cod	Fish no. 17	1,81	<0,01	10,4	<0,18	14,8	<0,01
Cod	Fish no. 18	<0,1	<0,01	<6,2	<0,18	<2,1	<0,01
Cod	Fish no. 19	<0,1	<0,01	<6,2	<0,18	<2,1	<0,01
Cod	Fish no. 20	<0,1	<0,01	<6,2	<0,18	11,9	<0,01
Cod	Fish no. 23	<0,1	<0,01	<6,2	<0,18	<2,1	<0,01
Cod	Fish no. 25	<0,1	<0,01	<6,2	<0,18	<2,1	<0,01
Cod	Fish no. 26	<0,1	<0,01	<6,2	<0,18	3,54	<0,01
Cod	Fish no. 27	0,79	<0,01	<6,2	<0,18	3,07	<0,01
Cod	Fish no. 28	0,94	<0,01	<6,2	<0,18	<2,1	<0,01

Comp. spec.	Note	EHDP ng/g (w.w.)	TEHP ng/g (w.w.)	Bisphenol A ng/g (w.w.)	Tetrabromobisphenol A ng/g (w.w.)
Polychaetes	1. P. crassa	<0,03	0,14	209	<1
Polychaetes	2. Terebellidae	0,25	1,51	306	45 172
Polychaetes	3. Misc.	0,25	0,74	9,03	<1
Mussel	Repl. 1	<0,03	0,21	<0,55	<1
Mussel	Repl. 2	<0,03	0,27	<0,55	<1
Mussel	Repl. 3	<0,03	0,24	<0,55	<1
Plankton	Repl. 1	<0,62	<0,11	<0,55	<1
Plankton	Repl. 2	<0,62	<0,11	<0,55	<1
Plankton	Repl. 3	<0,62	<0,11	4,10	<1
Prawns	Repl. 1	<0,02	<0,04	<0,55	<1
Prawns	Repl. 2	<0,02	0,05	28,7	<1
Prawns	Repl. 3	<0,02	0,04	<0,55	<1
Herring	Repl. 1	<0,03	0,37	10,9	<1
Herring	Repl. 2	0,08	< 0,11	<0,55	<1
Herring	Repl. 3	<0,03	0,27	<0,55	<1
Cod pool 1	Fish no. 1, 10, 14, 16, 23			78,2	
Cod pool 2	Fish no. 13, 17, 19, 20, 26			43,4	
Cod pool 3	Fish no. 12, 18, 25, 27, 28			36,3	

Comp. spec.	Note	EHDP ng/g (w.w.)	TEHP ng/g (w.w.)	Bisphenol A ng/g (w.w.)	Tetrabromobisphenol A ng/g (w.w.)
Cod	Fish no. 1	<0,02	<0,04	12,0	<2.2
Cod	Fish no. 10	<0,02	<0,04	112	<2.2
Cod	Fish no. 12	<0,02	<0,04	23,0	<2.2
Cod	Fish no. 13	<0,02	<0,04	31,0	<2.2
Cod	Fish no. 14	<0,02	<0,04	29,0	<2.2
Cod	Fish no. 16	<0,02	<0,04	195	<2.2
Cod	Fish no. 17	<0,02	<0,04	12,0	<2.2
Cod	Fish no. 18	<0,02	<0,04	23,0	<2.2
Cod	Fish no. 19	<0,02	<0,04	106	<2.2
Cod	Fish no. 20	<0,02	<0,04	45,0	<2.2
Cod	Fish no. 23	<0,02	<0,04	43,0	<2.2
Cod	Fish no. 25	<0,02	<0,04	25,0	<2.2
Cod	Fish no. 26	<0,02	<0,04	23,0	<2.2
Cod	Fish no. 27	<0,02	<0,04	37,0	<2.2
Cod	Fish no. 28	<0,02	<0,04	73,4	<2.2

Comp. spec.	Note	4,4-bisphenol F ng/g (w.w.)	2,2-bisphenol F ng/g (w.w.)	Hexafluorobisphenol A ng/g (w.w.)	Bisphenol BP ng/g (w.w.)
Polychaetes	1. P. crassa	<1	2,30	2,89	<1
Polychaetes	2. Terebellidae	<1	<1	<1	4,15
Polychaetes	3. Misc.	<1	1,71	5,90	<1
Mussel	Repl. 1	<1	1,73	5,45	<1
Mussel	Repl. 2	<1	1,07	2,83	1,32
Mussel	Repl. 3	<1	1,63	5,68	1,70
Plankton	Repl. 1	<1	<1	2,92	2,36
Plankton	Repl. 2	<1	<1	2,76	3,48
Plankton	Repl. 3	<1	<1	3,12	<1
Prawns	Repl. 1	1,67	<1	2,99	<1
Prawns	Repl. 2	<1	1,70	7,79	<1
Prawns	Repl. 3	<1	<1	2,95	<1
Herring	Repl. 1	<1	2,59	9,86	<1
Herring	Repl. 2	<1	1,35	5,78	<1
Herring	Repl. 3	<1	<1	5,20	4,64
Cod pool 1	Fish no. 1, 10, 14, 16, 23	13,7	2,60	0,42	
Cod pool 2	Fish no. 13, 17, 19, 20, 26	163	770		
Cod pool 3	Fish no. 12, 18, 25, 27, 28	36,4		0,40	

Comp. spec.	Note	4,4-bisphenol F ng/g (w.w.)	2,2-bisphenol F ng/g (w.w.)	Hexafluorobisphenol A ng/g (w.w.)	Bisphenol BP ng/g (w.w.)
Cod	Fish no. 1	13,2	<5	<5	<10
Cod	Fish no. 10	<5	<5	<5	<10
Cod	Fish no. 12	8,43	<5	<5	<10
Cod	Fish no. 13	<5	<5	<5	<10
Cod	Fish no. 14	<5	<5	<5	<10
Cod	Fish no. 16	12,8	<5	<5	<10
Cod	Fish no. 17	<5	<5	<5	<10
Cod	Fish no. 18	13,0	<5	<5	<10
Cod	Fish no. 19	9,20	<5	<5	<10
Cod	Fish no. 20	789	3 852	<5	<10
Cod	Fish no. 23	42,3	13,0	<5	<10
Cod	Fish no. 25	132	<5	<5	<10
Cod	Fish no. 26	16,9	<5	<5	<10
Cod	Fish no. 27	15,0	<5	<5	<10
Cod	Fish no. 28	13,4	<5	<5	<10

Comp. spec.	Note	Bisphenol S ng/g (w.w.)	4-nonylphenol ng/g (w.w.)	4-octylphenol ng/g (w.w.)	4-tert-octylphenol ng/g (w.w.)	Bisphenol B ng/g (w.w.)
Polychaetes	1. P. crassa	<1	21,9	<1	130	296
Polychaetes	2. Terebellidae	<1	<1	3,45	339	481
Polychaetes	3. Misc.	<1	<1	3,45	340	380
Mussel	Repl. 1	<1	14,4	3,02	293	239
Mussel	Repl. 2	<1	<1	<1	153	170
Mussel	Repl. 3	<1	<1	3,49	317	1 009
Plankton	Repl. 1	<1	<1	<1	167	218
Plankton	Repl. 2	<1	<1	<1	161	704
Plankton	Repl. 3	<1	<1	<1	164	237
Prawns	Repl. 1	<1	<1	<1	153	45,8
Prawns	Repl. 2	<1	<1	2,90	277	464
Prawns	Repl. 3	<1	<1	<1	141	36,2
Herring	Repl. 1	3,21	<1	3,22	294	2 677
Herring	Repl. 2	<1	1,74	3,61	282	455
Herring	Repl. 3	<1	3,30	3,08	290	440
Cod pool 1	Fish no. 1, 10, 14, 16, 23	0,97		4,74		189
Cod pool 2	Fish no. 13, 17, 19, 20, 26	0,35		7,62	554	412
Cod pool 3	Fish no. 12, 18, 25, 27, 28	2,31				265

Comp. spec.	Note	Bisphenol S ng/g (w.w.)	4-nonylphenol ng/g (w.w.)	4-octylphenol ng/g (w.w.)	4-tert-octylphenol ng/g (w.w.)	Bisphenol B ng/g (w.w.)
Cod	Fish no. 1	<1	<20	<25	<25	47,0
Cod	Fish no. 10	3,29	<20	<25	<25	56,3
Cod	Fish no. 12	1,55	<20	<25	<25	824
Cod	Fish no. 13	<1	<20	<25	<25	<10
Cod	Fish no. 14	1,58	<20	<25	<25	<10
Cod	Fish no. 16	<1	<20	<25	<25	<10
Cod	Fish no. 17	<1	<20	<25	<25	<10
Cod	Fish no. 18	10,0	<20	<25	<25	<10
Cod	Fish no. 19	1,75	<20	<25	2 772	1 995
Cod	Fish no. 20	<1	<20	<25	<25	35,9
Cod	Fish no. 23	<1	<20	<25	<25	842
Cod	Fish no. 25	<1	<20	<25	<25	36,9
Cod	Fish no. 26	<1	<20	<25	<25	30,1
Cod	Fish no. 27	<1	<20	<25	<25	466
Cod	Fish no. 28	<1	<20	<25	<25	<10

Comp. spec.	Note	Bisphenol Z ng/g (w.w.)	Bisphenol AP ng/g (w.w.)	Bisphenol E ng/g (w.w.)	Bisphenol FL ng/g (w.w.)	Bisphenol P ng/g (w.w.)
Polychaetes	1. P. crassa	7,30	<1	15,5	<1	2,06
Polychaetes	2. Terebellidae	44,6	20,8	112	44,5	<1
Polychaetes	3. Misc.	<1	<1	<1	<1	7,01
Mussel	Repl. 1	<1	1 872	<1	<1	7,09
Mussel	Repl. 2	5,95	1 050	<1	3,20	<1
Mussel	Repl. 3	<1	1 298	<1	<1	30,8
Plankton	Repl. 1	25,0	<1	<1	2,77	<1
Plankton	Repl. 2	42,4	<1	<1	<1	<1
Plankton	Repl. 3	<1	40,0	<1	<1	<1
Prawns	Repl. 1	<1	<1	4,88	<1	<1
Prawns	Repl. 2	<1	<1	<1	8,95	14,2
Prawns	Repl. 3	<1	<1	<1	<1	2,62
Herring	Repl. 1	<1	<1	<1	49,6	18,6
Herring	Repl. 2	1 975	98,4	59,9	15,8	19,0
Herring	Repl. 3	142	133	<1	<1	3,83
Cod pool 1	Fish no. 1, 10, 14, 16, 23	44,5	4,76	324		27,1
Cod pool 2	Fish no. 13, 17, 19, 20, 26	166	23,4	840		32,2
Cod pool 3	Fish no. 12, 18, 25, 27, 28	581	27,3	56,0	4,44	42,9

Comp. spec.	Note	Bisphenol Z ng/g (w.w.)	Bisphenol AP ng/g (w.w.)	Bisphenol E ng/g (w.w.)	Bisphenol FL ng/g (w.w.)	Bisphenol P ng/g (w.w.)
Cod	Fish no. 1	19,2	10,3	<4	<10	<5
Cod	Fish no. 10	<2	13,5	<4	<10	51,3
Cod	Fish no. 12	2 653	117	280	<10	131
Cod	Fish no. 13	<2	<2	957	<10	<5
Cod	Fish no. 14	<2	<2	1 618	<10	<5
Cod	Fish no. 16	203	<2	<4	<10	84,1
Cod	Fish no. 17	<2	<2	1 839	<10	<5
Cod	Fish no. 18	<2	6,27	<4	<10	<5
Cod	Fish no. 19	772	117	1 404	<10	88,2
Cod	Fish no. 20	56,9	<2	<4	<10	<5
Cod	Fish no. 23	<2	<2	<4	<10	<5
Cod	Fish no. 25	20,5	<2	<4	<10	<5
Cod	Fish no. 26	<2	<2	<4	<10	72,8
Cod	Fish no. 27	<2	<2	<4	<10	<5
Cod	Fish no. 28	232	12,6	<4	22,2	83,9

Comp. spec.	Note	Bisphenol M ng/g (w.w.)	Bisphenol G ng/g (w.w.)	Bisphenol TMC ng/g (w.w.)	Ni µg/g (w.w.)	Cu µg/g (w.w.)	Ag µg/g (w.w.)
Polychaetes	1. P. crassa	<1	147	<1	2,360	39,1	1,573
Polychaetes	2. Terebellidae	134	<1	<1	2,526	5,685	0,297
Polychaetes	3. Misc.	22,1	193	<1	2,444	13,3	0,904
Mussel	Repl. 1	21,3	1 034	<1	0,454	0,933	0,002
Mussel	Repl. 2	2,65	1 732	<1	0,487	1,121	<0,004
Mussel	Repl. 3	19,0	1 240	9,90	0,262	0,872	<0,003
Plankton	Repl. 1	20,6	87,9	<1	0,786	14,8	0,061
Plankton	Repl. 2	23,7	118	<1	0,159	13,0	0,055
Plankton	Repl. 3	5,78	26,5	<1	0,112	13,6	0,056
Prawns	Repl. 1	<1	<1	<1	0,046	4,521	0,202
Prawns	Repl. 2	19,3	<1	<1	0,036	6,667	0,300
Prawns	Repl. 3	<1	5,00	<1	0,046	6,545	0,280
Herring	Repl. 1	346	292	<1	0,050	0,708	<0,002
Herring	Repl. 2	105	<1	<1	0,063	0,748	<0,002
Herring	Repl. 3	2,80	176	<1	0,060	0,716	<0,002
Cod pool 1	Fish no. 1, 10, 14, 16, 23		128	389	0,086	7,222	5,405
Cod pool 2	Fish no. 13, 17, 19, 20, 26	24,5	10 697	649	0,056	7,455	4,584
Cod pool 3	Fish no. 12, 18, 25, 27, 28	34,0	2 908	1 448	0,046	8,441	2,964

Comp. spec.	Note	Bisphenol M ng/g (w.w.)	Bisphenol G ng/g (w.w.)	Bisphenol TMC ng/g (w.w.)	Ni µg/g (w.w.)	Cu µg/g (w.w.)	Ag µg/g (w.w.)
Cod	Fish no. 1	<3	<3	85,8	0,065	12,1	5,760
Cod	Fish no. 10	<3	<3	<3	0,065	4,820	4,032
Cod	Fish no. 12	110	14 360	7 145	0,035	2,630	1,436
Cod	Fish no. 13	<3	<3	<3	0,063	4,252	4,165
Cod	Fish no. 14	<3	<3	<3	0,162	8,705	6,988
Cod	Fish no. 16	<3	<3	<3	0,072	6,521	4,381
Cod	Fish no. 17	<3	<3	<3	0,084	13,7	6,891
Cod	Fish no. 18	<3	<3	53,4	0,040	11,4	2,824
Cod	Fish no. 19	122	53 448	3 162	0,044	5,383	2,558
Cod	Fish no. 20	<3	<3	42,8	0,050	7,304	4,241
Cod	Fish no. 23	<3	638	1 857	0,069	3,988	5,864
Cod	Fish no. 25	<3	<3	<3	0,075	7,930	6,018
Cod	Fish no. 26	<3	37,2	41,2	0,041	6,604	5,063
Cod	Fish no. 27	59,6	<3	<3	0,047	18,8	3,798
Cod	Fish no. 28	<3	181	40,4	0,034	1,491	0,746

Comp. spec.	Note	Cd µg/g (w.w.)	Hg ng/g (w.w.)	Pb µg/g (w.w.)	Cr µg/g (w.w.)	Fe µg/g (w.w.)	Zn µg/g (w.w.)
Polychaetes	1. P. crassa	0,385	46,6	1,589	3,736	921	7,416
Polychaetes	2. Terebellidae	0,079	124	3,850	4,961	2 113	30,7
Polychaetes	3. Misc.	0,086	52,2	3,322	4,029	1 494	35,5
Mussel	Repl. 1	0,189	14,9	0,672	0,371	33,8	18,0
Mussel	Repl. 2	0,162	14,9	0,559	0,475	49,4	22,2
Mussel	Repl. 3	0,133	16,7	0,343	0,213	26,4	16,6
Plankton	Repl. 1	0,016	16,7	0,142	1,128	27,1	12,4
Plankton	Repl. 2	0,014	15,5	0,011	0,089	10,5	11,1
Plankton	Repl. 3	0,011	16,6	0,014	0,046	6,661	11,0
Prawns	Repl. 1	<0,01	73,1	0,007	<0,012	2,080	10,8
Prawns	Repl. 2	0,011	95,3	0,007	0,026	2,848	11,5
Prawns	Repl. 3	0,011	89,6	0,008	0,034	3,056	11,5
Herring	Repl. 1	<0,009	68,2	0,003	0,049	8,979	7,550
Herring	Repl. 2	<0,01	124	<0,002	0,067	9,286	5,771
Herring	Repl. 3	<0,01	116	<0,002	0,069	9,248	5,337
Cod pool 1	Fish no. 1, 10, 14, 16, 23	0,120	258	0,093	0,031	24,5	23,9
Cod pool 2	Fish no. 13, 17, 19, 20, 26	0,154	266	0,101	0,016	24,4	23,4
Cod pool 3	Fish no. 12, 18, 25, 27, 28	0,057	375	0,018	0,011	18,0	19,1

Comp. spec.	Note	Cd µg/g (w.w.)	Hg ng/g (w.w.)	Pb µg/g (w.w.)	Cr µg/g (w.w.)	Fe µg/g (w.w.)	Zn µg/g (w.w.)
Cod	Fish no. 1	0,051	427	0,023	0,045	34,8	29,1
Cod	Fish no. 10	0,059	158	0,110	0,031	16,4	22,9
Cod	Fish no. 12	0,010	487	0,003	0,019	9,044	11,2
Cod	Fish no. 13	0,096	316	0,016	0,031	19,0	19,7
Cod	Fish no. 14	0,302	268	0,080	0,038	36,5	29,3
Cod	Fish no. 16	0,126	245	0,125	0,031	16,5	19,6
Cod	Fish no. 17	0,443	262	0,143	0,019	45,9	32,0
Cod	Fish no. 18	0,134	414	0,018	0,013	27,3	22,2
Cod	Fish no. 19	0,074	229	0,202	<0,011	17,6	21,4
Cod	Fish no. 20	0,108	298	0,125	0,018	20,9	21,3
Cod	Fish no. 23	0,060	189	0,127	0,013	18,3	18,5
Cod	Fish no. 25	0,050	346	0,040	<0,012	33,5	25,4
Cod	Fish no. 26	0,051	225	0,019	0,010	18,7	22,3
Cod	Fish no. 27	0,048	292	0,013	0,009	11,3	28,2
Cod	Fish no. 28	0,043	335	0,017	0,015	8,941	8,545

Comp. spec.	Note	As µg/g (w.w.)	PFPA ng/g (w.w.)	PFHxA ng/g (w.w.)	PFHpA ng/g (w.w.)	PFOA ng/g (w.w.)	PFNA ng/g (w.w.)
Polychaetes	1. P. crassa	2,082	<1	<0,5	<0,5	<0,5	<0,5
Polychaetes	2. Terebellidae	5,092	<1	<0,5	<0,5	0,63	<0,5
Polychaetes	3. Misc.	12,2	<1	<0,5	<0,5	0,72	<0,5
Mussel	Repl. 1	1,486	<1	<0,5	<0,5	<0,5	<0,5
Mussel	Repl. 2	1,881	<1	<0,5	<0,5	<0,5	<0,5
Mussel	Repl. 3	1,391	<1	<0,5	<0,5	<0,5	<0,5
Plankton	Repl. 1	7,860	<1	<0,5	<0,5	<0,5	<0,5
Plankton	Repl. 2	6,603	<1	<0,5	<0,5	<0,5	<0,5
Plankton	Repl. 3	6,872	<1	<0,5	<0,5	<0,5	<0,5
Prawns	Repl. 1	27,4	<1	<0,5	<0,5	<0,5	<0,5
Prawns	Repl. 2	29,1	<1	<0,5	<0,5	<0,5	<0,5
Prawns	Repl. 3	28,1	<1	<0,5	<0,5	<0,5	<0,5
Herring	Repl. 1	1,623	<1	<0,5	<0,5	<0,5	<0,5
Herring	Repl. 2	2,882	<1	<0,5	<0,5	<0,5	<0,5
Herring	Repl. 3	2,157	<1	<0,5	<0,5	<0,5	<0,5
Cod pool 1	Fish no. 1, 10, 14, 16, 23	24,7					
Cod pool 2	Fish no. 13, 17, 19, 20, 26	27,7					
Cod pool 3	Fish no. 12, 18, 25, 27, 28	17,9					

Comp. spec.	Note	As µg/g (w.w.)	PFPA ng/g (w.w.)	PFHxA ng/g (w.w.)	PFHpA ng/g (w.w.)	PFOA ng/g (w.w.)	PFNA ng/g (w.w.)
Cod	Fish no. 1	22,6	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 10	21,4	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 12	12,1	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 13	30,7	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 14	40,7	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 16	17,9	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 17	27,3	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 18	17,8	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 19	28,0	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 20	21,1	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 23	20,7	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 25	33,7	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 26	31,4	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 27	22,1	<1	<0,5	<0,5	<0,5	<0,5
Cod	Fish no. 28	4,108	<1	<0,5	<0,5	<0,5	<0,5

Comp. spec.	Note	PFDA ng/g (w.w.)	PFUdA ng/g (w.w.)	PFDoA ng/g (w.w.)	PFTrA ng/g (w.w.)	PFTeA ng/g (w.w.)	PFBS ng/g (w.w.)
Polychaetes	1. P. crassa	<0,5	0,72	1,30	1,33	0,62	5,81
Polychaetes	2. Terebellidae	1,57	2,10	1,25	0,74	<0,4	0,11
Polychaetes	3. Misc.	<0,5	0,57	0,41	0,40	0,43	0,11
Mussel	Repl. 1	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Mussel	Repl. 2	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Mussel	Repl. 3	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Plankton	Repl. 1	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Plankton	Repl. 2	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Plankton	Repl. 3	<0,5	<0,4	0,44	<0,4	<0,4	<0,1
Prawns	Repl. 1	<0,5	0,41	<0,4	0,49	<0,4	<0,1
Prawns	Repl. 2	<0,5	0,50	0,40	0,41	<0,4	<0,1
Prawns	Repl. 3	<0,5	0,48	<0,4	0,62	<0,4	<0,1
Herring	Repl. 1	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Herring	Repl. 2	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Herring	Repl. 3	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Cod pool 1	Fish no. 1, 10, 14, 16, 23	0,34	0,49	0,42	0,23		
Cod pool 2	Fish no. 13, 17, 19, 20, 26	0,27	0,38	0,24	0,09		
Cod pool 3	Fish no. 12, 18, 25, 27, 28	0,20	0,54	0,31	0,16		

Comp. spec.	Note	PFDA ng/g (w.w.)	PFUdA ng/g (w.w.)	PFDoA ng/g (w.w.)	PFTrA ng/g (w.w.)	PFTeA ng/g (w.w.)	PFBS ng/g (w.w.)
Cod	Fish no. 1	0,66	0,60	0,59	0,59	<0,4	<0,1
Cod	Fish no. 10	<0,5	0,66	0,41	<0,4	<0,4	<0,1
Cod	Fish no. 12	<0,5	0,64	0,55	0,42	<0,4	<0,1
Cod	Fish no. 13	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Cod	Fish no. 14	0,51	0,60	0,51	0,54	<0,4	<0,1
Cod	Fish no. 16	0,55	0,60	0,58	<0,4	<0,4	<0,1
Cod	Fish no. 17	<0,5	0,57	0,45	<0,4	<0,4	<0,1
Cod	Fish no. 18	<0,5	0,47	<0,4	<0,4	<0,4	<0,1
Cod	Fish no. 19	0,79	0,93	0,74	0,45	<0,4	<0,1
Cod	Fish no. 20	0,56	0,41	<0,4	<0,4	<0,4	<0,1
Cod	Fish no. 23	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Cod	Fish no. 25	<0,5	0,47	0,44	<0,4	<0,4	<0,1
Cod	Fish no. 26	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Cod	Fish no. 27	<0,5	0,42	<0,4	<0,4	<0,4	<0,1
Cod	Fish no. 28	1,01	0,68	0,55	0,40	<0,4	<0,1

Comp. spec.	Note	PFHxS ng/g (w.w.)	PFOS ng/g (w.w.)	PFDS ng/g (w.w.)	PFDoS ng/g (w.w.)	PFOSA ng/g (w.w.)	me-PFOSA ng/g (w.w.)
Polychaetes	1. P. crassa	<0,1	2,02	0,85	<0,2	2,87	<0,3
Polychaetes	2. Terebellidae	<0,1	1,97	0,84	<0,2	0,33	<0,3
Polychaetes	3. Misc.	0,16	1,62	0,40	<0,2	0,21	<0,3
Mussel	Repl. 1	<0,1	<0,1	<0,2	<0,2	0,32	<0,3
Mussel	Repl. 2	<0,1	<0,1	<0,2	<0,2	0,46	<0,3
Mussel	Repl. 3	<0,1	<0,1	<0,2	<0,2	0,35	<0,3
Plankton	Repl. 1	<0,1	0,17	<0,2	<0,2	1,76	<0,3
Plankton	Repl. 2	<0,1	0,20	<0,2	<0,2	3,36	<0,3
Plankton	Repl. 3	<0,1	0,16	<0,2	<0,2	2,63	<0,3
Prawns	Repl. 1	<0,1	0,72	<0,2	<0,2	0,18	<0,3
Prawns	Repl. 2	<0,1	0,59	<0,2	<0,2	0,20	<0,3
Prawns	Repl. 3	<0,1	0,91	<0,2	<0,2	0,20	<0,3
Herring	Repl. 1	<0,1	0,28	<0,2	<0,2	0,58	<0,3
Herring	Repl. 2	<0,1	0,23	<0,2	<0,2	0,88	<0,3
Herring	Repl. 3	<0,1	0,11	<0,2	<0,2	0,20	<0,3
Cod pool 1	Fish no. 1, 10, 14, 16, 23		3,09	0,24		5,24	
Cod pool 2	Fish no. 13, 17, 19, 20, 26		3,27	0,20		3,81	
Cod pool 3	Fish no. 12, 18, 25, 27, 28		3,31	0,28		4,69	

Comp. spec.	Note	PFHxS ng/g (w.w.)	PFOS ng/g (w.w.)	PFDS ng/g (w.w.)	PFDoS ng/g (w.w.)	PFOSA ng/g (w.w.)	me-PFOSA ng/g (w.w.)
Cod	Fish no. 1	<0,1	4,15	0,29	<0,2	12,2	<0,3
Cod	Fish no. 10	<0,1	2,77	0,23	<0,2	3,22	<0,3
Cod	Fish no. 12	<0,1	3,49	0,24	<0,2	4,98	<0,3
Cod	Fish no. 13	<0,1	2,98	<0,2	<0,2	6,18	<0,3
Cod	Fish no. 14	<0,1	3,61	0,37	<0,2	5,78	<0,3
Cod	Fish no. 16	<0,1	3,31	0,32	<0,2	2,19	<0,3
Cod	Fish no. 17	<0,1	1,88	0,20	<0,2	3,17	<0,3
Cod	Fish no. 18	<0,1	2,59	0,26	<0,2	7,40	<0,3
Cod	Fish no. 19	<0,1	6,33	0,48	<0,2	4,91	<0,3
Cod	Fish no. 20	<0,1	3,45	0,30	<0,2	3,04	<0,3
Cod	Fish no. 23	<0,1	1,59	<0,2	<0,2	2,84	<0,3
Cod	Fish no. 25	<0,1	2,24	0,23	<0,2	2,71	<0,3
Cod	Fish no. 26	<0,1	1,73	<0,2	<0,2	1,77	<0,3
Cod	Fish no. 27	<0,1	3,48	0,25	<0,2	3,60	<0,3
Cod	Fish no. 28	<0,1	4,77	0,44	<0,2	4,74	<0,3

Comp. spec.	Note	et-PFOSA ng/g (w.w.)	me-PFOSE ng/g (w.w.)	et-PFOSE ng/g (w.w.)	me-FOSAA ng/g (w.w.)	et-FOSAA ng/g (w.w.)	4:2 FTS ng/g (w.w.)
Polychaetes	1. P. crassa	<0,3	<5	<5	<0,3	<0,3	<0,3
Polychaetes	2. Terebellidae	<0,3	<5	<5	<0,3	<0,3	0,68
Polychaetes	3. Misc.	<0,3	<5	<5	<0,3	<0,3	91,2
Mussel	Repl. 1	<0,3	<5	<5	<0,3	<0,3	<0,3
Mussel	Repl. 2	<0,3	<5	<5	<0,3	<0,3	<0,3
Mussel	Repl. 3	<0,3	<5	<5	<0,3	<0,3	<0,3
Plankton	Repl. 1	<0,3	<5	<5	<0,3	<0,3	<0,3
Plankton	Repl. 2	<0,3	<5	<5	<0,3	<0,3	<0,3
Plankton	Repl. 3	<0,3	<5	<5	<0,3	<0,3	<0,3
Prawns	Repl. 1	<0,3	<5	<5	<0,3	<0,3	0,76
Prawns	Repl. 2	<0,3	<5	<5	<0,3	<0,3	0,86
Prawns	Repl. 3	<0,3	<5	<5	<0,3	<0,3	1,35
Herring	Repl. 1	<0,3	<5	<5	<0,3	<0,3	<0,3
Herring	Repl. 2	<0,3	<5	<5	<0,3	<0,3	<0,3
Herring	Repl. 3	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod pool 1	Fish no. 1, 10, 14, 16, 23						
Cod pool 2	Fish no. 13, 17, 19, 20, 26						
Cod pool 3	Fish no. 12, 18, 25, 27, 28						

Comp. spec.	Note	et-PFOSA ng/g (w.w.)	me-PFOSE ng/g (w.w.)	et-PFOSE ng/g (w.w.)	me-FOSAA ng/g (w.w.)	et-FOSAA ng/g (w.w.)	4:2 FTS ng/g (w.w.)
Cod	Fish no. 1	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 10	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 12	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 13	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 14	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 16	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 17	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 18	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 19	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 20	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 23	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 25	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 26	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 27	<0,3	<5	<5	<0,3	<0,3	<0,3
Cod	Fish no. 28	<0,3	<5	<5	<0,3	<0,3	<0,3

Comp. spec.	Note	6:2 FTS ng/g (w.w.)	8:2 FTS ng/g (w.w.)	6:2 diPAP ng/g (w.w.)	TCC ng/g (w.w.)	Triclosan ng/g (w.w.)	BP3 ng/g (w.w.)
Polychaetes	1. P. crassa	<0,3	<0,3		<1	<5	<10
Polychaetes	2. Terebellidae	<0,3	<0,3		1,40	<12	<80
Polychaetes	3. Misc.	<0,3	<0,3		<1	<5	<10
Mussel	Repl. 1	<0,3	<0,3		<1	<3	<80
Mussel	Repl. 2	<0,3	<0,3		<1	<3	<5
Mussel	Repl. 3	<0,3	<0,3		<1	<3	<5
Plankton	Repl. 1	<0,3	<0,3		<1	<3	<5
Plankton	Repl. 2	<0,3	<0,3		<1	<3	<5
Plankton	Repl. 3	<0,3	<0,3		<1	<3	<5
Prawns	Repl. 1	<0,3	<0,3		<1	<3	<5
Prawns	Repl. 2	<0,3	<0,3		<1	<3	<5
Prawns	Repl. 3	<0,3	<0,3		<1	<3	<5
Herring	Repl. 1	<0,3	<0,3		<1	<5	<10
Herring	Repl. 2	<0,3	<0,3		<1	<5	<10
Herring	Repl. 3	<0,3	<0,3		<1	<5	<10
Cod pool 1	Fish no. 1, 10, 14, 16, 23						
Cod pool 2	Fish no. 13, 17, 19, 20, 26						
Cod pool 3	Fish no. 12, 18, 25, 27, 28						

Comp. spec.	Note	6:2 FTS ng/g (w.w.)	8:2 FTS ng/g (w.w.)	6:2 diPAP ng/g (w.w.)	TCC ng/g (w.w.)	Triclosan ng/g (w.w.)	BP3 ng/g (w.w.)
Cod	Fish no. 1	<0,3	<0,3		<2	<5	<10
Cod	Fish no. 10	<0,3	<0,3		<2	<5	<10
Cod	Fish no. 12	<0,3	<0,3		<2	<10	<20
Cod	Fish no. 13	<0,3	<0,3		<2	<5	<10
Cod	Fish no. 14	<0,3	<0,3		<2	<5	<10
Cod	Fish no. 16	<0,3	<0,3		<2	<5	<10
Cod	Fish no. 17	<0,3	<0,3		<2	<5	<10
Cod	Fish no. 18	<0,3	<0,3		<2	<10	<20
Cod	Fish no. 19	<0,3	<0,3		<2	<5	<10
Cod	Fish no. 20	<0,3	<0,3		<2	<5	<10
Cod	Fish no. 23	<0,3	<0,3		<2	<5	<10
Cod	Fish no. 25	<0,3	<0,3		<2	<5	<10
Cod	Fish no. 26	<0,3	<0,3		<2	<5	<10
Cod	Fish no. 27	<0,3	<0,3		<2	<3	<5
Cod	Fish no. 28	<0,3	<0,3		<2	<5	<10

Comp. spec.	Note	EHMC ng/g (w.w.)	OC ng/g (w.w.)
Polychaetes	1. P. crassa	<10	<3
Polychaetes	2. Terebellidae	<10	<3
Polychaetes	3. Misc.	<10	<3
Mussel	Repl. 1	<20	<3
Mussel	Repl. 2	<10	<6
Mussel	Repl. 3	<10	<10
Plankton	Repl. 1	<5	<5
Plankton	Repl. 2	<5	<5
Plankton	Repl. 3	<5	<5
Prawns	Repl. 1	<5	<5
Prawns	Repl. 2	<5	<5
Prawns	Repl. 3	<5	<5
Herring	Repl. 1	<10	7,36
Herring	Repl. 2	<10	8,47
Herring	Repl. 3	<10	12,9
Cod pool 1	Fish no. 1, 10, 14, 16, 23		
Cod pool 2	Fish no. 13, 17, 19, 20, 26		
Cod pool 3	Fish no. 12, 18, 25, 27, 28		

Comp. spec.	Note	EHMC ng/g (w.w.)	OC ng/g (w.w.)
Cod	Fish no. 1	<12	<10
Cod	Fish no. 10	<12	<10
Cod	Fish no. 12	<20	<20
Cod	Fish no. 13	<12	<10
Cod	Fish no. 14	<12	<10
Cod	Fish no. 16	<12	<10
Cod	Fish no. 17	<12	<10
Cod	Fish no. 18	<20	<20
Cod	Fish no. 19	<12	<10
Cod	Fish no. 20	<12	<10
Cod	Fish no. 23	<12	<10
Cod	Fish no. 25	<12	<10
Cod	Fish no. 26	<12	<10
Cod	Fish no. 27	<6	<5
Cod	Fish no. 28	<12	<20

NILU-no.	NIVA-no.	Compartment	Comp. spec.	Note	Species	Tissue
15/1774	2015-6293	Organism	Gull, Blood	JCL 10	Herring gull	Blood
15/1775	2015-6294	Organism	Gull, Blood	JCL 11	Herring gull	Blood
15/1776	2015-6299	Organism	Gull, Blood	JCL 18	Herring gull	Blood
15/1777	2015-6297	Organism	Gull, Blood	JCL 20	Herring gull	Blood
15/1778	2015-6295	Organism	Gull, Blood	JCL 21	Herring gull	Blood
15/1779	2015-6298	Organism	Gull, Blood	JCL 22	Herring gull	Blood
15/1780	2015-6301	Organism	Gull, Blood	JCL 23	Herring gull	Blood
15/1781	2015-6292	Organism	Gull, Blood	JAM 63	Herring gull	Blood
15/1782	2015-6296	Organism	Gull, Blood	JAM 64	Herring gull	Blood
15/1783	2015-6304	Organism	Gull, Blood	JAM 70	Herring gull	Blood
15/1784	2015-6302	Organism	Gull, Blood	JAM 72	Herring gull	Blood
15/1785	2015-6303	Organism	Gull, Blood	JAM 74	Herring gull	Blood
15/1786	2015-6300	Organism	Gull, Blood	J 4157	Herring gull	Blood
15/1787	2015-6306	Organism	Gull, Blood	J 4438	Herring gull	Blood
15/1788	2015-6305	Organism	Gull, Blood	J 8195	Herring gull	Blood

NILU-no.	NIVA-no.	Compartment	Comp. spec.	Note	Species	Tissue
15/1789	2015-6893	Organism	Gull, Egg	JAM63	Herring gull	Egg
15/1790	2015-6894	Organism	Gull, Egg	JCL10	Herring gull	Egg
15/1791	2015-6895	Organism	Gull, Egg	JCL11	Herring gull	Egg
15/1792	2015-6896	Organism	Gull, Egg	jam 64	Herring gull	Egg
15/1793	2015-6897	Organism	Gull, Egg	jcl21	Herring gull	Egg
15/1794 B	2015-6898	Organism	Gull, Egg	JCl20	Herring gull	Egg
15/1795 C	2015-6899	Organism	Gull, Egg	JCL22	Herring gull	Egg
15/1796 C	2015-6900	Organism	Gull, Egg	JCL18	Herring gull	Egg
15/1797 B	2015-6901	Organism	Gull, Egg	J4157	Herring gull	Egg
15/1798 B	2015-6902	Organism	Gull, Egg	JCL23	Herring gull	Egg
15/1799	2015-6903	Organism	Gull, Egg	JAM72	Herring gull	Egg
15/1800	2015-6904	Organism	Gull, Egg	JAM74	Herring gull	Egg
15/1801	2015-6905	Organism	Gull, Egg	JAM70	Herring gull	Egg
15/1802	2015-6906	Organism	Gull, Egg	unlabelled	Herring gull	Egg
15/1803	2015-6907	Organism	Gull, Egg	unlabelled	Herring gull	Egg

Comp. spec.	Note	Lipid% (%)	PeCB ng/g (w.w.)	HCB ng/g (w.w.)	PCB-18 ng/g (w.w.)	PCB-28 ng/g (w.w.)	PCB-31 ng/g (w.w.)	PCB-33 ng/g (w.w.)
Gull, Blood	JCL 10	0,60	0,035	0,315	<0,007	0,085	<0,007	<0,007
Gull, Blood	JCL 11	0,30	0,046	0,586	<0,005	0,096	<0,005	<0,005
Gull, Blood	JCL 18	0,42	0,030	0,167	<0,007	0,070	<0,007	<0,006
Gull, Blood	JCL 20	0,30	0,023	0,231	<0,005	0,095	<0,005	<0,005
Gull, Blood	JCL 21	1,77	0,018	0,224	<0,005	0,048	<0,005	<0,005
Gull, Blood	JCL 22	0,30	0,131	2,930	<0,005	0,303	<0,005	<0,005
Gull, Blood	JCL 23	0,20	0,017	0,217	0,007	0,028	0,010	0,010
Gull, Blood	JAM 63	0,22	0,024	0,296	<0,005	0,079	<0,005	<0,005
Gull, Blood	JAM 64	0,30	0,035	0,476	<0,005	0,046	<0,005	<0,005
Gull, Blood	JAM 70	0,40	0,018	0,179	<0,005	0,033	<0,005	<0,005
Gull, Blood	JAM 72	0,32	0,036	0,141	<0,005	0,354	0,007	<0,005
Gull, Blood	JAM 74	0,30	0,030	0,241	<0,005	0,069	<0,005	<0,005
Gull, Blood	J 4157	0,31	0,037	0,462	<0,005	0,038	<0,005	<0,005
Gull, Blood	J 4438	0,30	0,059	0,546	<0,005	0,340	0,018	<0,005
Gull, Blood	J 8195	0,23	0,035	0,269	<0,005	0,022	<0,005	<0,005

Comp. spec.	Note	Lipid% (%)	PeCB ng/g (w.w.)	HCB ng/g (w.w.)	PCB-18 ng/g (w.w.)	PCB-28 ng/g (w.w.)	PCB-31 ng/g (w.w.)	PCB-33 ng/g (w.w.)
Gull, Egg	JAM63	17,4	0,434	8,470	0,068	1,270	0,077	<0,023
Gull, Egg	JCL10	10,2	0,142	3,030	0,008	1,180	0,029	<0,002
Gull, Egg	JCL11	9,16	0,180	3,590	0,018	1,500	0,041	0,004
Gull, Egg	jam 64	8,07	0,296	1,820	0,221	7,160	0,206	<0,002
Gull, Egg	jcl21	8,77	0,089	1,660	<0,006	0,709	<0,004	<0,004
Gull, Egg	JCl20	9,20	0,099	0,930	0,006	1,900	0,010	<0,003
Gull, Egg	JCL22	10,3	1,380	27,1	0,049	4,530	0,203	0,004
Gull, Egg	JCL18	7,84	0,113	1,540	0,045	1,670	0,027	0,008
Gull, Egg	J4157	9,33	0,210	6,890	<0,003	1,740	0,014	<0,003
Gull, Egg	JCL23	10,7	0,146	4,810	0,003	2,700	0,034	<0,002
Gull, Egg	JAM72	8,15	0,079	1,490	<0,005	0,299	0,010	<0,004
Gull, Egg	JAM74	7,08	0,170	3,010	0,025	0,493	0,011	<0,004
Gull, Egg	JAM70	7,77	0,082	1,350	0,032	0,515	0,029	<0,004
Gull, Egg	unlabelled	9,86	0,058	0,664	<0,024	0,463	<0,017	<0,017
Gull, Egg	unlabelled	8,85	0,089	1,210	0,025	1,580	0,047	<0,005

Comp. spec.	Note	PCB-37 ng/g (w.w.)	PCB-47 ng/g (w.w.)	PCB-52 ng/g (w.w.)	PCB-66 ng/g (w.w.)	PCB-74 ng/g (w.w.)	PCB-99 ng/g (w.w.)
Gull, Blood	JCL 10	<0,007	0,447	0,134	0,786	0,412	2,610
Gull, Blood	JCL 11	<0,005	0,279	0,103	0,674	0,331	1,130
Gull, Blood	JCL 18	<0,006	0,344	<0,052	0,725	0,383	1,290
Gull, Blood	JCL 20	<0,005	0,285	<0,04	0,812	0,403	1,080
Gull, Blood	JCL 21	<0,005	0,640	<0,041	1,270	0,629	3,170
Gull, Blood	JCL 22	<0,005	1,070	0,328	2,500	1,270	5,240
Gull, Blood	JCL 23	<0,005	0,061	<0,041	<0,137	0,071	0,268
Gull, Blood	JAM 63	<0,005	0,258	<0,041	0,699	0,302	0,936
Gull, Blood	JAM 64	<0,005	0,134	<0,041	0,363	0,185	0,575
Gull, Blood	JAM 70	<0,005	0,223	<0,042	0,439	0,233	1,200
Gull, Blood	JAM 72	<0,005	1,240	1,050	2,690	1,340	4,520
Gull, Blood	JAM 74	<0,005	0,412	<0,041	0,805	0,411	2,490
Gull, Blood	J 4157	<0,005	0,302	<0,041	0,543	0,244	1,700
Gull, Blood	J 4438	<0,005	1,620	0,390	3,030	1,550	7,500
Gull, Blood	J 8195	<0,005	0,080	<0,041	0,171	0,088	0,547

Comp. spec.	Note	PCB-37 ng/g (w.w.)	PCB-47 ng/g (w.w.)	PCB-52 ng/g (w.w.)	PCB-66 ng/g (w.w.)	PCB-74 ng/g (w.w.)	PCB-99 ng/g (w.w.)
Gull, Egg	JAM63	<0,031	3,750	1,500	8,830	4,710	17,1
Gull, Egg	JCL10	<0,003	6,680	1,770	13,9	7,840	41,0
Gull, Egg	JCL11	<0,002	4,170	1,060	10,8	5,870	15,8
Gull, Egg	jam 64	<0,003	21,6	24,0	65,3	34,5	82,1
Gull, Egg	jcl21	<0,005	8,980	0,211	17,7	9,440	46,7
Gull, Egg	JCl20	0,003	5,890	0,209	17,7	9,170	21,6
Gull, Egg	JCL22	0,004	15,1	12,2	36,0	20,3	72,3
Gull, Egg	JCL18	0,003	9,950	0,533	24,8	13,6	37,2
Gull, Egg	J4157	<0,003	12,1	0,163	27,5	13,3	61,0
Gull, Egg	JCL23	0,004	9,620	3,630	27,2	13,2	35,3
Gull, Egg	JAM72	<0,005	1,230	0,242	3,370	1,560	6,760
Gull, Egg	JAM74	<0,005	1,980	1,080	4,230	2,270	10,1
Gull, Egg	JAM70	<0,004	3,610	0,784	6,580	3,570	20,9
Gull, Egg	unlabelled	<0,021	3,030	0,658	7,760	3,910	16,8
Gull, Egg	unlabelled	<0,006	9,460	2,310	29,6	12,4	40,8

Comp. spec.	Note	PCB-101 ng/g (w.w.)	PCB-105 ng/g (w.w.)	PCB-114 ng/g (w.w.)	PCB-118 ng/g (w.w.)	PCB-122 ng/g (w.w.)	PCB-123 ng/g (w.w.)
Gull, Blood	JCL 10	<0,119	1,570	0,103	4,110	<0,007	0,067
Gull, Blood	JCL 11	0,092	0,681	0,043	1,900	<0,005	0,028
Gull, Blood	JCL 18	<0,111	0,680	0,068	2,080	<0,006	0,035
Gull, Blood	JCL 20	<0,085	0,691	0,052	1,800	<0,005	0,035
Gull, Blood	JCL 21	<0,085	1,740	0,145	4,580	<0,005	0,082
Gull, Blood	JCL 22	0,141	2,690	0,275	7,760	<0,005	0,013
Gull, Blood	JCL 23	<0,085	0,140	<0,005	0,402	<0,005	<0,005
Gull, Blood	JAM 63	<0,086	0,481	0,040	1,330	<0,005	0,014
Gull, Blood	JAM 64	<0,086	0,328	0,037	0,931	<0,005	0,013
Gull, Blood	JAM 70	<0,088	0,731	0,066	2,010	<0,005	0,029
Gull, Blood	JAM 72	0,388	2,500	0,138	7,030	<0,005	0,111
Gull, Blood	JAM 74	0,141	1,250	0,092	3,550	<0,005	0,061
Gull, Blood	J 4157	<0,088	0,537	0,058	2,040	<0,005	0,042
Gull, Blood	J 4438	0,472	3,660	0,261	11,0	<0,005	0,166
Gull, Blood	J 8195	<0,086	0,305	0,021	0,928	<0,005	0,013

Comp. spec.	Note	PCB-101 ng/g (w.w.)	PCB-105 ng/g (w.w.)	PCB-114 ng/g (w.w.)	PCB-118 ng/g (w.w.)	PCB-122 ng/g (w.w.)	PCB-123 ng/g (w.w.)
Gull, Egg	JAM63	1,080	9,200	0,984	26,4	<0,036	0,436
Gull, Egg	JCL10	2,490	21,3	1,920	57,9	<0,008	1,030
Gull, Egg	JCL11	1,300	9,100	0,780	22,8	<0,003	0,405
Gull, Egg	jam 64	23,7	42,7	3,040	111	<0,007	1,950
Gull, Egg	jcl21	0,171	22,5	1,990	60,9	<0,006	1,090
Gull, Egg	JCl20	0,139	12,8	0,923	30,5	<0,004	0,603
Gull, Egg	JCL22	20,6	32,3	3,220	91,9	<0,005	1,460
Gull, Egg	JCL18	1,190	17,4	1,560	52,9	<0,003	0,890
Gull, Egg	J4157	0,174	17,8	2,460	63,3	5,480	1,450
Gull, Egg	JCL23	5,200	15,9	1,300	42,2	2,210	0,856
Gull, Egg	JAM72	0,230	4,990	0,390	10,4	0,769	0,223
Gull, Egg	JAM74	1,550	5,560	0,482	16,1	<0,011	0,231
Gull, Egg	JAM70	1,640	12,0	0,941	31,9	2,120	0,461
Gull, Egg	unlabelled	1,220	13,2	0,906	28,0	1,060	0,489
Gull, Egg	unlabelled	1,990	25,5	1,790	61,0	<0,016	1,280

Comp. spec.	Note	PCB-128 ng/g (w.w.)	PCB-138 ng/g (w.w.)	PCB-141 ng/g (w.w.)	PCB-149 ng/g (w.w.)	PCB-153 ng/g (w.w.)	PCB-156 ng/g (w.w.)
Gull, Blood	JCL 10	1,210	7,330	0,027	0,430	11,4	0,565
Gull, Blood	JCL 11	0,401	2,470	0,022	0,232	3,670	0,171
Gull, Blood	JCL 18	0,476	3,030	<0,007	0,141	4,180	0,144
Gull, Blood	JCL 20	0,294	1,650	<0,005	0,068	2,400	0,098
Gull, Blood	JCL 21	1,150	6,880	<0,005	<0,048	10,1	0,460
Gull, Blood	JCL 22	2,390	14,1	0,050	0,934	20,6	0,872
Gull, Blood	JCL 23	0,103	0,609	<0,005	0,058	0,855	0,038
Gull, Blood	JAM 63	0,224	1,320	<0,005	0,065	1,950	0,084
Gull, Blood	JAM 64	0,206	1,660	<0,005	0,068	2,590	0,109
Gull, Blood	JAM 70	0,504	3,110	<0,005	0,108	4,640	0,214
Gull, Blood	JAM 72	1,180	7,200	0,032	0,636	9,890	0,420
Gull, Blood	JAM 74	1,080	7,250	0,005	0,176	10,5	0,524
Gull, Blood	J 4157	0,366	3,890	<0,005	<0,049	6,260	0,259
Gull, Blood	J 4438	2,410	14,6	0,116	1,990	21,9	1,020
Gull, Blood	J 8195	0,254	1,590	0,006	0,075	2,370	0,103

Comp. spec.	Note	PCB-128 ng/g (w.w.)	PCB-138 ng/g (w.w.)	PCB-141 ng/g (w.w.)	PCB-149 ng/g (w.w.)	PCB-153 ng/g (w.w.)	PCB-156 ng/g (w.w.)
Gull, Egg	JAM63	5,200	47,2	0,146	3,550	79,3	3,200
Gull, Egg	JCL10	14,6	109	0,445	3,940	177	9,030
Gull, Egg	JCL11	4,960	33,8	0,238	2,280	51,6	2,570
Gull, Egg	jam 64	19,8	126	1,530	17,5	170	8,510
Gull, Egg	jcl21	12,2	92,8	0,037	0,929	145	6,250
Gull, Egg	JCl20	5,250	27,7	0,032	1,220	45,2	1,930
Gull, Egg	JCL22	26,2	157	2,290	19,4	243	10,7
Gull, Egg	JCL18	12,0	73,3	0,237	4,410	114	4,130
Gull, Egg	J4157	12,3	111	0,062	1,480	184	9,050
Gull, Egg	JCL23	7,210	43,2	0,221	3,430	72,3	3,040
Gull, Egg	JAM72	3,030	19,8	0,060	0,703	26,9	1,270
Gull, Egg	JAM74	4,740	31,0	0,206	1,930	42,2	1,780
Gull, Egg	JAM70	7,540	50,9	0,241	2,270	80,2	3,490
Gull, Egg	unlabelled	4,700	29,2	0,146	1,180	34,8	2,110
Gull, Egg	unlabelled	10,9	70,7	0,359	4,580	90,8	4,440

Comp. spec.	Note	PCB-157 ng/g (w.w.)	PCB-167 ng/g (w.w.)	PCB-170 ng/g (w.w.)	PCB-180 ng/g (w.w.)	PCB-183 ng/g (w.w.)	PCB-187 ng/g (w.w.)
Gull, Blood	JCL 10	0,120	0,277	1,110	3,780	1,040	1,540
Gull, Blood	JCL 11	0,038	0,075	0,405	1,150	0,259	0,732
Gull, Blood	JCL 18	0,041	0,095	0,165	0,412	0,139	0,734
Gull, Blood	JCL 20	0,028	0,062	0,152	0,388	0,098	0,390
Gull, Blood	JCL 21	0,106	0,242	0,970	2,940	0,667	1,070
Gull, Blood	JCL 22	0,217	0,469	1,800	4,780	1,090	3,470
Gull, Blood	JCL 23	<0,005	0,019	0,077	0,208	0,051	0,142
Gull, Blood	JAM 63	0,025	0,044	0,137	0,366	0,099	0,321
Gull, Blood	JAM 64	0,025	0,056	0,225	0,640	0,130	0,521
Gull, Blood	JAM 70	0,055	0,095	0,349	1,030	0,264	0,713
Gull, Blood	JAM 72	0,106	0,247	0,585	1,860	0,517	1,560
Gull, Blood	JAM 74	0,111	0,267	1,050	3,210	0,834	1,390
Gull, Blood	J 4157	0,064	0,147	0,582	1,880	0,486	1,070
Gull, Blood	J 4438	0,242	0,500	1,950	6,360	1,610	3,800
Gull, Blood	J 8195	0,024	0,050	0,187	0,601	0,158	0,408

Comp. spec.	Note	PCB-157 ng/g (w.w.)	PCB-167 ng/g (w.w.)	PCB-170 ng/g (w.w.)	PCB-180 ng/g (w.w.)	PCB-183 ng/g (w.w.)	PCB-187 ng/g (w.w.)
Gull, Egg	JAM63	0,688	1,730	7,050	18,3	3,630	13,2
Gull, Egg	JCL10	1,820	4,690	15,8	55,0	14,4	15,7
Gull, Egg	JCL11	0,537	1,260	4,270	15,0	3,530	8,420
Gull, Egg	jam 64	1,990	4,960	9,230	34,4	9,740	23,7
Gull, Egg	jcl21	1,380	3,550	13,1	38,7	8,430	12,3
Gull, Egg	JCl20	0,464	1,090	2,100	7,090	1,930	7,360
Gull, Egg	JCL22	2,410	5,960	16,4	59,6	17,6	54,9
Gull, Egg	JCL18	0,946	2,580	2,990	9,960	4,580	24,8
Gull, Egg	J4157	2,100	5,150	11,9	53,2	17,7	40,1
Gull, Egg	JCL23	0,711	1,620	2,950	13,0	4,500	14,8
Gull, Egg	JAM72	0,267	0,737	1,410	5,170	1,800	5,630
Gull, Egg	JAM74	0,378	0,998	2,120	5,840	1,790	8,340
Gull, Egg	JAM70	0,762	1,700	4,780	16,6	4,660	12,3
Gull, Egg	unlabelled	0,497	0,888	2,340	6,970	1,820	5,410
Gull, Egg	unlabelled	0,970	3,050	5,970	18,5	5,320	13,4

Comp. spec.	Note	PCB-189 ng/g (w.w.)	PCB-194 ng/g (w.w.)	PCB-206 ng/g (w.w.)	PCB-209 ng/g (w.w.)	Sum PCB7 ng/g (w.w.)	Sum PCB ng/g (w.w.)
Gull, Blood	JCL 10	0,064	0,534	0,152	0,024	26,7	47,0
Gull, Blood	JCL 11	0,016	0,129	0,047	0,026	9,481	18,2
Gull, Blood	JCL 18	<0,007	0,053	0,022	<0,007	9,608	17,2
Gull, Blood	JCL 20	<0,005	0,048	<0,005	<0,005	6,208	12,3
Gull, Blood	JCL 21	0,042	0,385	0,115	0,022	24,4	44,5
Gull, Blood	JCL 22	0,096	0,535	0,209	0,147	48,0	89,6
Gull, Blood	JCL 23	<0,005	0,025	<0,005	<0,005	1,976	3,908
Gull, Blood	JAM 63	<0,005	0,055	<0,005	<0,005	4,918	10,4
Gull, Blood	JAM 64	0,013	0,071	0,024	0,026	5,741	10,3
Gull, Blood	JAM 70	0,020	0,122	0,066	0,050	10,7	18,2
Gull, Blood	JAM 72	0,032	0,186	0,060	0,015	27,8	54,3
Gull, Blood	JAM 74	0,051	0,353	0,125	0,020	24,7	41,6
Gull, Blood	J 4157	0,034	0,273	0,132	0,048	14,0	24,3
Gull, Blood	J 4438	0,098	0,755	0,271	0,054	55,1	107
Gull, Blood	J 8195	0,011	0,069	0,023	0,011	5,385	9,525

Comp. spec.	Note	PCB-189 ng/g (w.w.)	PCB-194 ng/g (w.w.)	PCB-206 ng/g (w.w.)	PCB-209 ng/g (w.w.)	Sum PCB7 ng/g (w.w.)	Sum PCB ng/g (w.w.)
Gull, Egg	JAM63	0,368	1,900	0,602	0,631	175	262
Gull, Egg	JCL10	1,030	8,160	2,890	0,452	404	592
Gull, Egg	JCL11	0,255	2,400	0,836	0,384	127	206
Gull, Egg	jam 64	0,681	5,210	1,700	0,374	496	853
Gull, Egg	jcl21	0,643	4,970	1,800	0,288	338	512
Gull, Egg	JCl20	0,133	1,100	0,278	0,126	113	239
Gull, Egg	JCL22	1,080	7,500	2,340	1,250	589	1 189
Gull, Egg	JCL18	0,247	1,400	0,338	0,134	254	495
Gull, Egg	J4157	0,981	8,840	2,290	0,745	414	794
Gull, Egg	JCL23	0,230	2,180	0,403	0,124	182	391
Gull, Egg	JAM72	0,094	0,847	0,248	0,162	63,0	98,6
Gull, Egg	JAM74	0,124	0,946	0,215	0,538	98,3	147
Gull, Egg	JAM70	0,284	2,320	0,857	0,647	183	275
Gull, Egg	unlabelled	0,137	1,320	0,226	0,127	101	169
Gull, Egg	unlabelled	0,314	2,790	0,688	0,160	247	421

Comp. spec.	Note	TBA ng/g (w.w.)	BDE-17 ng/g (w.w.)	BDE-28 ng/g (w.w.)	BDE-47 ng/g (w.w.)	BDE-49 ng/g (w.w.)	BDE-66 ng/g (w.w.)
Gull, Blood	JCL 10	<0,014	<0,007	<0,007	0,154	<0,007	<0,029
Gull, Blood	JCL 11	<0,011	<0,005	<0,005	0,518	<0,006	<0,022
Gull, Blood	JCL 18	<0,013	<0,006	<0,006	<0,075	<0,007	<0,027
Gull, Blood	JCL 20	<0,01	<0,005	<0,005	0,122	<0,005	<0,02
Gull, Blood	JCL 21	<0,01	<0,005	<0,005	0,199	<0,005	<0,021
Gull, Blood	JCL 22	<0,01	<0,005	<0,005	1,100	0,019	<0,021
Gull, Blood	JCL 23	<0,01	<0,005	<0,005	<0,058	<0,005	<0,021
Gull, Blood	JAM 63	<0,01	<0,005	<0,005	<0,058	<0,005	<0,021
Gull, Blood	JAM 64	<0,01	<0,005	<0,005	0,120	<0,005	<0,021
Gull, Blood	JAM 70	<0,01	<0,005	<0,005	0,081	<0,006	<0,021
Gull, Blood	JAM 72	<0,01	<0,005	<0,005	0,270	<0,005	<0,021
Gull, Blood	JAM 74	<0,01	<0,005	<0,005	0,177	<0,005	<0,021
Gull, Blood	J 4157	<0,01	<0,005	<0,005	0,596	<0,005	<0,021
Gull, Blood	J 4438	<0,01	<0,005	<0,005	1,070	0,008	<0,021
Gull, Blood	J 8195	<0,01	<0,005	<0,005	<0,058	<0,005	0,114

Comp. spec.	Note	TBA ng/g (w.w.)	BDE-17 ng/g (w.w.)	BDE-28 ng/g (w.w.)	BDE-47 ng/g (w.w.)	BDE-49 ng/g (w.w.)	BDE-66 ng/g (w.w.)
Gull, Egg	JAM63	<0,01	<0,01	0,011	4,957	0,102	0,098
Gull, Egg	JCL10	<0,01	<0,01	<0,01	3,163	0,068	0,035
Gull, Egg	JCL11	<0,01	<0,01	0,013	8,338	0,043	0,192
Gull, Egg	jam 64	0,012	<0,01	0,023	5,668	0,105	0,095
Gull, Egg	jcl21	<0,01	<0,01	<0,01	3,757	0,028	0,020
Gull, Egg	JCl20	<0,01	<0,01	<0,01	3,300	<0,01	0,020
Gull, Egg	JCL22	<0,01	<0,01	0,069	13,1	0,461	0,168
Gull, Egg	JCL18	0,015	<0,01	<0,01	2,316	0,016	0,012
Gull, Egg	J4157	<0,01	<0,01	0,015	24,8	0,059	0,017
Gull, Egg	JCL23	<0,01	<0,01	<0,01	4,036	0,011	0,022
Gull, Egg	JAM72	<0,01	<0,01	<0,01	1,283	<0,01	0,022
Gull, Egg	JAM74	<0,01	<0,01	0,011	3,259	0,014	0,030
Gull, Egg	JAM70	<0,01	<0,01	<0,01	2,063	0,021	0,017
Gull, Egg	unlabelled	0,021	<0,01	<0,01	2,265	0,010	0,032
Gull, Egg	unlabelled	<0,01	<0,01	0,027	5,087	0,022	0,049

Comp. spec.	Note	BDE-71 ng/g (w.w.)	BDE-77 ng/g (w.w.)	BDE-85 ng/g (w.w.)	BDE-99 ng/g (w.w.)	BDE-100 ng/g (w.w.)	BDE-119 ng/g (w.w.)
Gull, Blood	JCL 10	<0,007	<0,007	<0,007	0,030	0,021	<0,007
Gull, Blood	JCL 11	<0,005	<0,005	0,011	0,723	0,101	<0,005
Gull, Blood	JCL 18	<0,006	<0,006	<0,006	0,033	0,017	<0,006
Gull, Blood	JCL 20	<0,005	<0,005	<0,005	0,147	0,027	<0,005
Gull, Blood	JCL 21	<0,005	<0,005	<0,005	0,046	0,028	<0,005
Gull, Blood	JCL 22	<0,005	<0,005	<0,005	0,196	0,208	0,006
Gull, Blood	JCL 23	<0,005	<0,005	<0,005	0,034	0,012	<0,005
Gull, Blood	JAM 63	<0,005	<0,005	<0,005	0,043	0,007	<0,005
Gull, Blood	JAM 64	<0,005	<0,005	<0,005	0,081	0,015	<0,005
Gull, Blood	JAM 70	<0,005	<0,005	<0,005	0,043	0,012	<0,005
Gull, Blood	JAM 72	<0,005	<0,005	<0,005	0,044	0,039	<0,005
Gull, Blood	JAM 74	<0,005	<0,005	<0,005	0,034	0,030	<0,005
Gull, Blood	J 4157	<0,005	<0,005	0,008	0,620	0,087	<0,005
Gull, Blood	J 4438	<0,005	<0,005	<0,005	0,143	0,148	<0,005
Gull, Blood	J 8195	<0,005	<0,005	<0,005	0,052	0,012	<0,005

Comp. spec.	Note	BDE-71 ng/g (w.w.)	BDE-77 ng/g (w.w.)	BDE-85 ng/g (w.w.)	BDE-99 ng/g (w.w.)	BDE-100 ng/g (w.w.)	BDE-119 ng/g (w.w.)
Gull, Egg	JAM63	<0,01	<0,01	0,140	4,774	1,231	0,023
Gull, Egg	JCL10	<0,01	<0,01	0,015	1,062	0,712	0,017
Gull, Egg	JCL11	<0,01	0,012	0,378	12,2	1,961	0,041
Gull, Egg	jam 64	<0,01	0,012	0,023	1,684	1,174	0,040
Gull, Egg	jcl21	<0,01	<0,01	0,034	1,302	0,695	0,017
Gull, Egg	JCl20	<0,01	<0,01	0,180	4,413	0,773	<0,01
Gull, Egg	JCL22	<0,01	0,011	0,026	2,793	3,763	0,254
Gull, Egg	JCL18	<0,01	<0,01	0,084	1,771	0,644	<0,01
Gull, Egg	J4157	<0,01	<0,01	0,729	27,7	4,875	0,045
Gull, Egg	JCL23	<0,01	<0,01	0,122	6,059	1,286	0,015
Gull, Egg	JAM72	<0,01	<0,01	0,081	2,015	0,257	<0,01
Gull, Egg	JAM74	<0,01	<0,01	0,066	4,501	0,915	<0,01
Gull, Egg	JAM70	<0,01	<0,01	0,035	1,655	0,445	<0,01
Gull, Egg	unlabelled	<0,01	<0,01	0,187	4,773	0,521	<0,01
Gull, Egg	unlabelled	<0,01	<0,01	0,087	4,472	1,205	0,017

Comp. spec.	Note	BDE-126 ng/g (w.w.)	BDE-138 ng/g (w.w.)	BDE-153 ng/g (w.w.)	BDE-154 ng/g (w.w.)	BDE-156 ng/g (w.w.)	BDE-183 ng/g (w.w.)
Gull, Blood	JCL 10	<0,007	<0,009	<0,009	<0,007	<0,014	<0,007
Gull, Blood	JCL 11	<0,005	<0,007	0,094	0,039	<0,01	0,038
Gull, Blood	JCL 18	<0,006	<0,009	<0,008	<0,007	<0,013	<0,007
Gull, Blood	JCL 20	<0,005	<0,007	0,016	0,009	<0,01	<0,005
Gull, Blood	JCL 21	<0,005	<0,007	0,009	0,006	<0,01	<0,005
Gull, Blood	JCL 22	<0,005	<0,007	0,035	0,069	<0,01	0,007
Gull, Blood	JCL 23	<0,005	<0,007	0,007	<0,005	<0,01	<0,005
Gull, Blood	JAM 63	<0,005	<0,007	0,007	<0,005	<0,01	<0,005
Gull, Blood	JAM 64	<0,005	<0,007	0,013	0,006	<0,01	<0,005
Gull, Blood	JAM 70	<0,005	<0,007	0,012	<0,005	<0,01	<0,005
Gull, Blood	JAM 72	<0,005	<0,007	0,008	0,009	<0,01	<0,005
Gull, Blood	JAM 74	<0,005	<0,007	0,009	0,006	<0,01	<0,005
Gull, Blood	J 4157	<0,005	<0,007	0,074	0,018	<0,01	0,007
Gull, Blood	J 4438	<0,005	<0,007	0,021	0,020	<0,01	0,008
Gull, Blood	J 8195	<0,005	<0,007	0,009	<0,005	<0,01	<0,005

Comp. spec.	Note	BDE-126 ng/g (w.w.)	BDE-138 ng/g (w.w.)	BDE-153 ng/g (w.w.)	BDE-154 ng/g (w.w.)	BDE-156 ng/g (w.w.)	BDE-183 ng/g (w.w.)
Gull, Egg	JAM63	<0,01	0,059	0,897	0,438	<0,027	0,172
Gull, Egg	JCL10	<0,01	0,013	0,213	0,210	<0,01	0,046
Gull, Egg	JCL11	0,012	0,198	2,557	1,121	<0,013	1,080
Gull, Egg	jam 64	<0,01	0,021	0,367	0,400	<0,01	0,072
Gull, Egg	jcl21	<0,01	0,014	0,283	0,219	<0,01	0,071
Gull, Egg	JCl20	<0,01	0,048	0,715	0,391	<0,01	0,092
Gull, Egg	JCL22	0,018	0,011	0,767	1,341	<0,01	0,057
Gull, Egg	JCL18	<0,01	0,025	0,297	0,163	<0,01	0,077
Gull, Egg	J4157	<0,01	0,312	4,423	1,327	<0,01	0,389
Gull, Egg	JCL23	<0,01	0,071	0,983	0,453	<0,01	0,157
Gull, Egg	JAM72	<0,01	0,037	0,555	0,172	<0,01	0,126
Gull, Egg	JAM74	<0,01	0,077	0,953	0,418	<0,01	0,184
Gull, Egg	JAM70	<0,01	0,032	0,570	0,194	<0,01	0,173
Gull, Egg	unlabelled	<0,01	0,087	1,065	0,371	<0,01	0,121
Gull, Egg	unlabelled	<0,01	0,069	0,995	0,341	<0,01	0,240

Comp. spec.	Note	BDE-184 ng/g (w.w.)	BDE-191 ng/g (w.w.)	BDE-196 ng/g (w.w.)	BDE-197 ng/g (w.w.)	BDE-202 ng/g (w.w.)	BDE-206 ng/g (w.w.)
Gull, Blood	JCL 10	<0,007	<0,009	<0,012	<0,01	<0,011	<0,012
Gull, Blood	JCL 11	<0,005	<0,007	<0,009	0,043	<0,008	<0,009
Gull, Blood	JCL 18	<0,006	<0,008	<0,011	<0,01	<0,01	<0,011
Gull, Blood	JCL 20	<0,005	<0,006	<0,009	<0,007	<0,008	<0,009
Gull, Blood	JCL 21	<0,005	<0,006	<0,009	<0,008	<0,008	<0,009
Gull, Blood	JCL 22	<0,005	<0,006	<0,009	0,009	0,010	<0,009
Gull, Blood	JCL 23	<0,005	<0,006	<0,009	<0,008	<0,008	<0,009
Gull, Blood	JAM 63	<0,005	<0,006	<0,009	0,010	<0,008	<0,009
Gull, Blood	JAM 64	<0,005	<0,006	<0,009	0,009	<0,008	<0,009
Gull, Blood	JAM 70	<0,005	<0,006	<0,009	<0,008	<0,008	<0,009
Gull, Blood	JAM 72	<0,005	<0,006	<0,009	<0,008	<0,008	<0,009
Gull, Blood	JAM 74	<0,005	<0,006	<0,009	<0,008	<0,008	<0,009
Gull, Blood	J 4157	<0,005	<0,006	0,018	0,017	<0,008	0,018
Gull, Blood	J 4438	<0,005	<0,006	0,012	0,020	<0,008	0,012
Gull, Blood	J 8195	<0,005	<0,006	<0,009	<0,008	<0,008	<0,009

Comp. spec.	Note	BDE-184 ng/g (w.w.)	BDE-191 ng/g (w.w.)	BDE-196 ng/g (w.w.)	BDE-197 ng/g (w.w.)	BDE-202 ng/g (w.w.)	BDE-206 ng/g (w.w.)
Gull, Egg	JAM63	0,081	<0,01	0,117	0,336	0,060	0,304
Gull, Egg	JCL10	0,045	<0,01	0,026	0,039	0,026	0,026
Gull, Egg	JCL11	0,011	0,015	0,412	1,221	0,124	0,390
Gull, Egg	jam 64	0,075	<0,01	0,039	0,092	0,055	0,072
Gull, Egg	jcl21	0,045	<0,01	0,056	0,119	0,041	0,145
Gull, Egg	JCl20	<0,01	<0,01	0,056	0,161	0,027	0,253
Gull, Egg	JCL22	<0,01	<0,01	0,018	0,041	0,073	0,025
Gull, Egg	JCL18	<0,01	<0,01	0,056	0,067	0,025	0,276
Gull, Egg	J4157	<0,01	0,015	0,267	0,475	0,164	0,128
Gull, Egg	JCL23	<0,01	<0,01	0,113	0,400	0,039	0,180
Gull, Egg	JAM72	<0,01	<0,01	0,128	0,345	0,144	0,394
Gull, Egg	JAM74	<0,01	<0,01	0,101	0,345	0,049	0,122
Gull, Egg	JAM70	<0,01	<0,01	0,042	0,158	0,030	0,063
Gull, Egg	unlabelled	<0,01	<0,01	0,057	0,110	0,024	0,157
Gull, Egg	unlabelled	<0,01	<0,01	0,166	0,590	0,037	0,417

Comp. spec.	Note	BDE-207 ng/g (w.w.)	BDE-209 ng/g (w.w.)	DBDPE ng/g (w.w.)	o,p'-DDE ng/g (w.w.)	p,p'-DDE ng/g (w.w.)	o,p'-DDD ng/g (w.w.)
Gull, Blood	JCL 10	<0,011	<0,702	<1,6			
Gull, Blood	JCL 11	0,115	1,500	<1,94			
Gull, Blood	JCL 18	0,026	<0,652	<2,55			
Gull, Blood	JCL 20	0,018	<0,501	<1,952			
Gull, Blood	JCL 21	0,018	<0,503	<1,633			
Gull, Blood	JCL 22	0,033	<0,503	<1,553			
Gull, Blood	JCL 23	0,076	1,660	<2,543			
Gull, Blood	JAM 63	0,059	0,988	<2,722			
Gull, Blood	JAM 64	0,029	<0,506	<1,337			
Gull, Blood	JAM 70	0,013	<0,519	<1,898			
Gull, Blood	JAM 72	<0,008	<0,506	<2,487			
Gull, Blood	JAM 74	0,009	<0,506	<3,034			
Gull, Blood	J 4157	0,037	<0,516	<1,381			
Gull, Blood	J 4438	0,031	<0,508	<2,671			
Gull, Blood	J 8195	0,034	0,632	<2,374			

Comp. spec.	Note	BDE-207 ng/g (w.w.)	BDE-209 ng/g (w.w.)	DBDPE ng/g (w.w.)	o,p'-DDE ng/g (w.w.)	p,p'-DDE ng/g (w.w.)	o,p'-DDD ng/g (w.w.)
Gull, Egg	JAM63	1,152	17,3	16,1	<0,014	37,4	<0,009
Gull, Egg	JCL10	0,119	1,104	55,4	<0,005	33,5	0,022
Gull, Egg	JCL11	4,765	37,6	3,938	<0,021	109	0,058
Gull, Egg	jam 64	0,207	2,171	8,741	0,005	50,7	0,066
Gull, Egg	jcl21	0,613	8,575	95,1	<0,007	37,5	<0,005
Gull, Egg	JCl20	0,735	11,6	10,9	0,007	8,990	<0,003
Gull, Egg	JCL22	0,114	0,697	0,000	0,403	192	0,183
Gull, Egg	JCL18	0,582	13,9	6,160	0,010	24,4	0,019
Gull, Egg	J4157	1,479	6,623	3,402	0,014	197	0,015
Gull, Egg	JCL23	1,812	10,7	<3,531	<0,005	11,1	<0,003
Gull, Egg	JAM72	2,087	24,6	10,4	0,008	6,110	0,020
Gull, Egg	JAM74	1,086	6,205	25,2	0,049	17,3	0,024
Gull, Egg	JAM70	0,291	1,815	4,824	0,018	16,1	0,018
Gull, Egg	unlabelled	0,504	9,251	6,016	0,009	4,650	0,013
Gull, Egg	unlabelled	1,857	24,3	104	<0,005	19,5	<0,024

Comp. spec.	Note	p,p'-DDD ng/g (w.w.)	o,p'-DDT ng/g (w.w.)	p,p'-DDT ng/g (w.w.)	Sum DDT ng/g (w.w.)	SCCP ng/g (w.w.)	MCCP ng/g (w.w.)
Gull, Blood	JCL 10					1,40	1,00
Gull, Blood	JCL 11					0,70	2,00
Gull, Blood	JCL 18					1,50	<0,8
Gull, Blood	JCL 20					1,30	<0,3
Gull, Blood	JCL 21					1,80	0,50
Gull, Blood	JCL 22					<0,7	<0,1
Gull, Blood	JCL 23					2,50	0,60
Gull, Blood	JAM 63					2,20	0,60
Gull, Blood	JAM 64					1,30	0,30
Gull, Blood	JAM 70					0,90	0,90
Gull, Blood	JAM 72					<1	32,0
Gull, Blood	JAM 74					1,50	0,40
Gull, Blood	J 4157					1,50	14,0
Gull, Blood	J 4438					<0,6	<0,2
Gull, Blood	J 8195					1,30	1,20

Comp. spec.	Note	p,p'-DDD ng/g (w.w.)	o,p'-DDT ng/g (w.w.)	p,p'-DDT ng/g (w.w.)	Sum DDT ng/g (w.w.)	SCCP ng/g (w.w.)	MCCP ng/g (w.w.)
Gull, Egg	JAM63	0,025	<0,015	0,134	37,5	60,0	17,0
Gull, Egg	JCL10	0,361	0,014	0,269	34,2	44,0	7,00
Gull, Egg	JCL11	0,601	0,087	1,730	111	19,0	10,0
Gull, Egg	jam 64	1,010	0,073	1,890	53,7	25,0	6,00
Gull, Egg	jcl21	0,058	0,029	0,492	38,1	16,0	8,00
Gull, Egg	JCl20	0,036	0,009	0,105	9,145	8,00	8,00
Gull, Egg	JCL22	2,200	0,047	1,470	196	11,0	4,00
Gull, Egg	JCL18	0,308	0,057	0,726	25,5	34,0	6,00
Gull, Egg	J4157	0,240	0,474	13,0	211	12,0	5,00
Gull, Egg	JCL23	0,017	<0,006	0,189	11,3	9,00	3,00
Gull, Egg	JAM72	0,031	<0,035	0,197	6,331	25,0	9,00
Gull, Egg	JAM74	0,299	0,095	0,527	18,3	23 700	274
Gull, Egg	JAM70	0,428	<0,013	0,023	16,6	6,00	3,00
Gull, Egg	unlabelled	0,239	<0,011	0,167	5,067	9,00	4,00
Gull, Egg	unlabelled	0,058	<0,052	0,184	19,7	16,0	4,00

Comp. spec.	Note	Relative distributions of formula groups C-10 to C-13 and Cl-5 to Cl-10							
		(%) 10,5 (%)	(%) 10,6 (%)	(%) 10,7 (%)	(%) 10,8 (%)	(%) 10,9 (%)	(%) 10,10 (%)	(%) 11,5 (%)	(%) 11,6 (%)
Gull, Blood	JCL 10	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 11	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 18	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 20	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 21	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 22	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 23	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JAM 63	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JAM 64	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JAM 70	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JAM 72	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JAM 74	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	J 4157	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	J 4438	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	J 8195	0,00	100	0,00	0,00	0,00	0,00	0,00	0,00

Comp. spec.	Note	Relative distributions of formula groups C-10 to C-13 and Cl-5 to Cl-10							
		(%) 10,5 (%)	(%) 10,6 (%)	(%) 10,7 (%)	(%) 10,8 (%)	(%) 10,9 (%)	(%) 10,10 (%)	(%) 11,5 (%)	(%) 11,6 (%)
Gull, Egg	JAM63	0,00	13,0	4,39	2,91	0,42	0,00	5,87	17,8
Gull, Egg	JCL10	0,00	7,93	3,71	2,05	0,37	0,00	3,23	11,2
Gull, Egg	JCL11	0,00	9,68	3,52	1,82	0,85	0,00	5,53	17,2
Gull, Egg	jam 64	0,00	7,88	4,38	2,51	0,63	0,00	3,67	12,9
Gull, Egg	jcl21	0,00	9,26	4,10	1,81	1,82	0,00	7,20	0,00
Gull, Egg	JCl20	4,97	18,6	5,71	0,00	0,64	0,00	12,9	15,1
Gull, Egg	JCL22	3,25	14,5	4,05	3,22	0,00	0,00	10,6	13,1
Gull, Egg	JCL18	1,31	4,96	2,26	1,37	0,69	0,21	3,44	5,09
Gull, Egg	J4157	3,75	15,7	3,16	0,81	0,00	0,00	10,8	16,0
Gull, Egg	JCL23	4,42	17,2	1,42	0,00	0,00	0,00	12,7	18,5
Gull, Egg	JAM72	1,33	8,70	3,39	1,46	0,64	0,00	3,22	0,00
Gull, Egg	JAM74	0,00	0,03	0,10	0,44	0,29	0,05	0,00	0,06
Gull, Egg	JAM70	0,00	12,0	0,00	0,00	1,46	0,00	7,06	0,00
Gull, Egg	unlabelled	0,00	14,8	4,89	0,00	1,24	0,52	8,26	11,6
Gull, Egg	unlabelled	2,03	9,46	3,87	0,00	0,80	0,34	6,27	10,7

Comp. spec.	Note	(%) 11,7 (%)	(%) 11,8 (%)	(%) 11,9 (%)	(%) 11,10 (%)	(%) 12,6 (%)	(%) 12,7 (%)	(%) 12,8 (%)	(%) 12,9 (%)
Gull, Blood	JCL 10	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 11	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 18	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 20	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 21	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 22	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JCL 23	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JAM 63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JAM 64	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JAM 70	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JAM 72	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	JAM 74	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	J 4157	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	J 4438	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Gull, Blood	J 8195	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Comp. spec.	Note	(%) 11,7 (%)	(%) 11,8 (%)	(%) 11,9 (%)	(%) 11,10 (%)	(%) 12,6 (%)	(%) 12,7 (%)	(%) 12,8 (%)	(%) 12,9 (%)
Gull, Egg	JAM63	29,4	7,48	1,79	0,19	0,00	0,00	6,15	1,91
Gull, Egg	JCL10	22,1	6,19	1,27	0,18	0,00	30,8	4,11	1,31
Gull, Egg	JCL11	19,6	6,80	3,21	0,94	0,00	0,00	7,31	5,24
Gull, Egg	jam 64	26,2	8,69	2,75	0,68	0,00	15,5	5,96	1,99
Gull, Egg	jcl21	0,00	13,3	6,97	0,99	0,00	0,00	15,3	8,36
Gull, Egg	JCl20	18,5	4,43	2,03	0,54	0,00	0,00	4,62	2,28
Gull, Egg	JCL22	18,7	9,82	4,69	0,56	0,00	0,00	4,21	3,56
Gull, Egg	JCL18	12,2	6,61	3,15	1,21	0,00	29,5	9,25	4,98
Gull, Egg	J4157	17,6	7,39	2,59	0,93	0,00	0,00	3,27	2,94
Gull, Egg	JCL23	19,9	5,46	1,74	0,61	0,00	0,00	3,57	1,86
Gull, Egg	JAM72	11,9	7,25	3,85	1,32	0,00	0,00	11,8	7,39
Gull, Egg	JAM74	1,16	3,60	5,13	1,27	0,00	2,15	15,4	21,3
Gull, Egg	JAM70	22,7	8,41	4,83	2,60	0,00	0,00	5,46	6,79
Gull, Egg	unlabelled	13,1	6,05	4,56	3,41	0,00	0,00	5,69	6,18
Gull, Egg	unlabelled	17,3	8,17	5,79	3,40	0,00	0,00	8,03	6,47

Comp. spec.	Note	(%) 12,10 (%)	(%) 13,7 (%)	(%) 13,8 (%)	(%) 13,9 (%)	D4 ng/g (w.w.)	D5 ng/g (w.w.)	D6 ng/g (w.w.)
Gull, Blood	JCL 10	0,00	0,00	0,00	0,00	3,13	4,31	1,51
Gull, Blood	JCL 11	0,00	0,00	0,00	0,00	2,71	2,99	1,71
Gull, Blood	JCL 18	0,00	0,00	0,00	0,00	2,55	6,15	2,01
Gull, Blood	JCL 20	0,00	0,00	0,00	0,00	2,29	1,95	1,59
Gull, Blood	JCL 21	0,00	0,00	0,00	0,00	<2,26	2,47	1,26
Gull, Blood	JCL 22	0,00	0,00	0,00	0,00	<2,26	1,77	1,06
Gull, Blood	JCL 23	0,00	0,00	0,00	0,00	<2,26	1,84	1,21
Gull, Blood	JAM 63	0,00	0,00	0,00	0,00	<2,26	2,16	1,94
Gull, Blood	JAM 64	0,00	0,00	0,00	0,00	<2,26	3,65	2,38
Gull, Blood	JAM 70	0,00	0,00	0,00	0,00	<2,26	2,21	1,93
Gull, Blood	JAM 72	0,00	0,00	0,00	0,00	<2,26	2,91	3,70
Gull, Blood	JAM 74	0,00	0,00	0,00	0,00	<2,26	2,62	2,01
Gull, Blood	J 4157	0,00	0,00	0,00	0,00	<2,26	3,23	1,46
Gull, Blood	J 4438	0,00	0,00	0,00	0,00	<2,26	25,2	3,41
Gull, Blood	J 8195	0,00	0,00	0,00	0,00	<2,26	4,46	2,06

Comp. spec.	Note	(%) 12,10 (%)	(%) 13,7 (%)	(%) 13,8 (%)	(%) 13,9 (%)	D4 ng/g (w.w.)	D5 ng/g (w.w.)	D6 ng/g (w.w.)
Gull, Egg	JAM63	0,26	3,38	4,02	1,05	1,89	30,9	5,91
Gull, Egg	JCL10	0,30	2,60	1,97	0,72	1,88	115	6,39
Gull, Egg	JCL11	2,58	2,77	7,98	4,96	2,16	77,6	13,3
Gull, Egg	jam 64	0,55	3,00	2,02	0,66	4,67	303	9,58
Gull, Egg	jcl21	2,66	7,02	14,1	7,07	1,35	15,9	9,66
Gull, Egg	JCl20	1,09	0,00	6,20	2,40	1,49	24,4	6,03
Gull, Egg	JCL22	1,63	2,28	3,99	1,78	3,70	207	11,6
Gull, Egg	JCL18	2,04	4,06	5,23	2,37	1,89	98,7	9,67
Gull, Egg	J4157	2,37	3,95	5,06	3,66	2,30	96,8	28,5
Gull, Egg	JCL23	1,82	5,22	3,66	1,85	3,76	93,1	16,4
Gull, Egg	JAM72	3,02	6,10	18,3	10,3	1,40	13,2	5,50
Gull, Egg	JAM74	8,12	1,04	17,0	22,9	1,72	16,3	10,9
Gull, Egg	JAM70	4,84	8,16	8,96	6,75	6,40	126	9,31
Gull, Egg	unlabelled	5,17	2,10	6,62	5,75	2,15	60,4	15,2
Gull, Egg	unlabelled	4,26	1,79	6,51	4,76	2,17	52,8	10,4

Comp. spec.	Note	TEP ng/ml (w.w.)	TCEP ng/ml (w.w.)	TPrP ng/ml (w.w.)	TCPP ng/ml (w.w.)	TiBP ng/ml (w.w.)	BdPhP ng/ml (w.w.)
Gull, Blood	JCL 10		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	JCL 11		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	JCL 18		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	JCL 20		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	JCL 21		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	JCL 22		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	JCL 23		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	JAM 63		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	JAM 64		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	JAM 70		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	JAM 72		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	JAM 74		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	J 4157		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	J 4438		<0,5	<0,2	<5	<0,2	<0,2
Gull, Blood	J 8195		<0,5	<0,2	<5	<0,2	<0,2

Comp. spec.	Note	TEP ng/g (w.w.)	TCEP ng/g (w.w.)	TPrP ng/g (w.w.)	TCPP ng/g (w.w.)	TiBP ng/g (w.w.)	BdPhP ng/g (w.w.)
Gull, Egg	JAM63	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Gull, Egg	JCL10	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Gull, Egg	JCL11	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Gull, Egg	jam 64	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Gull, Egg	jcl21	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Gull, Egg	JCl20	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Gull, Egg	JCL22	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Gull, Egg	JCL18	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Gull, Egg	J4157	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Gull, Egg	JCL23	<0,18	<0,08	<0,03	<1,8	<1	<0,03
Gull, Egg	JAM72	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Gull, Egg	JAM74	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Gull, Egg	JAM70	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Gull, Egg	unlabelled	<0,52	<0,29	<0,05	<1,38	<1,08	<0,04
Gull, Egg	unlabelled	<0,18	0,26	<0,03	<1,8	<1	<0,03

Comp. spec.	Note	TPP ng/ml (w.w.)	DBPhP ng/ml (w.w.)	TnBP ng/ml (w.w.)	TDCPP ng/ml (w.w.)	TBEP ng/ml (w.w.)	TCP ng/ml (w.w.)
Gull, Blood	JCL 10	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	JCL 11	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	JCL 18	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	JCL 20	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	JCL 21	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	JCL 22	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	JCL 23	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	JAM 63	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	JAM 64	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	JAM 70	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	JAM 72	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	JAM 74	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	J 4157	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	J 4438	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2
Gull, Blood	J 8195	<0,2	<0,2	<0,2	<0,5	<0,2	<0,2

Comp. spec.	Note	TPP ng/g (w.w.)	DBPhP ng/g (w.w.)	TnBP ng/g (w.w.)	TDCPP ng/g (w.w.)	TBEP ng/g (w.w.)	TCP ng/g (w.w.)
Gull, Egg	JAM63	<0,2	<0,07	<3,31	<0,33	<3,13	<0,07
Gull, Egg	JCL10	<0,2	<0,07	<3,31	<0,33	<3,13	<0,07
Gull, Egg	JCL11	<0,2	<0,07	<3,31	<0,33	<3,13	<0,07
Gull, Egg	jam 64	<0,1	<0,01	<6,2	<0,18	<2,1	<0,01
Gull, Egg	jcl21	<0,1	<0,01	<6,2	<0,18	<2,1	<0,01
Gull, Egg	JCl20	<0,2	<0,07	<3,31	<0,33	<3,13	<0,07
Gull, Egg	JCL22	<0,2	<0,07	<3,31	<0,33	4,68	0,08
Gull, Egg	JCL18	<0,2	<0,07	<3,31	<0,33	<3,13	0,27
Gull, Egg	J4157	0,11	<0,01	<6,2	<0,18	<2,1	<0,01
Gull, Egg	JCL23	0,18	<0,01	<6,2	<0,18	<2,1	<0,01
Gull, Egg	JAM72	<0,2	<0,07	<3,31	<0,33	<3,13	0,12
Gull, Egg	JAM74	<0,2	<0,07	<3,31	<0,33	<3,13	<0,07
Gull, Egg	JAM70	<0,2	<0,07	4,41	<0,33	4,32	<0,07
Gull, Egg	unlabelled	<0,2	<0,07	<3,31	<0,33	<3,13	<0,07
Gull, Egg	unlabelled	0,10	<0,01	<6,2	0,20	<2,1	0,04

Comp. spec.	Note	EHDP ng/ml (w.w.)	TEHP ng/ml (w.w.)	Bisphenol A ng/g (w.w.)	Tetrabromobisphenol A ng/g (w.w.)
Gull, Blood	JCL 10	<0,2	<0,2		
Gull, Blood	JCL 11	<0,2	<0,2		
Gull, Blood	JCL 18	<0,2	<0,2		
Gull, Blood	JCL 20	<0,2	<0,2		
Gull, Blood	JCL 21	<0,2	<0,2		
Gull, Blood	JCL 22	<0,2	<0,2		
Gull, Blood	JCL 23	<0,2	<0,2		
Gull, Blood	JAM 63	<0,2	<0,2		
Gull, Blood	JAM 64	<0,2	<0,2		
Gull, Blood	JAM 70	<0,2	<0,2		
Gull, Blood	JAM 72	<0,2	<0,2		
Gull, Blood	JAM 74	<0,2	<0,2		
Gull, Blood	J 4157	<0,2	<0,2		
Gull, Blood	J 4438	<0,2	<0,2		
Gull, Blood	J 8195	<0,2	<0,2		

Comp. spec.	Note	EHDP ng/g (w.w.)	TEHP ng/g (w.w.)	Bisphenol A ng/g (w.w.)	Tetrabromobisphenol A ng/g (w.w.)
Gull, Egg	JAM63	<0,62	<0,11	24,6	<0,5
Gull, Egg	JCL10	<0,62	<0,11	<0,75	<0,5
Gull, Egg	JCL11	<0,62	<0,11	<0,75	<0,5
Gull, Egg	jam 64	<0,02	<0,04	<0,75	<0,5
Gull, Egg	jcl21	<0,02	<0,04	<0,75	<0,5
Gull, Egg	JCl20	<0,62	<0,11	<0,75	<0,5
Gull, Egg	JCL22	<0,62	<0,11	<0,75	<0,5
Gull, Egg	JCL18	1,66	<0,11	15,9	<0,5
Gull, Egg	J4157	<0,02	<0,04	<0,75	<0,5
Gull, Egg	JCL23	<0,02	<0,04	17,7	<0,5
Gull, Egg	JAM72	<0,62	<0,11	13,4	<0,5
Gull, Egg	JAM74	<0,62	<0,11	<0,75	<0,5
Gull, Egg	JAM70	<0,62	<0,11	<0,55	<1
Gull, Egg	unlabelled	<0,62	<0,11	16,8	<0,5
Gull, Egg	unlabelled	0,23	0,16	20,7	<0,5

Comp. spec.	Note	4,4-bisphenol F ng/g (w.w.)	2,2-bisphenol F ng/g (w.w.)	Hexafluorobisphenol A ng/g (w.w.)	Bisphenol BP ng/g (w.w.)
Gull, Blood	JCL 10				
Gull, Blood	JCL 11				
Gull, Blood	JCL 18				
Gull, Blood	JCL 20				
Gull, Blood	JCL 21				
Gull, Blood	JCL 22				
Gull, Blood	JCL 23				
Gull, Blood	JAM 63				
Gull, Blood	JAM 64				
Gull, Blood	JAM 70				
Gull, Blood	JAM 72				
Gull, Blood	JAM 74				
Gull, Blood	J 4157				
Gull, Blood	J 4438				
Gull, Blood	J 8195				

Comp. spec.	Note	4,4-bisphenol F ng/g (w.w.)	2,2-bisphenol F ng/g (w.w.)	Hexafluorobisphenol A ng/g (w.w.)	Bisphenol BP ng/g (w.w.)
Gull, Egg	JAM63	7,00	8,10	<1	32,3
Gull, Egg	JCL10	<1	7,98	<1	31,3
Gull, Egg	JCL11	3,48	<1	14,3	28,8
Gull, Egg	jam 64	<1	<1	15,1	30,4
Gull, Egg	jcl21	<1	<1	16,1	32,5
Gull, Egg	JCl20	3,45	<1	13,9	28,6
Gull, Egg	JCL22	<1	8,34	15,9	<1
Gull, Egg	JCL18	3,77	8,68	16,6	33,5
Gull, Egg	J4157	4,41	8,72	16,6	33,5
Gull, Egg	JCL23	5,27	8,63	16,4	33,2
Gull, Egg	JAM72	4,71	7,79	<1	<1
Gull, Egg	JAM74	5,41	7,68	14,7	31,2
Gull, Egg	JAM70	<1	<1	16,1	<1
Gull, Egg	unlabelled	4,83	8,68	16,2	33,3
Gull, Egg	unlabelled	4,53	8,24	15,2	<1

Comp. spec.	Note	Bisphenol S ng/g (w.w.)	4-nonylphenol ng/g (w.w.)	4-octylphenol ng/g (w.w.)	4-tert-octylphenol ng/g (w.w.)	Bisphenol B ng/g (w.w.)
Gull, Blood	JCL 10					
Gull, Blood	JCL 11					
Gull, Blood	JCL 18					
Gull, Blood	JCL 20					
Gull, Blood	JCL 21					
Gull, Blood	JCL 22					
Gull, Blood	JCL 23					
Gull, Blood	JAM 63					
Gull, Blood	JAM 64					
Gull, Blood	JAM 70					
Gull, Blood	JAM 72					
Gull, Blood	JAM 74					
Gull, Blood	J 4157					
Gull, Blood	J 4438					
Gull, Blood	J 8195					

Comp. spec.	Note	Bisphenol S ng/g (w.w.)	4-nonylphenol ng/g (w.w.)	4-octylphenol ng/g (w.w.)	4-tert-octylphenol ng/g (w.w.)	Bisphenol B ng/g (w.w.)
Gull, Egg	JAM63	<1	<1	3,71	<1	<1
Gull, Egg	JCL10	<1	2,15	4,52	<1	13,0
Gull, Egg	JCL11	<1	2,36	2,83	<1	12,0
Gull, Egg	jam 64	<1	12,6	3,49	<1	<1
Gull, Egg	jcl21	13,6	<1	4,80	<1	<1
Gull, Egg	JCl20	<1	<1	2,89	<1	11,1
Gull, Egg	JCL22	<1	<1	4,62	<1	13,3
Gull, Egg	JCL18	14,0	<1	3,85	<1	<1
Gull, Egg	J4157	14,1	<1	4,48	<1	<1
Gull, Egg	JCL23	<1	<1	6,92	<1	13,5
Gull, Egg	JAM72	<1	<1	<1	3,52	<1
Gull, Egg	JAM74	<1	<1	3,67	<1	<1
Gull, Egg	JAM70	<1	4 176	5,90	1,92	<1
Gull, Egg	unlabelled	14,1	<1	10,1	<1	13,6
Gull, Egg	unlabelled	<1	<1	<1	<1	<1

Comp. spec.	Note	Bisphenol Z ng/g (w.w.)	Bisphenol AP ng/g (w.w.)	Bisphenol E ng/g (w.w.)	Bisphenol FL ng/g (w.w.)	Bisphenol P ng/g (w.w.)
Gull, Blood	JCL 10					
Gull, Blood	JCL 11					
Gull, Blood	JCL 18					
Gull, Blood	JCL 20					
Gull, Blood	JCL 21					
Gull, Blood	JCL 22					
Gull, Blood	JCL 23					
Gull, Blood	JAM 63					
Gull, Blood	JAM 64					
Gull, Blood	JAM 70					
Gull, Blood	JAM 72					
Gull, Blood	JAM 74					
Gull, Blood	J 4157					
Gull, Blood	J 4438					
Gull, Blood	J 8195					

Comp. spec.	Note	Bisphenol Z ng/g (w.w.)	Bisphenol AP ng/g (w.w.)	Bisphenol E ng/g (w.w.)	Bisphenol FL ng/g (w.w.)	Bisphenol P ng/g (w.w.)
Gull, Egg	JAM63	46,8	<1	<1	<1	26,6
Gull, Egg	JCL10	44,9	<1	<1	<1	17,5
Gull, Egg	JCL11	37,2	<1	<1	<1	<1
Gull, Egg	jam 64	29,2	<1	<1	<1	<1
Gull, Egg	jcl21	47,9	<1	<1	<1	<1
Gull, Egg	JCl20	<1	<1	<1	<1	16,0
Gull, Egg	JCL22	<1	<1	<1	<1	<1
Gull, Egg	JCL18	21,5	<1	<1	<1	<1
Gull, Egg	J4157	21,8	<1	<1	<1	18,9
Gull, Egg	JCL23	50,6	<1	<1	<1	23,2
Gull, Egg	JAM72	42,7	6,95	<1	<1	<1
Gull, Egg	JAM74	33,7	<1	<1	<1	<1
Gull, Egg	JAM70	<1	<1	<1	<1	<1
Gull, Egg	unlabelled	28,6	<1	<1	<1	<1
Gull, Egg	unlabelled	<1	<1	<1	<1	48,7

Comp. spec.	Note	Bisphenol M ng/g (w.w.)	Bisphenol G ng/g (w.w.)	Bisphenol TMC ng/g (w.w.)	Ni µg/g (w.w.)	Cu µg/g (w.w.)	Ag µg/g (w.w.)
Gull, Blood	JCL 10						
Gull, Blood	JCL 11						
Gull, Blood	JCL 18						
Gull, Blood	JCL 20						
Gull, Blood	JCL 21						
Gull, Blood	JCL 22						
Gull, Blood	JCL 23						
Gull, Blood	JAM 63						
Gull, Blood	JAM 64						
Gull, Blood	JAM 70						
Gull, Blood	JAM 72						
Gull, Blood	JAM 74						
Gull, Blood	J 4157						
Gull, Blood	J 4438						
Gull, Blood	J 8195						

Comp. spec.	Note	Bisphenol M ng/g (w.w.)	Bisphenol G ng/g (w.w.)	Bisphenol TMC ng/g (w.w.)	Ni µg/g (w.w.)	Cu µg/g (w.w.)	Ag µg/g (w.w.)
Gull, Egg	JAM63	<1	<1	<1	0,091	0,651	0,004
Gull, Egg	JCL10	<1	8,69	43,2	0,015	0,769	0,001
Gull, Egg	JCL11	<1	<1	<1	0,040	0,650	0,001
Gull, Egg	jam 64	<1	11,6	<1	0,652	0,848	0,002
Gull, Egg	jcl21	<1	<1	44,7	0,024	0,699	0,001
Gull, Egg	JCl20	<1	<1	39,1	0,012	0,664	0,001
Gull, Egg	JCL22	<1	<1	<1	0,083	0,700	0,001
Gull, Egg	JCL18	<1	<1	<1	0,026	0,775	0,001
Gull, Egg	J4157	<1	<1	<1	0,024	0,714	0,001
Gull, Egg	JCL23	<1	<1	109	0,099	0,773	0,000
Gull, Egg	JAM72	<1	8,13	<1	0,022	0,606	0,001
Gull, Egg	JAM74	<1	<1	50,5	1,379	0,847	0,001
Gull, Egg	JAM70	19,0	<1	33,3	0,049	0,750	0,000
Gull, Egg	unlabelled	<1	<1	45,3	0,049	0,728	0,002
Gull, Egg	unlabelled	<1	<1	332	0,020	0,730	0,001

Comp. spec.	Note	Cd µg/g (w.w.)	Hg ng/g (w.w.)	Pb µg/g (w.w.)	Cr µg/g (w.w.)	Fe µg/g (w.w.)	Zn µg/g (w.w.)
Gull, Blood	JCL 10						
Gull, Blood	JCL 11						
Gull, Blood	JCL 18						
Gull, Blood	JCL 20						
Gull, Blood	JCL 21						
Gull, Blood	JCL 22						
Gull, Blood	JCL 23						
Gull, Blood	JAM 63						
Gull, Blood	JAM 64						
Gull, Blood	JAM 70						
Gull, Blood	JAM 72						
Gull, Blood	JAM 74						
Gull, Blood	J 4157						
Gull, Blood	J 4438						
Gull, Blood	J 8195						

Comp. spec.	Note	Cd µg/g (w.w.)	Hg ng/g (w.w.)	Pb µg/g (w.w.)	Cr µg/g (w.w.)	Fe µg/g (w.w.)	Zn µg/g (w.w.)
Gull, Egg	JAM63	0,000	<21,95	0,037	0,115	49,8	19,8
Gull, Egg	JCL10	0,000	53,6	0,007	0,019	37,6	12,9
Gull, Egg	JCL11	0,000	72,6	0,009	0,048	23,3	10,9
Gull, Egg	jam 64	0,000	222	0,008	0,949	29,6	14,5
Gull, Egg	jcl21	0,000	26,1	0,045	0,032	29,6	15,9
Gull, Egg	JCl20	0,000	21,3	0,005	0,017	24,9	12,8
Gull, Egg	JCL22	0,000	80,0	0,012	0,133	33,6	14,4
Gull, Egg	JCL18	0,000	117	0,050	0,035	22,0	11,8
Gull, Egg	J4157	0,000	75,6	0,014	0,020	21,3	12,1
Gull, Egg	JCL23	0,000	34,2	0,021	0,156	31,0	14,7
Gull, Egg	JAM72	0,000	43,8	0,014	0,028	22,1	12,3
Gull, Egg	JAM74	0,000	69,0	0,408	1,773	35,2	14,1
Gull, Egg	JAM70	0,000	41,2	0,004	0,072	10,9	10,7
Gull, Egg	unlabelled	0,000	50,1	0,010	0,068	24,8	12,6
Gull, Egg	unlabelled	0,000	86,6	0,027	0,024	18,5	10,6

Comp. spec.	Note	As µg/g (w.w.)	PFPA ng/g (w.w.)	PFHxA ng/g (w.w.)	PFHpA ng/g (w.w.)	PFOA ng/g (w.w.)	PFNA ng/g (w.w.)
Gull, Blood	JCL 10		<1	<0,5	<0,5	1,06	0,69
Gull, Blood	JCL 11		<1	<0,5	<0,5	1,21	0,96
Gull, Blood	JCL 18		<1	<0,5	<0,5	0,86	<0,5
Gull, Blood	JCL 20		<1	<0,5	<0,5	<0,5	<0,5
Gull, Blood	JCL 21		<1	<0,5	<0,5	<0,5	<0,5
Gull, Blood	JCL 22		<1	<0,5	<0,5	<0,5	<0,5
Gull, Blood	JCL 23		<1	<0,5	<0,5	1,78	1,10
Gull, Blood	JAM 63		<1	<0,5	<0,5	0,81	1,81
Gull, Blood	JAM 64		<1	<0,5	<0,5	0,56	0,64
Gull, Blood	JAM 70		<1	<0,5	<0,5	<0,5	<0,5
Gull, Blood	JAM 72		<1	<0,5	<0,5	0,64	<0,5
Gull, Blood	JAM 74		<1	<0,5	<0,5	0,54	0,92
Gull, Blood	J 4157		<1	<0,5	<0,5	0,54	<0,5
Gull, Blood	J 4438		<1	<0,5	<0,5	<0,5	0,53
Gull, Blood	J 8195		<1	<0,5	<0,5	<0,5	1,18

Comp. spec.	Note	As µg/g (w.w.)	PFPA ng/g (w.w.)	PFHxA ng/g (w.w.)	PFHpA ng/g (w.w.)	PFOA ng/g (w.w.)	PFNA ng/g (w.w.)
Gull, Egg	JAM63	0,024	<1	<0,5	<0,5	0,94	0,83
Gull, Egg	JCL10	0,091	<1	<0,5	<0,5	0,56	0,53
Gull, Egg	JCL11	0,022	<1	<0,5	<0,5	<0,5	0,63
Gull, Egg	jam 64	0,149	<1	<0,5	<0,5	<0,5	1,73
Gull, Egg	jcl21	0,014	<1	<0,5	<0,5	<0,5	<0,5
Gull, Egg	JCl20	0,051	<1	<0,5	<0,5	<0,5	<0,5
Gull, Egg	JCL22	0,112	<1	<0,5	<0,5	<0,5	<0,5
Gull, Egg	JCL18	0,067	<1	<0,5	<0,5	<0,5	<0,5
Gull, Egg	J4157	0,008	<1	<0,5	<0,5	<0,5	<0,5
Gull, Egg	JCL23	0,010	<1	<0,5	<0,5	<0,5	<0,5
Gull, Egg	JAM72	0,031	<1	<0,5	<0,5	<0,5	0,51
Gull, Egg	JAM74	0,015	<1	<0,5	<0,5	<0,5	<0,5
Gull, Egg	JAM70	0,033	<1	<0,5	<0,5	<0,5	<0,5
Gull, Egg	unlabelled	0,030	<1	<0,5	<0,5	<0,5	<0,5
Gull, Egg	unlabelled	0,042	<1	<0,5	<0,5	<0,5	<0,5

Comp. spec.	Note	PFDA ng/g (w.w.)	PFUdA ng/g (w.w.)	PFDoA ng/g (w.w.)	PFTrA ng/g (w.w.)	PFTeA ng/g (w.w.)	PFBS ng/g (w.w.)
Gull, Blood	JCL 10	1,25	1,54	0,97	1,30	0,42	<0,1
Gull, Blood	JCL 11	0,62	0,74	0,42	0,90	0,89	<0,1
Gull, Blood	JCL 18	0,73	0,57	0,57	0,74	0,46	<0,1
Gull, Blood	JCL 20	1,11	1,02	1,32	1,17	0,78	<0,1
Gull, Blood	JCL 21	<0,5	0,54	1,25	0,89	1,89	<0,1
Gull, Blood	JCL 22	0,50	0,49	0,27	0,61	0,44	<0,1
Gull, Blood	JCL 23	1,75	1,13	0,91	1,20	0,53	<0,1
Gull, Blood	JAM 63	5,61	3,61	1,66	1,86	1,31	<0,1
Gull, Blood	JAM 64	0,81	0,68	1,11	1,33	1,53	<0,1
Gull, Blood	JAM 70	0,61	0,74	0,59	0,74	0,75	<0,1
Gull, Blood	JAM 72	0,87	0,87	0,84	0,68	0,42	<0,1
Gull, Blood	JAM 74	1,25	1,04	1,58	1,64	1,05	<0,1
Gull, Blood	J 4157	0,68	0,64	0,78	0,91	0,73	<0,1
Gull, Blood	J 4438	0,81	0,80	0,83	0,97	0,85	<0,1
Gull, Blood	J 8195	4,83	4,71	3,63	2,83	1,21	<0,1

Comp. spec.	Note	PFDA ng/g (w.w.)	PFUdA ng/g (w.w.)	PFDoA ng/g (w.w.)	PFTrA ng/g (w.w.)	PFTeA ng/g (w.w.)	PFBS ng/g (w.w.)
Gull, Egg	JAM63	1,37	0,86	2,82	2,43	2,85	<0,1
Gull, Egg	JCL10	1,19	1,32	1,45	1,67	1,04	<0,1
Gull, Egg	JCL11	0,97	0,83	0,75	1,04	0,56	<0,1
Gull, Egg	jam 64	8,85	4,10	2,94	<0,4	<0,4	<0,1
Gull, Egg	jcl21	<0,5	<0,4	0,40	<0,4	<0,4	<0,1
Gull, Egg	JCl20	<0,5	<0,4	0,52	0,41	<0,4	<0,1
Gull, Egg	JCL22	1,23	1,48	1,58	2,05	<0,4	<0,1
Gull, Egg	JCL18	0,62	<0,4	0,45	0,87	0,78	<0,1
Gull, Egg	J4157	1,03	1,27	2,56	2,62	1,79	<0,1
Gull, Egg	JCL23	0,86	0,71	2,70	1,46	1,62	<0,1
Gull, Egg	JAM72	0,93	0,89	1,60	1,79	1,14	<0,1
Gull, Egg	JAM74	<0,5	<0,4	0,47	0,51	0,40	<0,1
Gull, Egg	JAM70	0,51	0,59	0,65	<0,4	<0,4	<0,1
Gull, Egg	unlabelled	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Gull, Egg	unlabelled	0,80	1,18	0,91	0,91	0,47	<0,1

Comp. spec.	Note	PFHxS ng/g (w.w.)	PFOS ng/g (w.w.)	PFDS ng/g (w.w.)	PFDoS ng/g (w.w.)	PFOSA ng/g (w.w.)	me-PFOSA ng/g (w.w.)
Gull, Blood	JCL 10	0,67	14,4	0,42	<0,2	<0,1	<0,3
Gull, Blood	JCL 11	0,50	14,6	0,23	<0,2	<0,1	<0,3
Gull, Blood	JCL 18	0,49	5,60	<0,2	<0,2	<0,1	<0,3
Gull, Blood	JCL 20	0,43	18,5	0,30	<0,2	<0,1	<0,3
Gull, Blood	JCL 21	0,23	4,35	<0,2	<0,2	<0,1	<0,3
Gull, Blood	JCL 22	0,33	5,56	<0,2	<0,2	<0,1	<0,3
Gull, Blood	JCL 23	0,83	17,4	0,43	<0,2	<0,1	<0,3
Gull, Blood	JAM 63	0,35	47,8	1,21	<0,2	0,41	<0,3
Gull, Blood	JAM 64	0,30	20,0	0,50	<0,2	<0,1	<0,3
Gull, Blood	JAM 70	0,14	14,7	0,32	<0,2	0,37	<0,3
Gull, Blood	JAM 72	0,28	6,30	<0,2	<0,2	<0,1	<0,3
Gull, Blood	JAM 74	0,34	11,3	0,29	<0,2	<0,1	<0,3
Gull, Blood	J 4157	0,41	4,63	<0,2	<0,2	<0,1	<0,3
Gull, Blood	J 4438	0,42	4,91	0,23	<0,2	0,11	<0,3
Gull, Blood	J 8195	0,97	125	1,25	<0,2	3,07	<0,3

Comp. spec.	Note	PFHxS ng/g (w.w.)	PFOS ng/g (w.w.)	PFDS ng/g (w.w.)	PFDoS ng/g (w.w.)	PFOSA ng/g (w.w.)	me-PFOSA ng/g (w.w.)
Gull, Egg	JAM63	0,27	16,1	1,35	<0,2	<0,1	<0,3
Gull, Egg	JCL10	0,44	11,9	0,46	<0,2	<0,1	<0,3
Gull, Egg	JCL11	0,36	20,8	0,56	<0,2	<0,1	<0,3
Gull, Egg	jam 64	0,50	46,5	0,52	<0,2	0,19	<0,3
Gull, Egg	jcl21	0,12	<0,1	0,24	<0,2	<0,1	<0,3
Gull, Egg	JCl20	<0,1	4,32	<0,2	<0,2	<0,1	<0,3
Gull, Egg	JCL22	0,34	26,1	0,73	<0,2	0,20	<0,3
Gull, Egg	JCL18	0,11	4,16	<0,2	<0,2	<0,1	<0,3
Gull, Egg	J4157	0,36	22,2	0,49	<0,2	<0,1	<0,3
Gull, Egg	JCL23	0,16	4,97	<0,2	<0,2	<0,1	<0,3
Gull, Egg	JAM72	0,20	12,3	0,21	<0,2	<0,1	<0,3
Gull, Egg	JAM74	<0,1	5,14	<0,2	<0,2	<0,1	<0,3
Gull, Egg	JAM70	0,10	4,86	<0,2	<0,2	0,11	<0,3
Gull, Egg	unlabelled	0,35	5,55	<0,2	<0,2	<0,1	<0,3
Gull, Egg	unlabelled	0,25	9,63	<0,2	<0,2	<0,1	<0,3

Comp. spec.	Note	et-PFOSA ng/g (w.w.)	me-PFOSE ng/g (w.w.)	et-PFOSE ng/g (w.w.)	me-FOSAA ng/g (w.w.)	et-FOSAA ng/g (w.w.)	4:2 FTS ng/g (w.w.)
Gull, Blood	JCL 10	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	JCL 11	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	JCL 18	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	JCL 20	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	JCL 21	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	JCL 22	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	JCL 23	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	JAM 63	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	JAM 64	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	JAM 70	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	JAM 72	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	JAM 74	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	J 4157	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	J 4438	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Blood	J 8195	<0,3	<5	<5	<0,3	<0,3	<0,3

Comp. spec.	Note	et-PFOSA ng/g (w.w.)	me-PFOSE ng/g (w.w.)	et-PFOSE ng/g (w.w.)	me-FOSAA ng/g (w.w.)	et-FOSAA ng/g (w.w.)	4:2 FTS ng/g (w.w.)
Gull, Egg	JAM63	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	JCL10	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	JCL11	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	jam 64	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	jcl21	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	JCl20	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	JCL22	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	JCL18	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	J4157	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	JCL23	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	JAM72	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	JAM74	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	JAM70	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	unlabelled	<0,3	<5	<5	<0,3	<0,3	<0,3
Gull, Egg	unlabelled	<0,3	<5	<5	<0,3	<0,3	<0,3

Comp. spec.	Note	6:2 FTS ng/g (w.w.)	8:2 FTS ng/g (w.w.)	6:2 diPAP ng/g (w.w.)	TCC ng/ml (w.w.)	Triclosan ng/ml (w.w.)	BP3 ng/ml (w.w.)
Gull, Blood	JCL 10	<0,3	<0,3		<1	<3	<4
Gull, Blood	JCL 11	<0,3	<0,3		<1	<3	<4
Gull, Blood	JCL 18	<0,3	<0,3		<1	<3	<4
Gull, Blood	JCL 20	<0,3	<0,3		<1	<3	<4
Gull, Blood	JCL 21	<0,3	<0,3		<1	<3	<4
Gull, Blood	JCL 22	<0,3	<0,3		3,20	<3	<4
Gull, Blood	JCL 23	<0,3	<0,3		<1	<3	<4
Gull, Blood	JAM 63	<0,3	<0,3		<1	<3	<4
Gull, Blood	JAM 64	<0,3	<0,3		<1	<3	<4
Gull, Blood	JAM 70	<0,3	<0,3		<1	<3	<4
Gull, Blood	JAM 72	<0,3	<0,3		<1	<3	<4
Gull, Blood	JAM 74	<0,3	<0,3		<1	<3	<4
Gull, Blood	J 4157	<0,3	<0,3		<1	<3	<4
Gull, Blood	J 4438	<0,3	<0,3		<1	<3	<4
Gull, Blood	J 8195	<0,3	<0,3		<1	<3	<4

Comp. spec.	Note	6:2 FTS ng/g (w.w.)	8:2 FTS ng/g (w.w.)	6:2 diPAP ng/g (w.w.)	TCC ng/g (w.w.)	Triclosan ng/g (w.w.)	BP3 ng/g (w.w.)
Gull, Egg	JAM63	<0,3	<0,3	<0,3	<1	<4	<8
Gull, Egg	JCL10	<0,3	<0,3	<0,3	<1	<4	<8
Gull, Egg	JCL11	<0,3	<0,3	0,64	<1	<4	<8
Gull, Egg	jam 64	<0,3	<0,3	<0,3	<1	<4	<8
Gull, Egg	jcl21	<0,3	<0,3	<0,3	<1	<4	<8
Gull, Egg	JCl20	<0,3	<0,3	<0,3	<1	<4	<8
Gull, Egg	JCL22	<0,3	<0,3	<0,3	<1	<4	<8
Gull, Egg	JCL18	<0,3	<0,3	<0,3	<1	<4	<8
Gull, Egg	J4157	<0,3	<0,3	<0,3	<1	<4	<8
Gull, Egg	JCL23	<0,3	0,35	0,38	<1	<4	<8
Gull, Egg	JAM72	<0,3	<0,3	<0,3	<1	<4	<8
Gull, Egg	JAM74	<0,3	<0,3	<0,3	<1	<4	<8
Gull, Egg	JAM70	<0,3	<0,3	<0,3	<1	<7	<8
Gull, Egg	unlabelled	<0,3	<0,3	<0,3	<1	<4	<8
Gull, Egg	unlabelled	<0,3	<0,3	<0,3	<1	<4	<8

Comp. spec.	Note	EHMC ng/ml (w.w.)	OC ng/ml (w.w.)
Gull, Blood	JCL 10	<3	<6
Gull, Blood	JCL 11	<3	<6
Gull, Blood	JCL 18	<3	<6
Gull, Blood	JCL 20	<3	<6
Gull, Blood	JCL 21	<3	<6
Gull, Blood	JCL 22	<3	<6
Gull, Blood	JCL 23	<3	13,4
Gull, Blood	JAM 63	<3	<6
Gull, Blood	JAM 64	<3	<6
Gull, Blood	JAM 70	<3	<6
Gull, Blood	JAM 72	8,70	9,28
Gull, Blood	JAM 74	<3	<6
Gull, Blood	J 4157	3,49	15,4
Gull, Blood	J 4438	<3	<6
Gull, Blood	J 8195	2,96	<6

Comp. spec.	Note	EHMC ng/g (w.w.)	OC ng/g (w.w.)
Gull, Egg	JAM63	<10	<8
Gull, Egg	JCL10	<10	<8
Gull, Egg	JCL11	<10	<8
Gull, Egg	jam 64	<10	<8
Gull, Egg	jcl21	<10	<8
Gull, Egg	JCl20	<10	<8
Gull, Egg	JCL22	<10	10,5
Gull, Egg	JCL18	<10	<8
Gull, Egg	J4157	<10	<8
Gull, Egg	JCL23	<10	9,82
Gull, Egg	JAM72	<10	<8
Gull, Egg	JAM74	<10	<8
Gull, Egg	JAM70	<10	<8
Gull, Egg	unlabelled	<10	<8
Gull, Egg	unlabelled	<10	<8

NILU-no.	NIVA-no.	Compartment	Comp. spec.	Note	Area
15/1804	2015-13581	Storm water	Water	ALN 125x	Bryn Ring3/E6
15/1805	2015-13582	Storm water	Water	ALN 136x	Breivoll E6, Downstr. Term.
15/1806	2015-13583	Storm water	Water	ALN 138x	Breivoll/Alnabru Term.
15/1807	2015-13580	Storm water	Water	HOV 122z	Hasle, snow dep.
15/1808	2015-13581	Storm water	Particles	ALN 125x	Bryn Ring3/E6
15/1809	2015-13582	Storm water	Particles	ALN 136x	Breivoll E6, Downstr. Term.
15/1810	2015-13583	Storm water	Particles	ALN 138x	Breivoll/Alnabru Term.
15/1811	2015-13580	Storm water	Particles	HOV 122z	Hasle, snow dep.

NILU-no.	NIVA-no.	Compartment	Comp. spec.	Note
15/1815	2015-11957	Sediment	Sediment	Cm21

Comp. spec.	Note	PeCB ng/L	HCB ng/L	PCB-18 ng/L	PCB-28 ng/L	PCB-31 ng/L	PCB-33 ng/L
Water	ALN 125x	0,064	0,063	0,010	0,014	0,011	<0,01
Water	ALN 136x	0,118	0,059	0,217	0,138	0,160	0,071
Water	ALN 138x	0,133	0,812	0,017	0,029	<0,01	0,017
Water	HOV 122z	0,077	0,037	<0,01	<0,01	<0,01	<0,01
Particles	ALN 125x	0,048	0,049	0,015	0,049	0,044	0,025
Particles	ALN 136x	0,133	0,236	0,887	0,997	1,049	0,379
Particles	ALN 138x	0,113	0,268	0,028	0,038	0,033	0,017
Particles	HOV 122z	0,043	0,060	0,010	0,012	0,011	<0,01

Comp. spec.	Note	PeCB ng/g (d.w.)	HCB ng/g (d.w.)	PCB-18 ng/g (d.w.)	PCB-28 ng/g (d.w.)	PCB-31 ng/g (d.w.)	PCB-33 ng/g (d.w.)
Sediment	Cm21	0,241	0,420	0,208	1,164	0,644	0,291

Comp. spec.	Note	PCB-37 ng/L	PCB-47 ng/L	PCB-52 ng/L	PCB-66 ng/L	PCB-74 ng/L	PCB-99 ng/L
Water	ALN 125x	<0,01	<0,01	0,019	<0,01	<0,01	0,018
Water	ALN 136x	<0,01	0,070	0,285	0,088	0,043	0,018
Water	ALN 138x	<0,01	<0,01	0,049	0,021	<0,01	<0,01
Water	HOV 122z	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Particles	ALN 125x	0,030	0,031	0,080	0,077	0,035	0,064
Particles	ALN 136x	0,200	0,969	3,085	1,721	0,802	0,884
Particles	ALN 138x	0,012	0,016	0,056	0,022	0,010	0,028
Particles	HOV 122z	<0,01	0,010	0,031	0,021	<0,01	0,018

Comp. spec.	Note	PCB-37 ng/g (d.w.)	PCB-47 ng/g (d.w.)	PCB-52 ng/g (d.w.)	PCB-66 ng/g (d.w.)	PCB-74 ng/g (d.w.)	PCB-99 ng/g (d.w.)
Sediment	Cm21	0,331	0,752	1,038	2,287	1,001	1,459

Comp. spec.	Note	PCB-101 ng/L	PCB-105 ng/L	PCB-114 ng/L	PCB-118 ng/L	PCB-122 ng/L	PCB-123 ng/L
Water	ALN 125x	0,038	0,021	<0,01	0,049	<0,01	<0,01
Water	ALN 136x	0,072	0,015	<0,01	0,039	<0,01	<0,01
Water	ALN 138x	0,031	<0,01	<0,01	0,022	<0,01	<0,01
Water	HOV 122z	0,012	<0,01	<0,01	<0,01	<0,01	<0,01
Particles	ALN 125x	0,153	0,059	<0,01	0,155	<0,01	<0,01
Particles	ALN 136x	2,788	0,765	0,048	1,631	0,024	0,030
Particles	ALN 138x	0,098	0,040	<0,01	0,093	<0,01	<0,01
Particles	HOV 122z	0,079	0,013	<0,01	0,043	<0,01	<0,01

Comp. spec.	Note	PCB-101 ng/g (d.w.)	PCB-105 ng/g (d.w.)	PCB-114 ng/g (d.w.)	PCB-118 ng/g (d.w.)	PCB-122 ng/g (d.w.)	PCB-123 ng/g (d.w.)
Sediment	Cm21	1,730	1,241	0,065	2,898	<0,014	<0,014

Comp. spec.	Note	PCB-128 ng/L	PCB-138 ng/L	PCB-141 ng/L	PCB-149 ng/L	PCB-153 ng/L	PCB-156 ng/L
Water	ALN 125x	0,014	0,064	0,012	0,035	0,068	<0,01
Water	ALN 136x	<0,01	0,032	<0,01	0,029	0,046	<0,01
Water	ALN 138x	<0,01	0,024	<0,01	<0,01	0,028	<0,01
Water	HOV 122z	<0,01	0,012	<0,01	0,010	0,017	<0,01
Particles	ALN 125x	0,039	0,204	0,042	0,163	0,213	0,019
Particles	ALN 136x	0,395	1,825	0,575	2,245	1,991	0,203
Particles	ALN 138x	0,043	0,150	0,030	0,119	0,120	0,018
Particles	HOV 122z	0,013	0,071	0,022	0,102	0,106	<0,01

Comp. spec.	Note	PCB-128 ng/g (d.w.)	PCB-138 ng/g (d.w.)	PCB-141 ng/g (d.w.)	PCB-149 ng/g (d.w.)	PCB-153 ng/g (d.w.)	PCB-156 ng/g (d.w.)
Sediment	Cm21	0,831	3,984	0,270	2,507	4,365	0,294

Comp. spec.	Note	PCB-157 ng/L	PCB-167 ng/L	PCB-170 ng/L	PCB-180 ng/L	PCB-183 ng/L	PCB-187 ng/L
Water	ALN 125x	<0,01	<0,01	<0,01	0,025	<0,01	<0,01
Water	ALN 136x	<0,01	<0,01	<0,01	0,019	<0,01	<0,01
Water	ALN 138x	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Water	HOV 122z	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Particles	ALN 125x	<0,01	<0,01	0,034	0,087	0,016	0,045
Particles	ALN 136x	0,033	0,085	0,490	1,225	0,263	0,673
Particles	ALN 138x	<0,01	<0,01	0,034	0,077	0,015	0,038
Particles	HOV 122z	<0,01	<0,01	0,014	0,045	0,011	0,030

Comp. spec.	Note	PCB-157 ng/g (d.w.)	PCB-167 ng/g (d.w.)	PCB-170 ng/g (d.w.)	PCB-180 ng/g (d.w.)	PCB-183 ng/g (d.w.)	PCB-187 ng/g (d.w.)
Sediment	Cm21	0,077	0,185	0,846	1,746	0,428	1,319

Comp. spec.	Note	PCB-189 ng/L	PCB-194 ng/L	PCB-206 ng/L	PCB-209 ng/L	Sum PCB7 ng/L	Sum PCB ng/L
Water	ALN 125x	<0,01	<0,01	<0,01	<0,01	0,277	0,520
Water	ALN 136x	<0,01	<0,01	<0,01	<0,01	0,631	2,358
Water	ALN 138x	<0,01	<0,01	<0,01	<0,01	0,173	0,270
Water	HOV 122z	<0,01	<0,01	<0,01	<0,01	0,002	0,075
Particles	ALN 125x	<0,01	0,010	<0,01	<0,01	0,940	2,664
Particles	ALN 136x	0,018	0,201	0,045	<0,01	13,5	48,2
Particles	ALN 138x	<0,01	0,013	<0,01	<0,01	0,633	1,806
Particles	HOV 122z	<0,01	<0,01	<0,01	<0,01	0,387	1,084

Comp. spec.	Note	PCB-189 ng/g (d.w.)	PCB-194 ng/g (d.w.)	PCB-206 ng/g (d.w.)	PCB-209 ng/g (d.w.)	Sum PCB7 ng/g (d.w.)	Sum PCB ng/g (d.w.)
Sediment	Cm21	<0,011	0,475	0,260	0,166	16,9	48,1

Comp. spec.	Note	TBA ng/L	BDE-17 ng/L	BDE-28 ng/L	BDE-47 ng/L	BDE-49 ng/L	BDE-66 ng/L
Water	ALN 125x	0,019	<0,01	<0,01	0,042	<0,01	<0,01
Water	ALN 136x	0,025	<0,01	<0,01	0,038	<0,01	<0,01
Water	ALN 138x	0,013	<0,01	<0,01	0,051	<0,01	<0,01
Water	HOV 122z	0,011	<0,01	<0,01	0,035	<0,01	<0,01
Particles	ALN 125x	<0,01	<0,01	<0,01	0,014	<0,01	<0,01
Particles	ALN 136x	0,013	<0,01	<0,01	0,115	<0,01	<0,01
Particles	ALN 138x	<0,01	<0,01	<0,01	0,017	<0,01	<0,01
Particles	HOV 122z	<0,01	<0,01	<0,01	0,028	<0,01	<0,01

Comp. spec.	Note	TBA ng/g (d.w.)	BDE-17 ng/g (d.w.)	BDE-28 ng/g (d.w.)	BDE-47 ng/g (d.w.)	BDE-49 ng/g (d.w.)	BDE-66 ng/g (d.w.)
Sediment	Cm21	0,016	<0,01	<0,01	0,062	0,013	<0,01

Comp. spec.	Note	BDE-71 ng/L	BDE-77 ng/L	BDE-85 ng/L	BDE-99 ng/L	BDE-100 ng/L	BDE-119 ng/L
Water	ALN 125x	<0,01	<0,01	<0,01	0,016	<0,01	<0,01
Water	ALN 136x	<0,01	<0,01	<0,01	0,013	<0,01	<0,01
Water	ALN 138x	<0,01	<0,01	<0,01	0,046	<0,01	<0,01
Water	HOV 122z	<0,01	<0,01	<0,01	0,020	<0,01	<0,01
Particles	ALN 125x	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Particles	ALN 136x	<0,01	<0,01	<0,01	0,153	0,021	<0,01
Particles	ALN 138x	<0,01	<0,01	<0,01	0,018	<0,01	<0,01
Particles	HOV 122z	<0,01	<0,01	<0,01	0,022	<0,01	<0,01

Comp. spec.	Note	BDE-71 ng/g (d.w.)	BDE-77 ng/g (d.w.)	BDE-85 ng/g (d.w.)	BDE-99 ng/g (d.w.)	BDE-100 ng/g (d.w.)	BDE-119 ng/g (d.w.)
Sediment	Cm21	<0,01	<0,01	<0,01	0,036	0,012	<0,01

Comp. spec.	Note	BDE-126 ng/L	BDE-138 ng/L	BDE-153 ng/L	BDE-154 ng/L	BDE-156 ng/L	BDE-183 ng/L
Water	ALN 125x	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Water	ALN 136x	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Water	ALN 138x	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Water	HOV 122z	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Particles	ALN 125x	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Particles	ALN 136x	<0,01	<0,01	0,031	0,015	<0,011	0,036
Particles	ALN 138x	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Particles	HOV 122z	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01

Comp. spec.	Note	BDE-126 ng/g (d.w.)	BDE-138 ng/g (d.w.)	BDE-153 ng/g (d.w.)	BDE-154 ng/g (d.w.)	BDE-156 ng/g (d.w.)	BDE-183 ng/g (d.w.)
Sediment	Cm21	<0,01	<0,01	<0,01	<0,01	<0,017	<0,01

Comp. spec.	Note	BDE-184 ng/L	BDE-191 ng/L	BDE-196 ng/L	BDE-197 ng/L	BDE-202 ng/L	BDE-206 ng/L
Water	ALN 125x	<0,01	<0,01	<0,01	<0,01	<0,01	0,019
Water	ALN 136x	<0,01	<0,01	<0,01	<0,01	<0,01	0,016
Water	ALN 138x	<0,01	<0,01	<0,01	<0,01	<0,01	0,016
Water	HOV 122z	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Particles	ALN 125x	<0,01	<0,01	<0,01	<0,01	<0,01	0,014
Particles	ALN 136x	<0,01	<0,01	<0,017	<0,013	<0,016	<0,084
Particles	ALN 138x	<0,01	<0,01	<0,01	<0,01	<0,01	0,047
Particles	HOV 122z	<0,01	<0,01	<0,01	<0,01	<0,01	<0,018

Comp. spec.	Note	BDE-184 ng/g (d.w.)	BDE-191 ng/g (d.w.)	BDE-196 ng/g (d.w.)	BDE-197 ng/g (d.w.)	BDE-202 ng/g (d.w.)	BDE-206 ng/g (d.w.)
Sediment	Cm21	<0,01	<0,01	<0,01	<0,01	<0,01	0,080

Comp. spec.	Note	BDE-207 ng/L	BDE-209 ng/L	DBDPE ng/L	o,p'-DDE ng/L	p,p'-DDE ng/L	o,p'-DDD ng/L
Water	ALN 125x	0,017	0,248	115			
Water	ALN 136x	0,013	0,115	47,7			
Water	ALN 138x	0,014	0,155	57,7			
Water	HOV 122z	0,011	0,132	53,0			
Particles	ALN 125x	<0,01	0,331	8,477			
Particles	ALN 136x	<0,075		0,000			
Particles	ALN 138x	0,033		0,000			
Particles	HOV 122z	0,037		0,000			

Comp. spec.	Note	BDE-207 ng/g (d.w.)	BDE-209 ng/g (d.w.)	DBDPE ng/g (d.w.)	o,p'-DDE ng/g (d.w.)	p,p'-DDE ng/g (d.w.)	o,p'-DDD ng/g (d.w.)
Sediment	Cm21	0,068	<0,801	26,9			

Comp. spec.	Note	p,p'-DDD ng/L	o,p'-DDT ng/L	p,p'-DDT ng/L	Sum DDT ng/L	SCCP ng/L	MCCP ng/L
Water	ALN 125x					90,0	18,0
Water	ALN 136x					44,0	0,60
Water	ALN 138x					92,0	13,0
Water	HOV 122z					36,0	0,60
Particles	ALN 125x					40,0	1,10
Particles	ALN 136x					220	17,0
Particles	ALN 138x					45,0	19,0
Particles	HOV 122z					33,0	19,0

Comp. spec.	Note	p,p'-DDD ng/g (d.w.)	o,p'-DDT ng/g (d.w.)	p,p'-DDT ng/g (d.w.)	Sum DDT ng/g (d.w.)	SCCP ng/g (d.w.)	MCCP ng/g (d.w.)
Sediment	Cm21					38,0	1,00

		Relative distributions of formula groups C-10 to C-13 and Cl-5 to Cl-10							
Comp. spec.	Note	(%) 10,5 (%)	(%) 10,6 (%)	(%) 10,7 (%)	(%) 10,8 (%)	(%) 10,9 (%)	(%) 10,10 (%)	(%) 11,5 (%)	(%) 11,6 (%)
Water	ALN 125x	0,00	7,89	0,00	0,00	3,58	2,55	1,82	0,00
Water	ALN 136x	0,00	50,5	0,00	0,00	0,00	0,00	23,0	20,6
Water	ALN 138x	0,00	25,1	1,66	4,20	0,41	0,00	7,46	6,35
Water	HOV 122z	6,68	37,8	3,97	0,00	0,00	0,00	30,4	0,00
Particles	ALN 125x	3,12	26,5	0,00	0,00	0,00	0,00	15,7	31,0
Particles	ALN 136x	0,00	6,35	2,39	2,98	1,26	0,47	3,39	6,53
Particles	ALN 138x	1,92	19,2	4,28	0,00	0,00	0,00	9,06	17,0
Particles	HOV 122z	3,64	19,2	2,24	0,00	0,00	0,00	18,6	22,1

		Relative distributions of formula groups C-10 to C-13 and Cl-5 to Cl-10							
Comp. spec.	Note	(%) 10,5 (%)	(%) 10,6 (%)	(%) 10,7 (%)	(%) 10,8 (%)	(%) 10,9 (%)	(%) 10,10 (%)	(%) 11,5 (%)	(%) 11,6 (%)
Sediment	Cm21	0,00	24,9	5,73	0,00	3,07	1,29	0,00	15,7

Comp. spec.	Note	(%) 11,7 (%)	(%) 11,8 (%)	(%) 11,9 (%)	(%) 11,10 (%)	(%) 12,6 (%)	(%) 12,7 (%)	(%) 12,8 (%)	(%) 12,9 (%)
Water	ALN 125x	0,00	12,7	32,9	11,5	0,00	0,00	6,69	10,0
Water	ALN 136x	0,00	2,79	0,00	0,00	0,00	0,00	2,72	0,00
Water	ALN 138x	19,5	5,51	1,91	0,04	0,00	0,00	8,07	3,88
Water	HOV 122z	17,0	2,09	0,00	0,00	0,00	0,00	2,11	0,00
Particles	ALN 125x	12,8	2,65	1,23	0,00	0,00	0,00	2,58	1,15
Particles	ALN 136x	15,9	10,2	8,94	2,32	10,9	0,00	10,7	8,18
Particles	ALN 138x	18,1	8,03	5,52	1,25	0,00	0,00	4,31	2,82
Particles	HOV 122z	16,5	3,07	1,68	0,19	0,00	0,00	4,60	2,04

Comp. spec.	Note	(%) 11,7 (%)	(%) 11,8 (%)	(%) 11,9 (%)	(%) 11,10 (%)	(%) 12,6 (%)	(%) 12,7 (%)	(%) 12,8 (%)	(%) 12,9 (%)
Sediment	Cm21	0,00	6,88	16,7	7,41	0,00	0,00	3,72	7,41

Comp. spec.	Note	(%) 12,10 (%)	(%) 13,7 (%)	(%) 13,8 (%)	(%) 13,9 (%)	D4 ng/L	D5 ng/L	D6 ng/L
Water	ALN 125x	2,91	0,00	3,97	3,42			
Water	ALN 136x	0,00	0,00	0,00	0,35			
Water	ALN 138x	0,11	3,07	10,3	2,39			
Water	HOV 122z	0,00	0,00	0,00	0,00			
Particles	ALN 125x	0,00	0,00	2,71	0,46			
Particles	ALN 136x	1,70	0,00	4,95	2,80			
Particles	ALN 138x	0,77	0,00	6,11	1,69			
Particles	HOV 122z	0,28	0,00	4,76	1,11			

Comp. spec.	Note	(%) 12,10 (%)	(%) 13,7 (%)	(%) 13,8 (%)	(%) 13,9 (%)	D4 ng/g (d.w.)	D5 ng/g (d.w.)	D6 ng/g (d.w.)
Sediment	Cm21	5,73	0,00	0,00	1,49	2,05	77,8	19,2

Comp. spec.	Note	TEP ng/L	TCEP ng/L	TPrP ng/L	TCPP ng/L	TiBP ng/L	BdPhP ng/L
Water	ALN 125x	266	48,1	<50	669	<855	<1,5
Water	ALN 136x	1 394	475	<50	1 407	<855	<1,5
Water	ALN 138x	1 141	<25	<50	541	<855	<1,5
Water	HOV 122z	1 881	66,4	<50	832	962	<1,5
Particles	ALN 125x	416	<6	<11	<61	<400	<1,5
Particles	ALN 136x	1 480	<6	<11	1 391	<400	<1,5
Particles	ALN 138x	248	<6	<11	397	3 396	<1,5
Particles	HOV 122z	464	<6	<11	<61	<400	<1,5

Comp. spec.	Note	TEP ng/g (d.w.)	TCEP ng/g (d.w.)	TPrP ng/g (d.w.)	TCPP ng/g (d.w.)	TiBP ng/g (d.w.)	BdPhP ng/g (d.w.)
Sediment	Cm21	<0,7	<0,03	<0,15	12,4	<1,7	<0,01

Comp. spec.	Note	TPP ng/L	DBPhP ng/L	TnBP ng/L	TDCPP ng/L	TBEP ng/L	TCP ng/L
Water	ALN 125x	<47	<46	183	<1300	26,8	<3
Water	ALN 136x	<47	<46	112	<1300	112	<3
Water	ALN 138x	611	<46	174	<1300	55,1	<3
Water	HOV 122z	521	<46	307	<1300	17,6	<3
Particles	ALN 125x	<39	<15	332	<170	300	<2
Particles	ALN 136x	<39	<15	290	<170	585	<2
Particles	ALN 138x	1 430	<15	1 001	<170	1 674	26,7
Particles	HOV 122z	<39	<15	398	<170	566	<2

Comp. spec.	Note	TPP ng/g (d.w.)	DBPhP ng/g (d.w.)	TnBP ng/g (d.w.)	TDCPP ng/g (d.w.)	TBEP ng/g (d.w.)	TCP ng/g (d.w.)
Sediment	Cm21	<0,2	<0,1	<0,5	<0,7	3,54	<0,01

Comp. spec.	Note	EHDP ng/L	TEHP ng/L	Bisphenol A ng/L	Tetrabromobisphenol A ng/L
Water	ALN 125x	<420	<27	1,17	<1
Water	ALN 136x	<420	<27	5,86	<1
Water	ALN 138x	<420	<27	5,25	<1
Water	HOV 122z	<420	<27	9,57	<1
Particles	ALN 125x	<350	<5	1,28	<1
Particles	ALN 136x	<350	<5	4,48	<1
Particles	ALN 138x	648	28,5	7,55	<1
Particles	HOV 122z	<350	<5	5,86	<1

Comp. spec.	Note	EHDP ng/g (d.w.)	TEHP ng/g (d.w.)	Bisphenol A ng/g (d.w.)	Tetrabromobisphenol A ng/g (d.w.)
Sediment	Cm21	<1,5	<0,02	25,0	<1

Comp. spec.	Note	4,4-bisphenol F ng/L	2,2-bisphenol F ng/L	Hexafluorobisphenol A ng/L	Bisphenol BP ng/L
Water	ALN 125x	<1	2,95	<1	<1
Water	ALN 136x	<1	3,91	<1	<1
Water	ALN 138x	<1	3,66	<1	<1
Water	HOV 122z	<1	4,17	<1	<1
Particles	ALN 125x	<1	1,97	2,17	1,90
Particles	ALN 136x	<1	2,39	<1	1,92
Particles	ALN 138x	<1	2,15	<1	1,94
Particles	HOV 122z	<1	1,99	2,17	2,06

Comp. spec.	Note	4,4-bisphenol F ng/g (d.w.)	2,2-bisphenol F ng/g (d.w.)	Hexafluorobisphenol A ng/g (d.w.)	Bisphenol BP ng/g (d.w.)
Sediment	Cm21	1,55	6,31	20,9	3,76

Comp. spec.	Note	Bisphenol S ng/L	4-nonylphenol ng/L	4-octylphenol ng/L	4-tert-octylphenol ng/L	Bisphenol B ng/L
Water	ALN 125x	1,92	<1	<1	<1	<1
Water	ALN 136x	25,0	<1	<1	<1	<1
Water	ALN 138x	4,25	<1	<1	<1	<1
Water	HOV 122z	4,87	<1	<1	<1	<1
Particles	ALN 125x	<10	<10	<1	<1	<1
Particles	ALN 136x	<10	<10	<1	9,44	<1
Particles	ALN 138x	<10	<10	<1	8,01	<1
Particles	HOV 122z	<10	<10	1,05	5,81	<1

Comp. spec.	Note	Bisphenol S ng/g (d.w.)	4-nonylphenol ng/g (d.w.)	4-octylphenol ng/g (d.w.)	4-tert-octylphenol ng/g (d.w.)	Bisphenol B ng/g (d.w.)
Sediment	Cm21	2,46	<1	18,0	994	51,2

Comp. spec.	Note	Bisphenol Z ng/L	Bisphenol AP ng/L	Bisphenol E ng/L	Bisphenol FL ng/L	Bisphenol P ng/L
Water	ALN 125x	<1	<1	<1	<1	<1
Water	ALN 136x	<1	<1	29,9	<1	<1
Water	ALN 138x	<1	<1	<1	<1	<1
Water	HOV 122z	<1	<1	<1	<1	<1
Particles	ALN 125x	2,20	1,08	<1	<1	<1
Particles	ALN 136x	<1	<1	<1	<1	<1
Particles	ALN 138x	<1	1,13	<1	<1	<1
Particles	HOV 122z	<1	1,21	<1	<1	<1

Comp. spec.	Note	Bisphenol Z ng/g (d.w.)	Bisphenol AP ng/g (d.w.)	Bisphenol E ng/g (d.w.)	Bisphenol FL ng/g (d.w.)	Bisphenol P ng/g (d.w.)
Sediment	Cm21	27,6	21,2	<1	<1	30,9

Comp. spec.	Note	Bisphenol M ng/L	Bisphenol G ng/L	Bisphenol TMC ng/L	Ni ng/ml	Cu ng/ml	Ag ng/ml
Water	ALN 125x	<1	<1	<1			
Water	ALN 136x	<1	<1	<1	1,385	8,835	<0,09
Water	ALN 138x	<1	<1	<1	0,711	4,190	<0,09
Water	HOV 122z	<1	<1	<1	1,641	6,554	<0,09
Particles	ALN 125x	<1	<1	<1			
Particles	ALN 136x	<1	<1	<1	6,965	13,5	0,058
Particles	ALN 138x	<1	<1	8,54	1,656	7,221	0,014
Particles	HOV 122z	<1	<1	<1	2,667	5,420	<0,014

Comp. spec.	Note	Bisphenol M ng/g (d.w.)	Bisphenol G ng/g (d.w.)	Bisphenol TMC ng/g (d.w.)	Ni µg/g (d.w.)	Cu µg/g (d.w.)	Ag µg/g (d.w.)
Sediment	Cm21	<1	24,3	<1	58,6	75,0	1,808

Comp. spec.	Note	Cd ng/ml	Hg ng/L	Pb ng/ml	Cr ng/ml	Fe ng/ml	Zn ng/ml
Water	ALN 125x						
Water	ALN 136x	0,031	15,8	0,268	1,256	71,5	3,250
Water	ALN 138x	0,026	2,291	0,336	0,801	51,2	71,4
Water	HOV 122z	0,076	1,196	0,208	2,743	35,5	14,3
Particles	ALN 125x						
Particles	ALN 136x	0,102	0,026	7,265	11,4	5 622	105
Particles	ALN 138x	0,037	0,007	1,779	2,707	1 271	113
Particles	HOV 122z	0,109	0,003	1,112	3,788	1 403	23,9

Comp. spec.	Note	Cd µg/g (d.w.)	Hg ng/g (d.w.)	Pb µg/g (d.w.)	Cr µg/g (d.w.)	Fe µg/g (d.w.)	Zn µg/g (d.w.)
Sediment	Cm21	0,167	940	95,3	124	62 378	306

Comp. spec.	Note	As ng/ml	PFPA ng/L	PFHxA ng/L	PFHpA ng/L	PFOA ng/L	PFNA ng/L
Water	ALN 125x		2,59	2,29	1,89	3,36	1,77
Water	ALN 136x	0,809	4,29	6,44	6,12	9,51	1,49
Water	ALN 138x	0,300	1,07	1,65	1,18	3,03	0,76
Water	HOV 122z	1,609	1,85	3,71	2,92	5,59	1,06
Particles	ALN 125x		<0,5	<0,5	<0,5	<0,5	<0,5
Particles	ALN 136x	1,764	<0,5	<0,5	<0,5	<0,5	<0,5
Particles	ALN 138x	0,417	<0,5	<0,5	<0,5	<0,5	<0,5
Particles	HOV 122z	0,360	<0,5	<0,5	<0,5	<0,5	<0,5

Comp. spec.	Note	As µg/g (d.w.)	PFPA ng/g (d.w.)	PFHxA ng/g (d.w.)	PFHpA ng/g (d.w.)	PFOA ng/g (d.w.)	PFNA ng/g (d.w.)
Sediment	Cm21	53,7	<1	<0,5	<0,5	<0,5	<0,5

Comp. spec.	Note	PFDA ng/L	PFUdA ng/L	PFDoA ng/L	PFTrA ng/L	PFTeA ng/L	PFBS ng/L
Water	ALN 125x	0,77	<0,4	<0,4	<0,4	<0,4	2,56
Water	ALN 136x	0,70	<0,4	<0,4	<0,4	<0,4	3,84
Water	ALN 138x	0,47	<0,4	<0,4	<0,4	<0,4	0,46
Water	HOV 122z	0,63	<0,4	<0,4	<0,4	<0,4	1,27
Particles	ALN 125x	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Particles	ALN 136x	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Particles	ALN 138x	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1
Particles	HOV 122z	<0,5	<0,4	<0,4	<0,4	<0,4	<0,1

Comp. spec.	Note	PFDA ng/g (d.w.)	PFUdA ng/g (d.w.)	PFDoA ng/g (d.w.)	PFTrA ng/g (d.w.)	PFTeA ng/g (d.w.)	PFBS ng/g (d.w.)
Sediment	Cm21	<0,5	1,26	<0,4	<0,4	<0,4	<0.1

Comp. spec.	Note	PFHxS ng/L	PFOS ng/L	PFDS ng/L	PFDoS ng/L	PFOSA ng/L	me-PFOSA ng/L
Water	ALN 125x	0,29	4,95	0,30	<0,2	<0,1	<0,3
Water	ALN 136x	2,68	28,7	<0,2	<0,2	0,10	<0,3
Water	ALN 138x	0,23	3,02	<0,2	<0,2	<0,1	<0,3
Water	HOV 122z	0,20	2,46	<0,2	<0,2	<0,1	<0,3
Particles	ALN 125x	<0,1	<0,1	<0,2	<0,2	<0,1	<0,3
Particles	ALN 136x	<0,1	<0,1	<0,2	<0,2	<0,1	<0,3
Particles	ALN 138x	<0,1	<0,1	<0,2	<0,2	<0,1	<0,3
Particles	HOV 122z	<0,1	<0,1	<0,2	<0,2	<0,1	<0,3

Comp. spec.	Note	PFHxS ng/g (d.w.)	PFOS ng/g (d.w.)	PFDS ng/g (d.w.)	PFDoS ng/g (d.w.)	PFOSA ng/g (d.w.)	me-PFOSA ng/g (d.w.)
Sediment	Cm21	<0.1	0,53	<0,2	<0,2	<0.1	<0,3

Comp. spec.	Note	et-PFOSA ng/L	me-PFOSE ng/L	et-PFOSE ng/L	me-FOSAA ng/L	et-FOSAA ng/L	4:2 FTS ng/L
Water	ALN 125x	<0,3	<5	<5	<0,3	<0,3	<0,3
Water	ALN 136x	<0,3	<5	<5	<0,3	<0,3	<0,3
Water	ALN 138x	<0,3	<5	<5	<0,3	<0,3	<0,3
Water	HOV 122z	<0,3	<5	<5	<0,3	<0,3	<0,3
Particles	ALN 125x	<0,3	<5	<5	<0,3	<0,3	<0,3
Particles	ALN 136x	<0,3	<5	<5	<0,3	<0,3	<0,3
Particles	ALN 138x	<0,3	<5	<5	<0,3	<0,3	<0,3
Particles	HOV 122z	<0,3	<5	<5	<0,3	<0,3	<0,3

Comp. spec.	Note	et-PFOSA ng/g (d.w.)	me-PFOSE ng/g (d.w.)	et-PFOSE ng/g (d.w.)	me-FOSAA ng/g (d.w.)	et-FOSAA ng/g (d.w.)	4:2 FTS ng/g (d.w.)
Sediment	Cm21	<0,3	<5	<5	<0,3	<0,3	

Comp. spec.	Note	6:2 FTS ng/L	8:2 FTS ng/L	6:2 diPAP ng/L	TCC ng/L	Triclosan ng/L	BP3 ng/L
Water	ALN 125x	<0,3	<0,3		i.a.	i.a.	<5
Water	ALN 136x	0,62	<0,3		i.a.	i.a.	<5
Water	ALN 138x	<0,3	<0,3		i.a.	i.a.	<5
Water	HOV 122z	0,63	<0,3		i.a.	i.a.	<5
Particles	ALN 125x	<0,3	<0,3		i.a.	i.a.	<5
Particles	ALN 136x	<0,3	<0,3		i.a.	i.a.	<5
Particles	ALN 138x	<0,3	<0,3		i.a.	i.a.	<5
Particles	HOV 122z	<0,3	<0,3		i.a.	i.a.	<5

Comp. spec.	Note	6:2 FTS ng/g (d.w.)	8:2 FTS ng/g (d.w.)	6:2 diPAP ng/g (d.w.)	TCC ng/g (d.w.)	Triclosan ng/g (d.w.)	BP3 ng/g (d.w.)
Sediment	Cm21	<0,3	<0,3		3,40	<10	<50

Comp. spec.	Note	EHMC ng/L	OC ng/L
Water	ALN 125x	<10	<5
Water	ALN 136x	<10	<5
Water	ALN 138x	<10	<5
Water	HOV 122z	12,0	45,0
Particles	ALN 125x	60,0	<15
Particles	ALN 136x	<50	32,0
Particles	ALN 138x	<50	27,0
Particles	HOV 122z	90,0	46,0

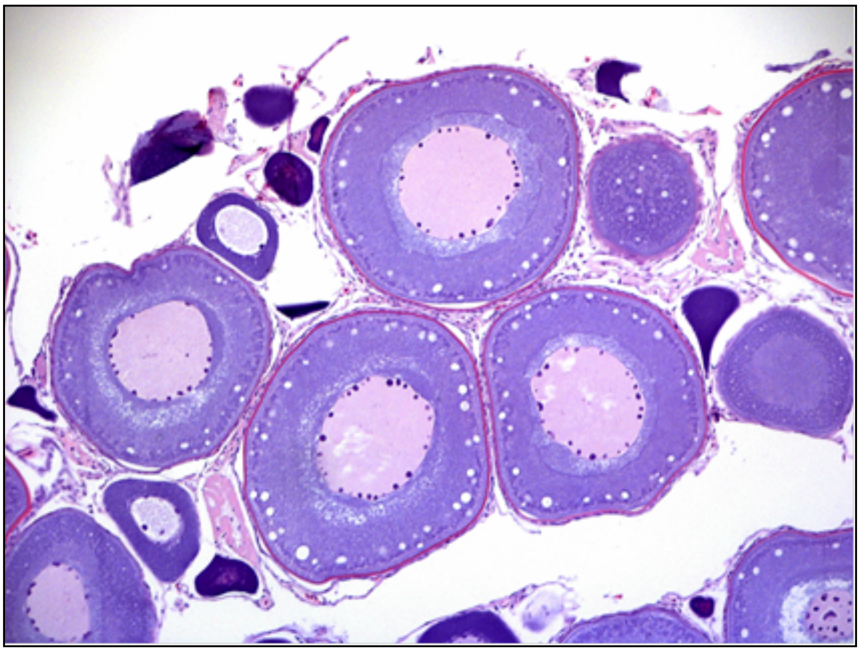
Comp. spec.	Note	EHMC ng/g (d.w.)	OC ng/g (d.w.)
Sediment	Cm21	22,6	22,4

Compound	CAS
Mercury (Hg)	7439-9-76
Lead (Pb)	7439-92-1
Cadmium (Cd)	7440-43-9
Nickel (Ni)	7440-02-0
Silver (Ag)	7440-22-4
Copper (Cu)	7440-50-8
PCB 28	7012-37-5
PCB 52	35693-99-3
PCB 101	37680-73-2
PCB 118	31508-00-6
PCB 138	35065-28-2
PCB 153	35065-27-1
PCB 180	35065-29-3
PFBS	29420-49-3
PFHxS	82382-12-5
PFOS	4021-47-0
(P)FOSA	754-91-6
N-Et-FOSA	4151-50-2
N-Et-FOSE	1691-99-2
N-Me-FOSA	31506-32-8
N-Me-FOSE	24448-09-7
N-Me-FOSEA	25268-77-3
BDE 28	41318-75-6
BDE 47	5436-43-1
BDE 99	60348-60-9
BDE 100	189084-64- 8
BDE 126	366791-32-4
BDE 153	68631-49-2
BDE 154	207122-15-4
BDE 183	207122-16-5
BDE 196	32536-52-0
BDE 202	67797-09-5
BDE 206	63387-28-0
BDE 207	437701-79-6
BDE 209	1163-19-5

DBDPE	84852-53-9
Bisphenol A	80-05-7
Bisphenol S	80-09-1
Bisphenol F	620-92-8
Octylphenol	27193-28-8 (1806-26-4, 67632-66-0, 140-66-9)
(4-)nonylphenol	104-40-5 (25154-52-3, 84852-15-3)
TBBPA	79-94-7
SCCP (C10-C13)	85535-84-8
MCCP (C14-C17)	85535-85-9
p,p´-DDT	50-29-3
p,p´-DDE	82413-20-5
p,p´-DDD	72-54-8
Tri-iso-butylphosphate (TIBT)	126-71-6
Tributylphosphate (TBP)	126-73-8
Tri(2-chloroethyl)phosphate	115-96-8
Tri(1-chloro-2-propyl)phosphate (TCP	13674-84-5
Tri(1,3-dichloro-2-propyl)phosphate (	13674-87-8
Tri(2-butoxyethyl)phosphate (TBEP)	78-51-3
Triphenylphosphate (TPhP)	115-86-6
2-ethylhexyl-di-phenylphosphate (EHI	1241-94-7
Dibutylphenylphosphate (DBPhP)	2528-36-1
Butyldiphenylphosphate (BdPhP)	2752-95-6
Tris(2-ethylhexyl)phosphate (TEHP)	78-42-2
Tris-o-cresyl phosphate (ToCrP)	78-30-8
Tricresylphosphate (TCrP)	1330-78-5
Octocrylene	6197-30-4
Benzophenone-3	131-57-7
Ethylhexylmethoxycinnamate	5466-77-3
D4	556-67-2
D5	541-02-6
D6	540-97-6
Triclosan	3380-34-5
Triclocarban	101-20-2

International Research Institute of Stavanger

Urban Fjord project 2015
Report



Daniela M. Pampanin, Evgenia Dunaevskaya

Urban fjord project
Histopathological analysis of gonads in Atlantic cod

Report 2015-207

Project number:	7911944
Project title:	Biomonitoring screening – NIVA
Client(s):	NIVA

Stavanger, 30/11/2015

(Daniela M. Pampanin) Sign.date
Project Manager

(Thorleifur Agustsson) Sign.date
Sr. Vice President

Preface

The objective of this work was to perform histological analysis of gonad of Atlantic cod collected in a Urban fjord.
The method used is considered to be the best available technology for the assessment of histological status of gonads, including histopathological conditions.
Samples were received from NIVA in Oslo, they were preserved in formalin solutions. The analyses were performed in October-November 2015.

Stavanger, November 2015

Daniela M. Pampanin

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1. Introduction

1.1 Purpose of the study

The purpose of this work was to perform histological analysis of gonadic tissue of Atlantic cod collected in an Urban fjord area.
Fish samples were collected by NIVA in August and afterwards delivered to IRIS laboratory for the analysis.
The method used is considered to be the best available technology for the assessment of histological status of gonads, including histopathological conditions.

1.2 Histological evaluation of fish tissues

Histological parameters are commonly used as markers of health status in various fish species. The identification of pathologies and diseases are increasingly being used as indicators of environmental stress since they provide a definite and ecologically-relevant end-point for chronic/ sub chronic contaminant exposure (Au, 2004). The application of histological markers in fish can include measures of reproductive and metabolic condition, and allows for the detection of various pathogens that may affect population mortality. The data generated from this type of analysis in various organs (i.e. gills, gonads, digestive gland) is helpful in providing information for biomonitoring programme (Corbett et al., 2011).
Histopathological alterations illustrate a definitive endpoint of historical exposure, intermediate between initial biochemical changes and reproductive capability and growth (Stentiford et al., 2003, Salamat et al., 2013).

2. Materials and Methods

2.1 Source of fish

Samples were collected by NIVA and delivered to IRIS for the histological evaluation of gonadic tissue. In total 15 samples of Atlantic cod were analysed, 11 female and 4 male individuals.

2.2 Histopathology in gonads

Gonad were dissected, putted in histocassette and placed into histological fixative (3.7% formaldehyde) for wax sections. Tissue samples were no thicker than 1 cm to ensure proper fixation. Samples were then stored at 4˚C until embedding.
Histological sections (3 μm) were prepared at Stavanger University Hospital (SUS). The tissues were examined for health parameters related to physiological conditions, inflammatory and non-specific pathologies and those associated with pathogen and parasites infections. Gonad abnormalities were scored using the criteria suggested by Benly et al. (2008) and Sensini et al. (2008). Each alteration was scored according to its severity and frequency (0 = absence of alteration, 1 = ≤ 10 % of the histological section showed the alteration, 2 = between 10% and 50% of the histological section showed the

alteration, 3 = between 50% and 100% of the histological section showed the alteration).

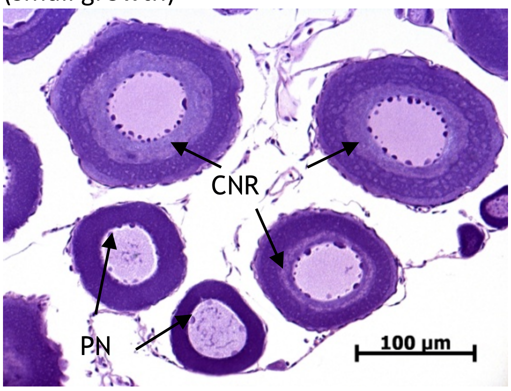
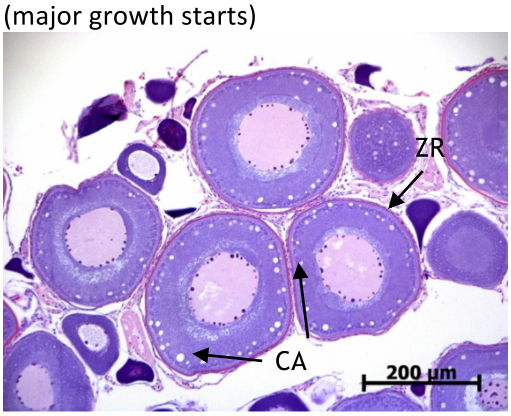
The presence of parasites and non-specific inflammation were scored as absent (0) or present (1). All micrographs were captured using an AxioCam MRc5 (Zeiss) digital camera mounted on a *Zeiss Axioplan 2* light microscope (Göttingen, Germany). The slides were analysed blind.

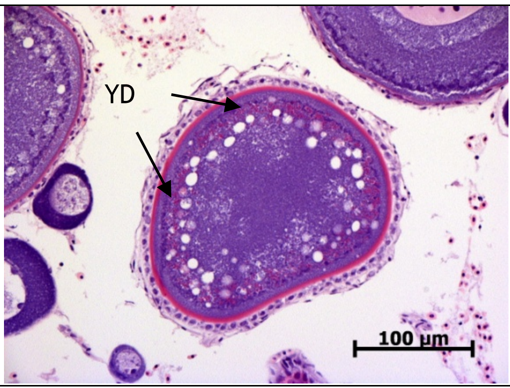
The stage of the gonads were also evaluated.

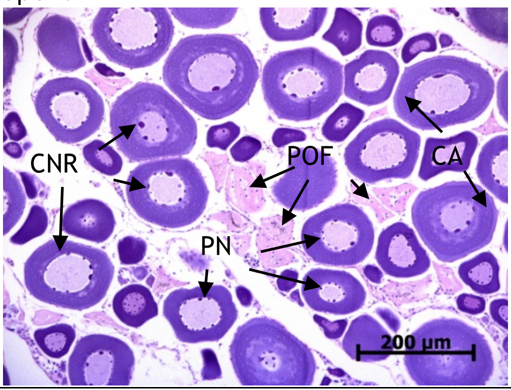
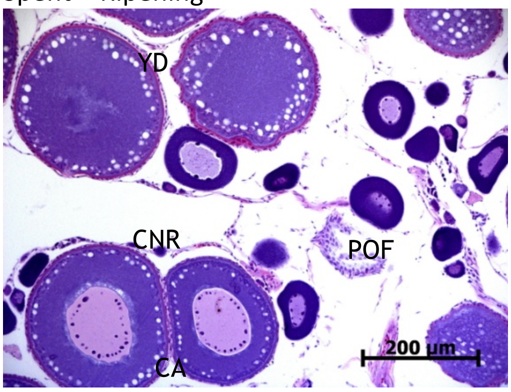
3. Results

First of all a table was built to score the gonad development, including some pictures. The summary of reproductive stages of Atlantic cod, both female and male individuals, is reported in Table 1.

Table 1 - Summary of reproductive stages of Atlantic cod

Reproductive stage	Description
1. Immature (small growth)  	Ovary wall thin. Oocytes vary from small (20 µm) with pale uniform cytoplasm to larger with basophilic cytoplasm apart from ølight ring of mitochondria around nucleus. Oocytes up to about 130 µm in diameter are irregular in outline, then round. Several nucleoli at periphery of nucleus – **perinuclear stage PN**. Ring of mitochondria moves away – **circumnuclear ring stage CNR.**
2. Mature Ripening 1 (major growth starts)  	Zona radiata (**ZR**) appears as eosinophilic ring. Cortical alveoli appear in peripheral cytoplasm – **CA** * *Image is from stage 5, to show oocytes in stage of major growth but not the characteristics of the ovary*
3. Ripening 2 (early and late vitellogenesis)	Yolk droplets **YD** first appear as small inclusions between vesicles, then enlarge and fill whole cytoplasm, restricting CA to periphery. Zona radiate widens and forms

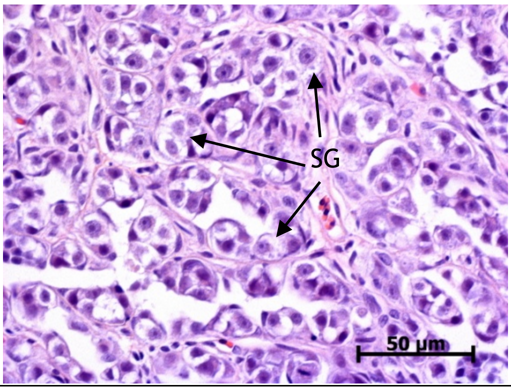
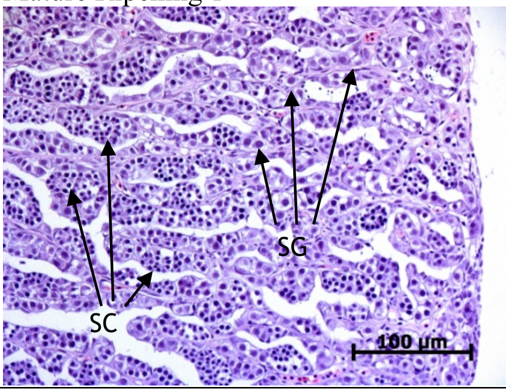
<table>
<tr>
<td>
</td>
<td>two layers in which radial striations can be seen. Irregular outlines of nucleus, nucleoli detached from periphery

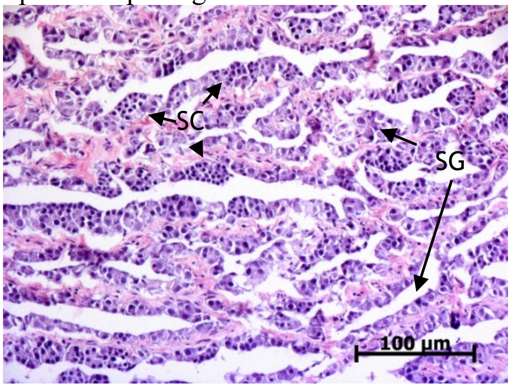
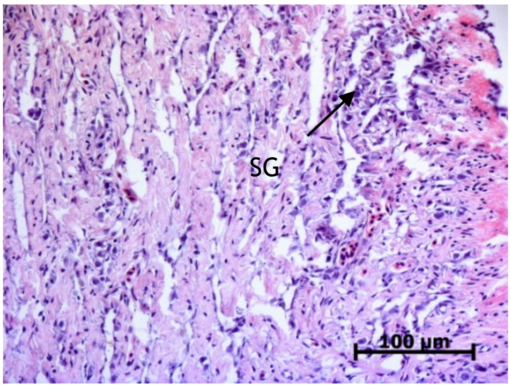
* Image is from stage 6 (spent ripening), to show oocytes in stage of vitellogenesis but not the characteristics of the ovary</td>
</tr>
<tr>
<td>4. Ripe and Spawning</td>
<td>Oocytes hydrates in batches. Yolk as homogenous mass.</td>
</tr>
<tr>
<td>5. Spent

</td>
<td>Empty follicles (post ovulatrory follicles POF) and a few atretic hydrated oocytes. Small oocytes: formation of zona radiata, CA</td>
</tr>
<tr>
<td>6. Spent – Ripening


6*. Resting

(see stage 5)</td>
<td>Oocytes start vitellogenesis, empty follicles but no atretic hydrated oocytes

Larger oocytes in CNR stage</td>
</tr>
</table>

Reproductive stage of males	Description
1. Immature 	Wall thin. Spermatogonia present single or in small groups
2. Mature Ripening 1 	Cysts of spermatocytes form
3. Ripening 2	All stages of development. Earlier stages along distal edge. In later stages cysts containing mature spermatozoa break down and coalesce to form tubules filled with spermatozoa, but lined with developing cysts. Few spermatozoa in large efferent ducts near mesochrium
4. Ripe and Spawning	All tubules and efferent ducts packed with spermatozoa. Few developing cysts left in early part of stage. Single or small groups spermatogonia in lining of tubules will give rise to SZ in next spawning season.
5. Spent	Tubules contain SZ. But few in large efferent ducts near mesochrium. Spermatogonia in distal part of testis

<table>
<tr><td>6. Spent – Ripening
</td><td>Cysts of spermatogonia SG and spermatocytes SC form in distal part of testis, SZ visible in proximal part</td></tr>
<tr><td>6*. Resting
</td><td>Distally only spermatogonia SG present. SZ may still be present in efferent ducts</td></tr>
</table>

Most of the fish were in spent stage of development (5 specimens) or either ripening (3 specimens) or resting (4 specimens). Three individuals (1 male, 2 females) probably immature, this should be checked by size/age/gross morphology. The overview of the results is reported in Table 2 and 3.

Table 2 – Results of female cod

Fish code n	**1**	**10**	**12**	**13**	**16**	**17**	**18**	**20**	**25**	**26**	**27**
Stage	5	1/6*	6	6	5	5	5	1/6*	6	6	5
Increased oocyte atresia											
Perifollicular cell hyperplasia/hypertrophy											
Decreased vitellogenesis											
Changes in gonadal staging											
Interstitial fibrosis											
Egg debris in the oviduct											
Increased vascular or interstitial proteinaceous						1	1				
Granulomatous inflammation	2				2		1				
Parasite											
Postovulatory follicles	2				2	2	2				1
Atretic follicles					2					1	
mmc	2				2	3		1		1	1

*Immature or resting, the results should be confirmed by size/age/gross morphology.

Table 3 – Results of male cod

Fish code n	**14**	**19**	**23**	**28**
Stage	1/6*	6	6	6
Increased proportion of spermatogonia				
Presence of testis-ova				
Increased testicular degeneration (apoptotic)				
Interstitial (Leydig) cell hyperplasia/hypertrophy				
Decreased proportion of spermatogonia				
Interstitial fibrosis				
Increased vascular or interstitial proteinaceous fluid			2	
synchronous gonad development				
Altered proportions of spermatozoa or spermatocytes				
Gonadal staging				
Granulomatous inflammation				1
Parasite				1
mmc				2

*Immature or resting, the results should be confirmed by size/age/gross morphology.

Few extra observations are reported below, including images. Three individuals were characterized by increased vascular fluid (VF) what is considered to be a normal condition for spent gonads (Fig.1 and 2).

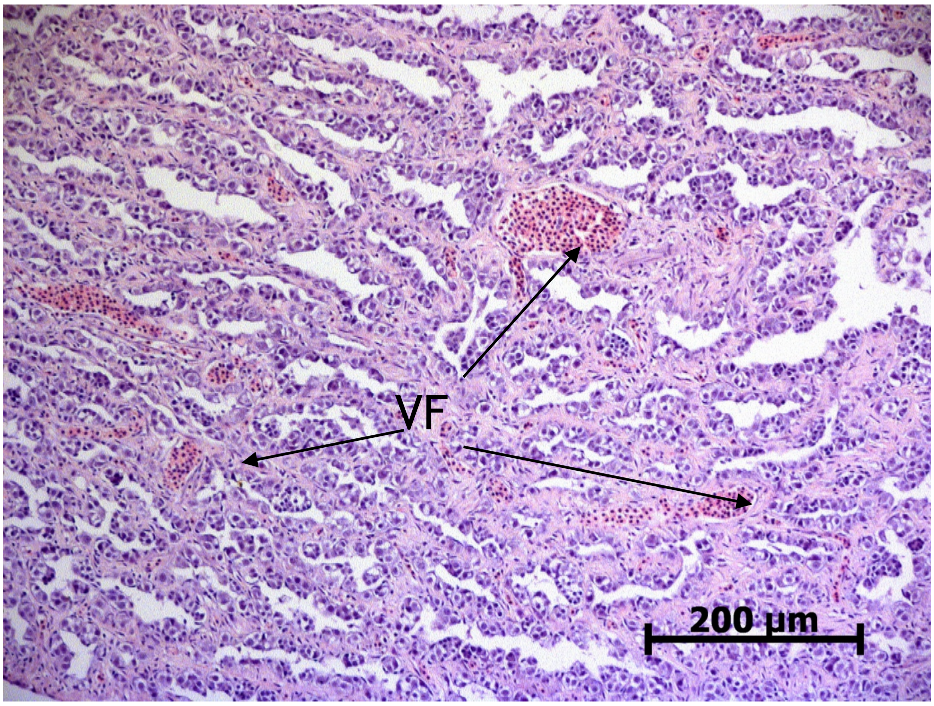


Figure 1

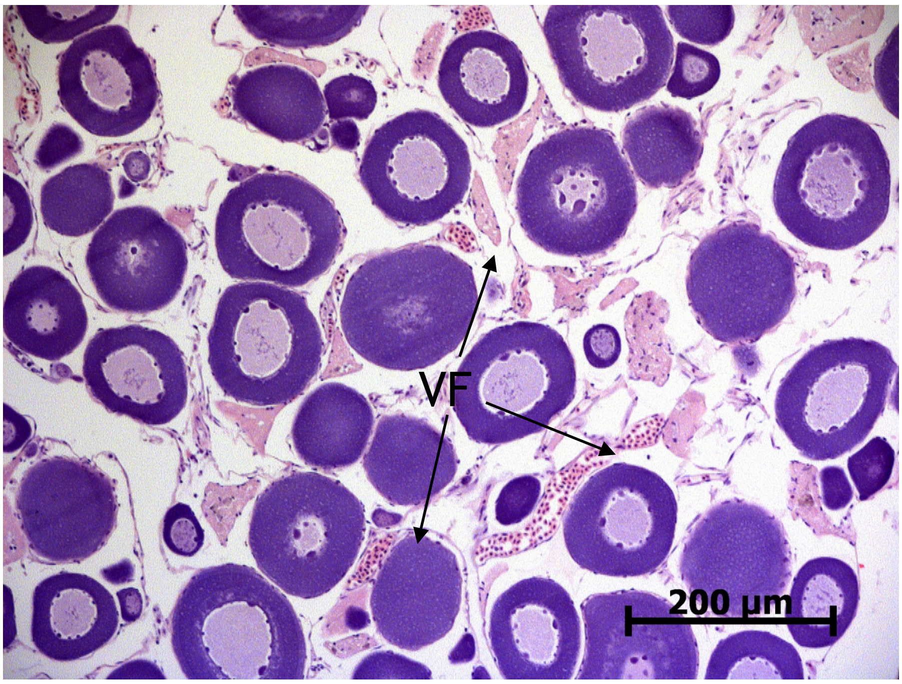


Figure 2.

In 1 female granulomatous inflammation (G) together with fibrosis appeared during normal spawning process as utilization of atretic hydrated oocytes. In 2 female specimens granulomas (G) were sign of pathology (one mild and one moderate) as utilization of oocytes failed to mature. One male specimen was characterized by mild degree of granulomatous inflammation and MMC presence, in addition it was affected by parasite (p) (Fig. 3, 4 and 5).

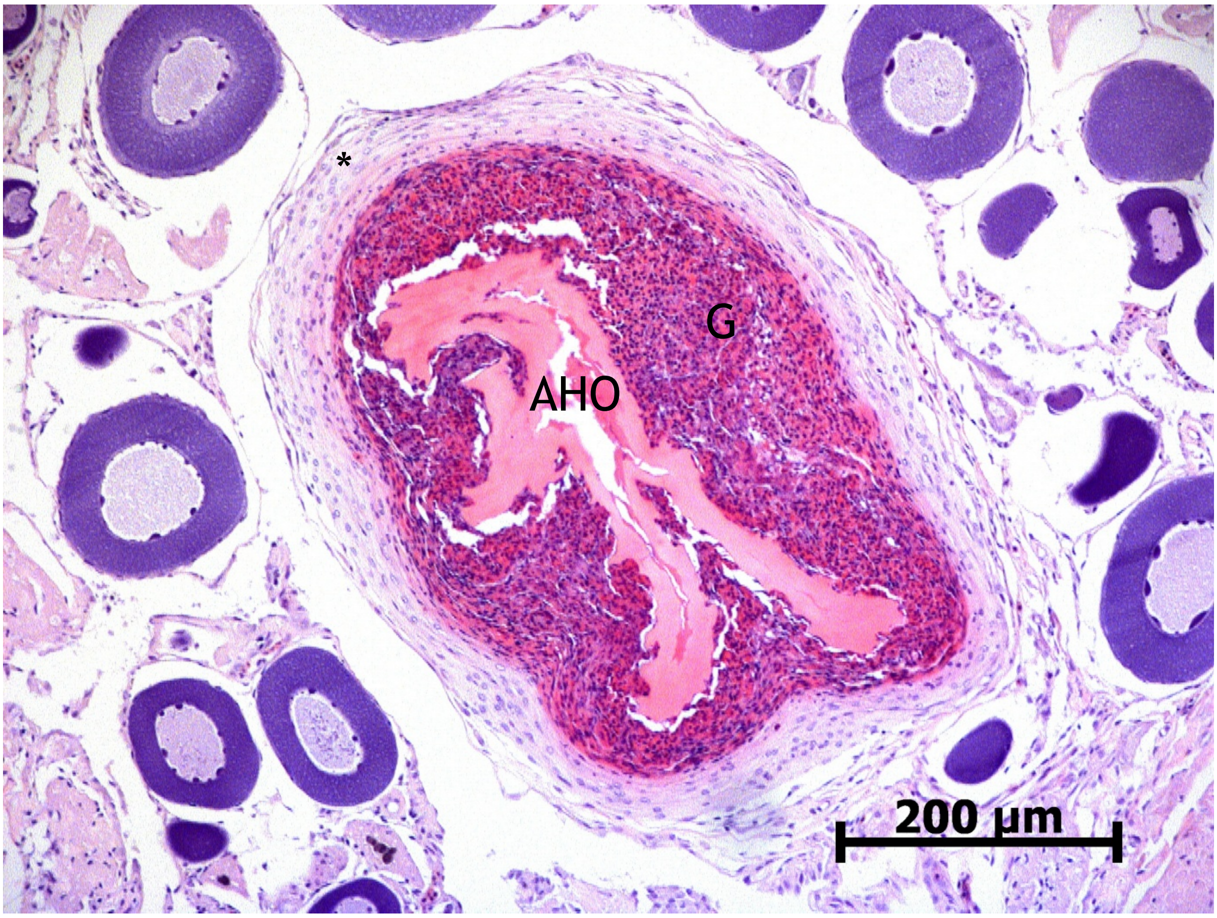


Figure 3 - * fibrous capsule: macrophages and fibroblasts; AHO – atretic hydrated oocyted; G – granulomatous inflammation.

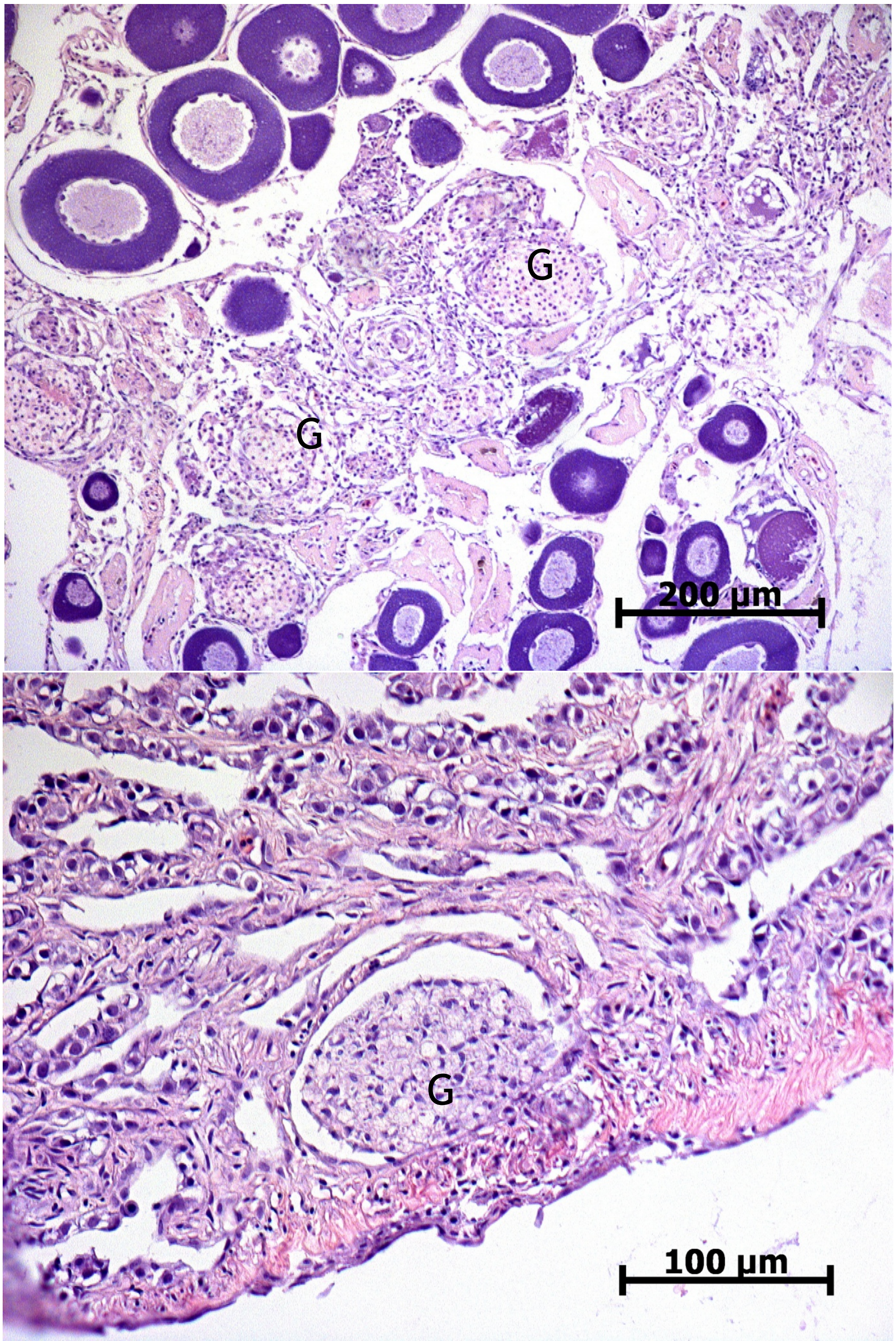


Figure 4.

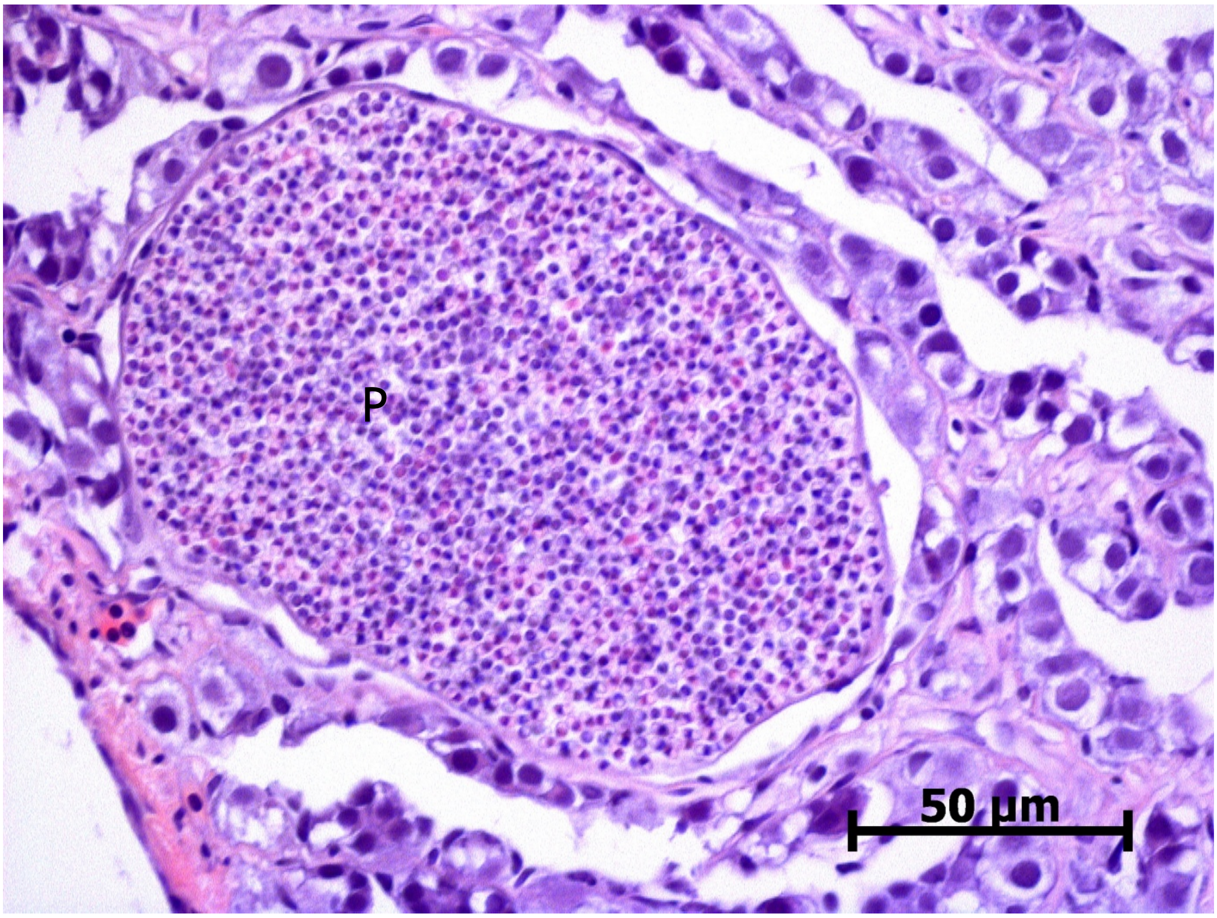


Figure 5.

The post-ovulatory follicles recorded in 5 female individuals simply characterize spent gonads. Occurrence of melanomacrophage complexes (MMC) is also a generalized mechanism of gonadal regression. MMC are thought to be involved in the processing of breakdown products associated with atresia of non-spawned oocytes or post ovulatory follicles. In total 7 individuals showed the presence of MMC (Fig. 6).

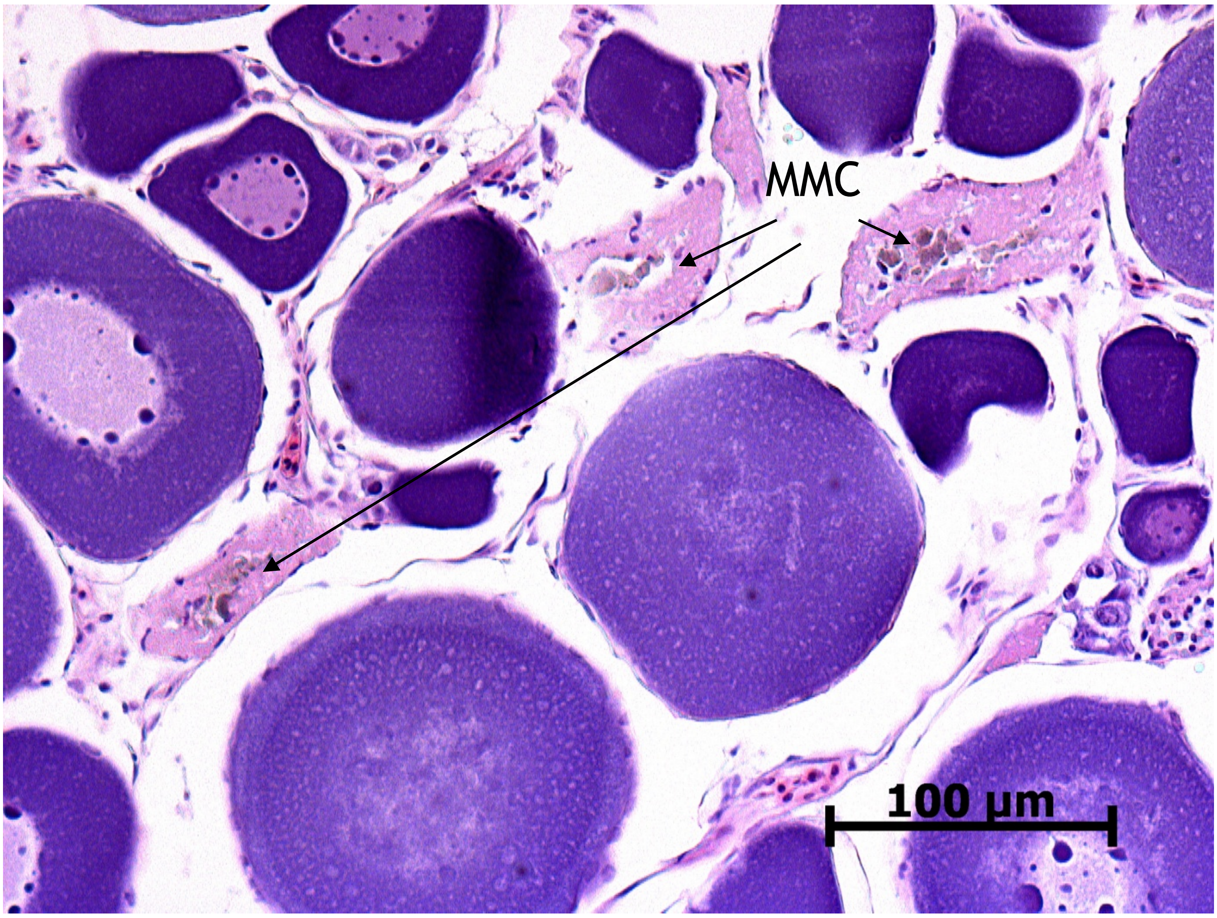


Figure 6.

It can be concluded that there were only 3 individuals with pathological changes in gonads, i.e. granulomatous inflammation. And only one of them had it at a moderate stage.

4. References

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