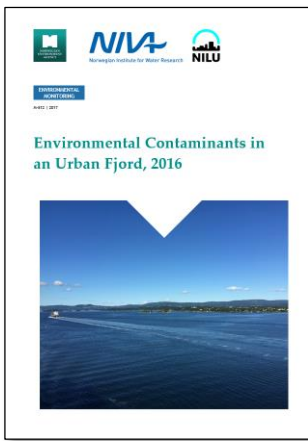


Monitoring of contaminants in Norwegian city animals and urban lakes and fjords

«Environmental contaminants in an urban fjord»

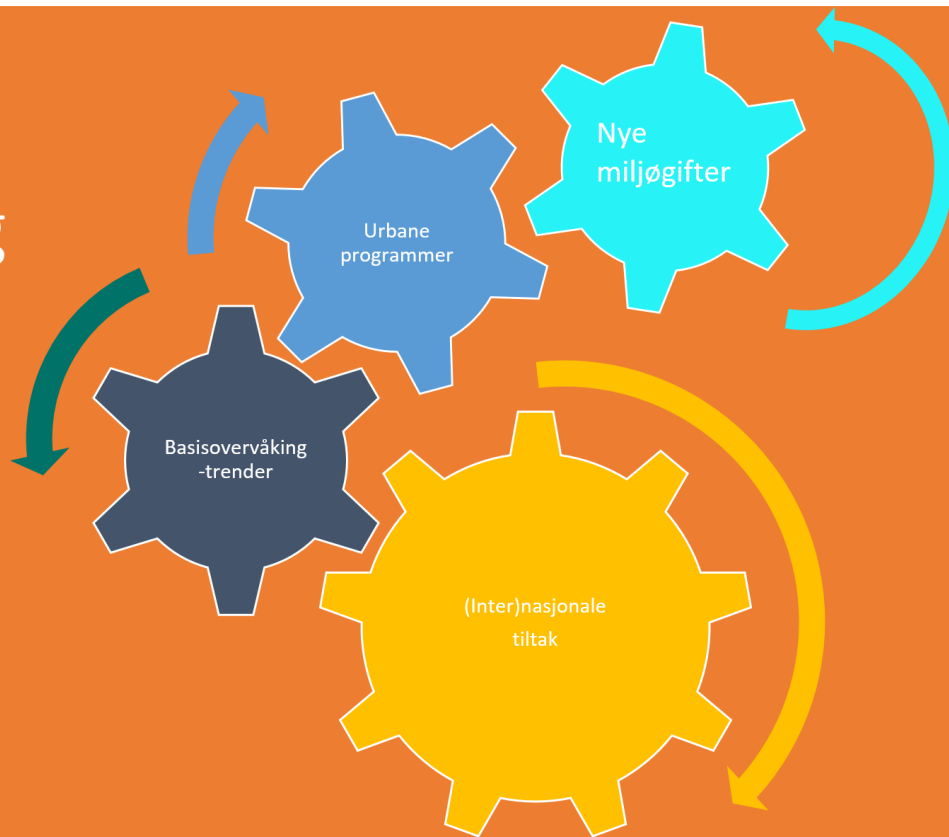




Objectives:

- Investigate inputs of environmental contaminants that are present in a densely populated area and study how these affect a fjord system
- Estimate the degree of bioaccumulation of selected environmental contaminants at multiple trophic levels in a marine food web
- Connect exposure of environmental contaminants to toxic effects at different biological levels
- Identify sources and sinks of environmental contaminants in fjord systems, and design targeted measures
- Provide data that will assist in implementing the requirements of the Water Framework Directive (EU)

Vår strategi på miljøgiftovervåking



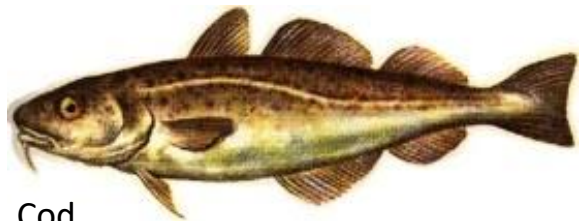
Sampling

Overview of samples collected for the "Urban Fjord" programme, including optional sampling conducted in 2017.			
Species/matrix	Locality	Frequency	No. for analysis
Sediment	Cm21	Once per year	1
Polychaetes	Cm21	Once per year	3 pooled samples
Zooplankton (krill)	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 and <u>Revlingen *</u>	Once per year	15 individuals
Herring gull (egg)	Søndre skjælholmen and <u>Revlingen *</u>	Once per year	15 eggs
<u>Eider duck (blood) *</u>	Inner Oslofjord	Once	15 individuals
<u>Eider duck (egg) *</u>	Inner Oslofjord	Once	15 eggs
Inputs storm water		Once per year	4 samples (2 samples of dissolved fraction plus 2 of particulate fraction)
Inputs from Sewage Treatment Plant	Bekkelaget	Twice per year	4 samples (2 samples of discharge water and 2 samples of sludge)

* Optional activity conducted in 2017

2017

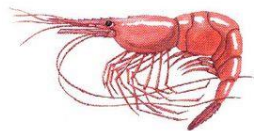
Sampling



Cod



Herring



Prawn

Zooplankton
(Krill)



Common eider
(2017)



Blue mussel



Polychaeta

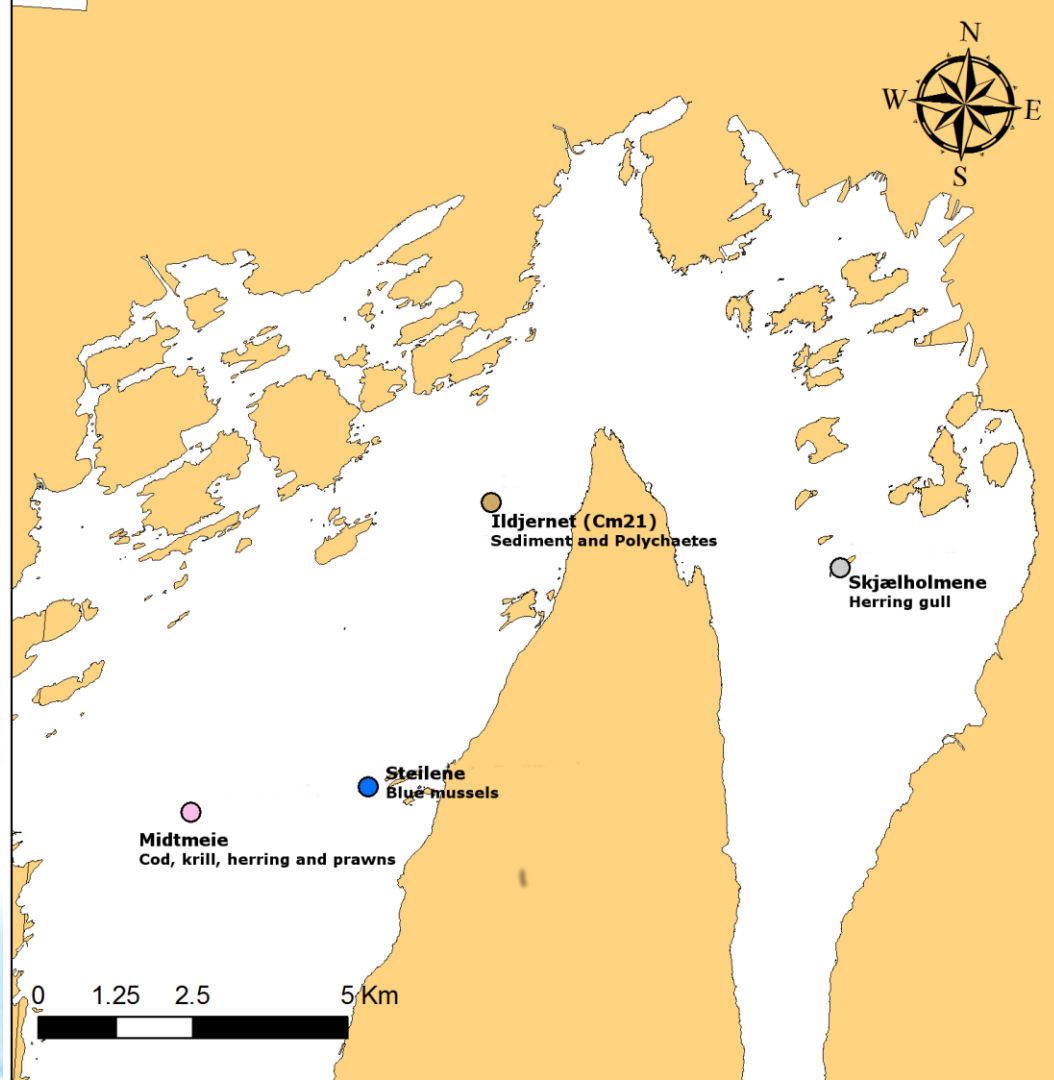


Herring gull



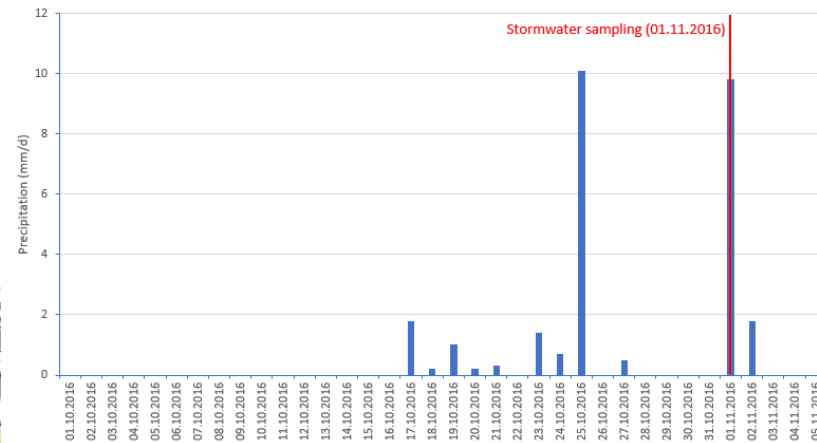
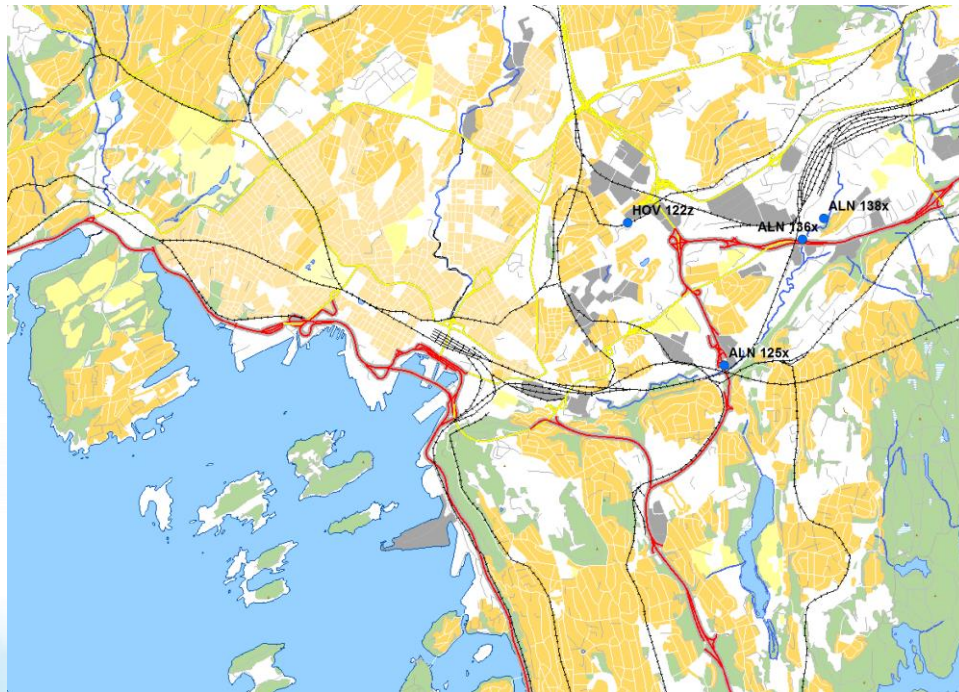
Sediment

Sampling

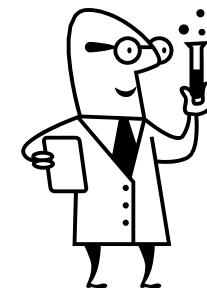


Sampling

Stormwater



Analytes



In addition:

- Biological effect parameters
 - AChE
 - Micronuclei
 - Vitellogenin
 - Histopathologi

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, Sb)
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, 4:2 FTS, PFDS, PFDoS, N-EtFOSE, N-MeFOSE, N-EtFOSA, N-MeFOSA, N-MeFOSAA, N-EtFOSAA) Perfluorinated carboxylic acids (6-15 C-atoms): PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnA, PFDoA, PFTra, PFTeA, PFPeA (plus PFPS, PFHpS, PFNS and 10:2 FTS)
Brominated flameretardants	PBDEs: BDE-47, -99, -100, -126, -153, -154, -175, -183, -190, -196, -202, -206, -207, and -209. Tetrabromobisphenol A (TBBPA), Decabromodiphenyl ethane (DBDPE), Bis(2-ethylhexyl) tetrabromophthalate (TBPH/BEH-TBP), Hexabromobenzene (HBB), pentabromotoluene (PBT)
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-specific, i.e. we separate 4- and 4-tert)
UV-chemicals	Octocrylene, benzophenone-3, ethylhexylmethoxycinnamate
Chloroparaffins	SCCP (C10-C13) and MCPP (C14-C17)
Siloxanes	Octamethylcyclotetrasiloxane (D4), decamethylcyclopentasiloxane (D5), dodecamethylcyclohexasiloxane (D6) Tris(trimethylsiloxy) Phenylsilane (M3T(Ph))
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-butoxyethyl)phosphate (TBEP), triphenylphosphate (TPHP), 2-ethylhexyl-di-phenylphosphate (EHDPP), dibutylphenylphosphate (DBPhP), butyldiphenylphosphate (BdPhP), tris(2-ethylhexyl)phosphate (TEHP), tris-o-cresylphosphate (ToCrP), tricresylphosphate (TCrP)
Antioxidant MB1	4,4'-methylenebis[2,6-bis (1,1 dimethylethyl)-phenol]

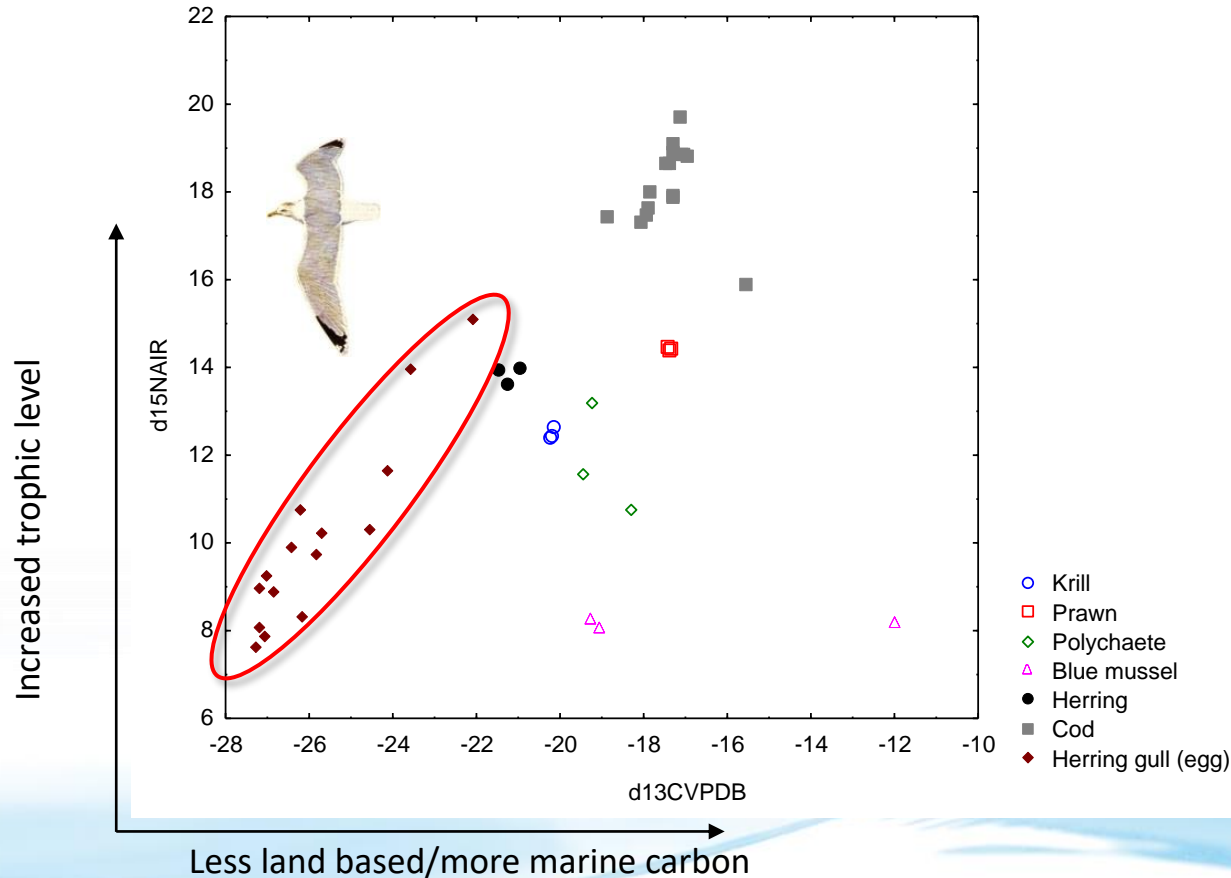
Specifics regarding compounds optionally analysed in 2017. (See the Appendix for CAS-no.).	
Parameter	Single compounds
M3T(Ph)	Tris(trimethylsiloxy) Phenylsilane (siloxane)
MB1	4,4'-methylenebis[2,6-bis (1,1-dimethylethyl)-phenol]
F53/F53B	F-53 (potassium 1,1,2,2-tetrafluoro-2-(perfluorohexyloxy)ethane sulfonate) F 53B (potassium 2-(6-chloro-1,1,2,2,3,3,4,4,5,5,6,6-dodecafluorohexyloxy)-1,1,2,2-tetrafluoroethane sulfonate)
Decloranplus	Decloranplus, Dec-602, -603 og -604
Behentrimonium	ATAC-C20 and ATAC-C22

Support parameters

Supportparameters included in the programme		
Parameter	Specific single parameters	Comment
Stable isotopes	$\delta^{15}\text{N}$ and $\delta^{13}\text{C}$	In biological matrices
Lipid content (%) in biota		In biological matrices
Weight and length		Fish
Age		Cod
Grain size distribution	Fraction <63 μm	Sediment
TOC		Sediment

The food web

Balanced
design

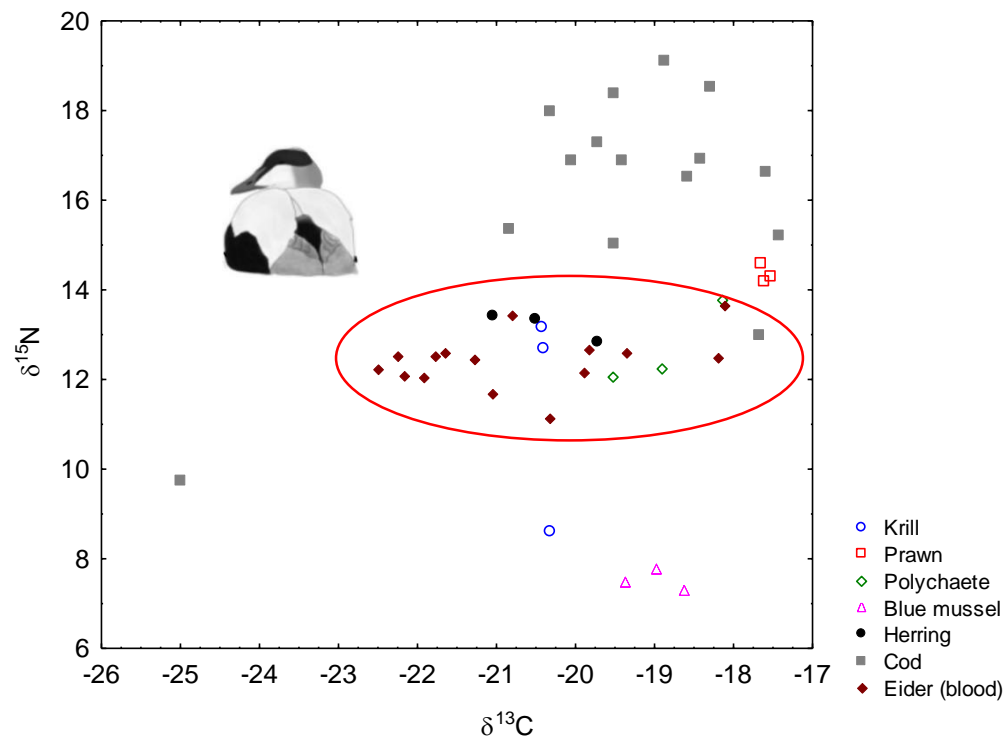


Not much «sea food» for these gulls...



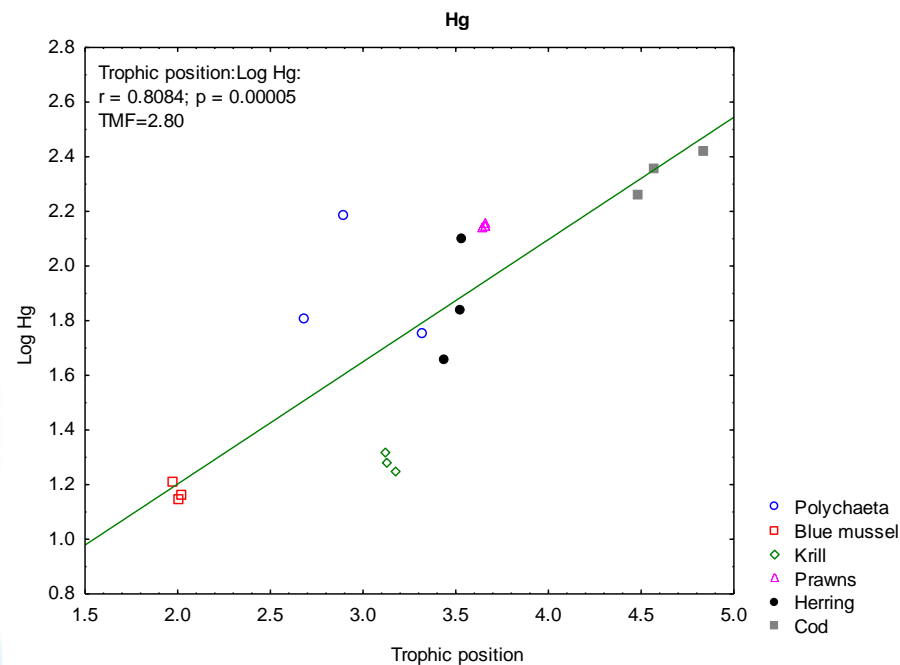
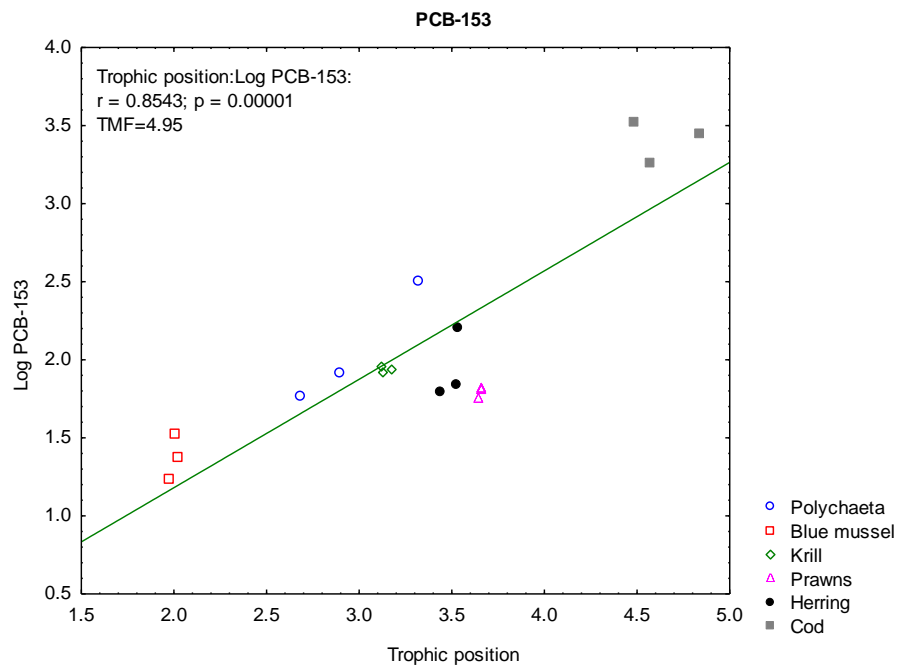
Photo: Morten Helberg

Eider

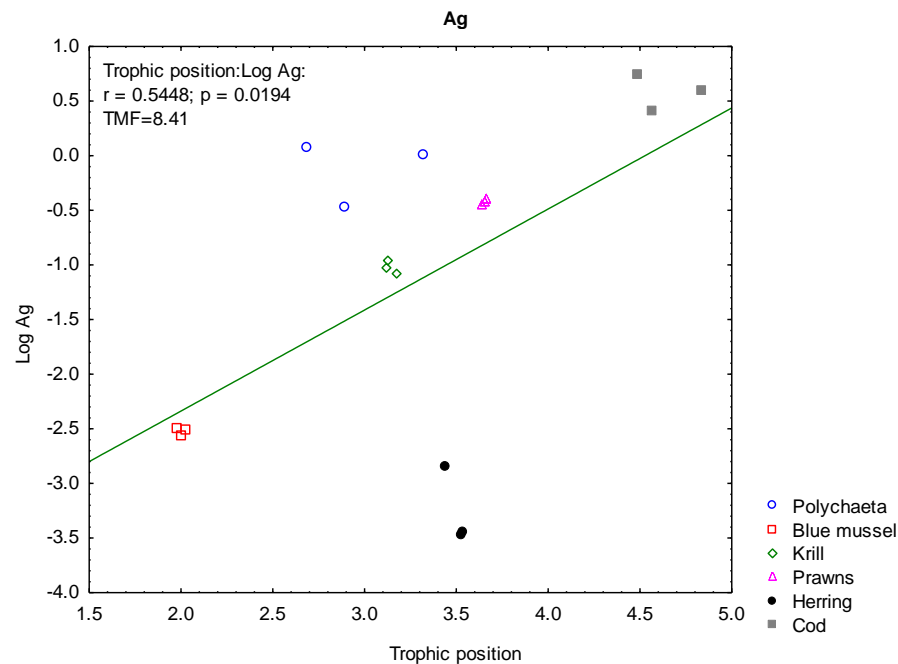
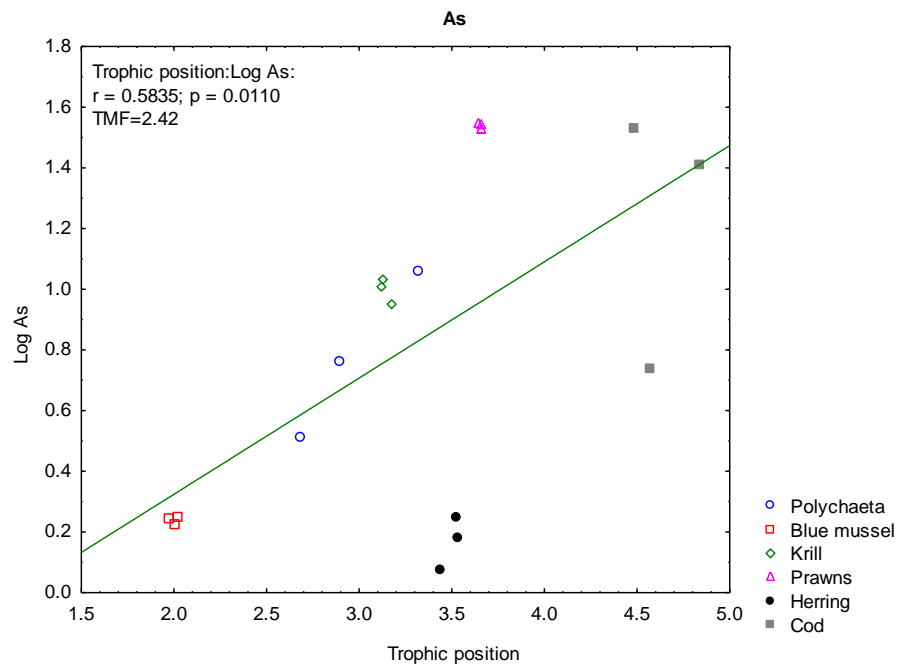


Results: The Oslofjord marine food web

also:
27 PCB congeners
7 PBDE congeners
PFOS and PFOSA

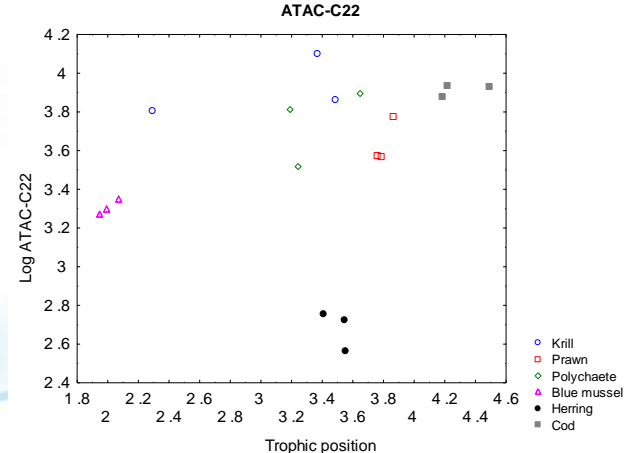
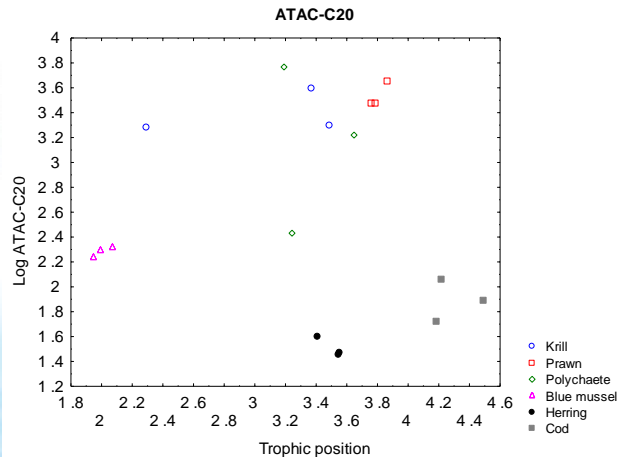
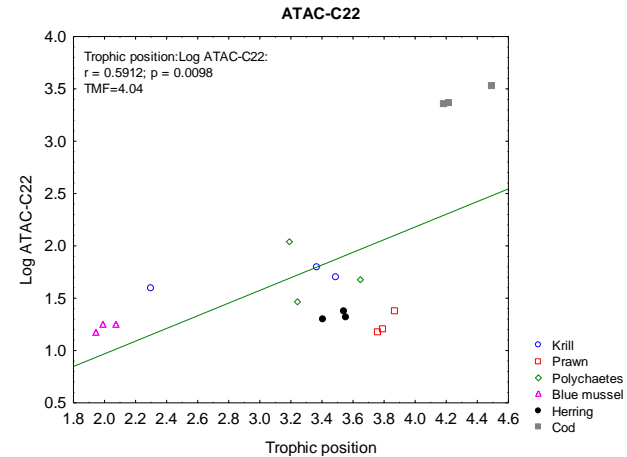
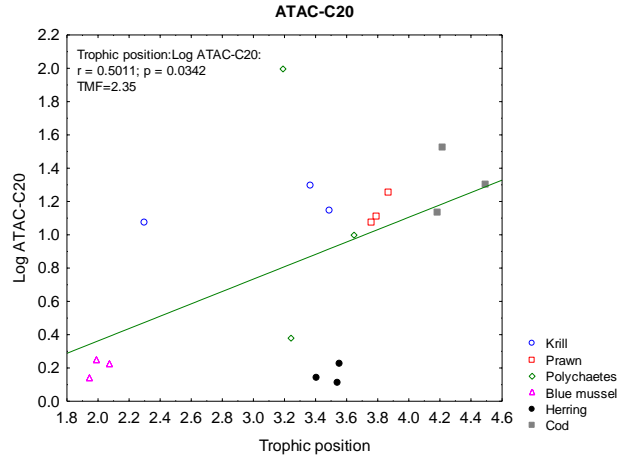


Results: The Oslofjord marine food web

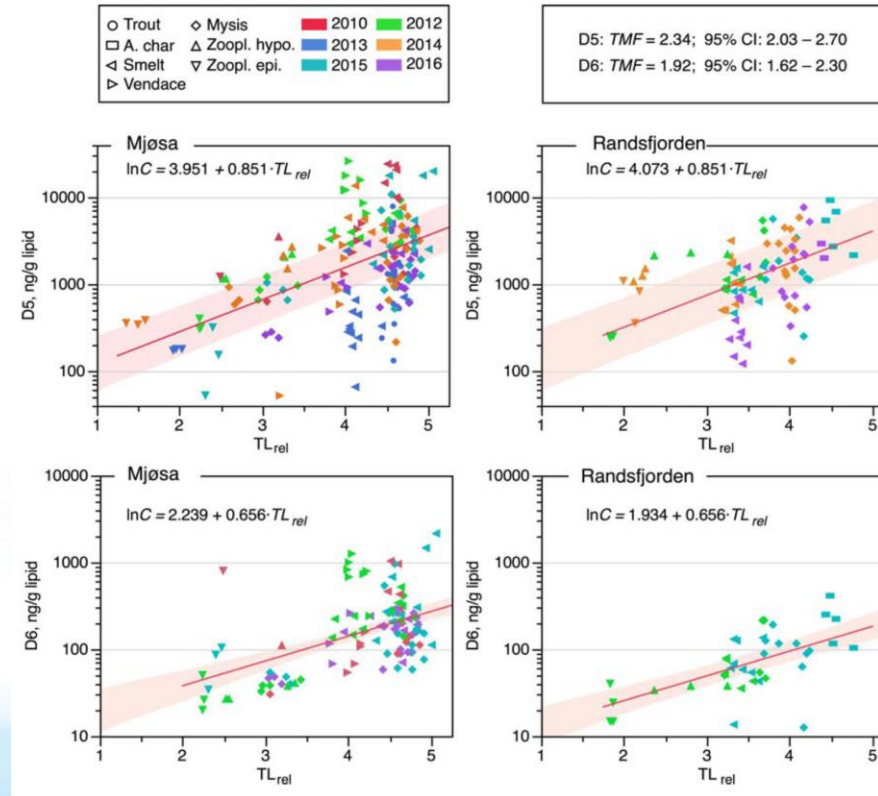


The Oslofjord marine food web

W.W.

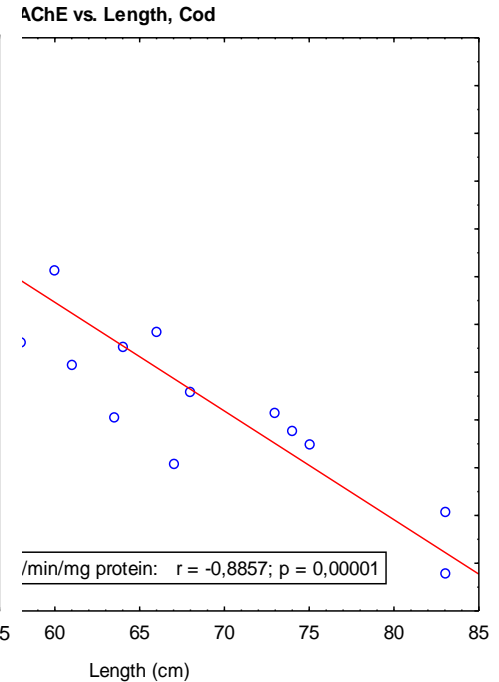
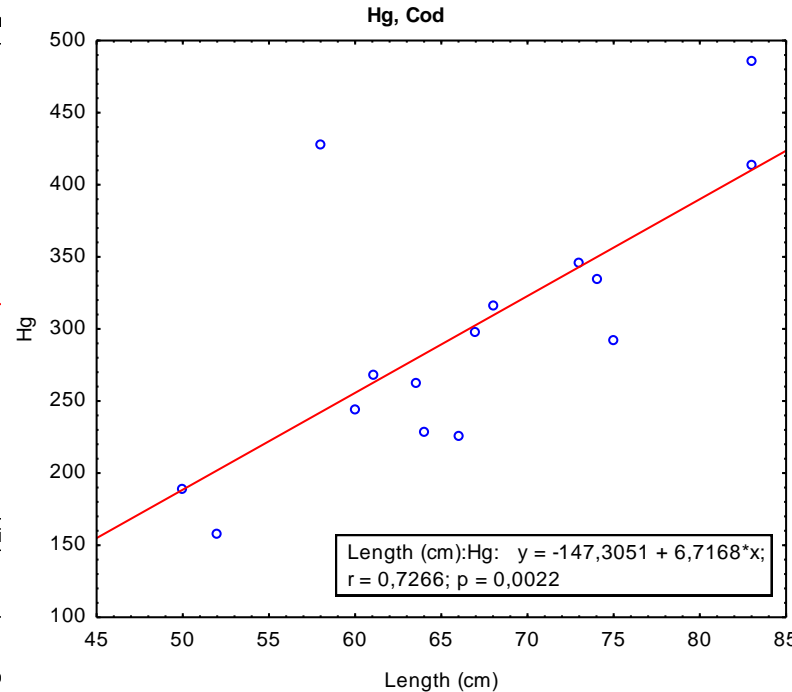
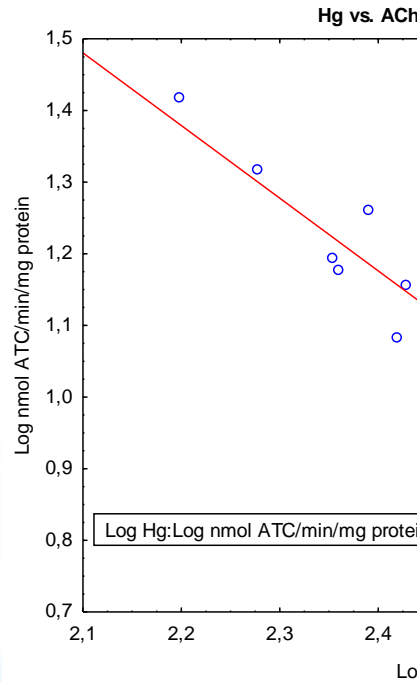


Siloxanes in Norwegian lake food webs

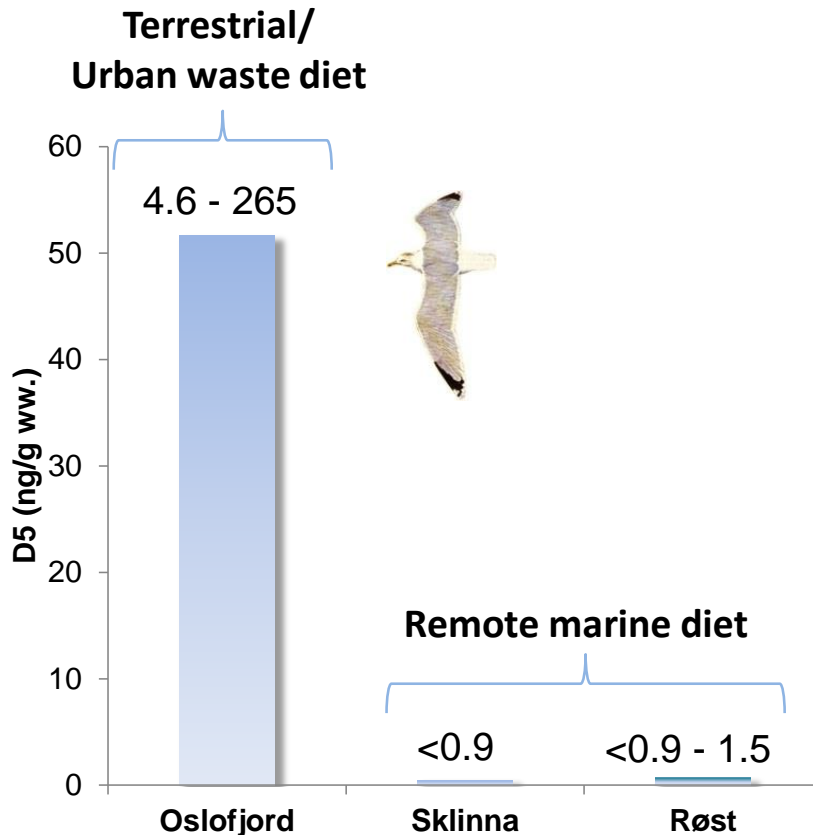
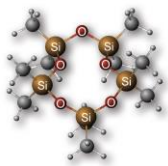


Cod, 2015

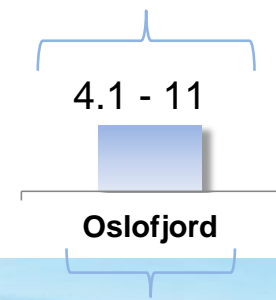
A result of lower AChE: muscle protein-ratio in larger cod?



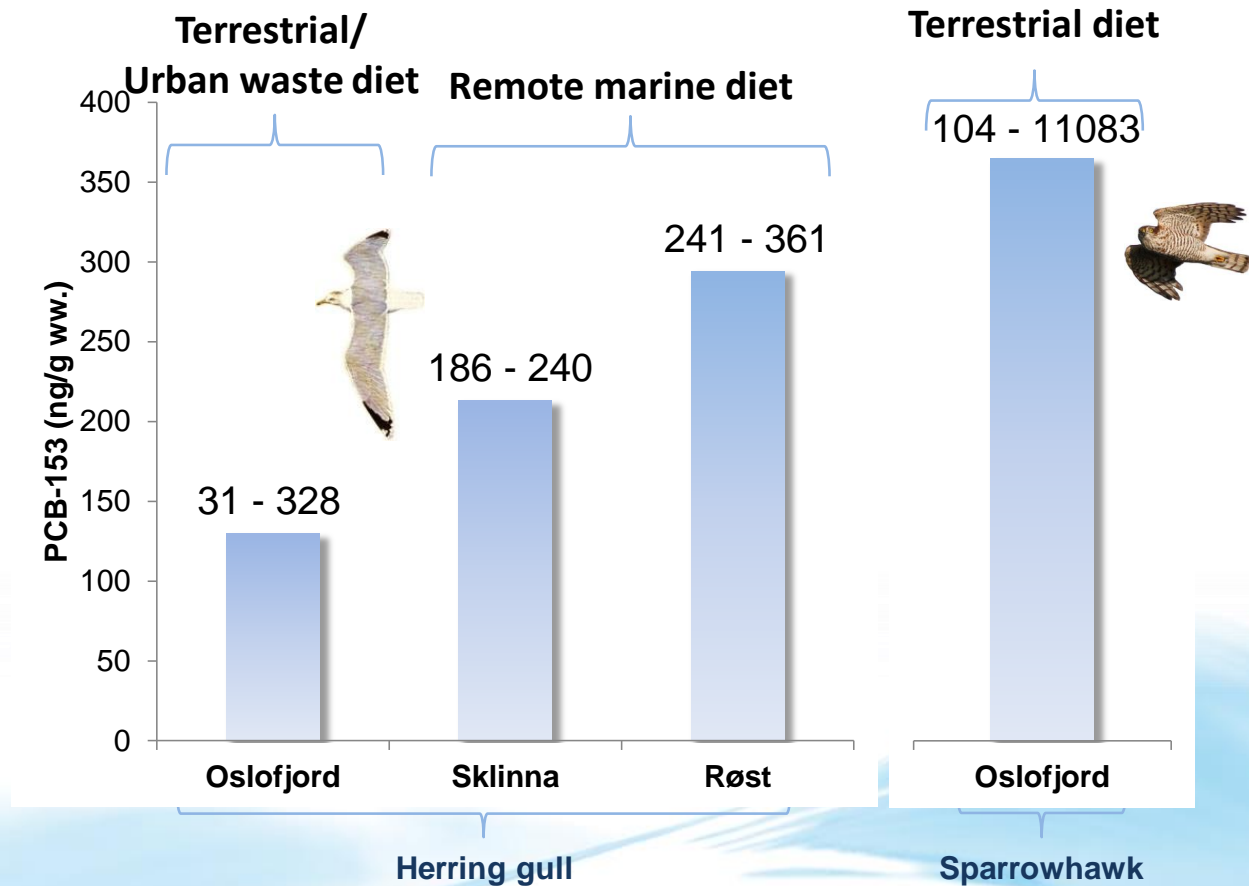
Gull D5



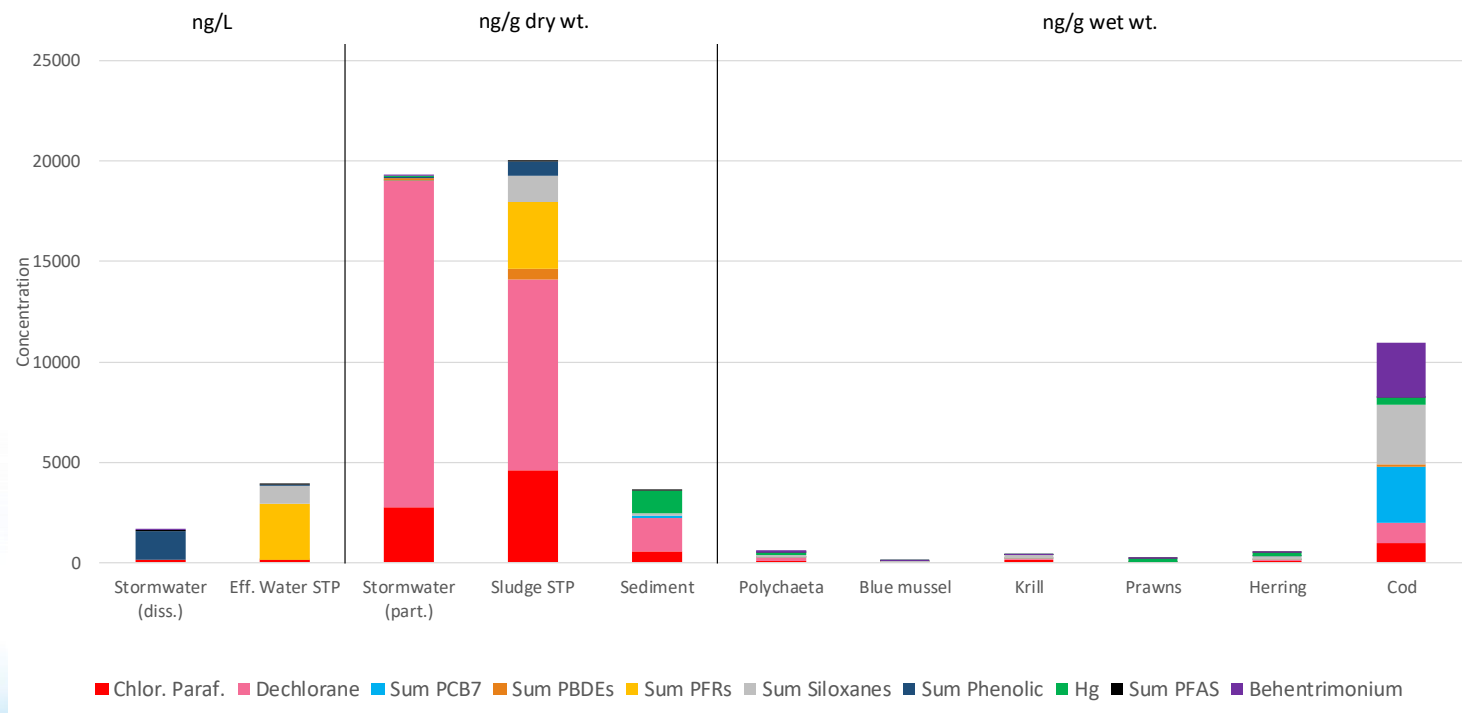
Terrestrial diet



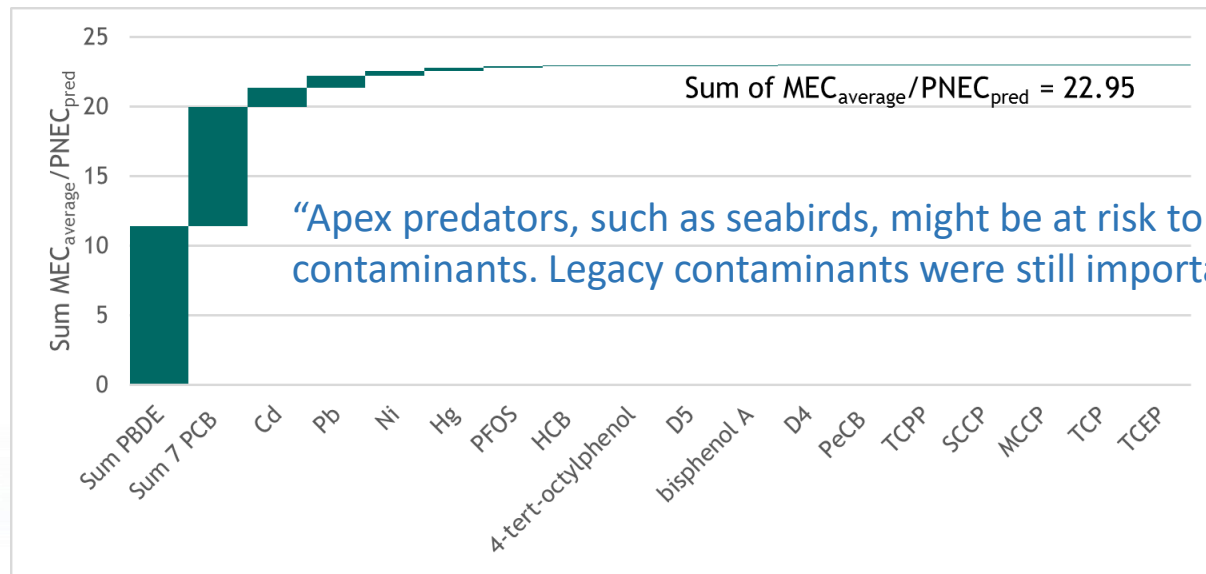
Gull PCB-153



Interspecies and matrix comparisons



Mixture toxicity / cumulative risk



Contribution plot of $MEC/PNEC_{pred}$ summation for values measured in polychaetes. Values for sum PBDE (BDE-28, -47, -99, -100, -153, -154), sum PCB7, HCB, PeCB and TCEP were calculated based on $QS_{biota,hhr}$ whereas all other values were calculated based on $PNEC_{pred}$ values.



Keilen (2017)

Levels and effects of environmental contaminants in herring gull (*Larus argentatus*) from an urban and a rural colony in Norway

Ellen Kristine Keilen

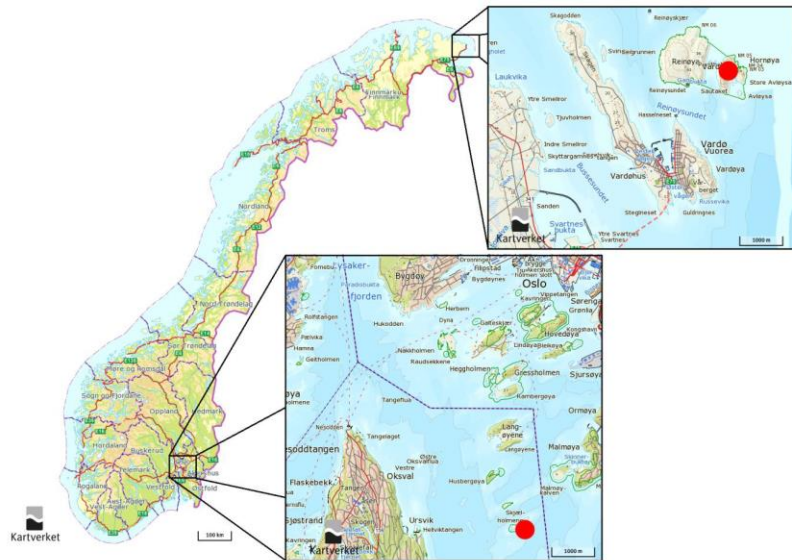


Master thesis in toxicology

Department of Biosciences
Faculty of Mathematics and Natural Sciences

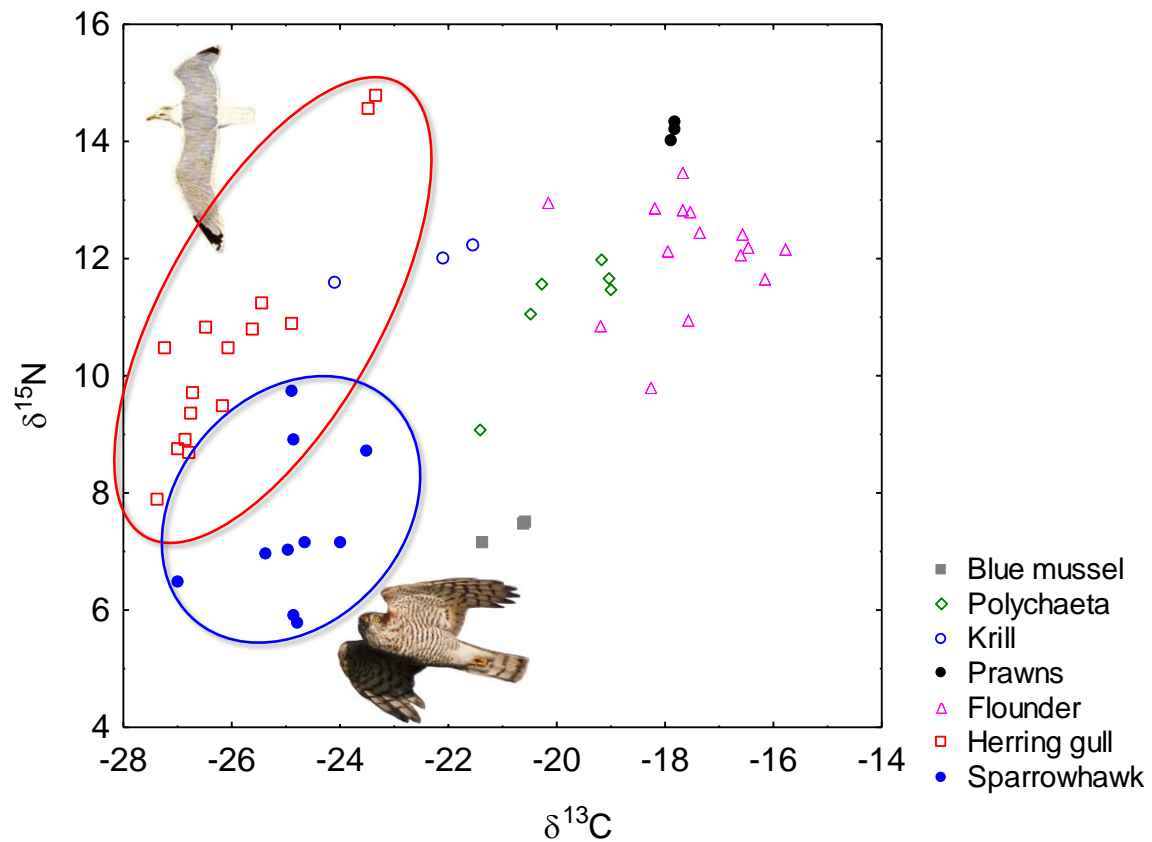
UNIVERSITY OF OSLO

06.06.2017



“Significantly higher levels in the Hornøya colony and Oslofjord herring gulls with enriched SI ratios, for Σ PCB, ploybrominated diphenyl ethers (PBDEs) and perfluorooctane sulfonate (PFOS), compared to the Oslofjord herring gulls with depleted SI ratios. This indicates that the exposure to the POPs is different depending on the diet, and is virtually independent of the habitat.”

“The baseline DNA damage was significantly higher in the Oslofjord population compared to the Hornøya population, meaning the DNA damage was caused by other stressors or contaminants not quantified in this thesis.”



Gull

Egg

Also:
Multiple PCB congeners
Multiple PBDE congeners
Multiple PFASs (incl. PFOS)

