



Deltares

Enabling Delta Life



Research centre
for toxic compounds
in the environment

Monitoring by passive sampling: spatial and temporal trend assessment

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NORMAN Inter-Laboratory Study (ILS) on passive sampling of emerging pollutants
DG Joint Research Centre, 29 – 30 October, 2012, Ispra, Italy

Results from a decade monitoring with PS from 2001 - today

Monitoring programme by passive sampling was initiated by the :

National Institute for Coastal and Marine Management
(RIKZ), The Netherlands,
(dissolved in the Centre for Water Management in 2008)

Started at 8 marine stations in 2001 (+ 6 in rivers from 2009)
6 weeks exposure around November and February
(only November from 2011)

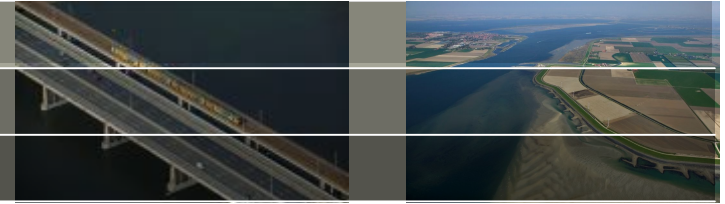


Results from a decade monitoring with PS from 2001 - today

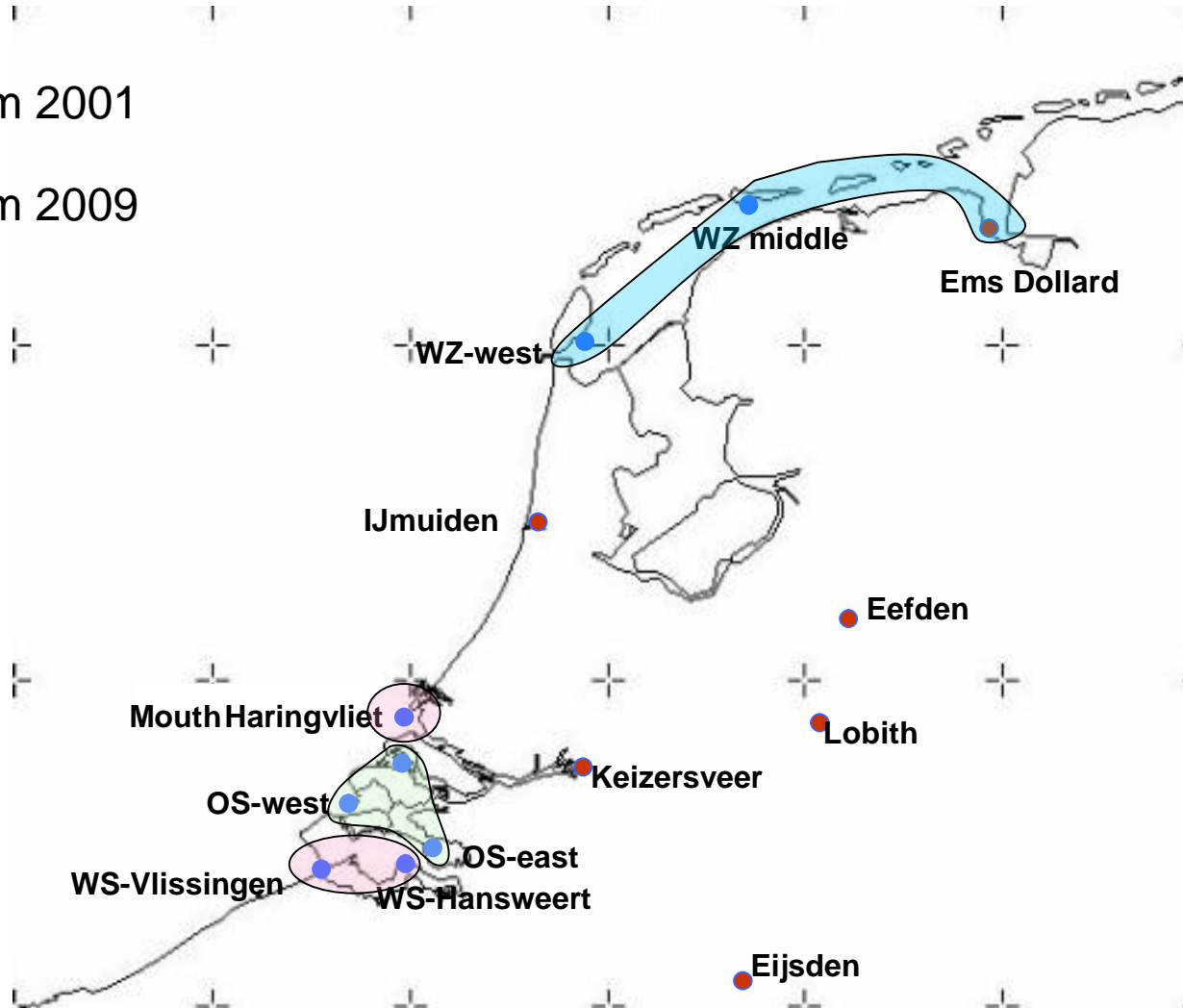
- 8 sampling stations (more after 2009)
- 6 weeks exposure around November and February
- Silicone rubber 55x90x0.5 mm (SRPS) –(400-600cm²)
- Pre-extracted >100 h with ethylacetate
- 4 up to 14 PRC standards (logK_{OW} 4 - 6.5)
- After recovery store in freezer until processing
- Soxhlet extraction, cleanup Al₂O₃, SiO₂, C18 silica
- PCB's analysed by GC-ECD → GCMS
- PAH's by HPLC and fluorescence detection → GCMS
- Calculation of sampling rates (Ld⁻¹)
- and free dissolved concentrations.



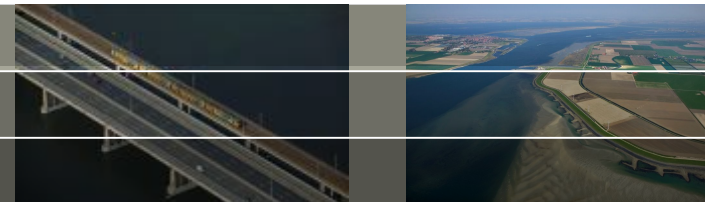
Stations for Passive Sampling



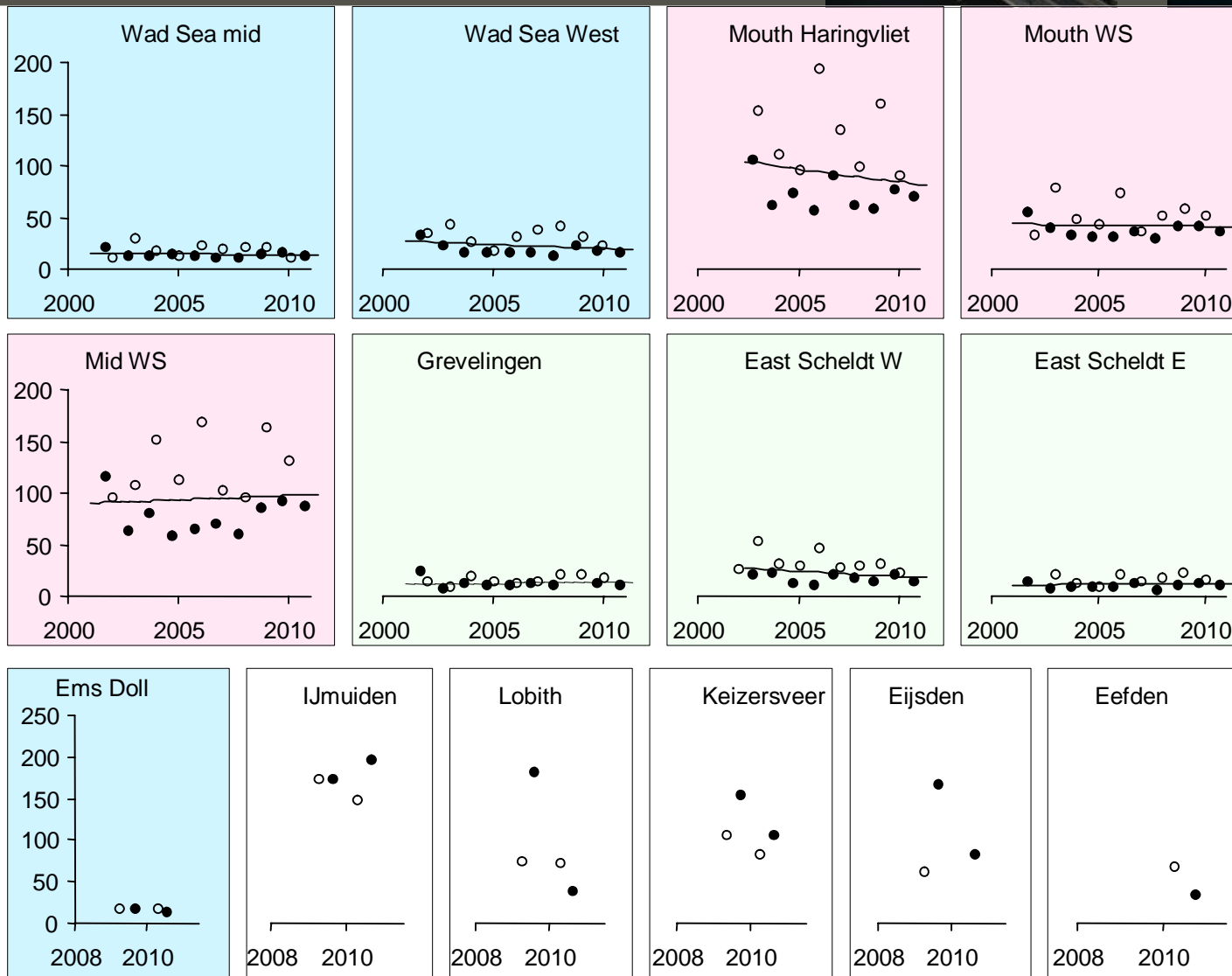
- from 2001
- from 2009



Trendlines for PCB 52 (pg/L)

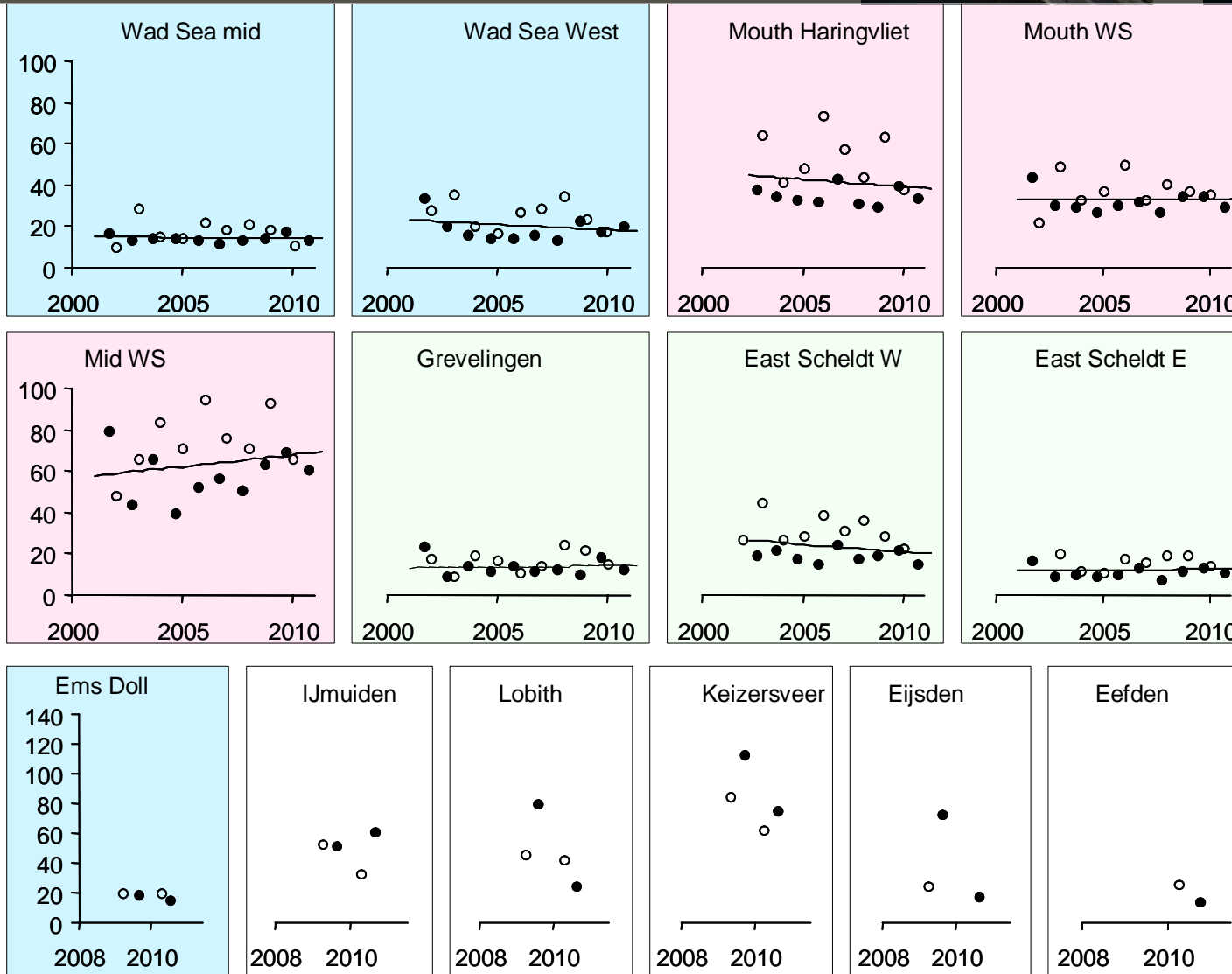


- Winter
- Autumn



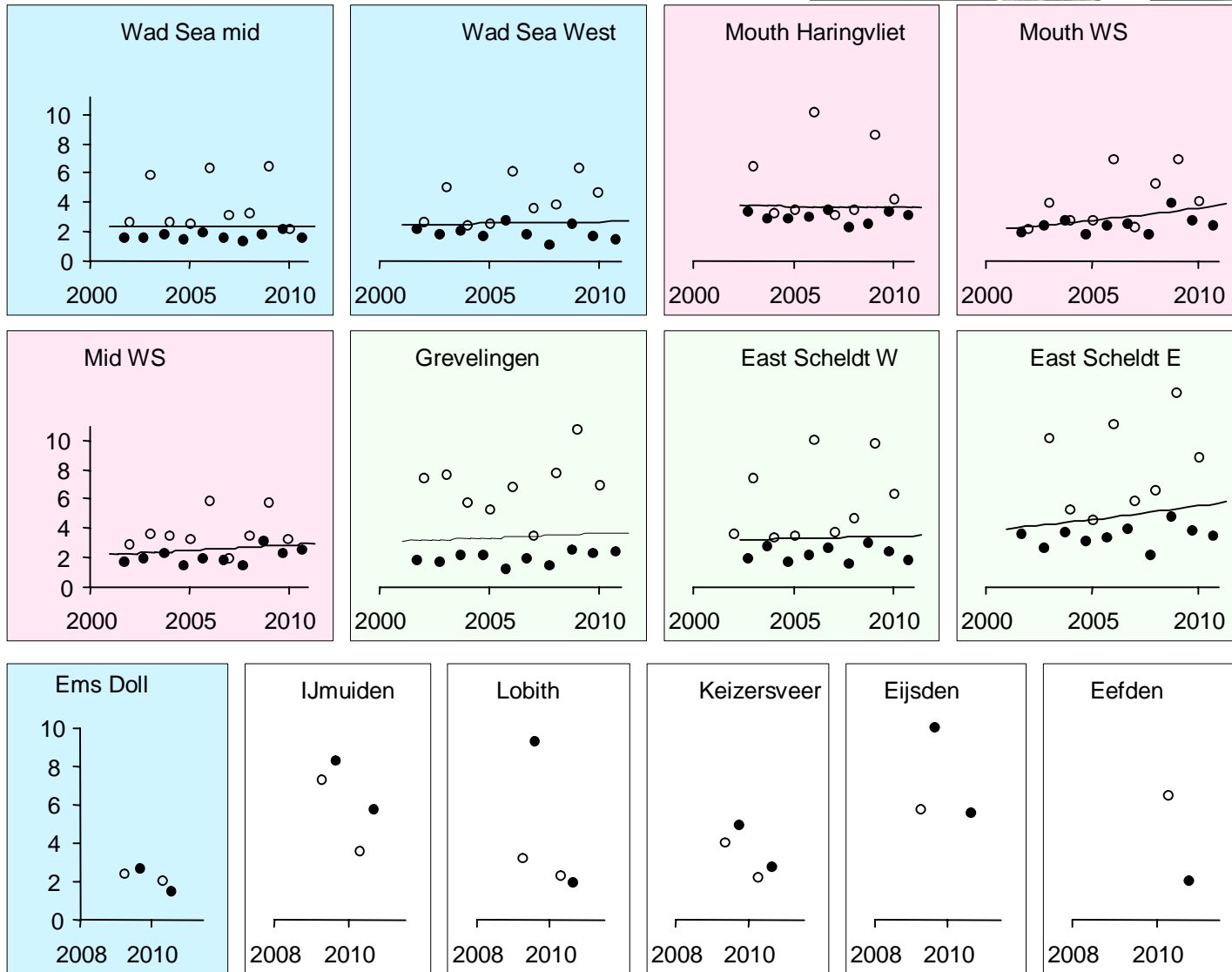
Trendlines for PCB 153 (pg/L)

- Winter
- Autumn

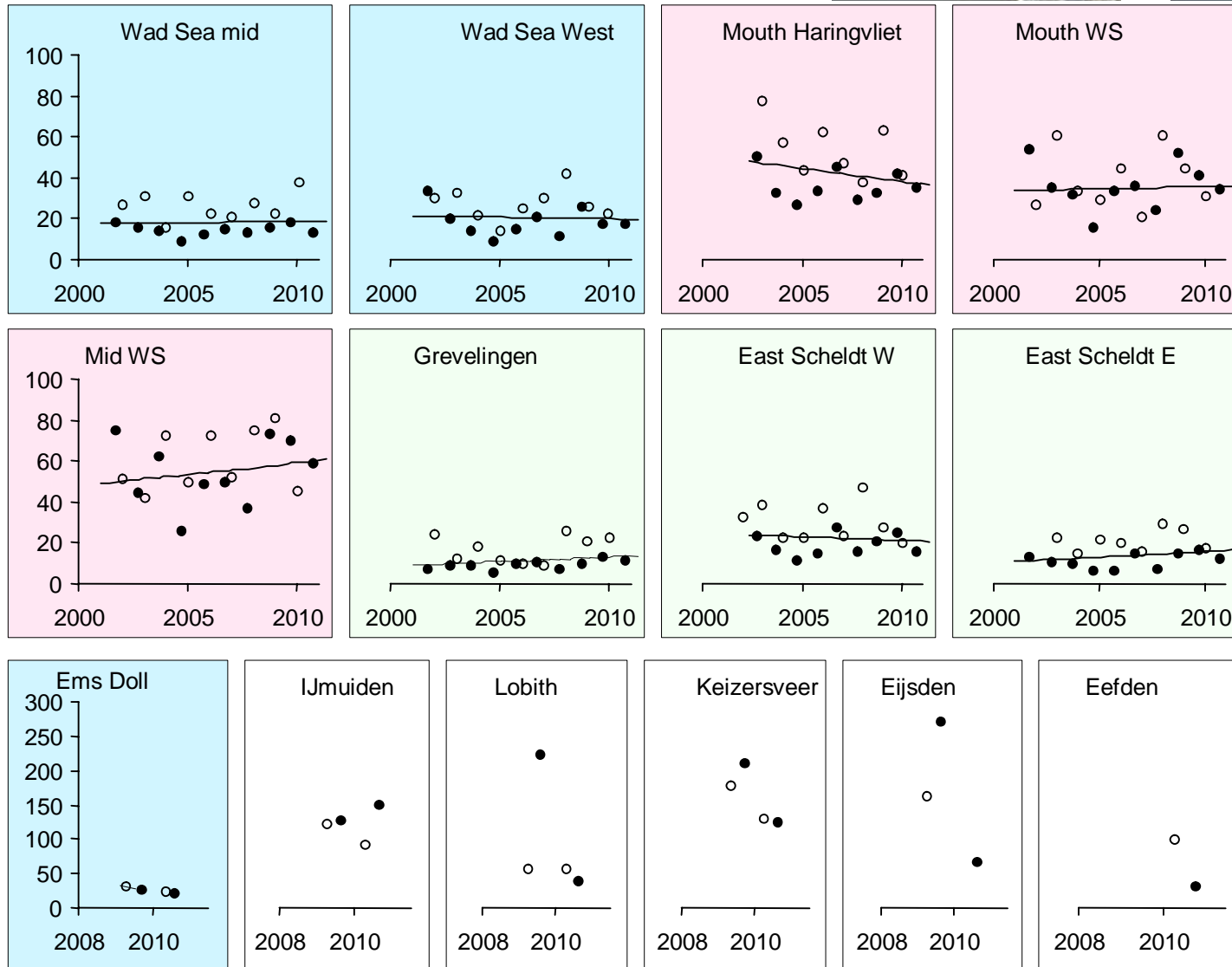


Trendlines: fluoranthene (ng/L)

- Winter
- Autumn



Trendlines: Benzo(a)pyrene (pg/L)



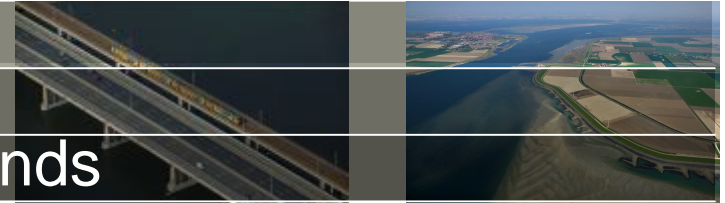
OSPAR/ICES Trial Survey and Intercalibration (PSTS)

Exercise was initiated by two ICES working groups

- Marine Chemistry Working Group
- Working Group on Marine Sediments in relation to pollution

Thirteen laboratories from eleven countries joined,
covering 30 sampling stations.



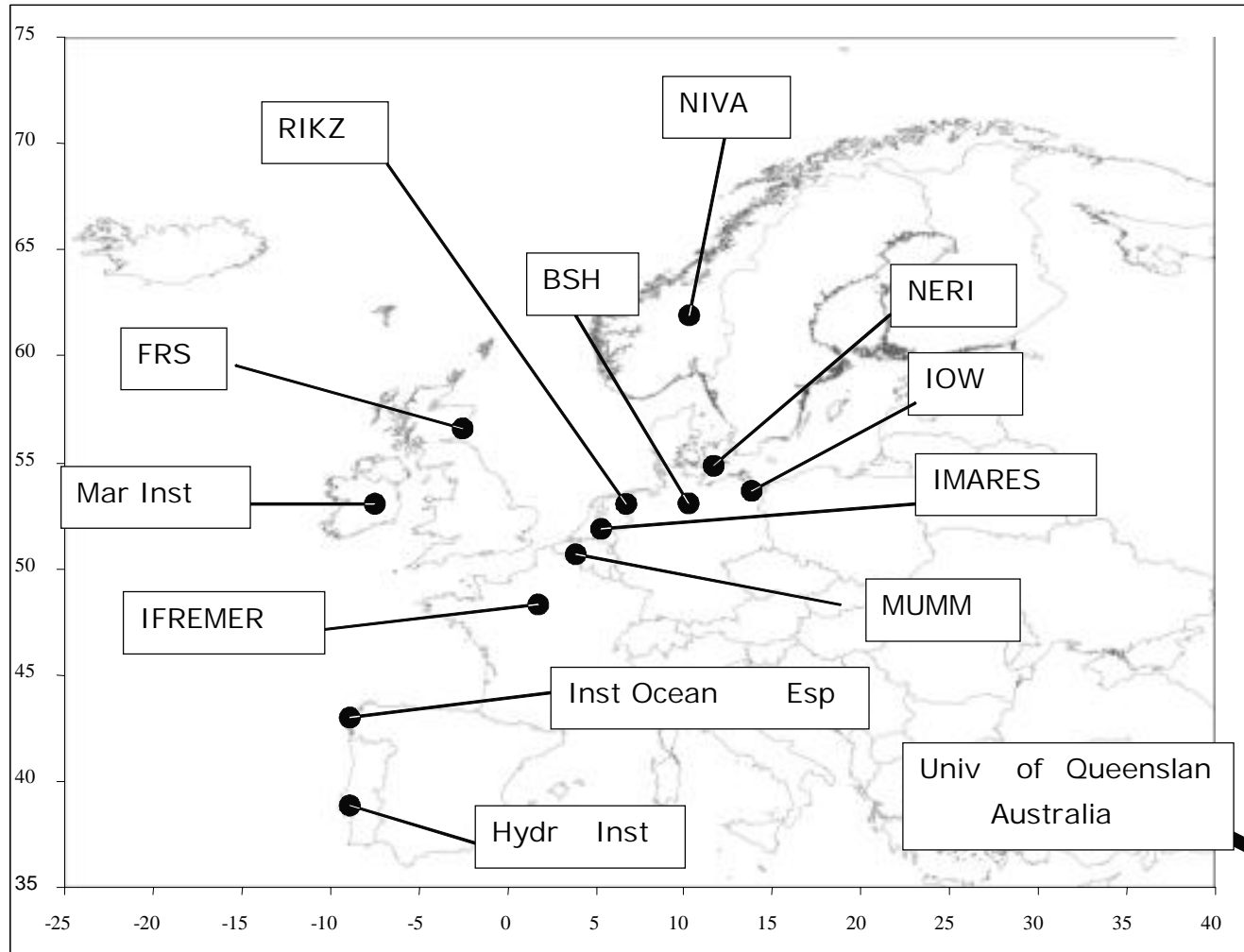
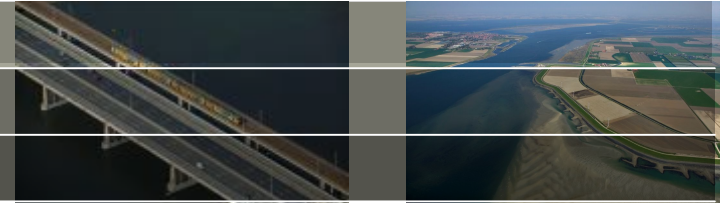


ICES Passive Sampling Trial Survey and intercalibration

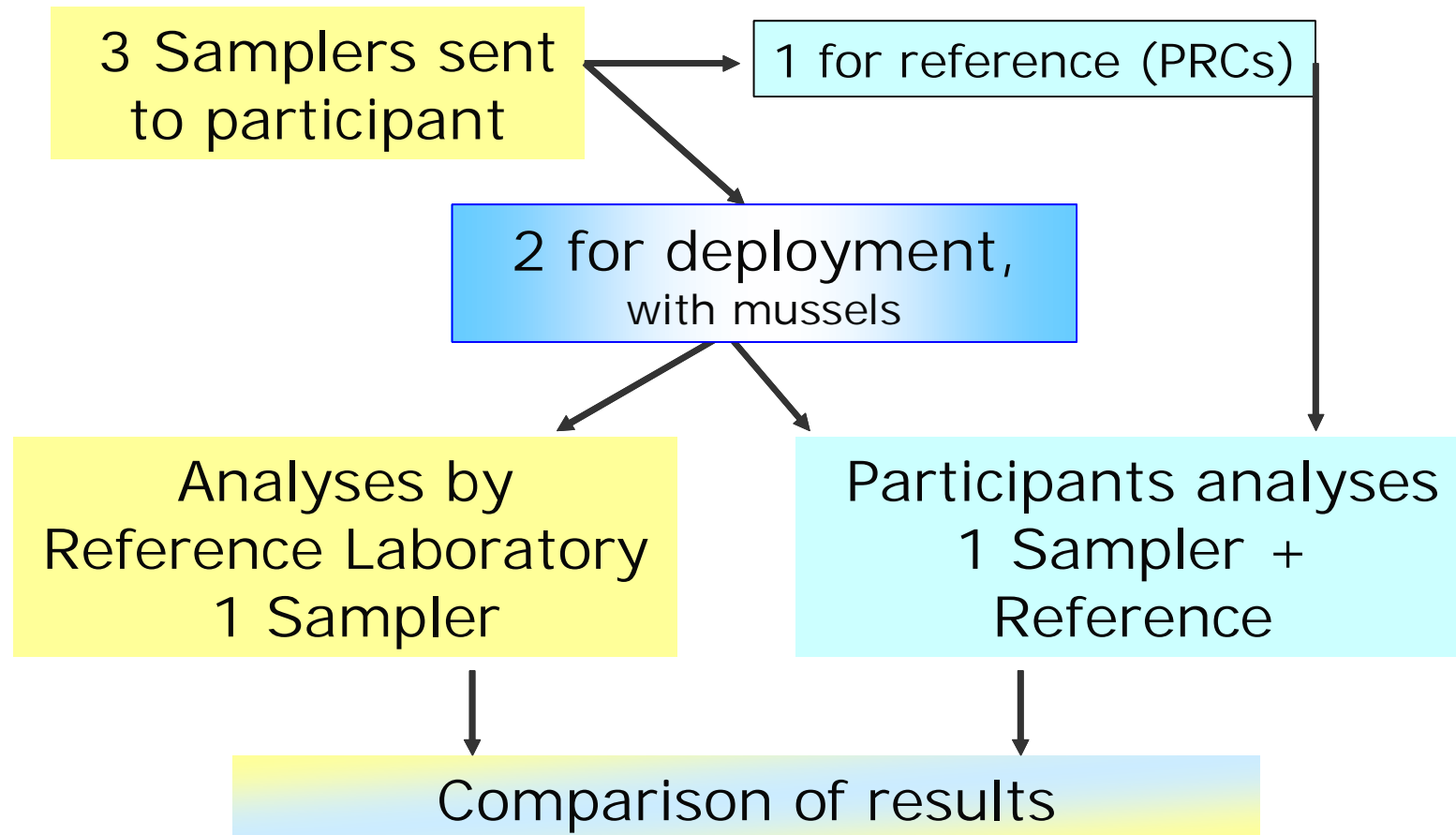
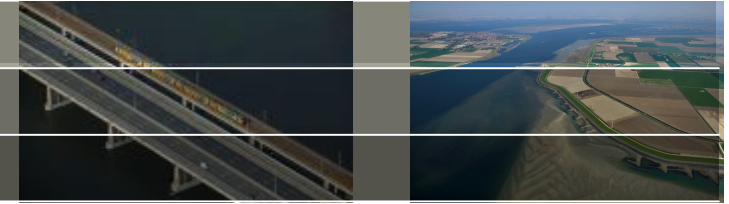
- F. Smedes, I. M. Davies, and J. Tronczynski, ICES CM 2007/J:02, ICES Passive sampling trial survey for water and sediment (PSTS) 2006-2007. Part 1: Objectives, Design and Realization, .*
<http://www.ices.dk/products/CMdocs/CM-2007/J/J0207.pdf>
- F. Smedes, T. van der Zande, C. Tixier, and I. M. Davies, ICES CM 2007/J:03 ICES Passive sampling trial survey for water and sediment (PSTS) 2006-2007. Part 2: Laboratory intercomparison, analytical issues and lessons learned.*
<http://www.ices.dk/products/CMdocs/CM-2007/J/J0307.pdf>
- F. Smedes, T. van der Zande, and I. M. Davies, ICES CM 2007/J:04, ICES Passive sampling trial survey for water and sediment (PSTS) 2006-2007. Part 3: Preliminary interpretation of field data, <http://www.ices.dk/products/CMdocs/CM-2007/J/J0407.pdf>*



Participating institutes



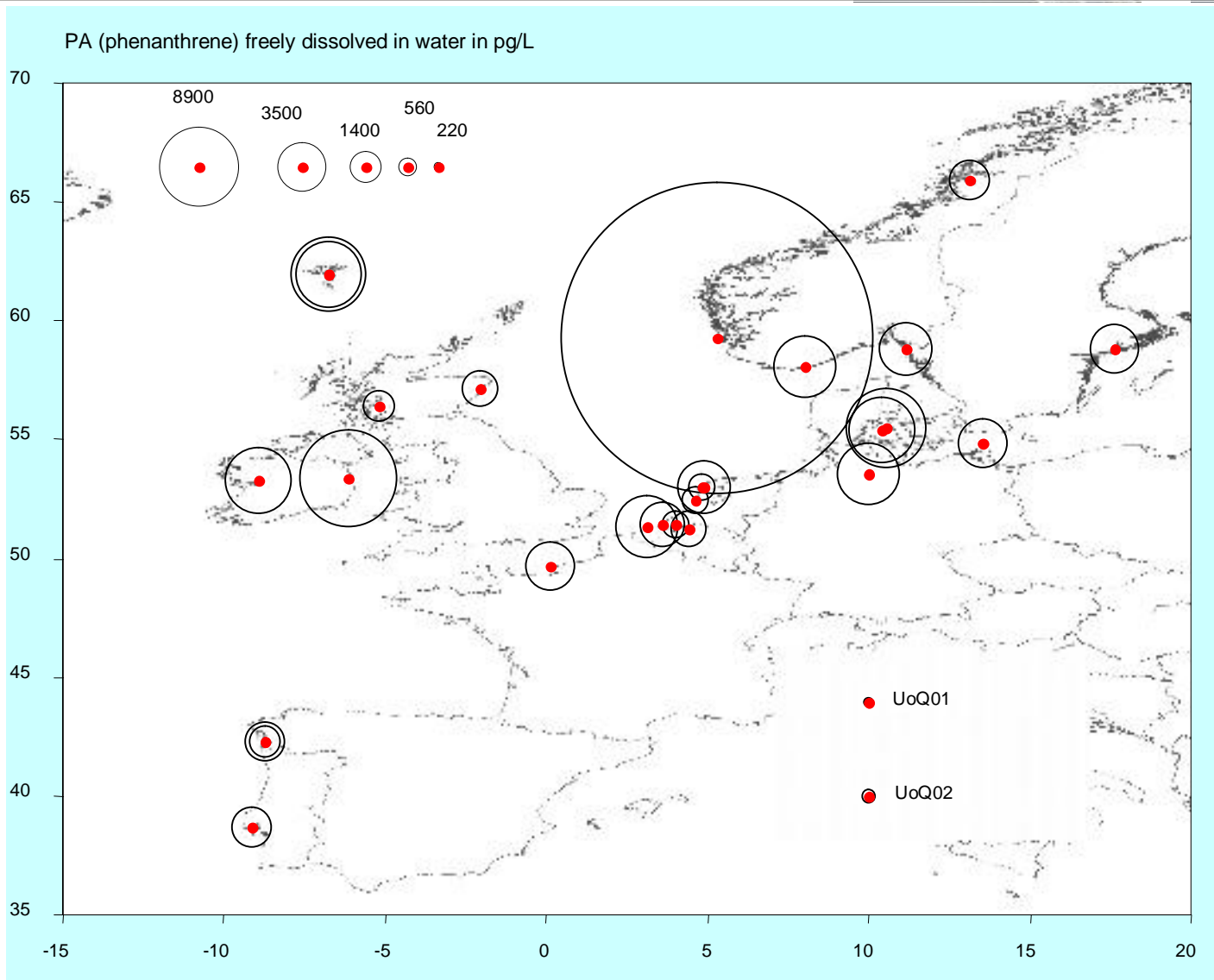
Distribution of samplers



Phenanthrene in pg/l

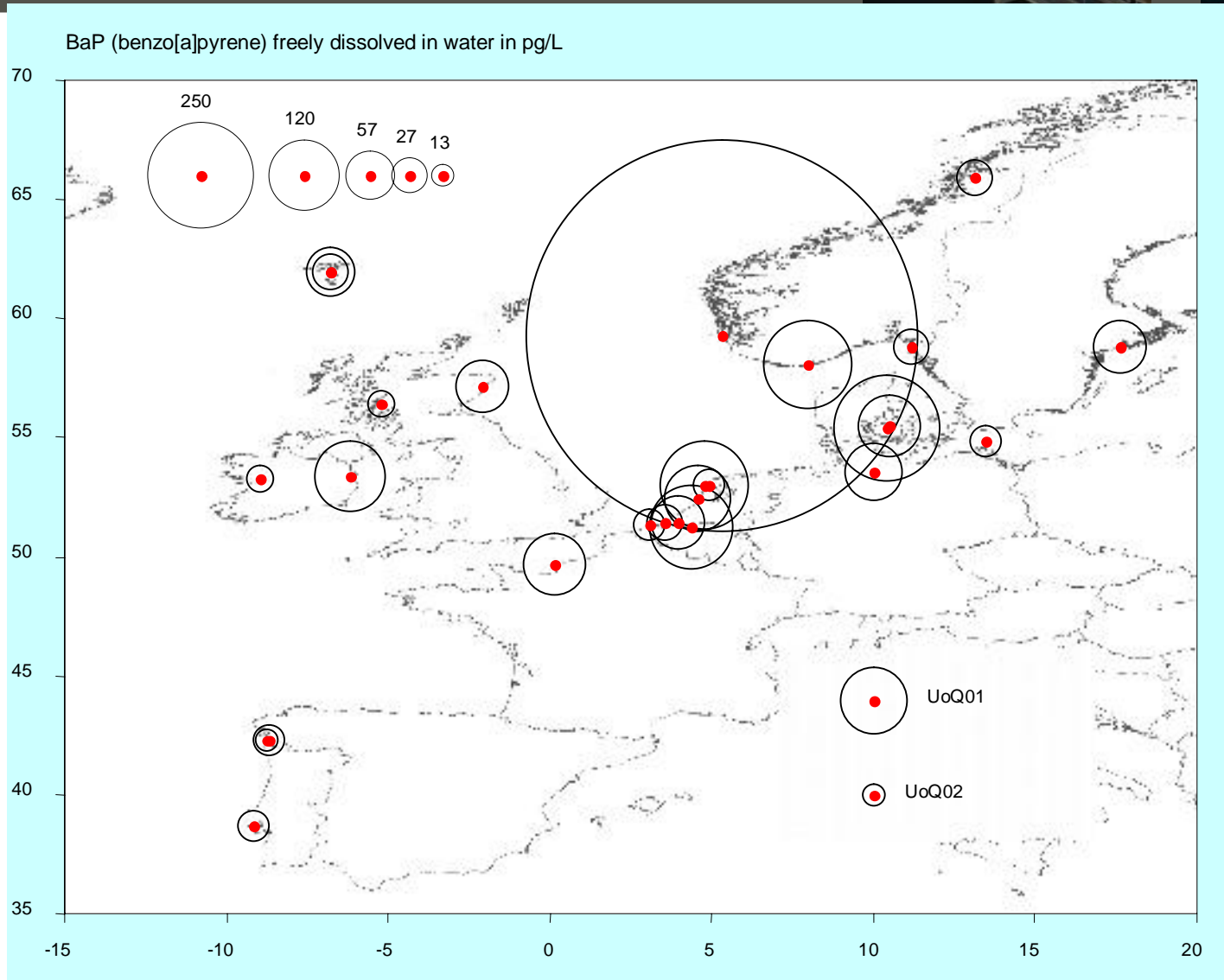


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Benz(a)pyrene in pg/l

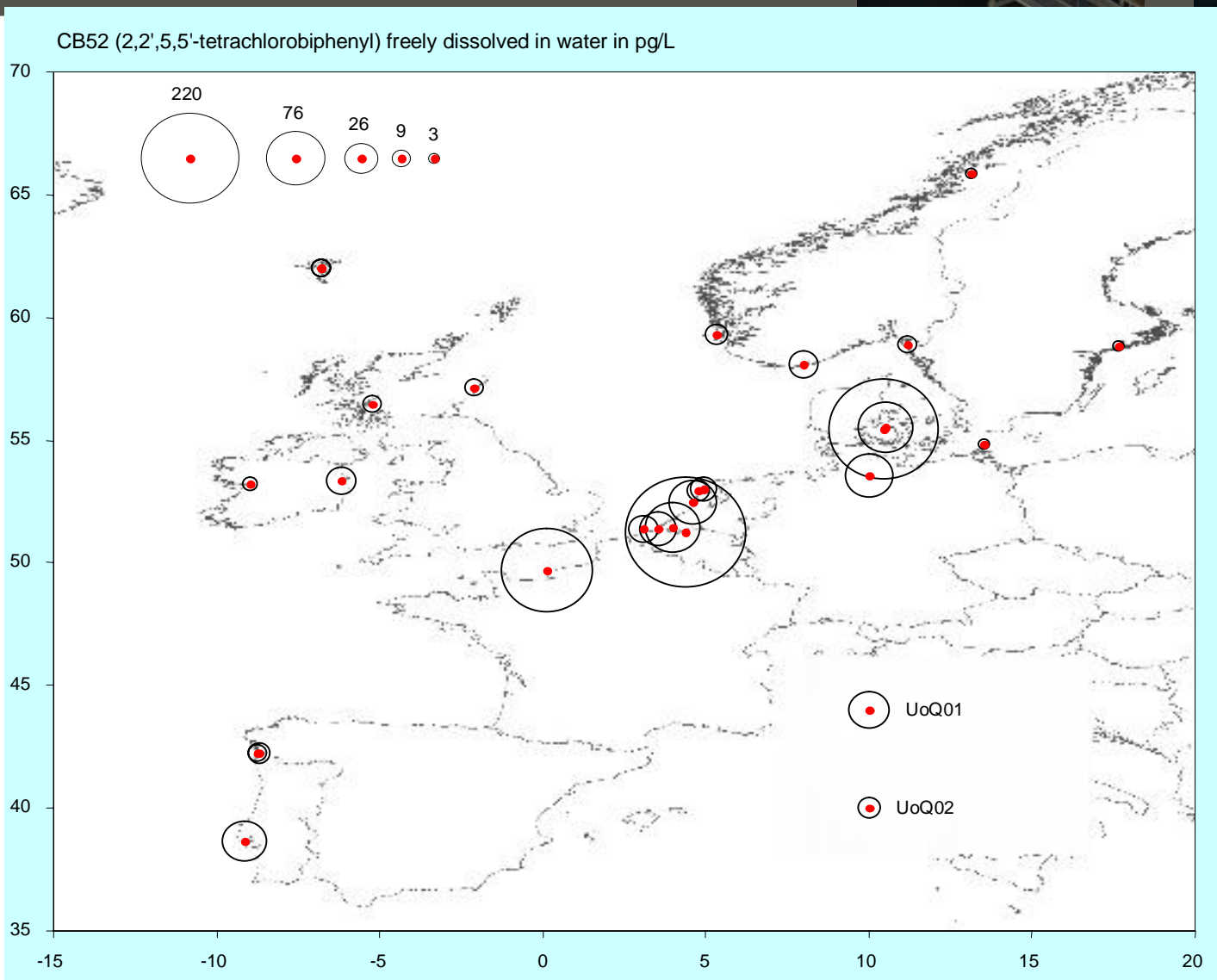
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CB52 in pg/l



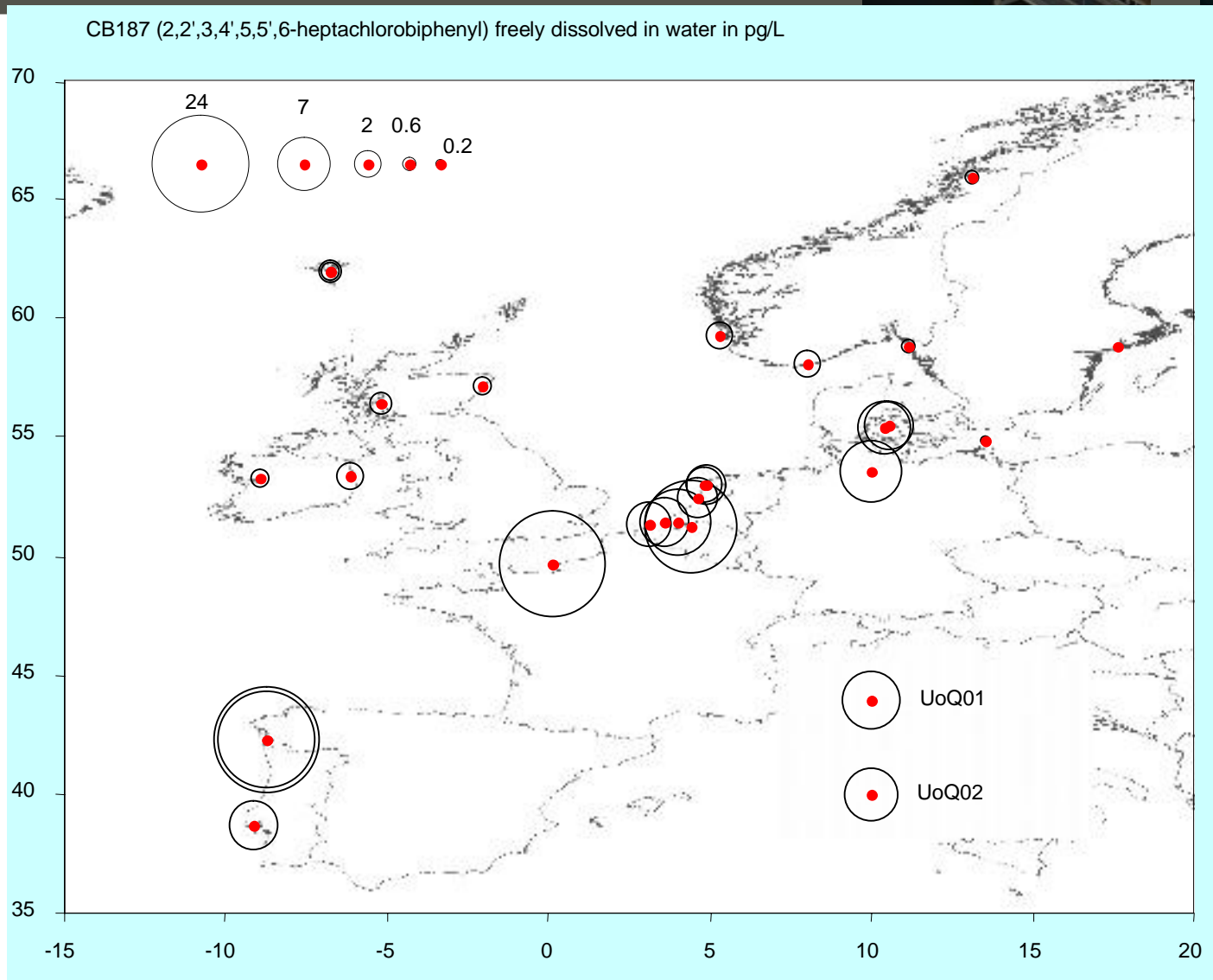
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CB187 in pg/l



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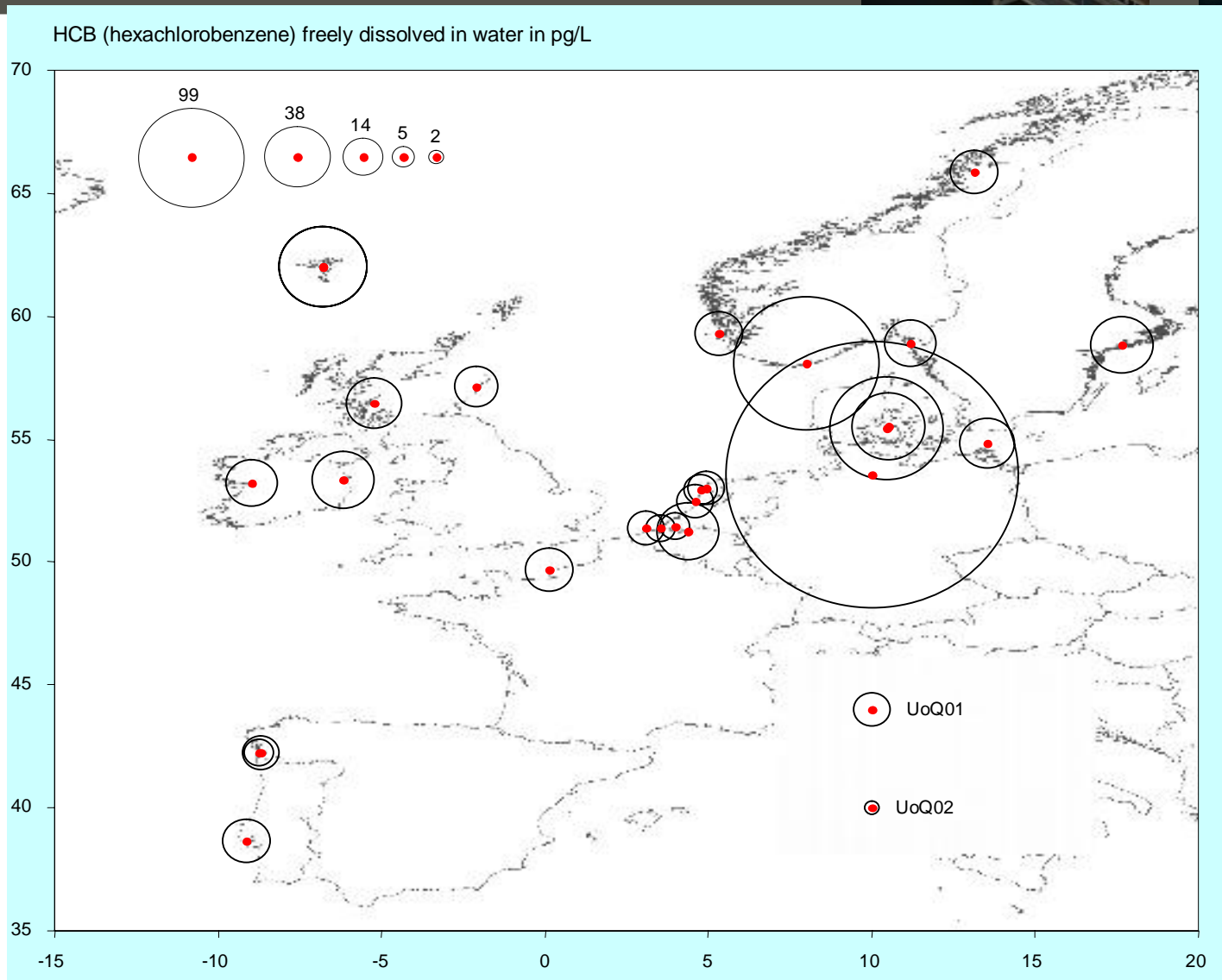
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HCB in pg/l

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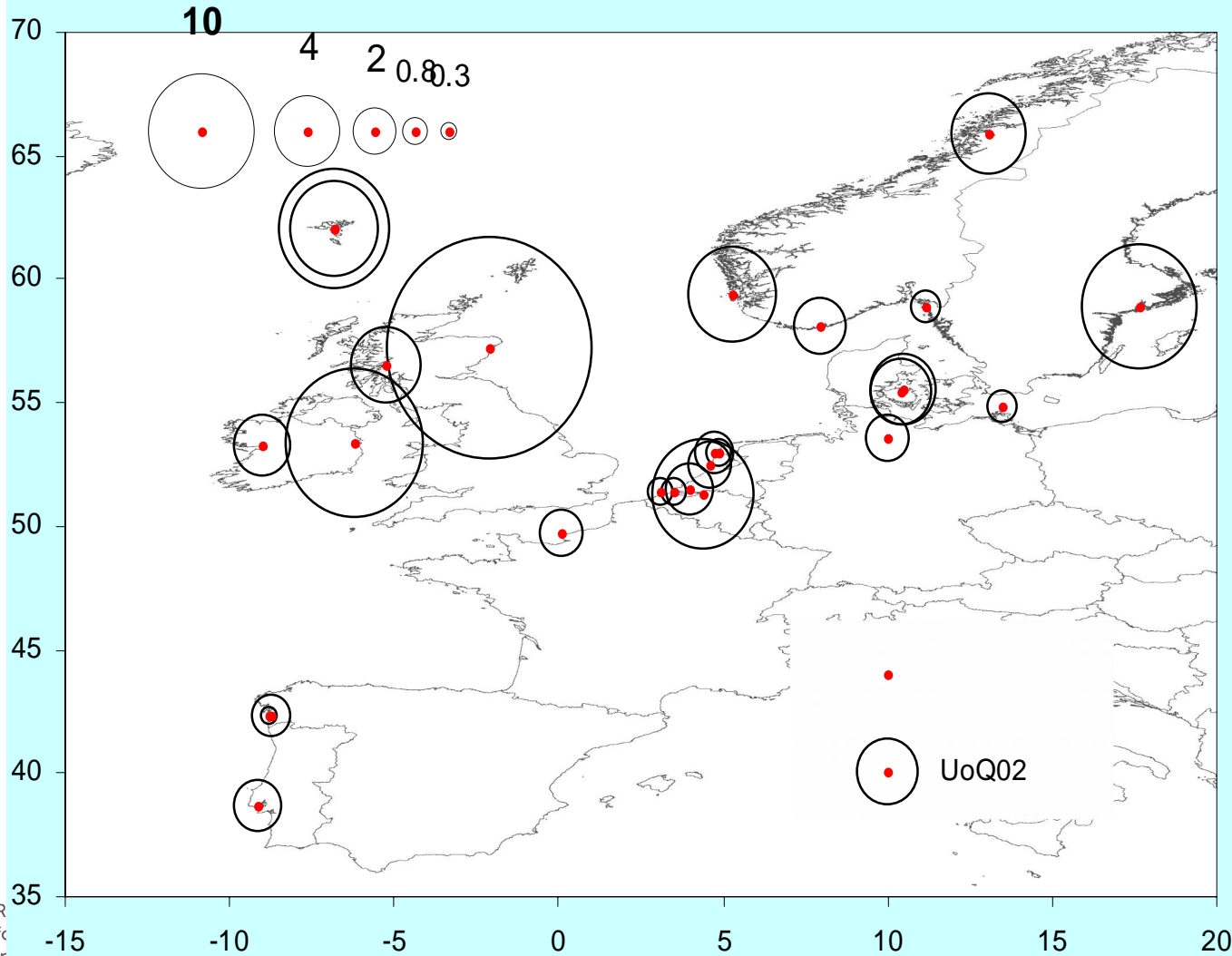


BDE99 in water



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BDE099 in water in pg/L

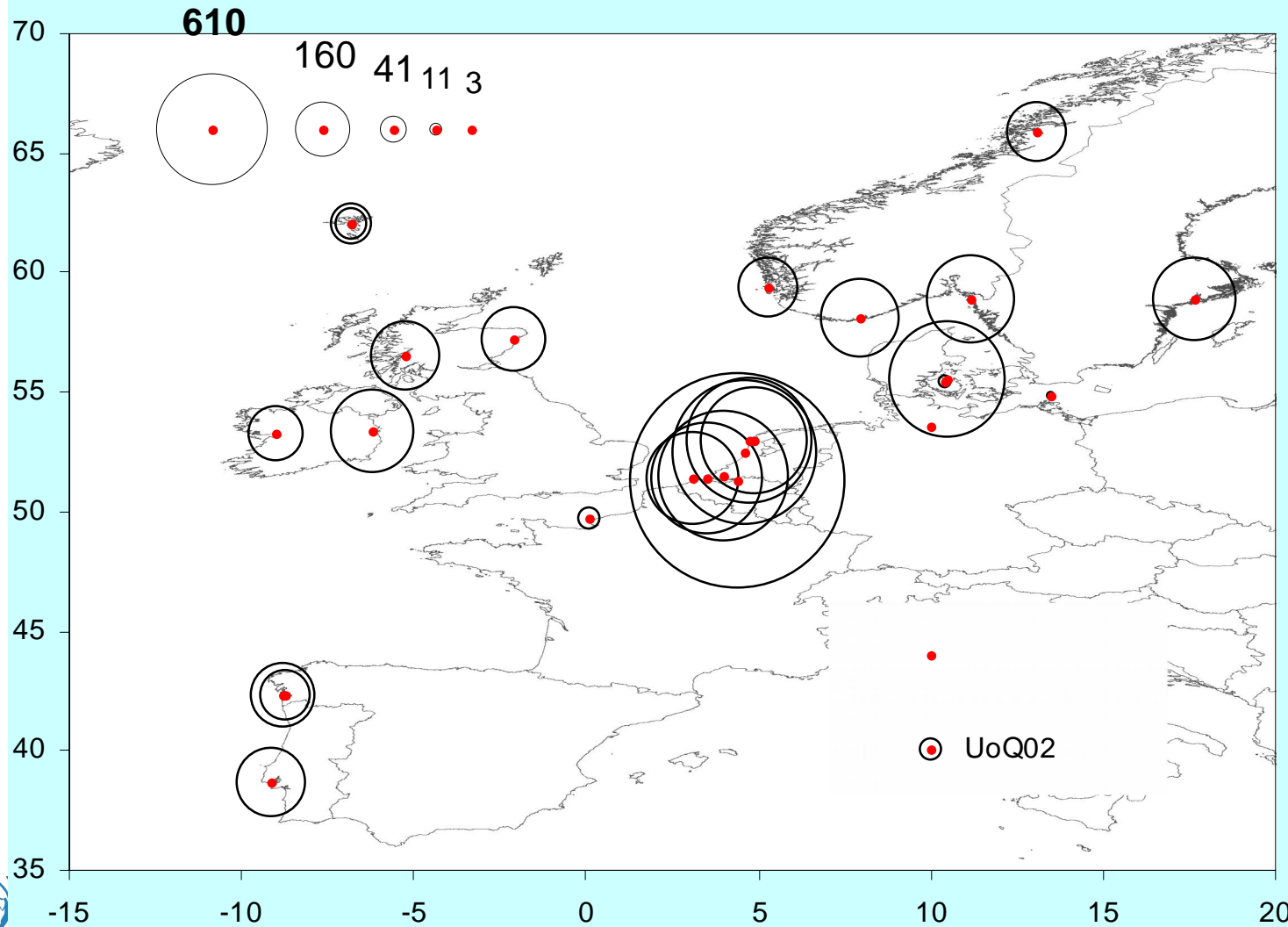


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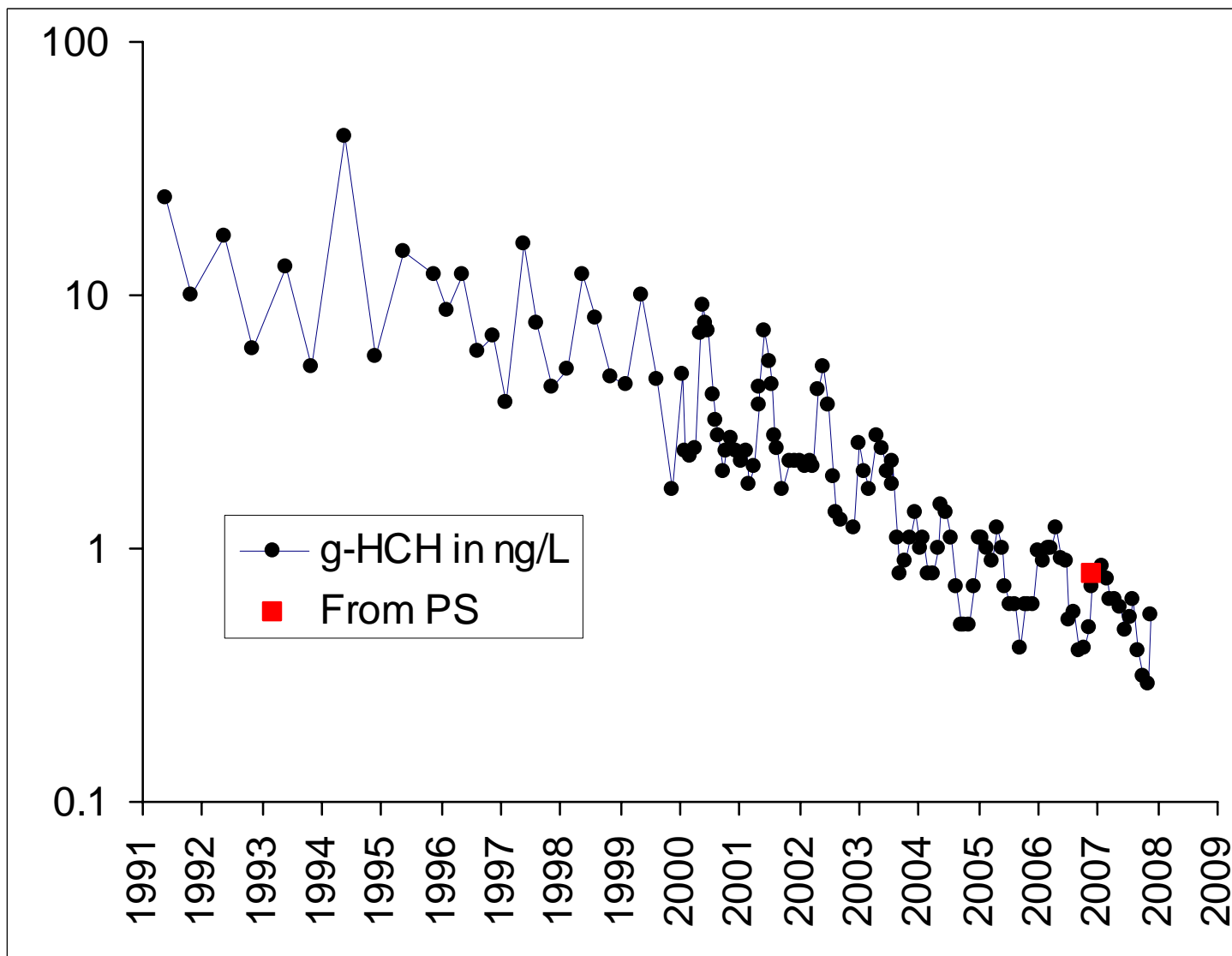
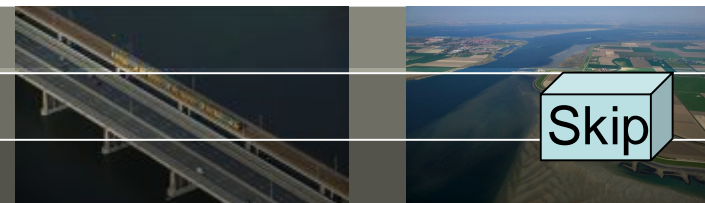
g-HCH in water



g-HCH in water in pg/L



Spotsampling of water for Lindane Hansweert, Western Scheldt, Station 5

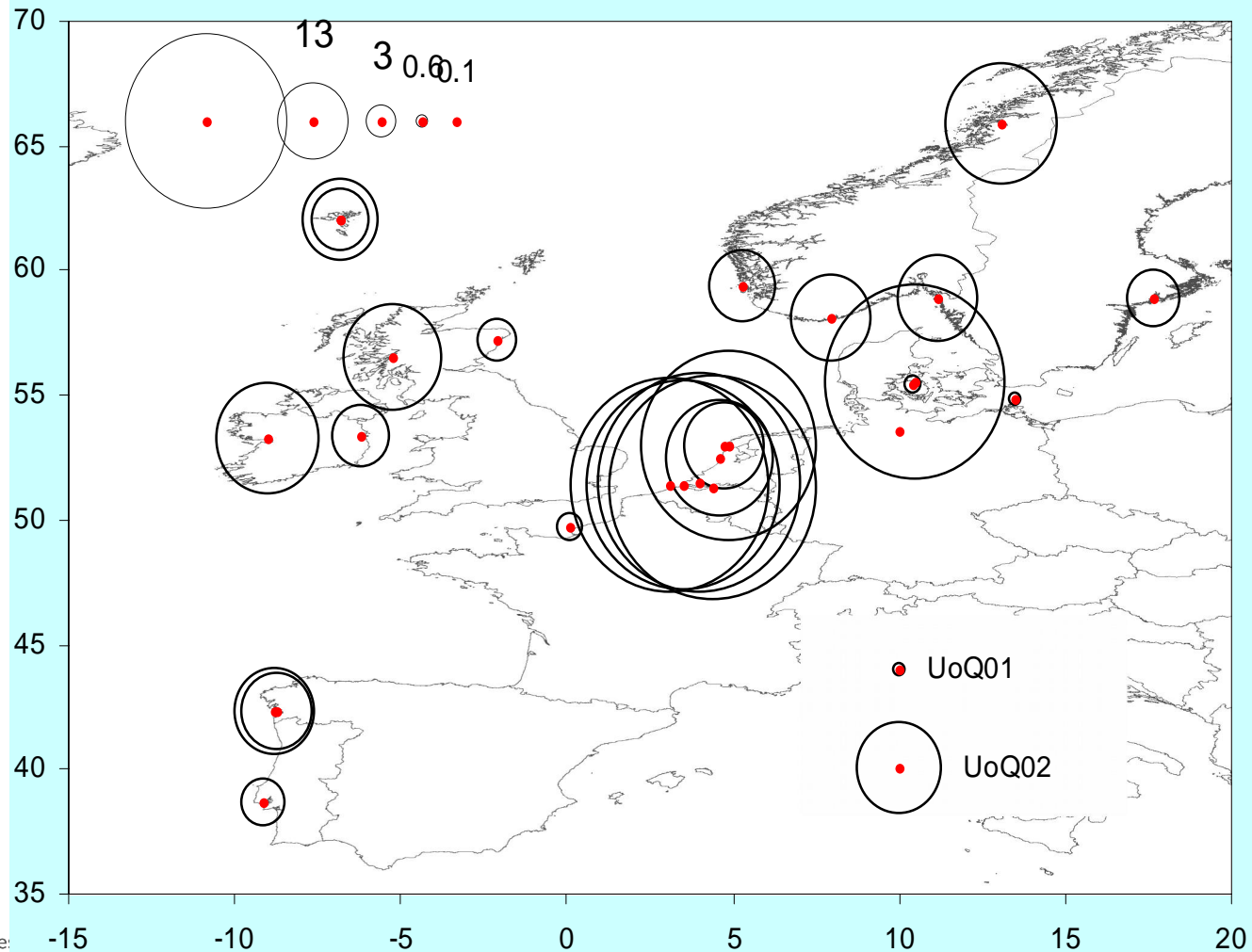


Alpha endosulfan



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Endosulfan-1 in water in pg/L



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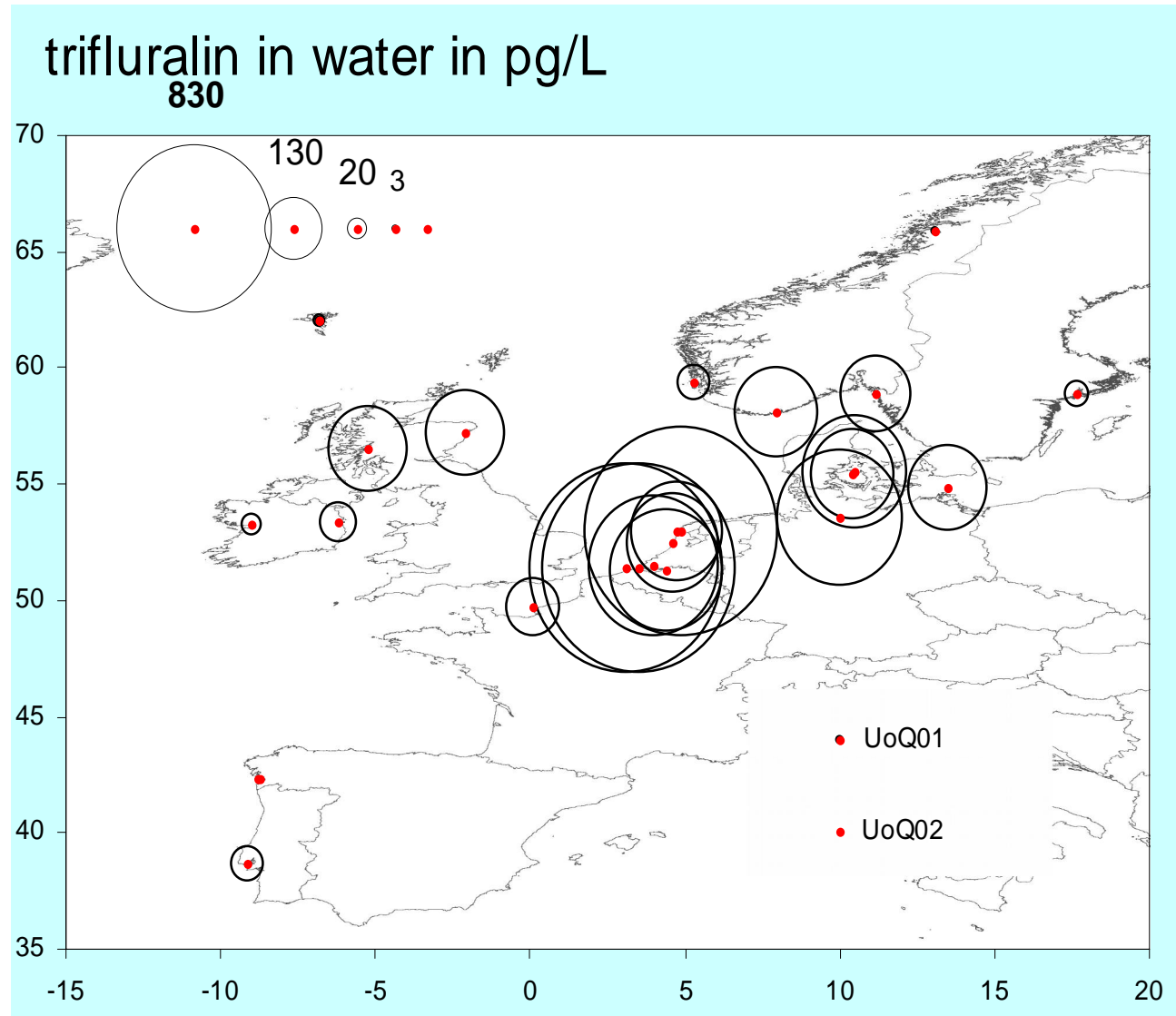
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Trifluralin in water



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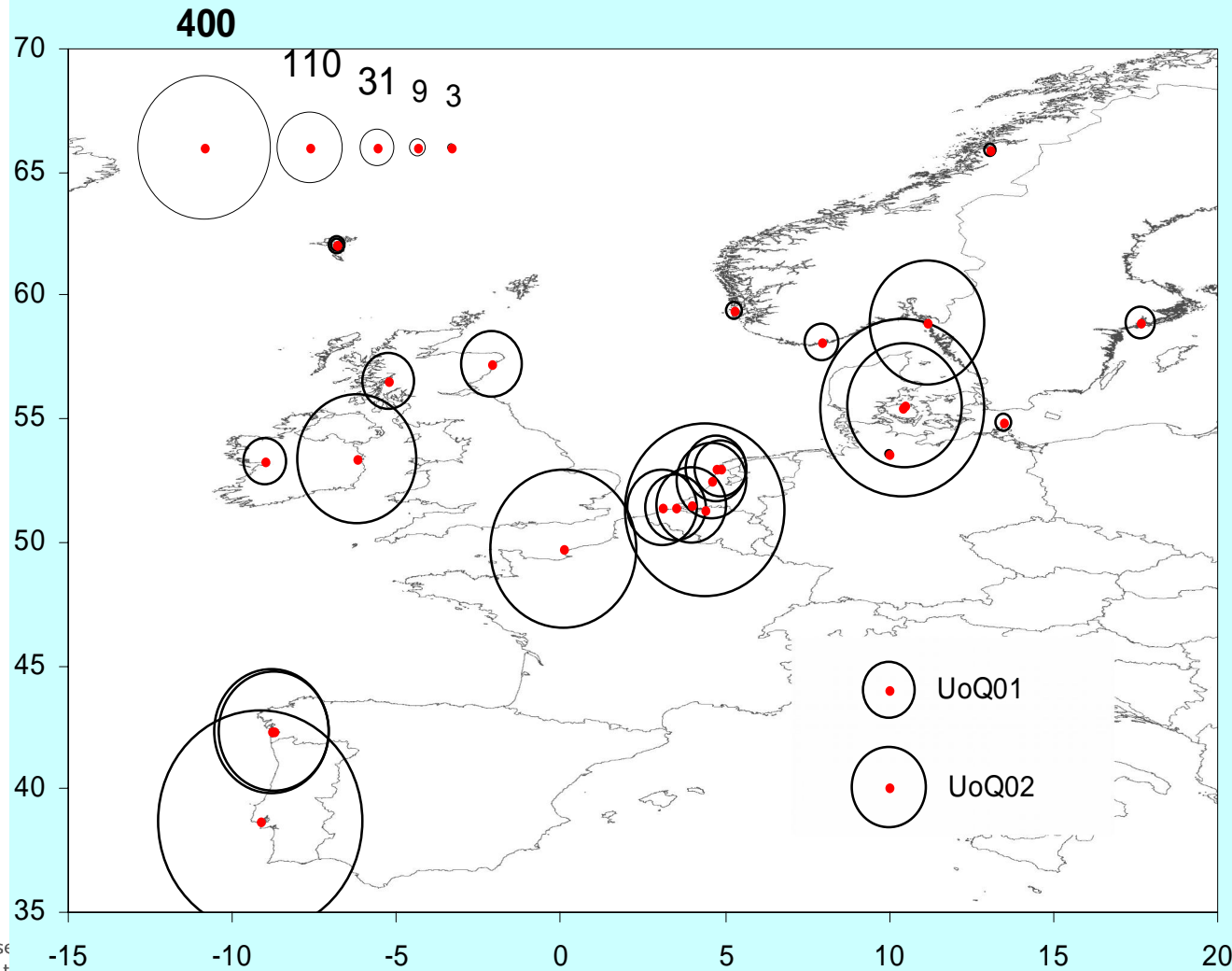


Chlorpyrifos



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Chlorpyrifos in water in pg/L



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There was also passive sampling in Sediment in PSTS

Water

Free dissolved concentrations (C_W)

PAH, PCB

Sediment

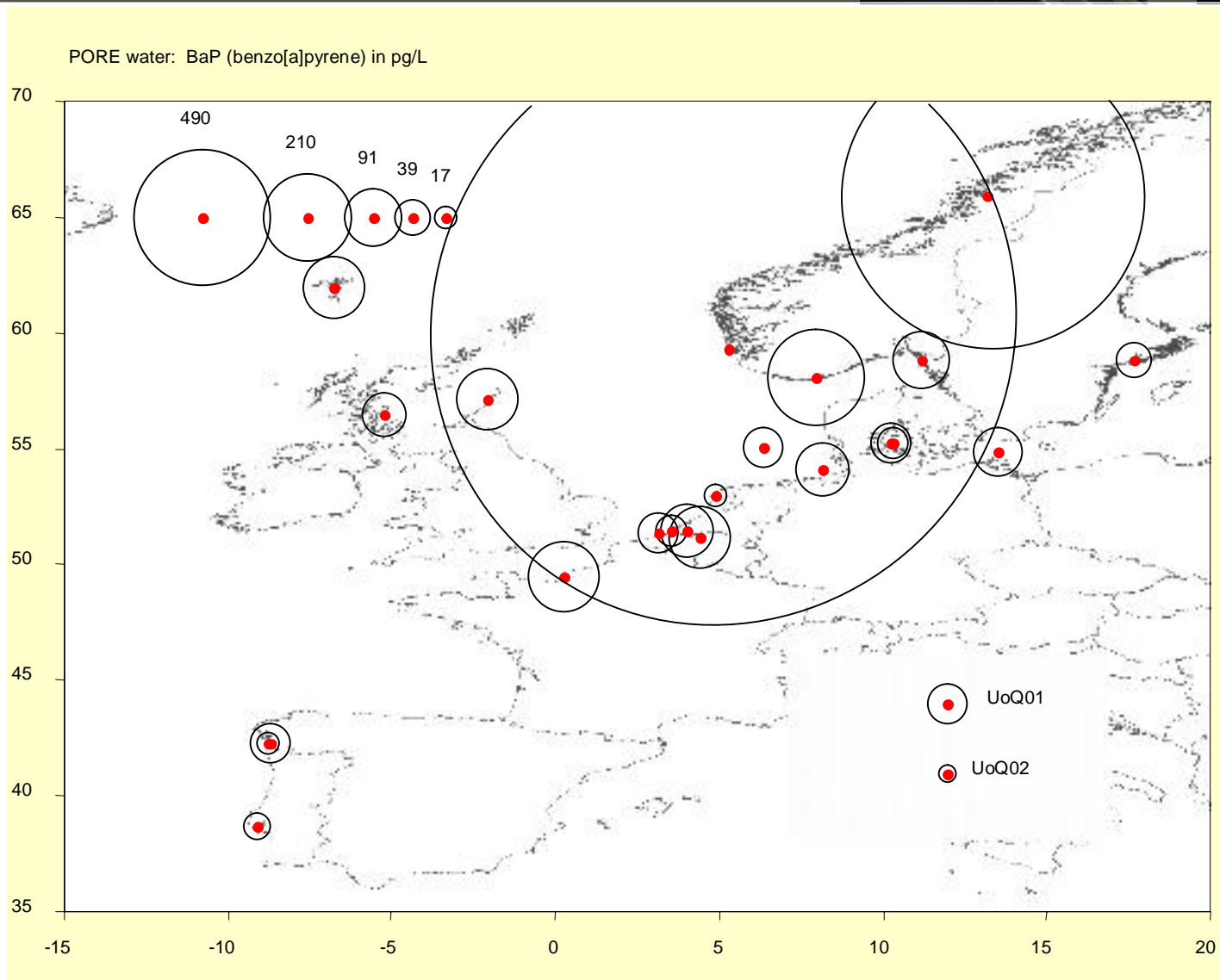
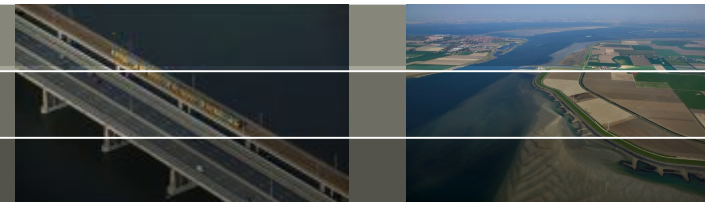
Free dissolved pore-water concentrations

(PAH and PCB)

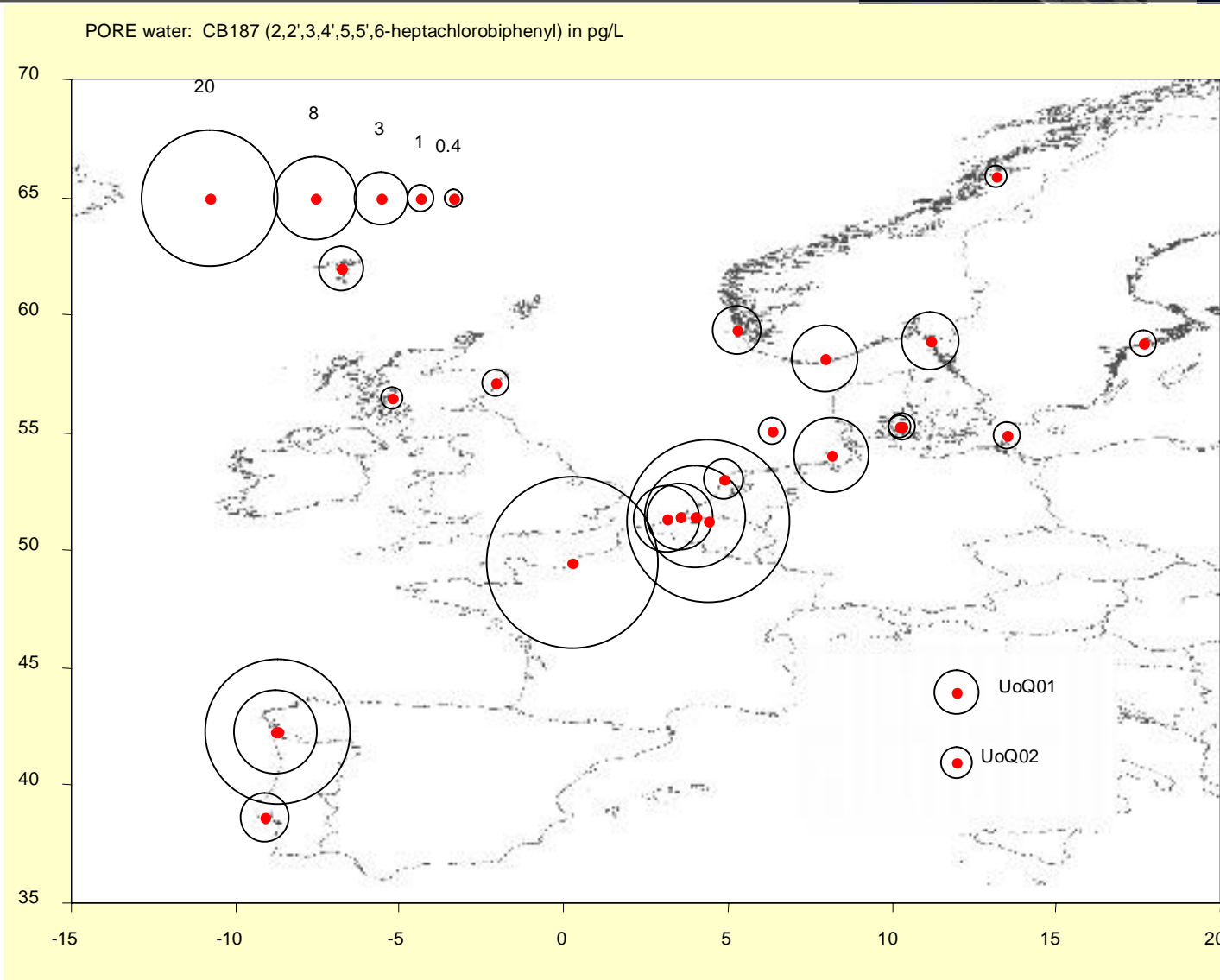
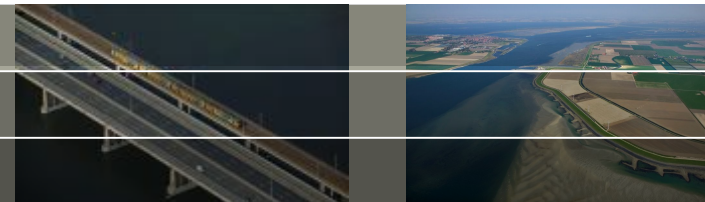
Comparison between surface
and pore water



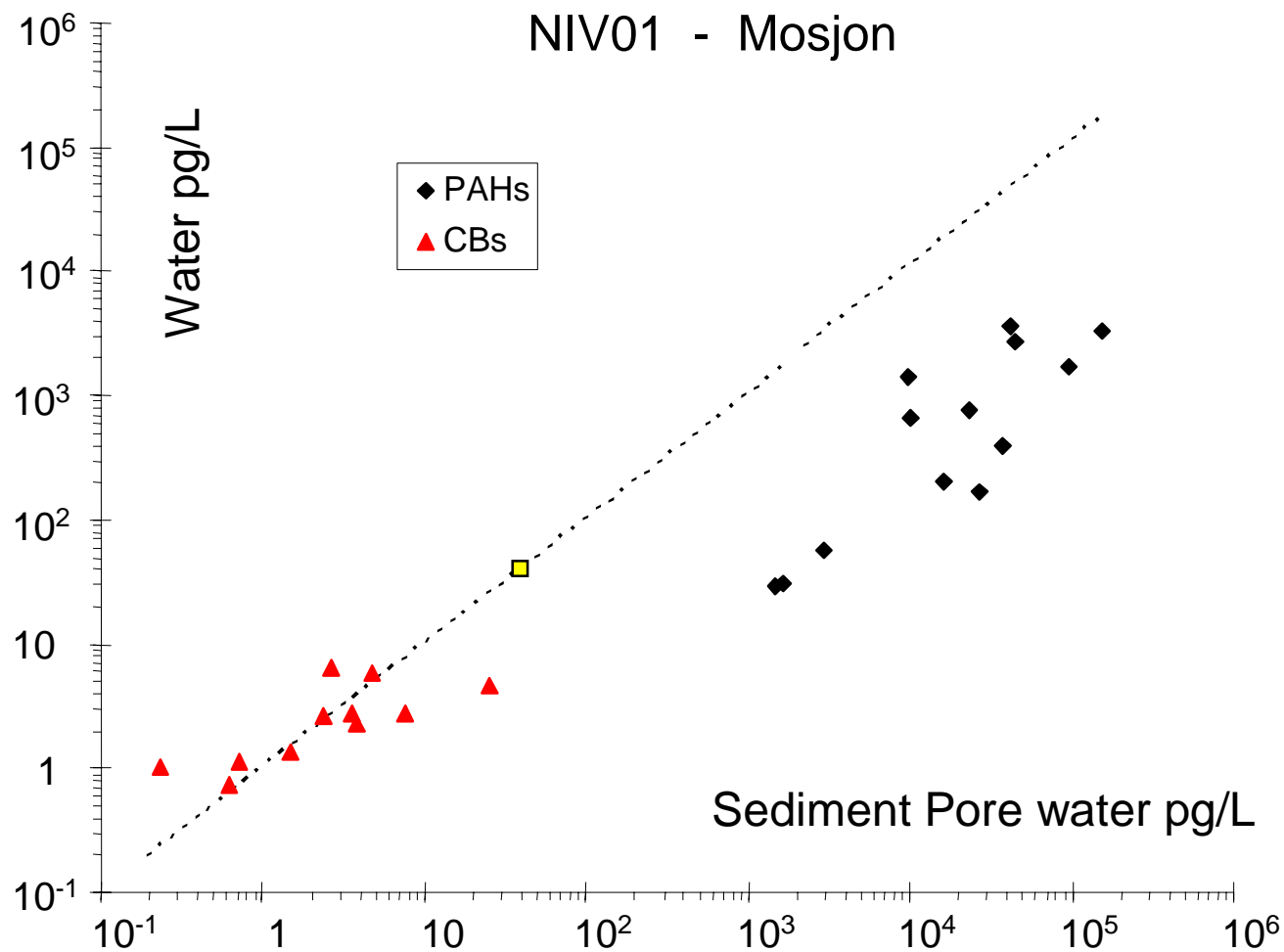
Benz(a)pyrene in Pore water (pg/l)



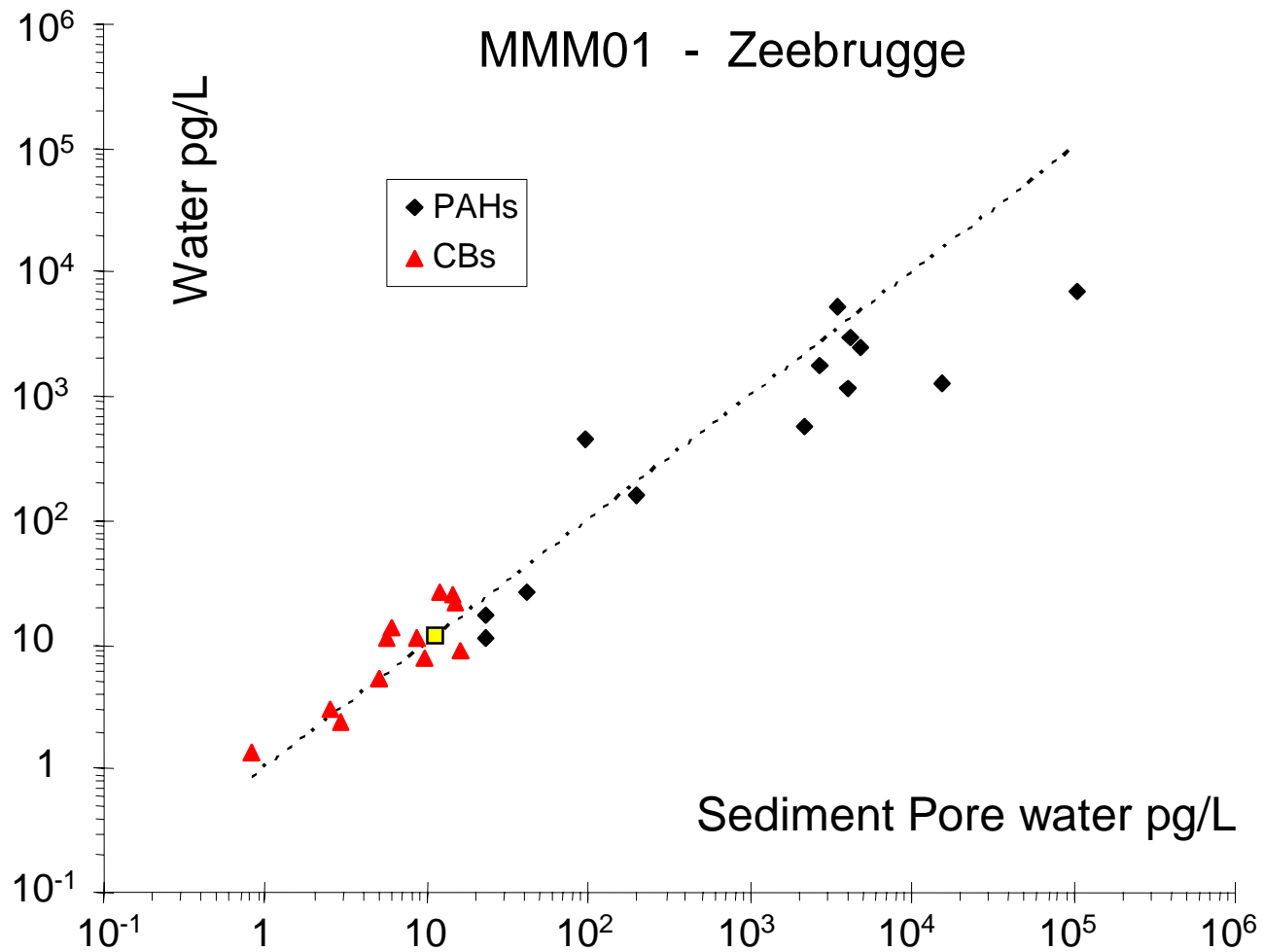
CB187 in Pore water (pg/l)



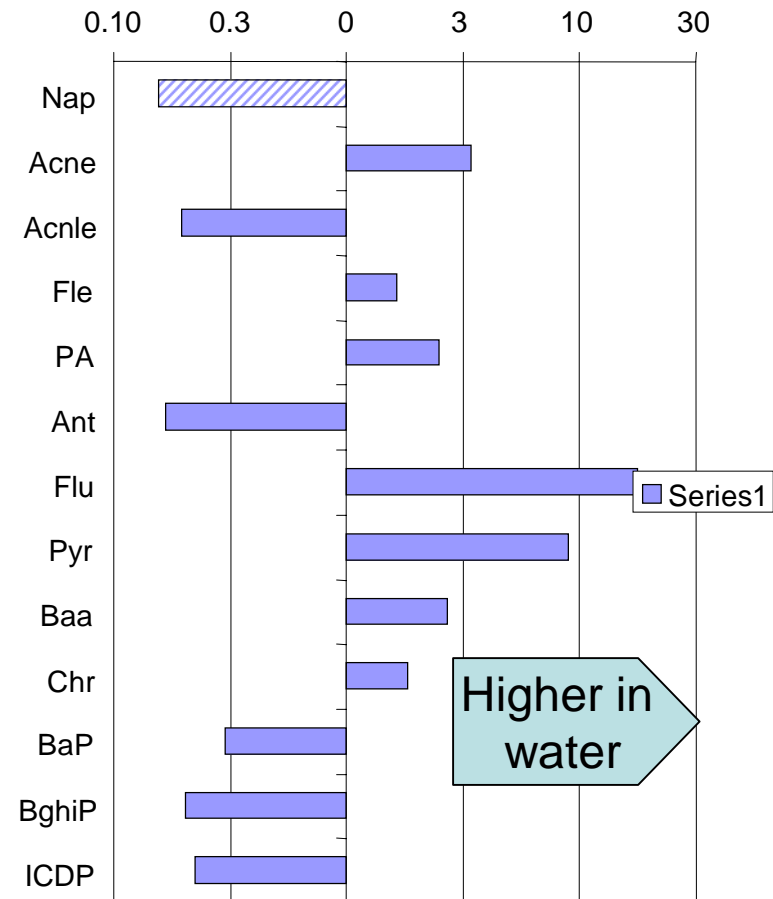
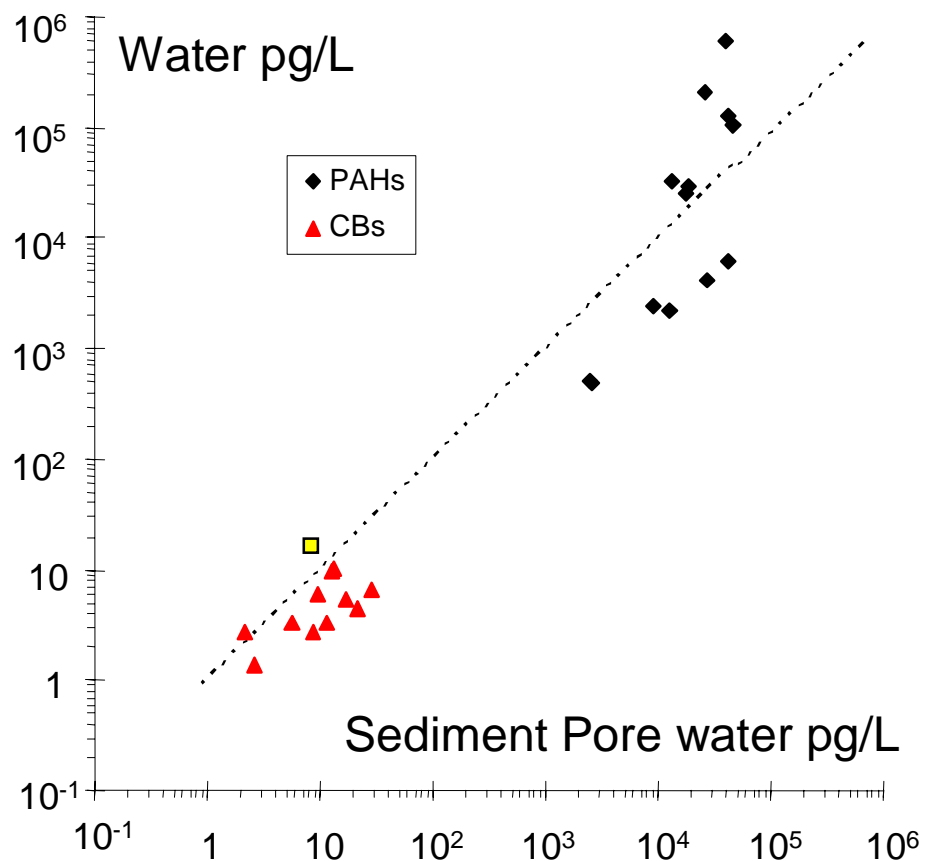
Surface- versus pore water (Mosjon)

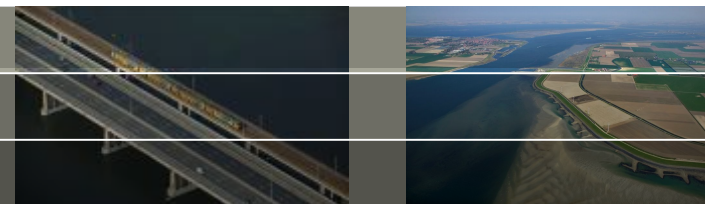


Surface versus pore water Zeebrugge



Surface versus pore water at Karmoy





Sediment samples from:

Integrated marine contaminant monitoring in the North Sea (*ICON*):
a framework for integrated chemical and biological monitoring.

Exercise was initiated the ICES

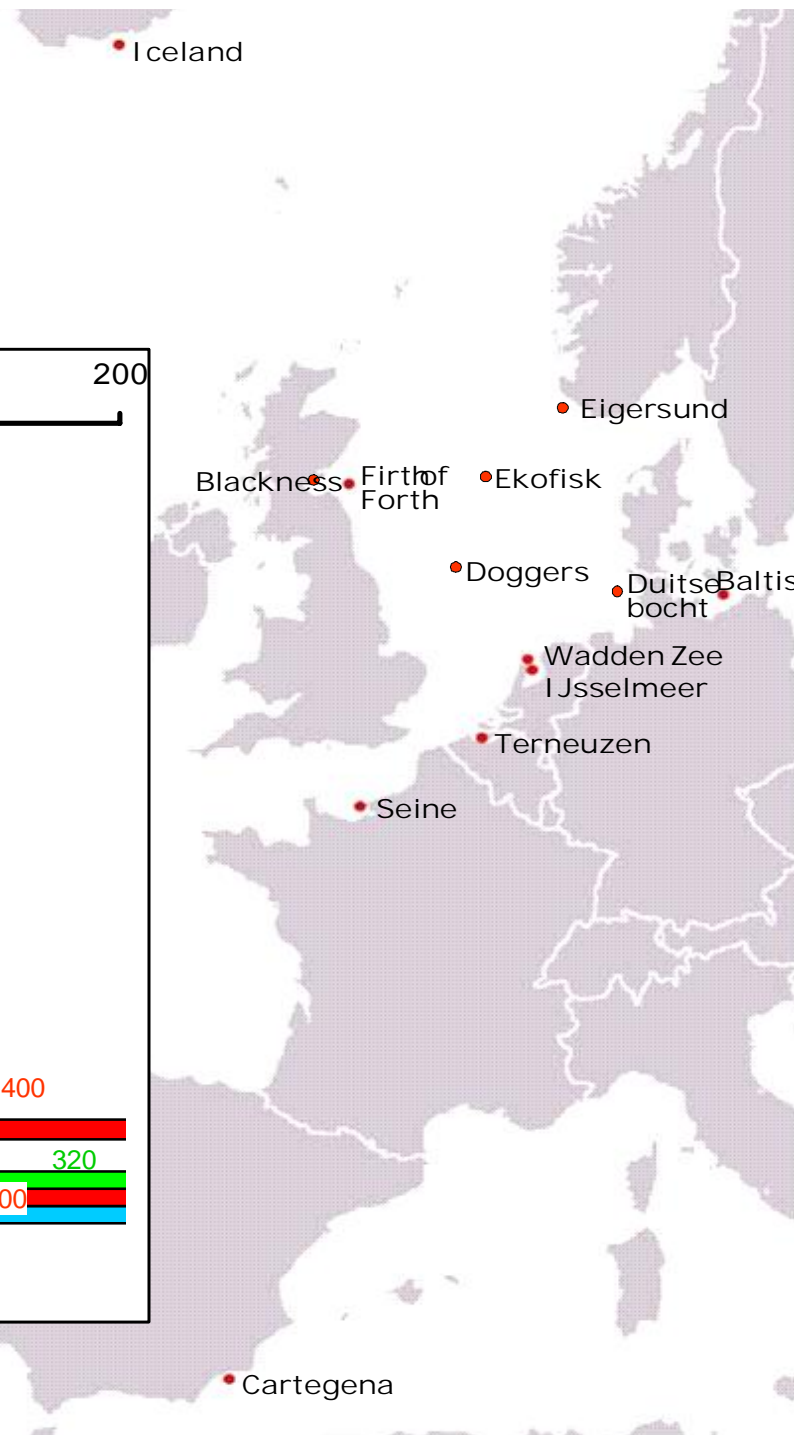
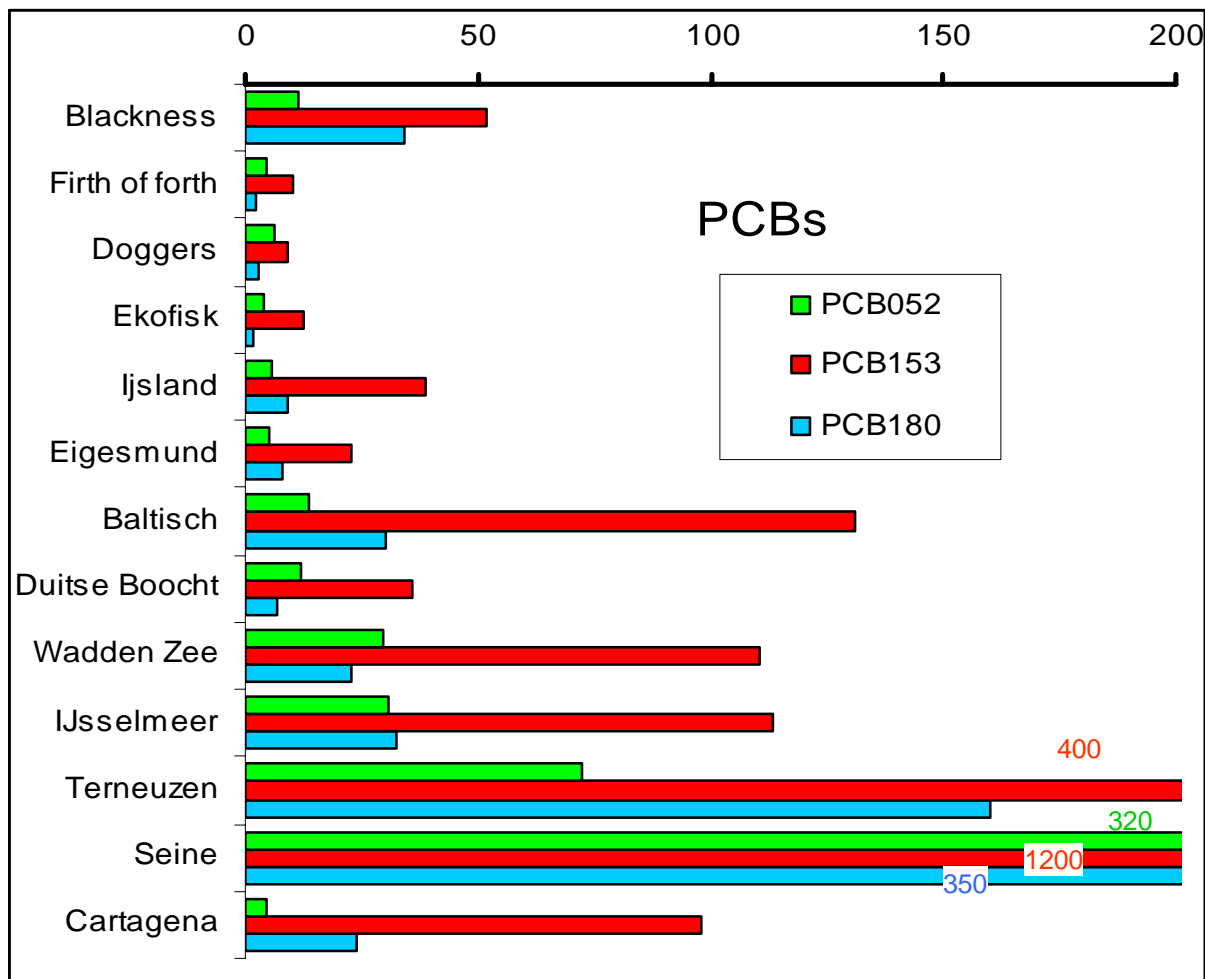
Working Group on Biological Effect of Conataminants (WGBEC)

Ketil Hylland, Dick Vethaak, Thomas Lang et al



PCBs in pore water

Nano gram substance at 3g siliconenrubber
Equilibrated with 2 kg sediment

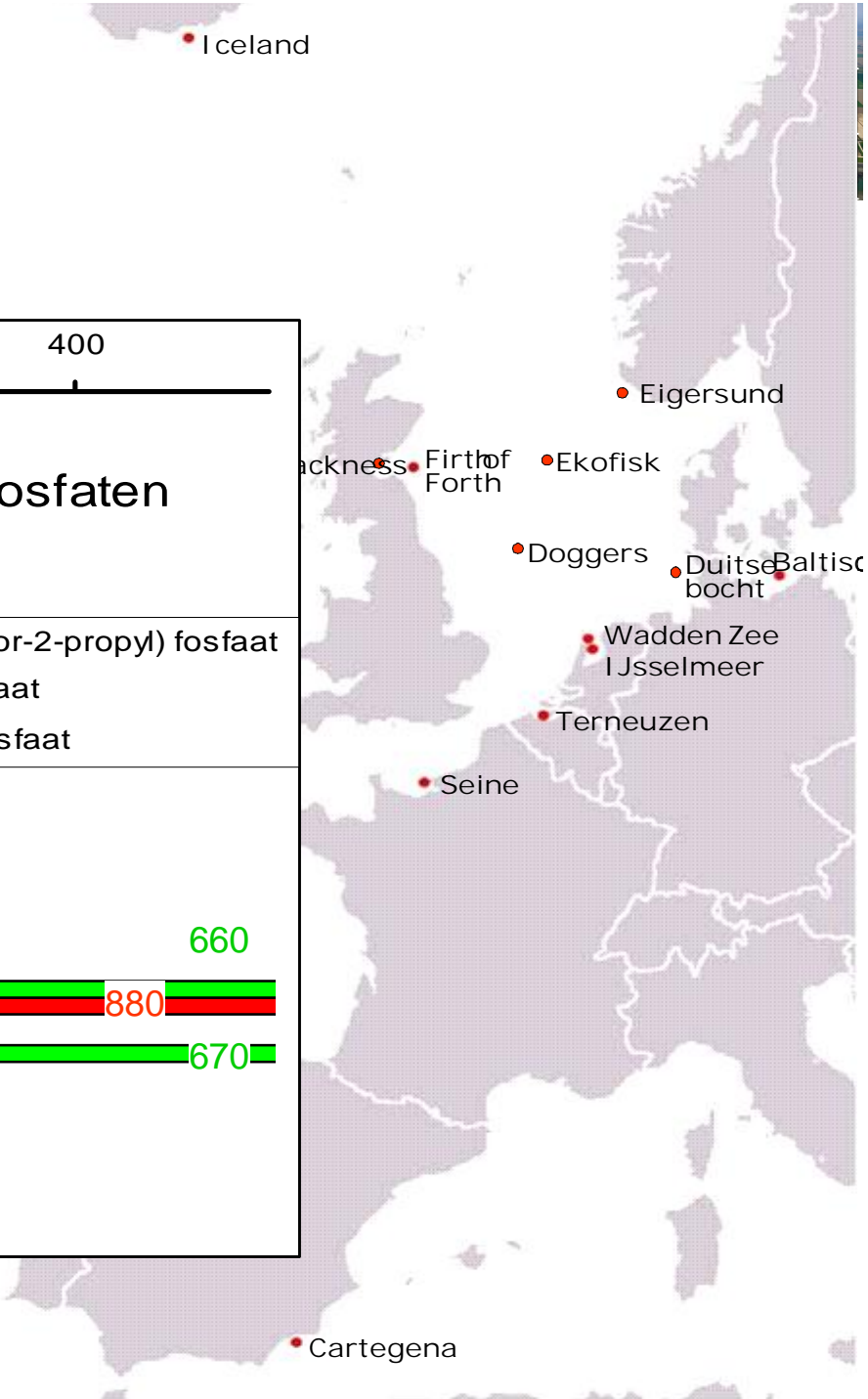
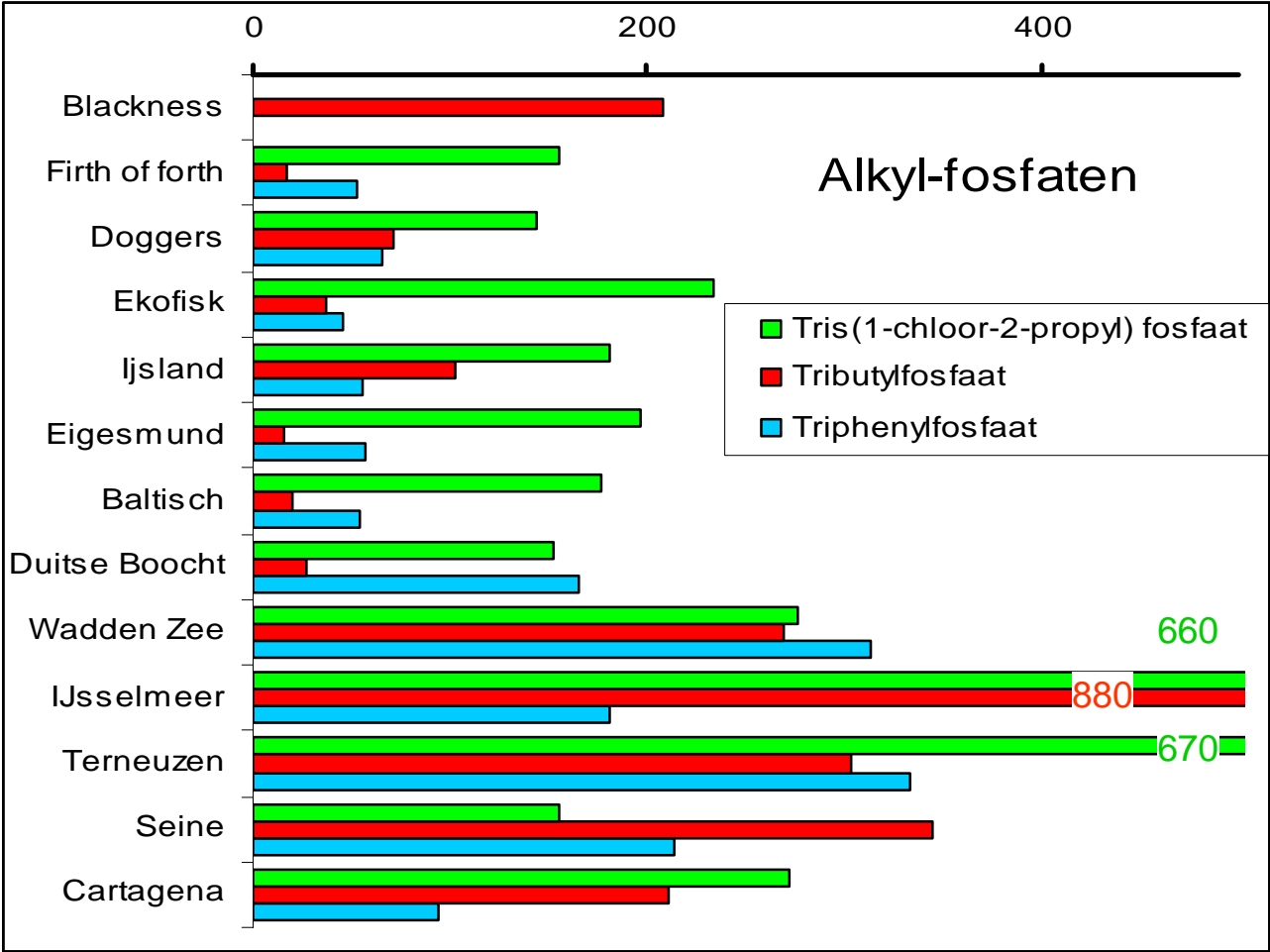


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Alkylphosphates in pore water

Nano gram substance at 3g siliconenrubber
Equilibrated with 2 kg sediment

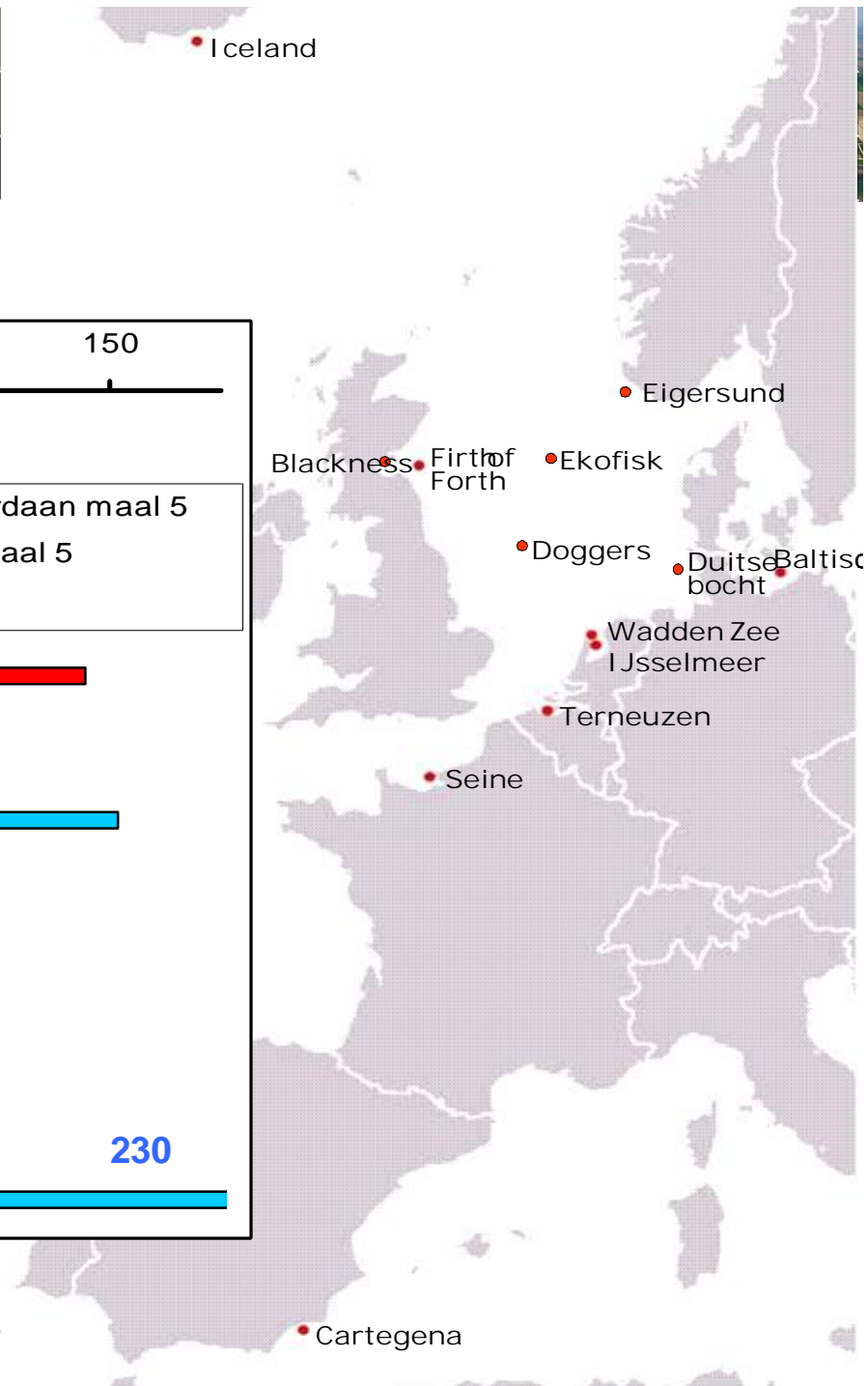
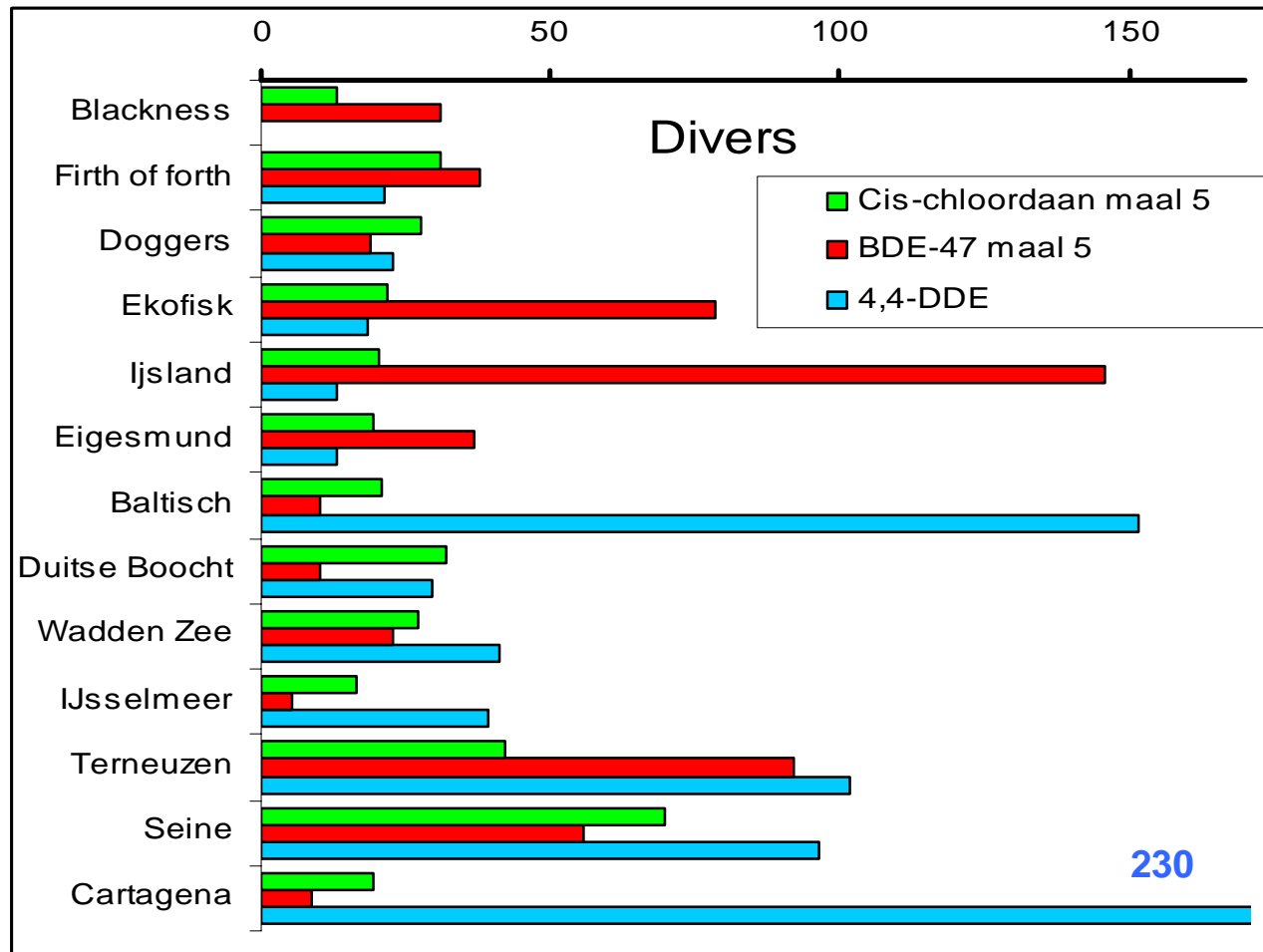


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Cis-chlordane, BDE47, 44DDE

Nano gram substance at 3g siliconenrubber
Equilibrated with 2 kg sediment



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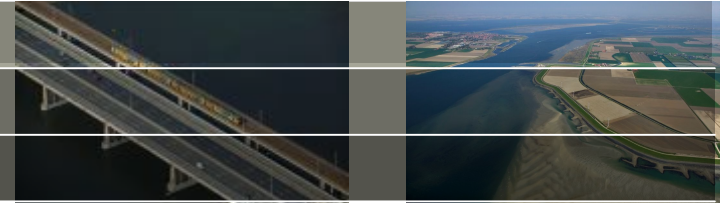
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Pro's of Passive sampling in water

- ✓ Worldwide comparability
- ✓ Different waters
Fresh and saline water, toxic, anoxic, porewater
- ✓ Sediment does also work



Con's of Passive sampling



Secure fixing facilities, buoy required

Hydro-phobic/philic compounds

multiple samplers required

~~Dual uptake~~

~~(a) equilibrium (b) depend on sampling rate measurement~~

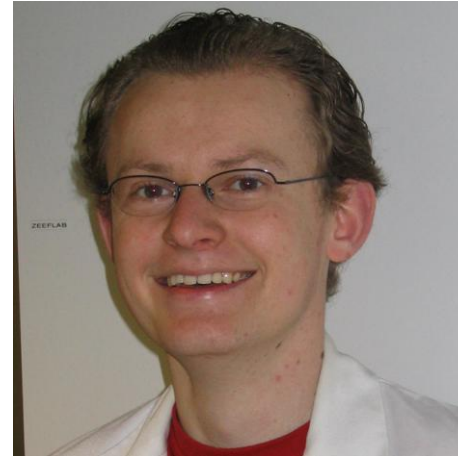
~~Bio-fouling, turbulence~~



Any applause should be dedicated to the RIKZ team



Karin
Koning



René
Geertsma



Wubbo
Wilts



Marjan
Veldman



Grietje
Nummerdor



Theo
Siderius



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Thank you for your attention

NORMAN Inter-Laboratory Study (ILS) on passive sampling of emerging pollutants
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