DGT 2019 VIENNA

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new tools for water quality monitoring

High-frequency spot sampling versus passive sampling: steps towards the acceptance of DGTs for regulatory monitoring. Case study in two estuaries of the Basque Coast

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Bigest European consortium working on DGTs

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Introduction

European Water Framework Directive (WFD;2000/60/EC)

Aim: to achieve a "Good Ecological and Chemical Status" for all European Union waters (including transitional/estuarine and coastal waters)

Ecological status

- Biological
- Hydromorphological
- Physico-chemical (main pollutants)

Chemical status

- Priority substances

- WFD (2013/39/EU)→ 45 priority substances
  - Four toxic metals (Cd, Pb, Ni, Hg)
- Good chemical status (*sensu* WFD)
  - [priority substances] < Environmental Quality Standards (EQS)
  - 'Compliance Checking'

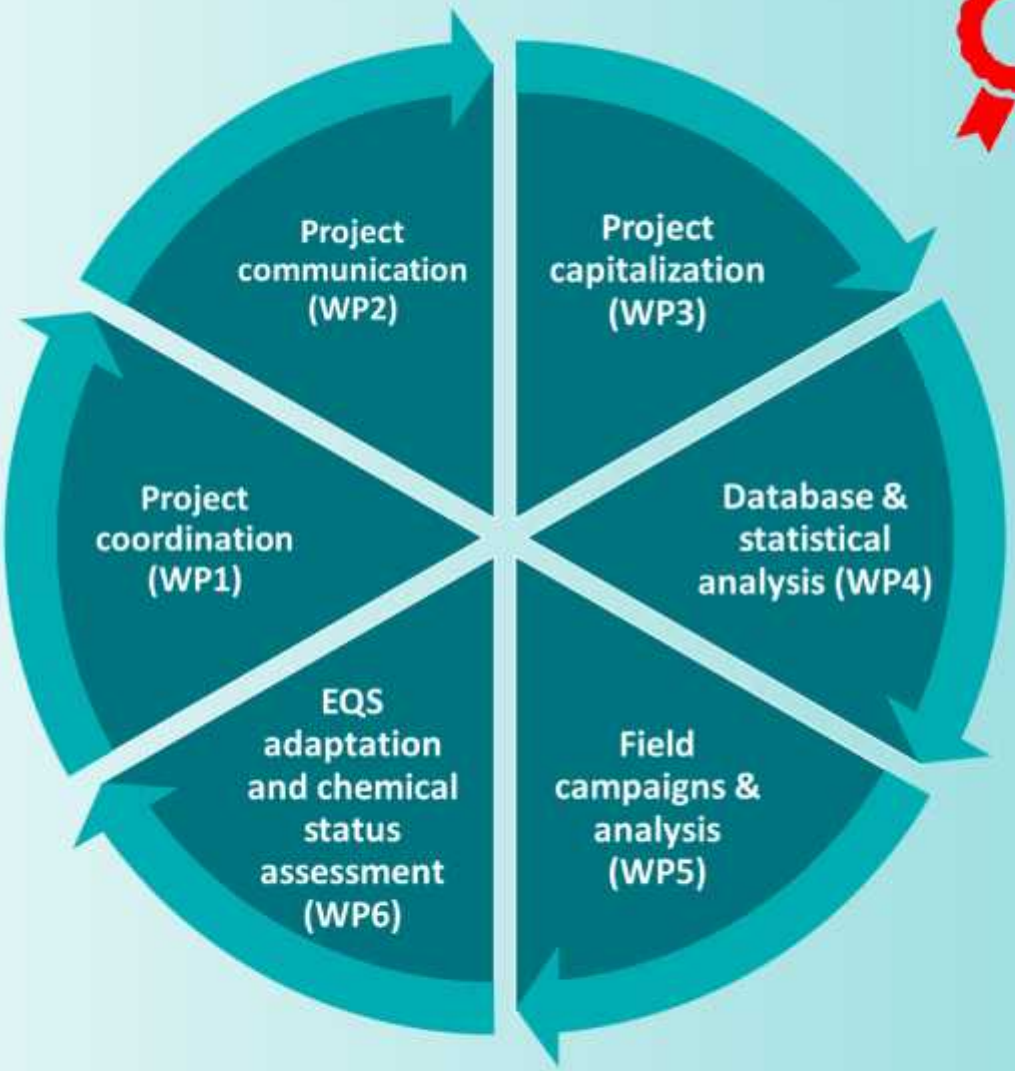
MONITOOL Project EAPA_565/2016

Interreg Atlantic Area Transnational Cooperation Programme
3 years (2017-2020)
Total cost: 1.92 M€
ERDF 75 %: 1,5 M€

Main objectives:

- To define Environmental Quality Standards and protocols for the use of DGTs in chemical monitoring within the European Water Framework Directive
- To develop a network of laboratories focused on the use of DGTs within the European Water Framework Directive

Monitool Work Packages



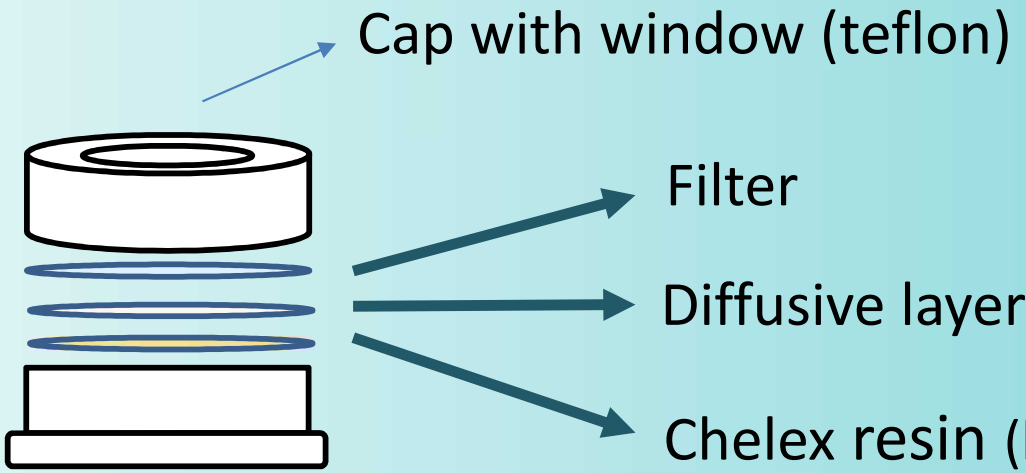
Common protocols for sampling and análisis:
ALL partners followed the same protocol in the different regions

All samples were analyzed within the Consortium:
3 different labs for:
Metals in Waters by ICPMS.
Metals in Waters by voltametry
Metals in DGT resins by ICPMS

All results from the different regions are recorded in a common database

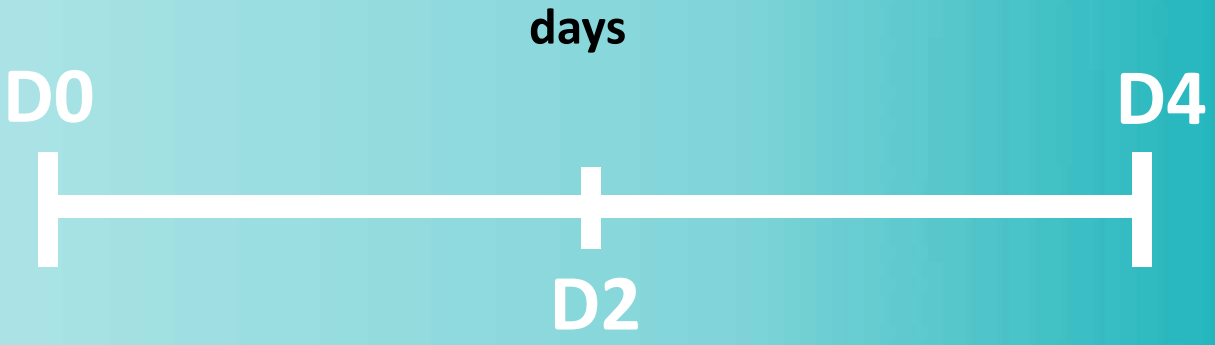
Passive samplers for metals DGT type

- DGT: Diffussive Gradient in Thin Films
- Disc of ± 4 cm of diameter and 2.0 cm of diameter of the exposition window
- Filled by three membranes:
  - Polysulfone filter (0.45 µm Ø; avoid particle abrasion)
  - Diffusive layer of hydrogel (0.8 mm thickness; **Polyacrylamide**)
  - **Chelex-100** resin immersed in polyacrylamide (0.4 mm thickness; cations exchange)

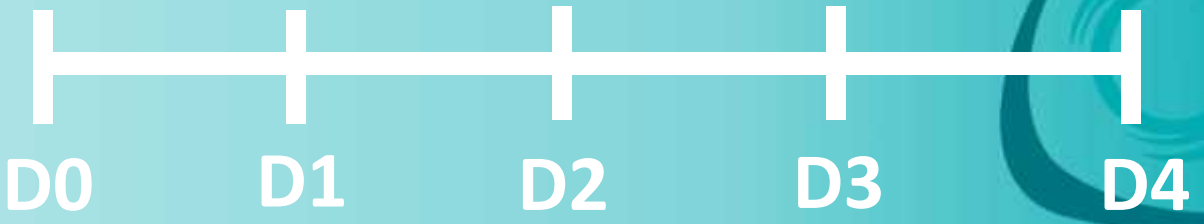


WP5: Monitool sampling strategy

- 8 European regions
- 4 sampling sites per region (estuary or coast)
- In 2018: 2 sampling campaigns (wet and dry seasons)



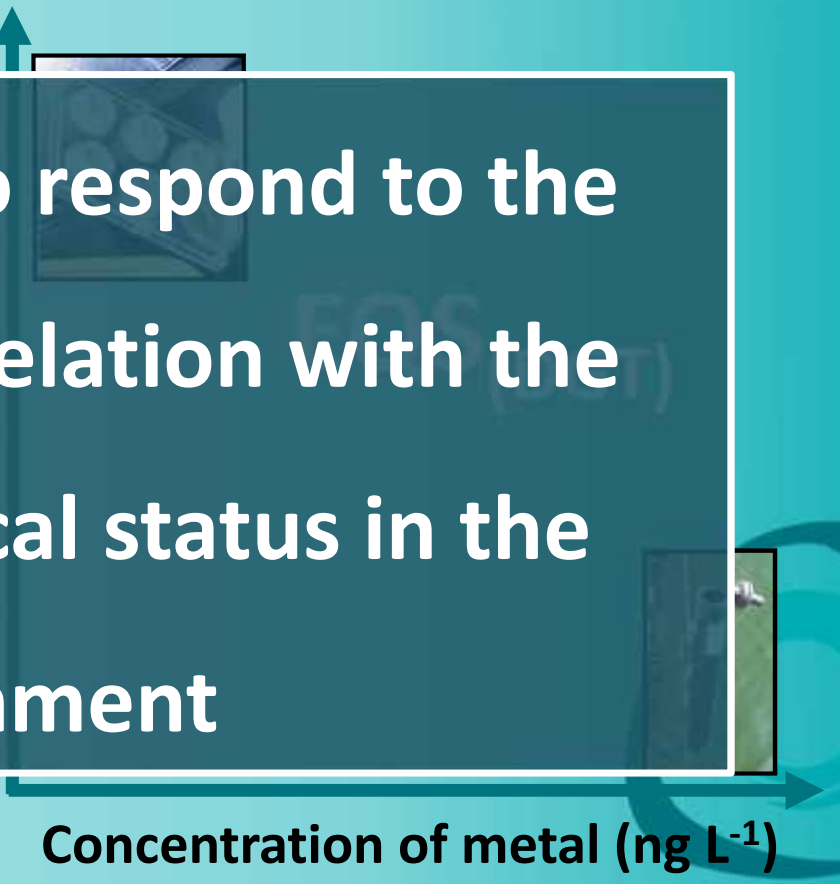
Coast: 3 days (1 sampling per day)
Estuary: 5 days and 2 sampling per day (at high and low tide)



WP4: Database and statistical analysis

Published/ unpublished data + MONITOOL data → Environmental quality standard (EQS) adaptation for DGT

The application of DGT to respond to the demands of the WFD in relation with the evaluation of the chemical status in the marine environment

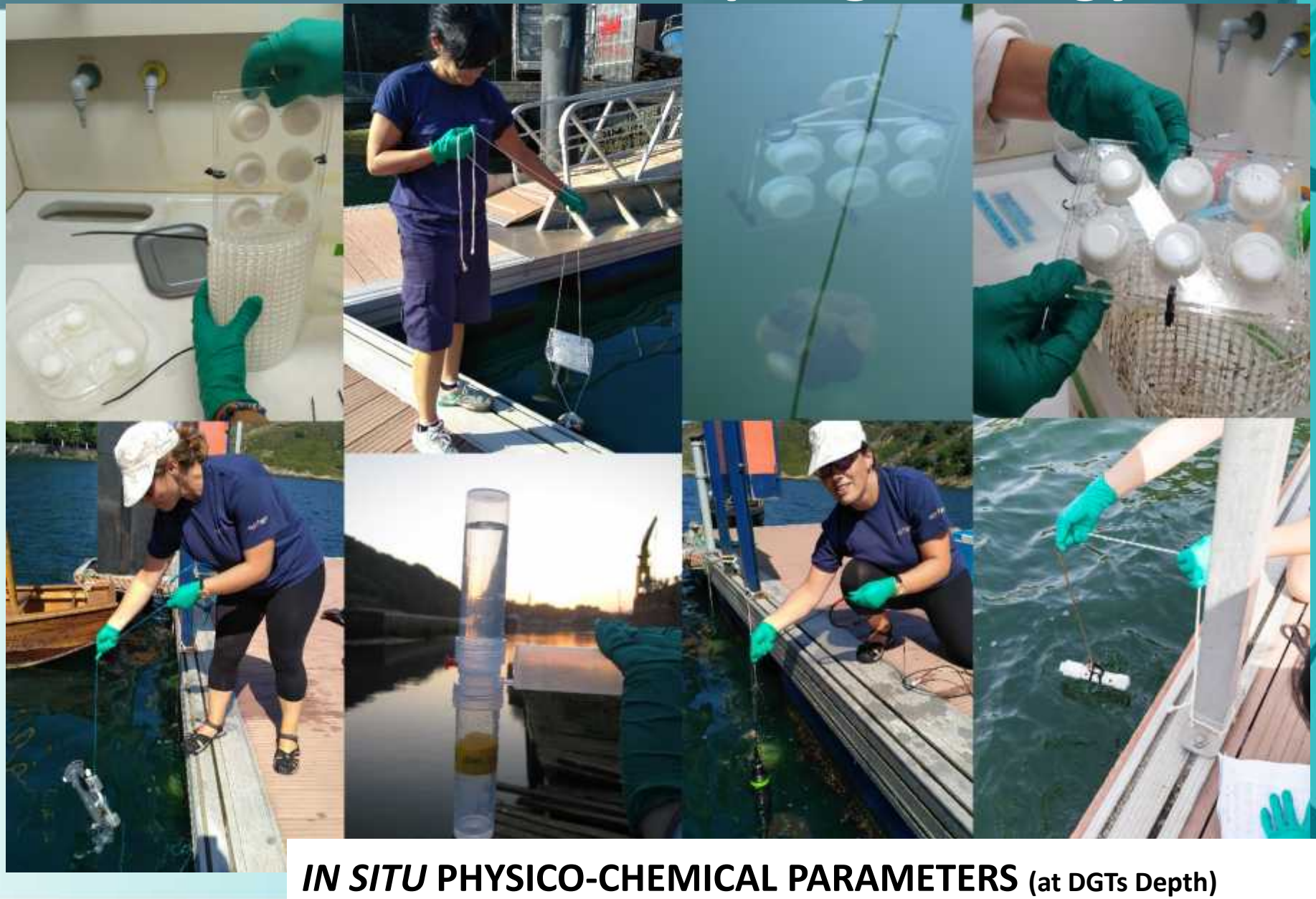


WP5: Monitool Sampling Sites

TOTAL nº of sites:
21 coastal sites
13 estuarine sites

Over 250 DGTs and over 500 seawater samples from wet and dry campaign

WP5: Monitool sampling strategy



***IN SITU* PHYSICO-CHEMICAL PARAMETERS (at DGTs Depth)**

Temperature, salinity, DO (mg/L and %), pH, turbidity, depth, specific conductivity, biofouling

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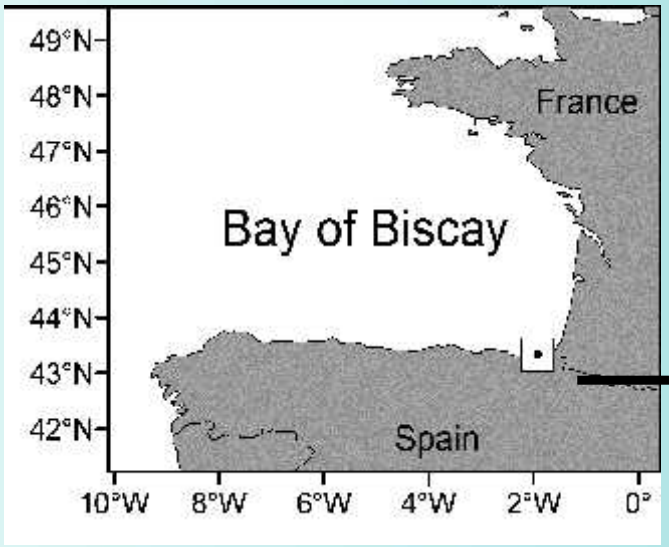
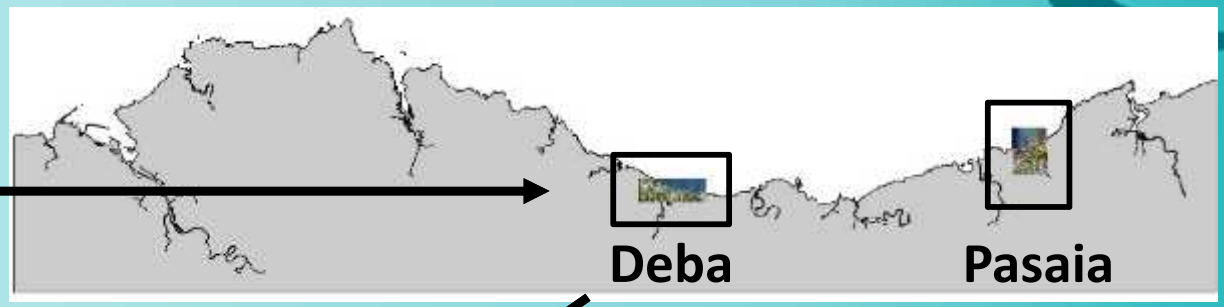
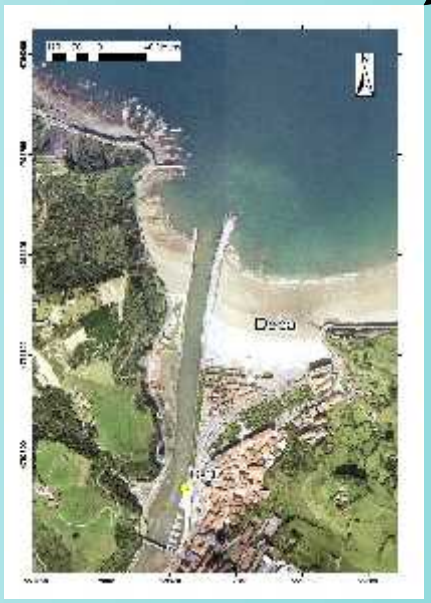
Sampling campaigns in the Basque Coast



Basque coast





2 estuaries with different riverine/marine influence; different contamination sources.
4 stations
2 campaigns:
Wet season (February-March 2018)
Dry season (September 2018)

Sampling sites in the Basque Coast

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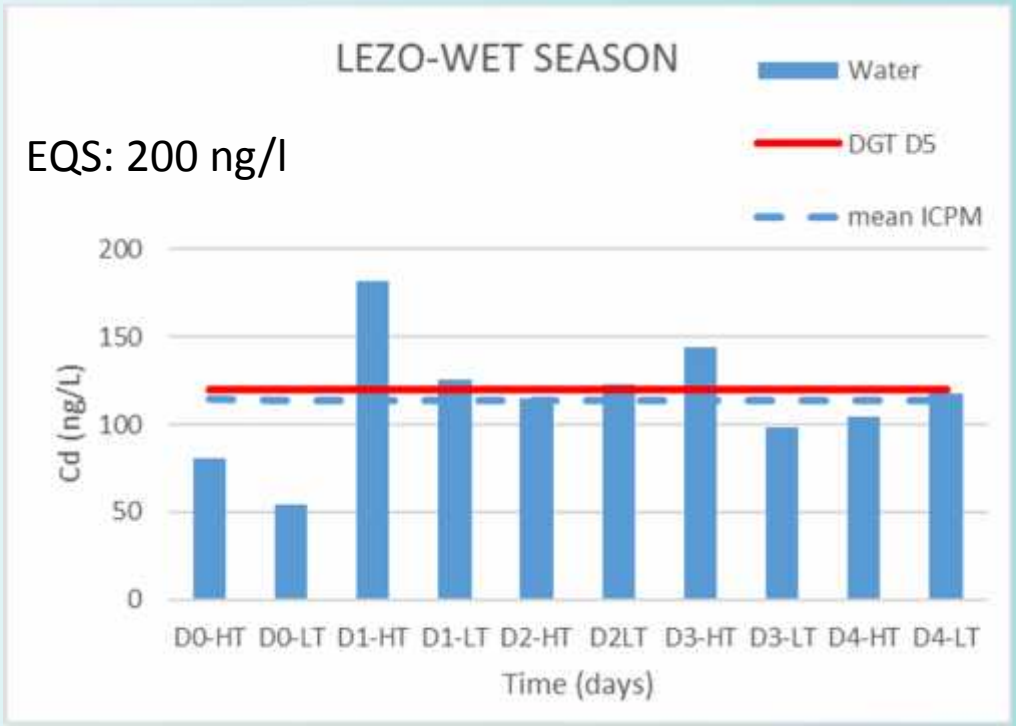
Results

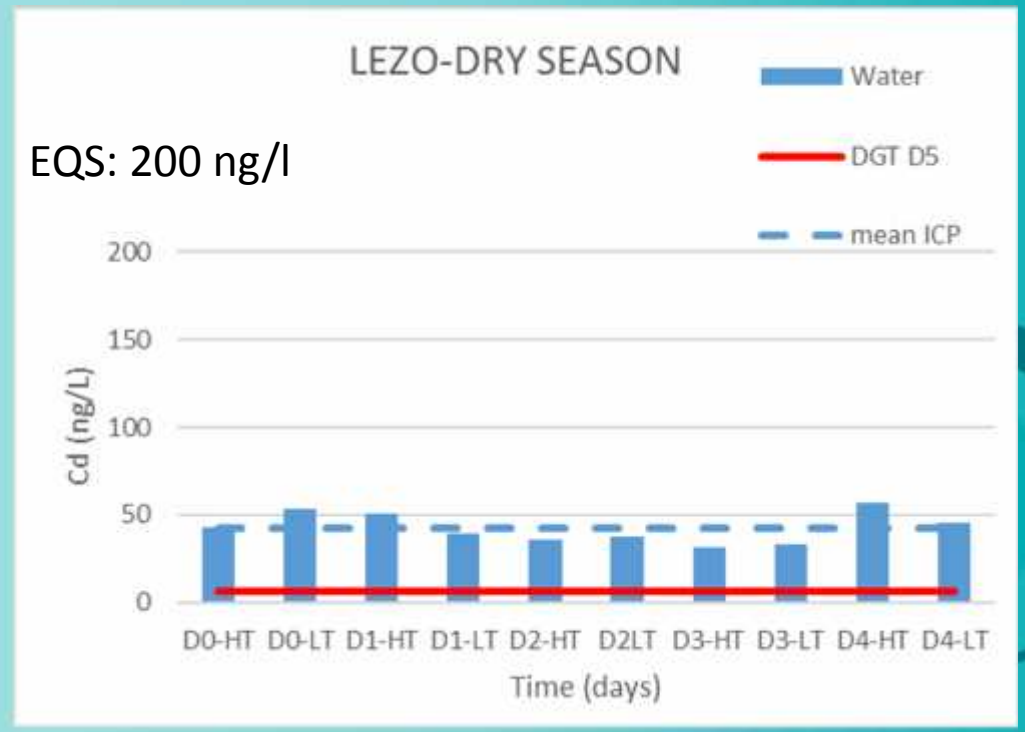
Cd, **Ni**, **Pb**, Co, Cr, Cu, Fe, Mn, Zn

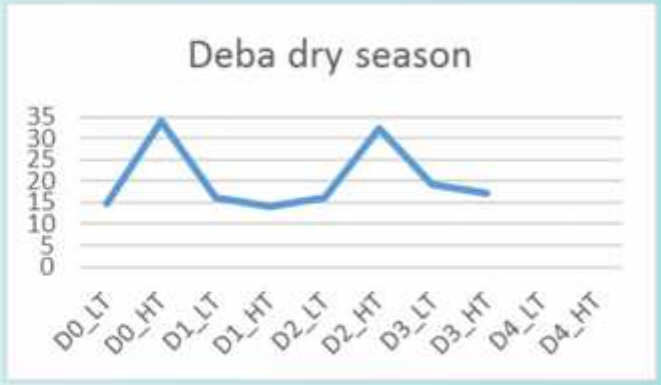
Results show differences with seasonality and between estuaries (different salinity ranges, DOC, spm, turbidity, different contamination sources….)

Salinity range: 3-28 psu

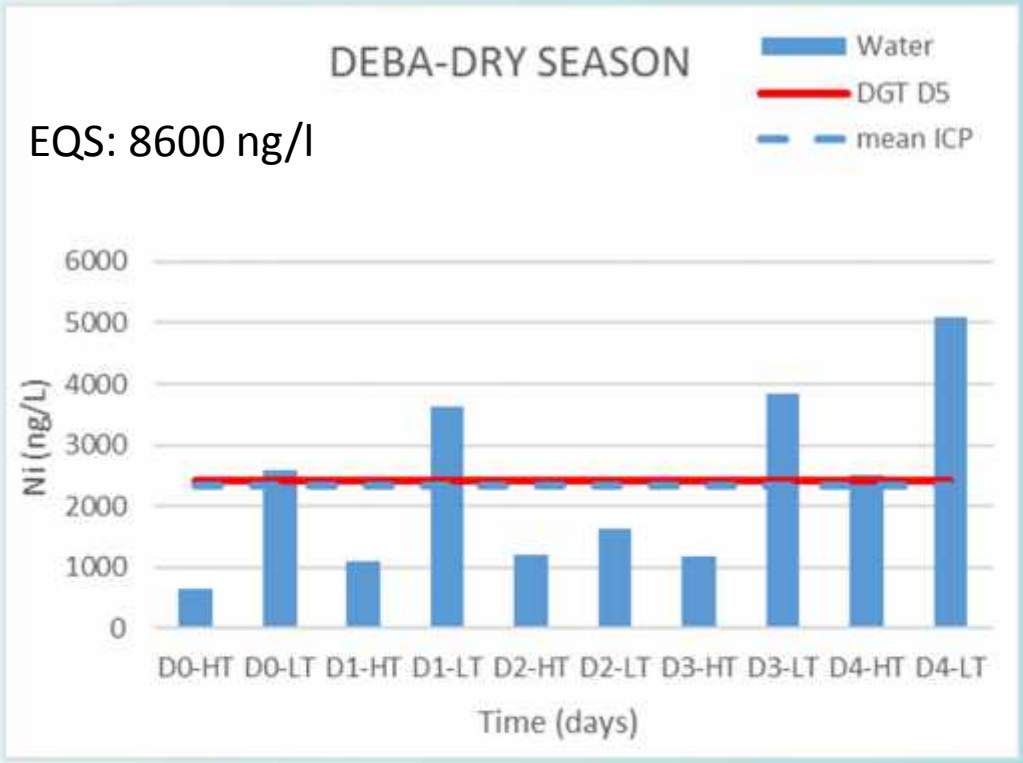


Salinity range: 24-34 psu

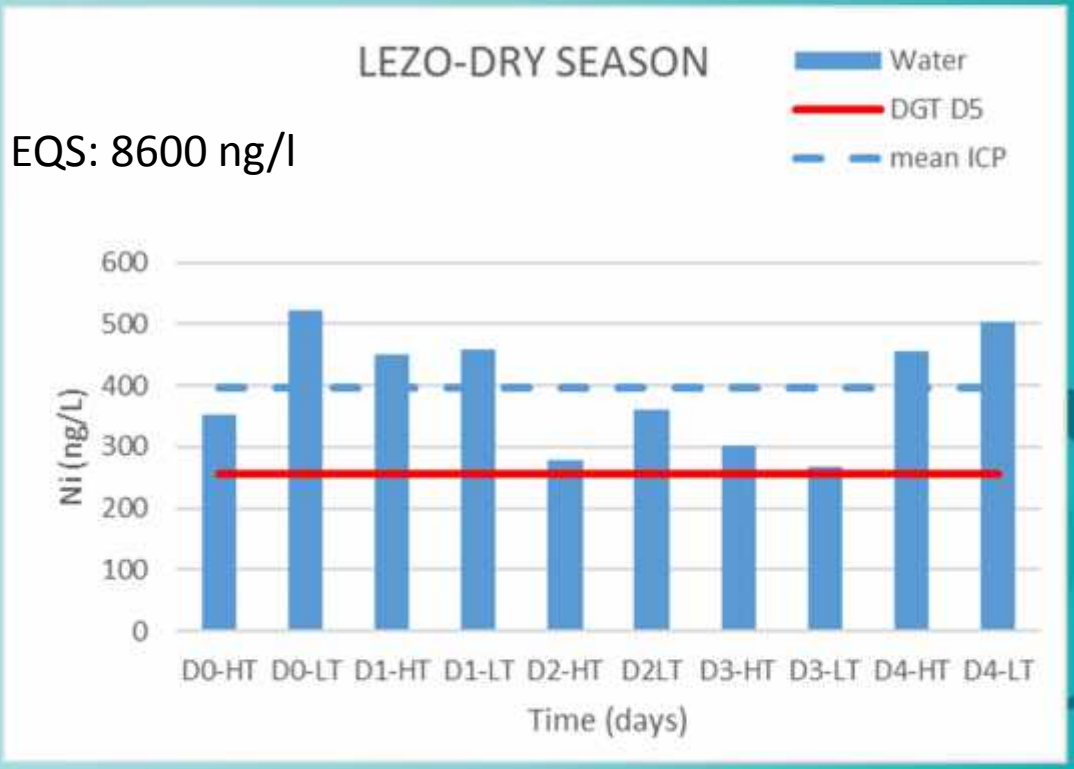




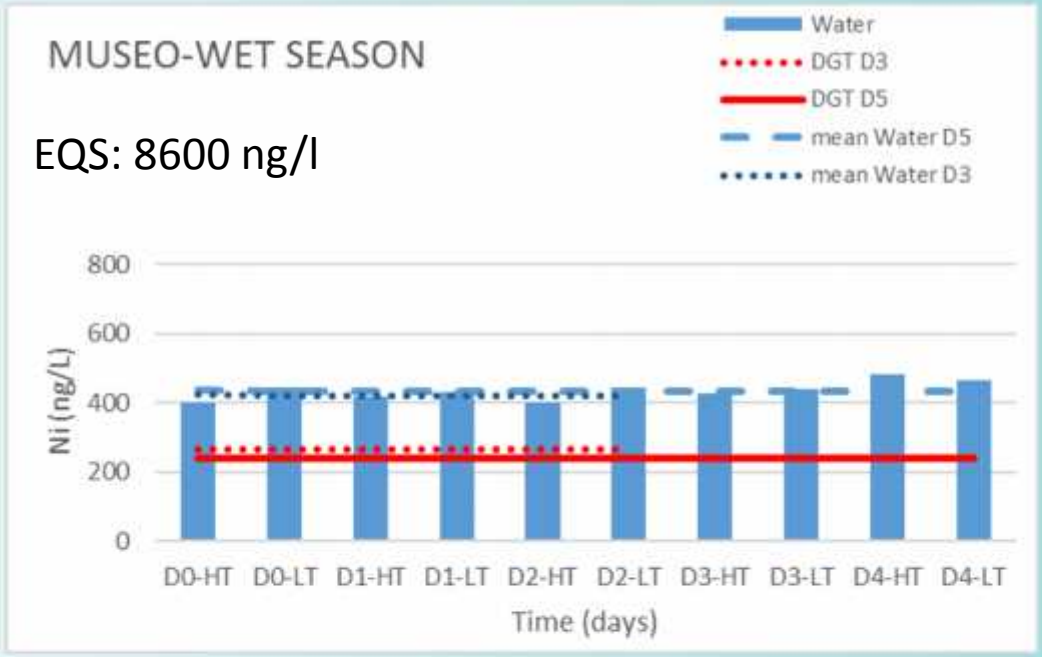
EQS: 8600 ng/l

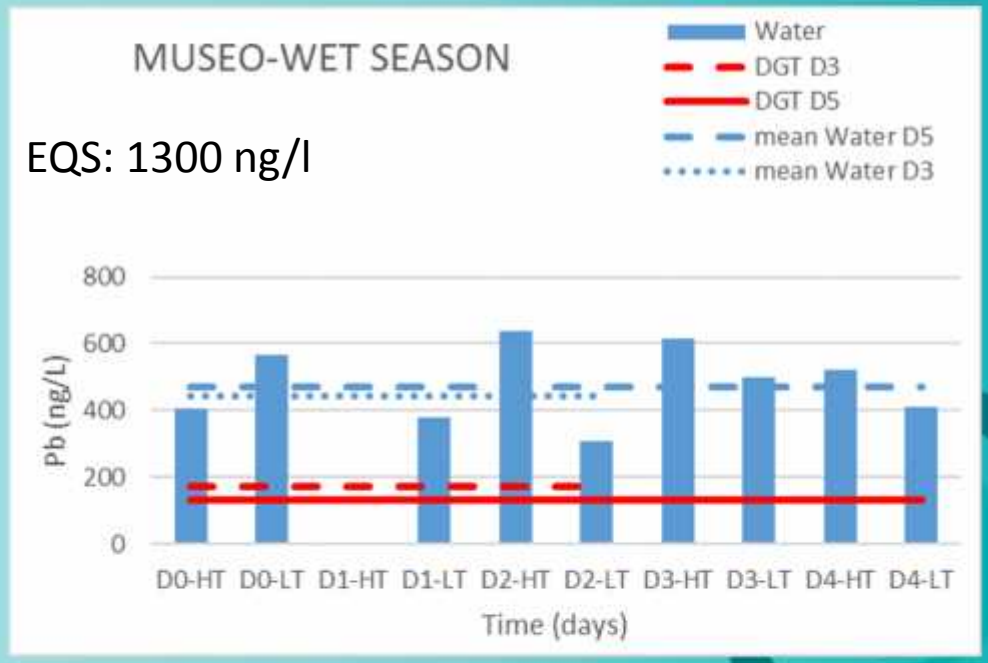


EQS: 8600 ng/l



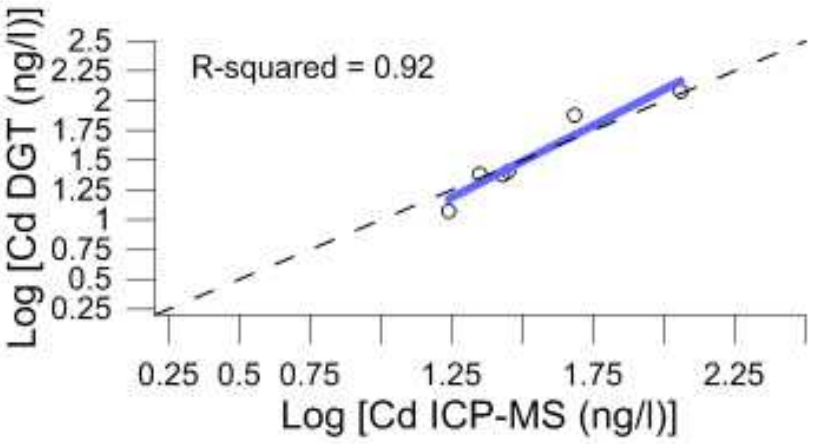

Museo wet season
35
30
25
20
15
10
5
0
D0_LT D0_HT D1_LT D1_HT D2_LT D2_HT D3_LT D3_HT D4_LT D4_HT

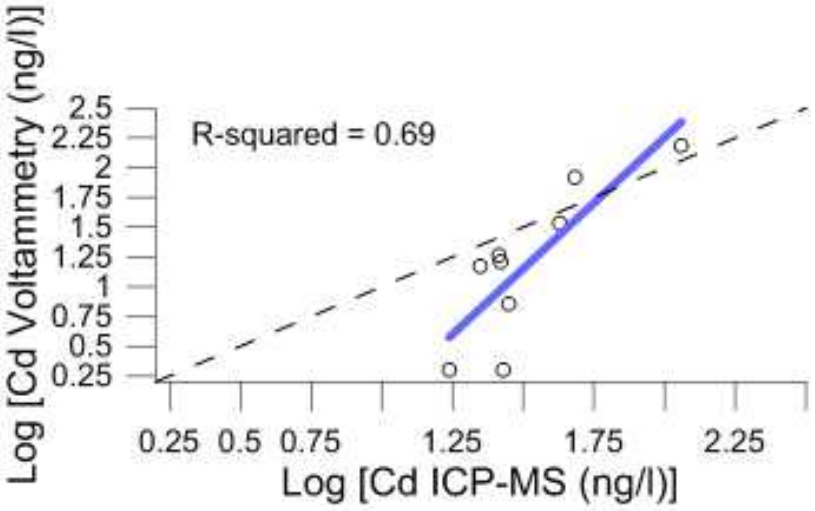

MUSEO-WET SEASON
EQS: 8600 ng/l
Water
DGT D3
DGT D5
mean Water D5
mean Water D3
800
600
400
200
0
Ni (ng/L)
D0-HT D0-LT D1-HT D1-LT D2-HT D2-LT D3-HT D3-LT D4-HT D4-LT
Time (days)

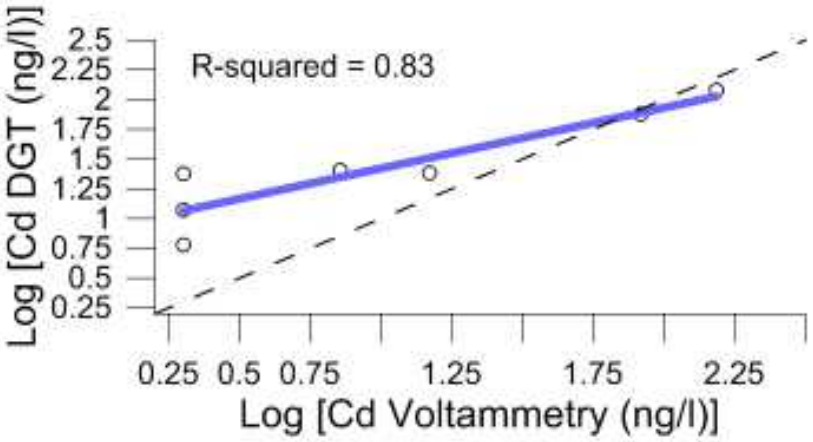

MUSEO-WET SEASON
EQS: 1300 ng/l
Water
DGT D3
DGT D5
mean Water D5
mean Water D3
800
600
400
200
0
Pb (ng/L)
D0-HT D0-LT D1-HT D1-LT D2-HT D2-LT D3-HT D3-LT D4-HT D4-LT
Time (days)

Results: correlations

Cd

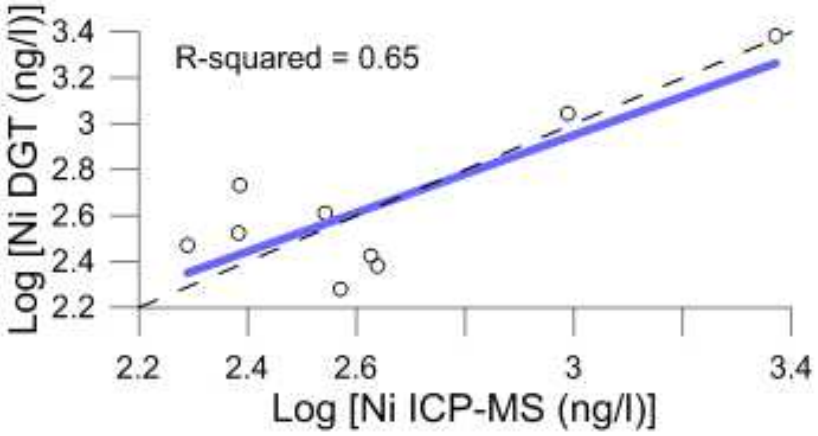


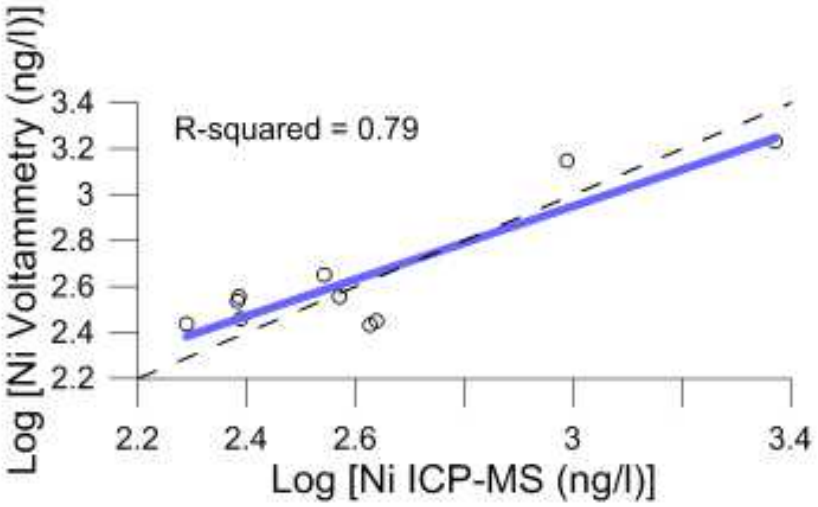


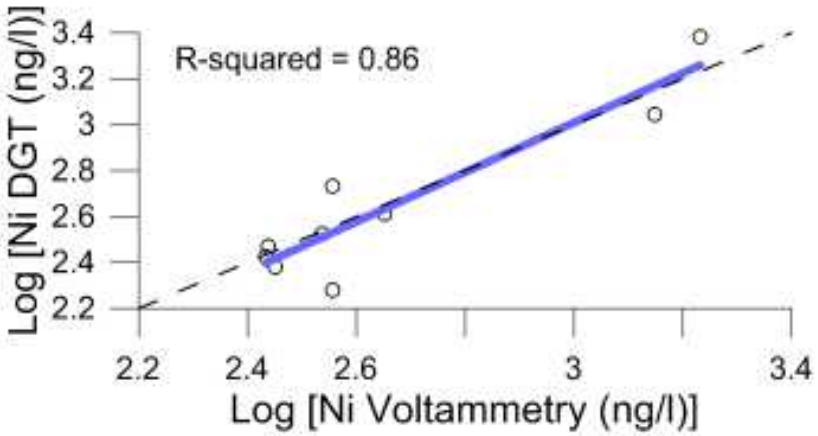


Results: correlations

Ni

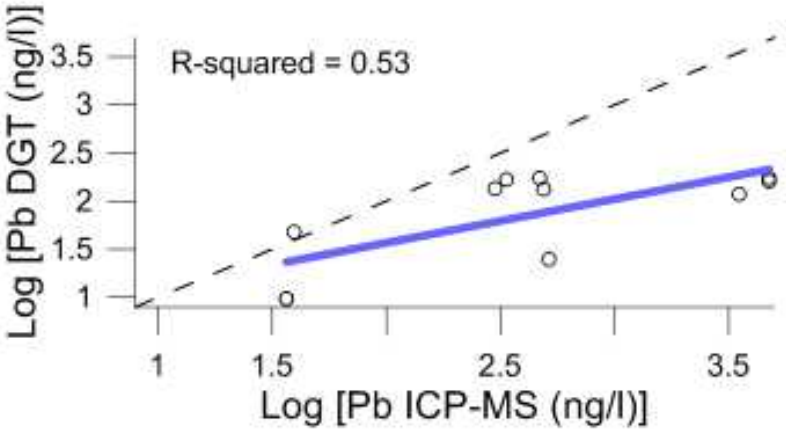


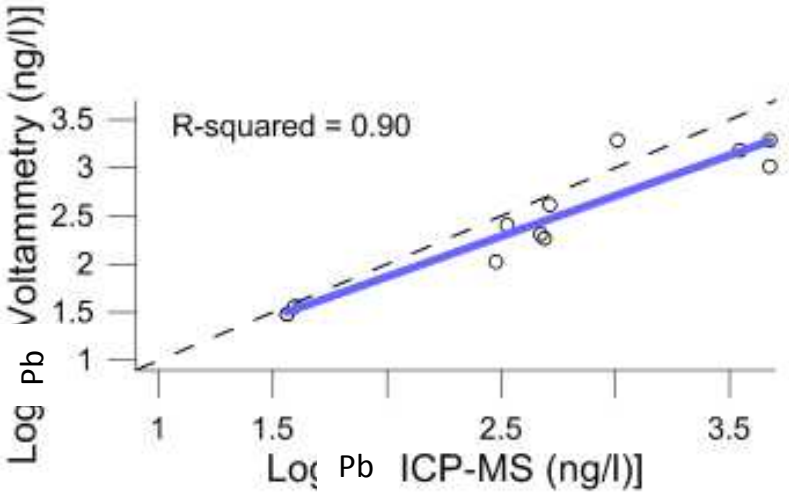


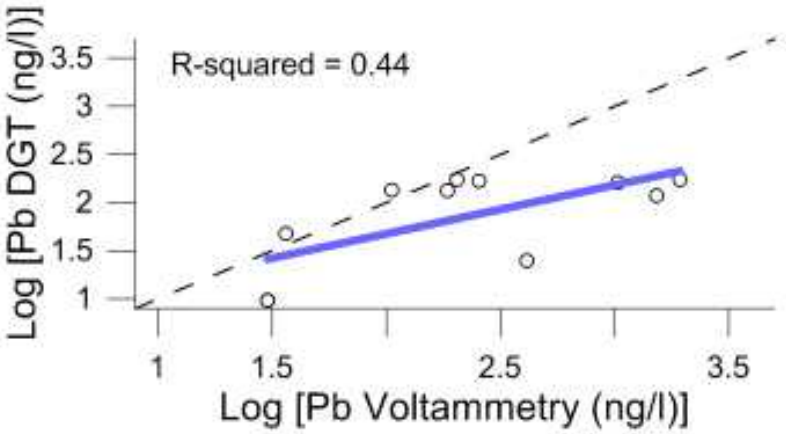


Results: correlations

Pb

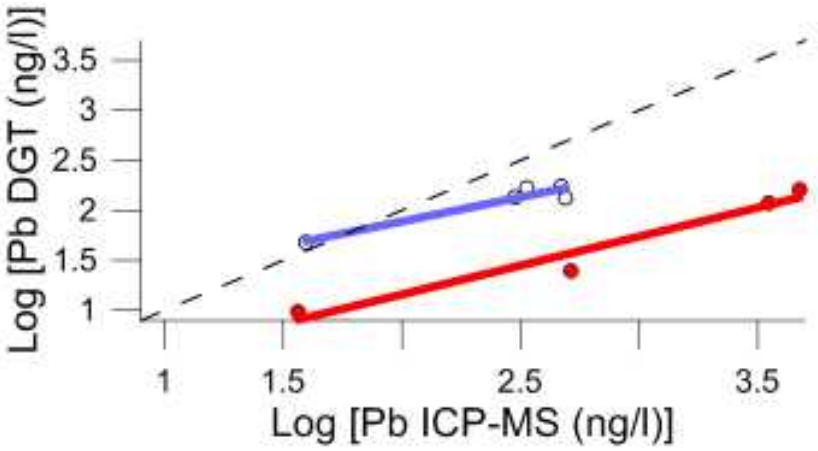


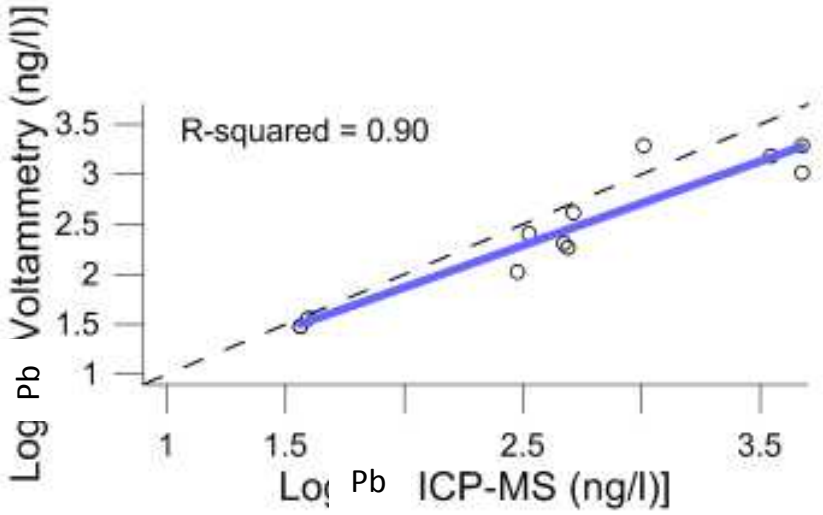


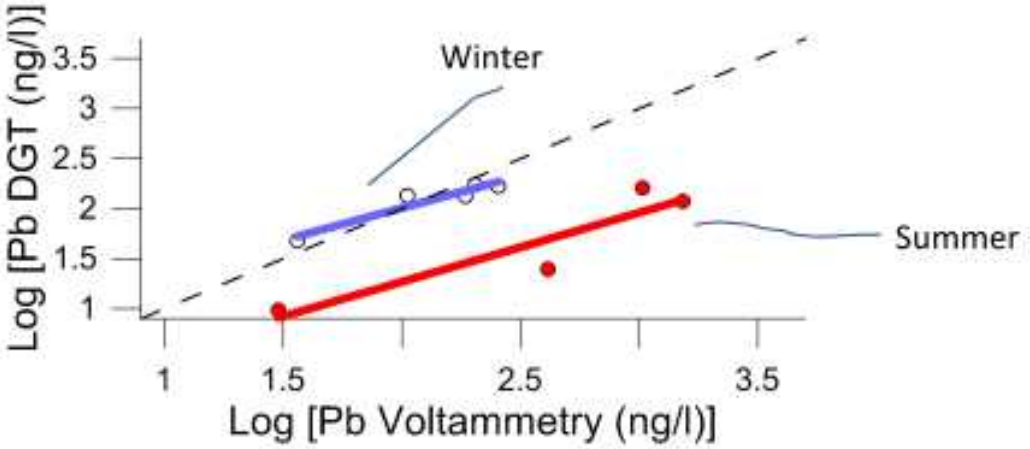


Results: correlations

Pb







Next steps:

- Correlation analysis of metal concentrations with environmental parameters.

- Statistical analysis with all data from 8 regions.

- To derive the EQS

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