MONITOOL PROJECT

Step-by-step practical case study: learn to use DGTs for the chemical assessment of marine waters

Natalia Montero, AZTI

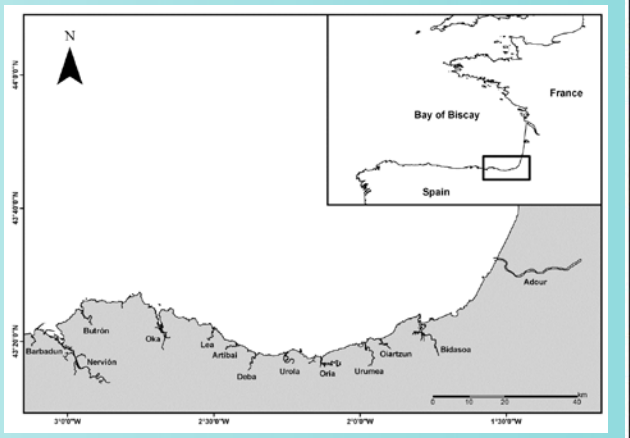
Cagliari, 19 May 2023

MONITOOL
new tools for water quality monitoring

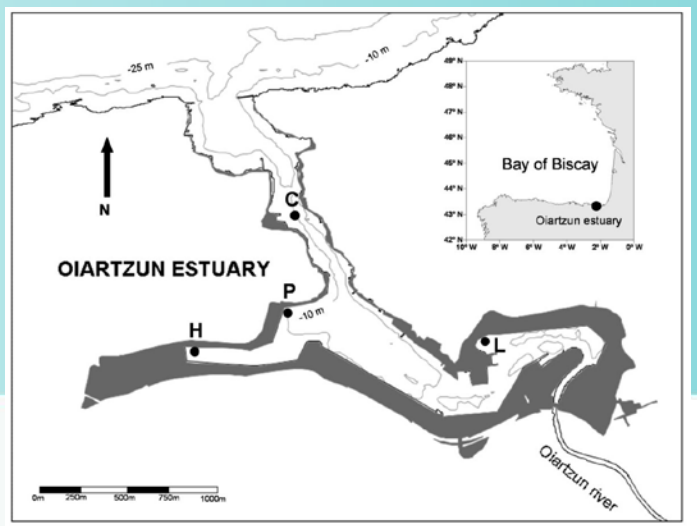
Let's start.....

- Decide your sampling strategy based on the questions you'd like to answer:
  - Number of stations (spatial coverage)
  - Number of sampling campaigns (temporal resolution): e.g., dry/wet season

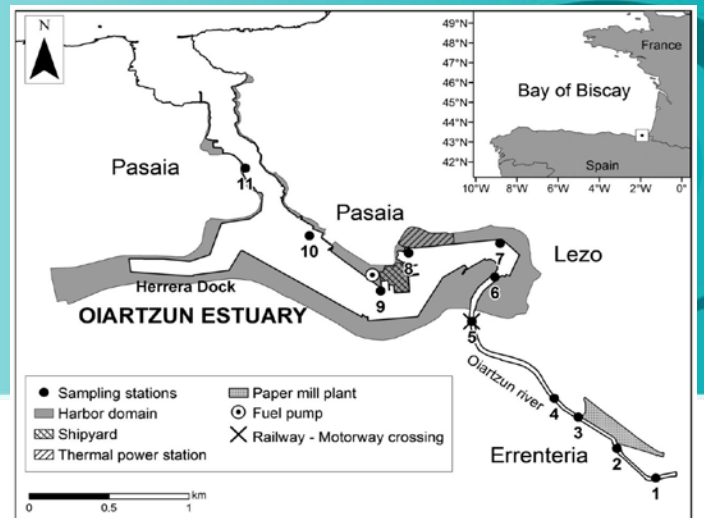
Water quality in estuaries
(oligohaline/euhaline stretches)



Dredging activity
(dispersion of contaminants)



Identification of sources
(high spatial coverage)



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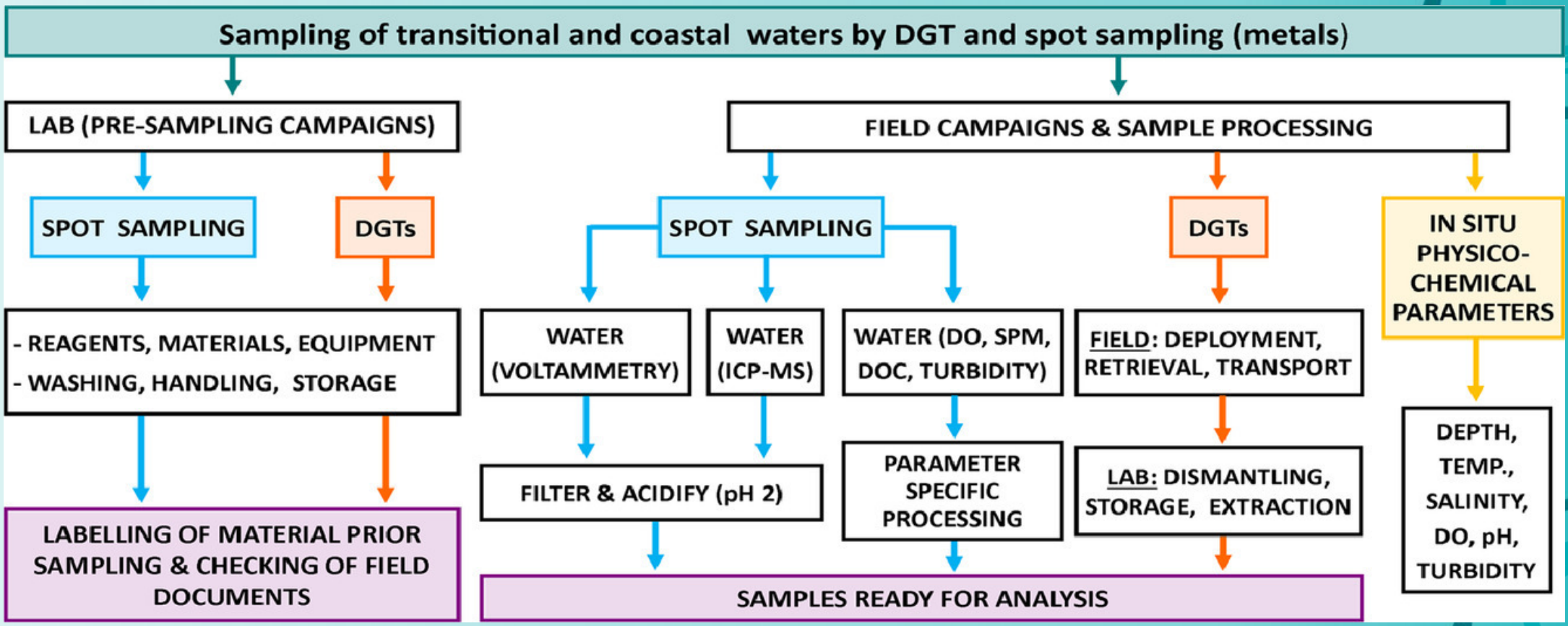
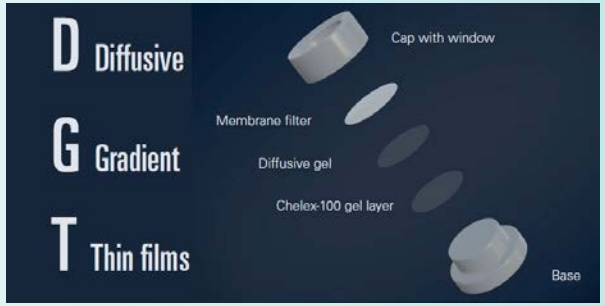
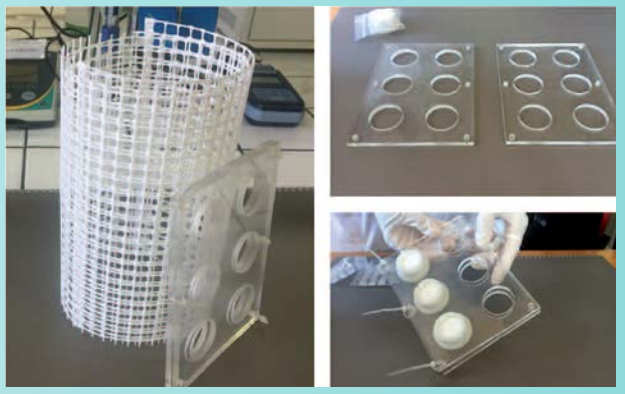
Laboratory work & Sampling campaigns (freely available videos & protocols)

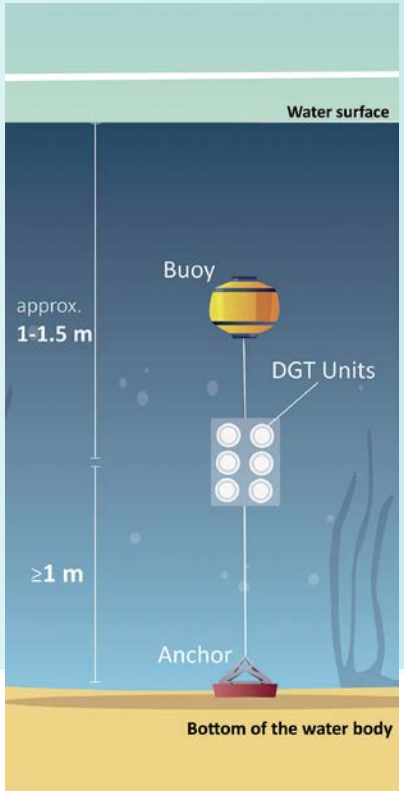


- Bersuder et al. 2021. Concurrent sampling of transitional and coastal waters by Diffusive Gradient in Thin-films (DGT) and spot sampling for trace metals analysis. MethodsX 8, 101462.
- Millán et al. 2021. A Good Practice Guide for the Use of DGTs Sampling of metals in transitional and coastal waters by Diffusive Gradient in Thin films (DGT) technique. Publisher: Instituto Tecnológico de Canarias, 44 pp.
- Tutorials: https://www.monitoolproject.eu/multimedia/videos (laboratory, DGT deployment/retrieval, DGT processing)

Step-by-step preparation (I): laboratory preparation & deployment



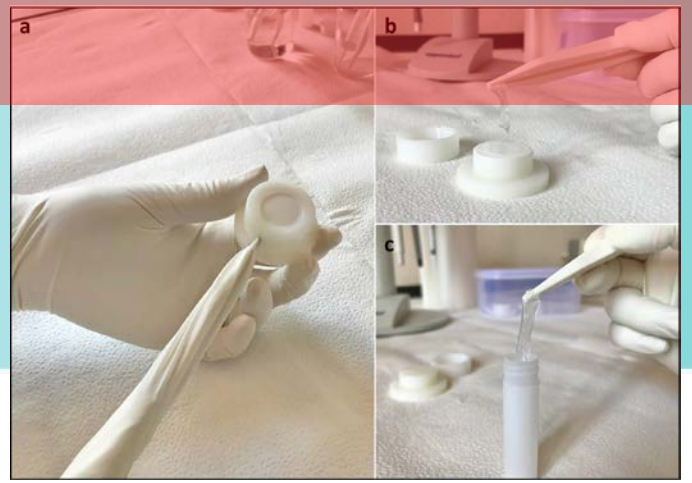


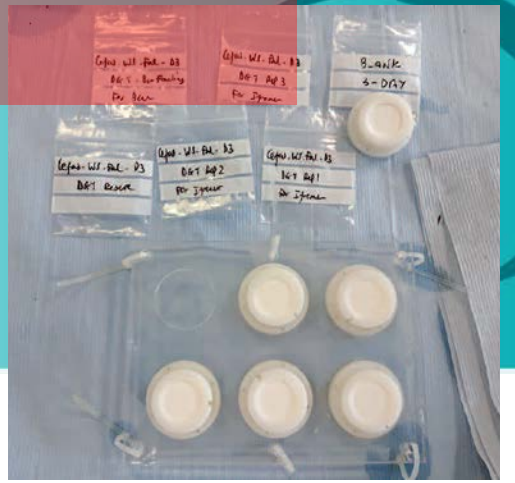


Step-by-step preparation (II): retrieval, DGT processing & analysis

Remember to note down

deployment time & temperature





From DGTs to water concentration during the deployment time (I)

$$M = \frac{C_{eluate}(V_{gel} + V_{HNO3})}{f_e}$$

M (µg)= mass of metal accumulated in the resin

C_{eluate} ($\mu g L^{-1}$)= concentration of metals in the eluate

V_{gel} (mL)= volume of the resin gel (typically 0.15 ml)

V_{HNO_3} (mL)= volume of HNO_3 added for resin elution

f_e= elution factor (typically 0.8)

$$C_{water} = \frac{M\Delta g}{DtA}$$

C_{water} ($\mu g L^{-1}$)= metal concentration in water

Δg (cm)= thickness diffusive membrane + filter

D ($cm^2 s^{-1}$)= difussion coefficient of metal in the gel

t (seconds)= deployment time

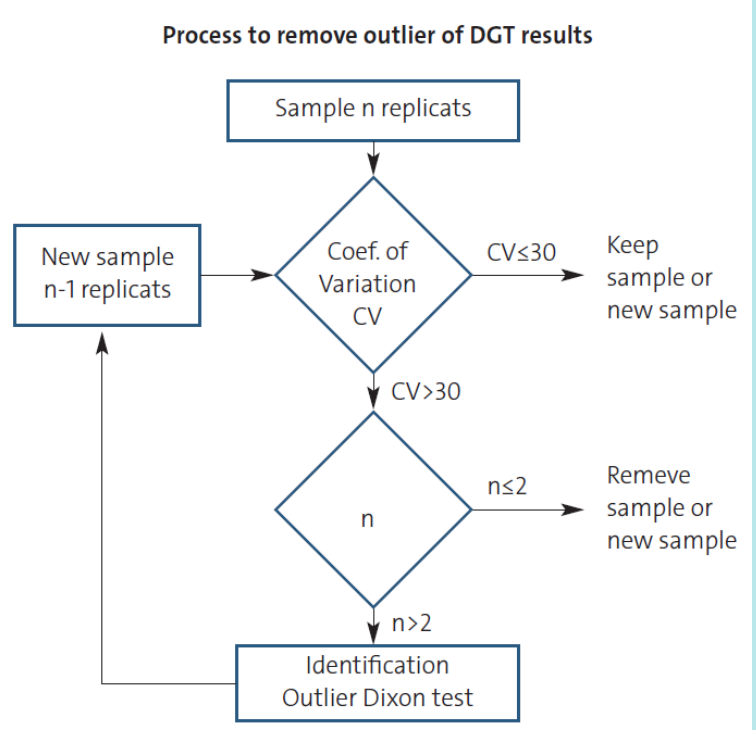
A (cm^2) = exposure area (3.14 cm^2)

From DGTs to water concentration during the deployment time (II)

Pb

	ICP-MS Ce (µg/L	Time (s)	4,5+ 0,16 ml VHNO3 + Vgel (L)	Fe	Mass (µg)	Mean temp.	it is specific for each metal and temperature Diff. Coeff. (cm2s-1)	diffusive gel + filter thickness Δg (cm)	Exposure area A (cm2)	Cwater (µg/L)	Mean C_{water}	Desvest	SE	CV
STATION 1a	2.72	242100	0.00465	0.8	0.01581	12.0	0.00000549	0.091	3.14	0.34				
STATION 1b	1.88	242100	0.00465	0.8	0.01091	12.0	0.00000549	0.091	3.14	0.24				
STATION 1c	1.87	242100	0.00465	0.8	0.01089	12.0	0.00000549	0.091	3.14	0.24				
STATION 1d	2.27	242100	0.00465	0.8	0.01322	12.0	0.00000549	0.091	3.14	0.29	0.277	0.051	0.029	18.427
STATION 2a	1.64	241440	0.00465	0.8	0.00955	13.1	0.00000567	0.091	3.14	0.20				
STATION 2b	1.72	241440	0.00465	0.8	0.01002	13.1	0.00000567	0.091	3.14	0.21				
STATION 2c	1.69	241440	0.00465	0.8	0.0098	13.1	0.00000567	0.091	3.14	0.21				
STATION 2d	1.80	241440	0.00465	0.8	0.01046	13.1	0.00000567	0.091	3.14	0.22	0.211	0.008	0.005	3.865
STATION 3a	1.70	240480	0.00465	0.8	0.00991	13.1	0.00000567	0.091	3.14	0.21				
STATION 3b	1.21	240480	0.00465	0.8	0.00706	13.1	0.00000567	0.091	3.14	0.15				
STATION 3c	1.85	240480	0.00465	0.8	0.01075	13.1	0.00000567	0.091	3.14	0.23				
STATION 3d	1.67	240480	0.00465	0.8	0.00973	13.1	0.00000567	0.091	3.14	0.21	0.199	0.034	0.020	17.099
STATION 4a	1.71	238800	0.00465	0.8	0.00991	13.2	0.00000569	0.091	3.14	0.21				
STATION 4b	1.67	238800	0.00465	0.8	0.00969	13.2	0.00000569	0.091	3.14	0.21				
STATION 4c	1.22	238800	0.00465	0.8	0.00707	13.2	0.00000569	0.091	3.14	0.15				
STATION 4d	1.36	238800	0.00465	0.8	0.00792	13.2	0.00000569	0.091	3.14	0.17	0.184	0.029	0.017	15.952
STATION 5a	1.27	239880	0.00465	0.8	0.00737	13.2	0.00000569	0.091	3.14	0.16				
STATION 5b	5.20	239880	0.00465	0.8	0.03023	13.2	0.00000569	0.091	3.14	0.64				
STATION 5c	1.23	239880	0.00465	0.8	0.00714	13.2	0.00000569	0.091	3.14	0.15				
STATION 5d	1.28	239880	0.00465	0.8	0.00742	13.2	0.00000569	0.091	3.14	0.16	0.277	0.243	0.140	87.888

Check your data: identification of outliers



Cwater (µg/L)	Mean C_{water}	Desvest	SE	CV
0.34				
0.24				
0.24				
0.29	0.277	0.051	0.029	18.427
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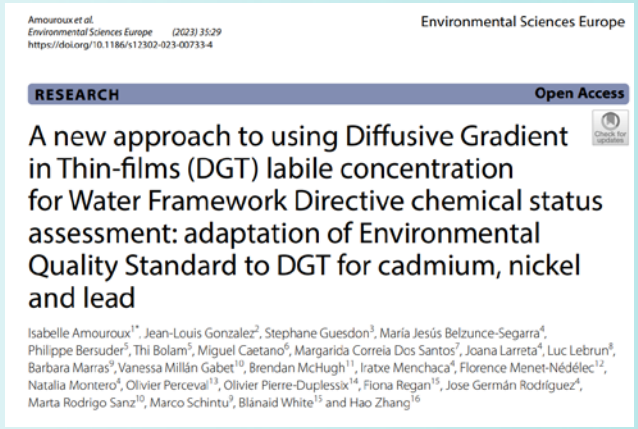
0.21				
0.15				
0.17	0.184	0.029	0.017	15.952
0.16				
0.64				
0.15				
0.16	0.155	0.003	0.002	2.059

Chemical assessment of marine waters



Amouroux et al.
Environmental Sciences Europe (2023) 35:29
https://doi.org/10.1186/s12302-023-00733-4

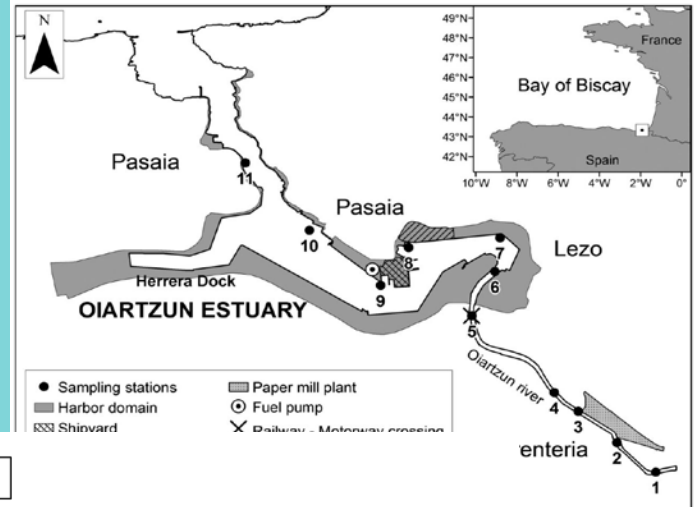
Environmental Sciences Europe

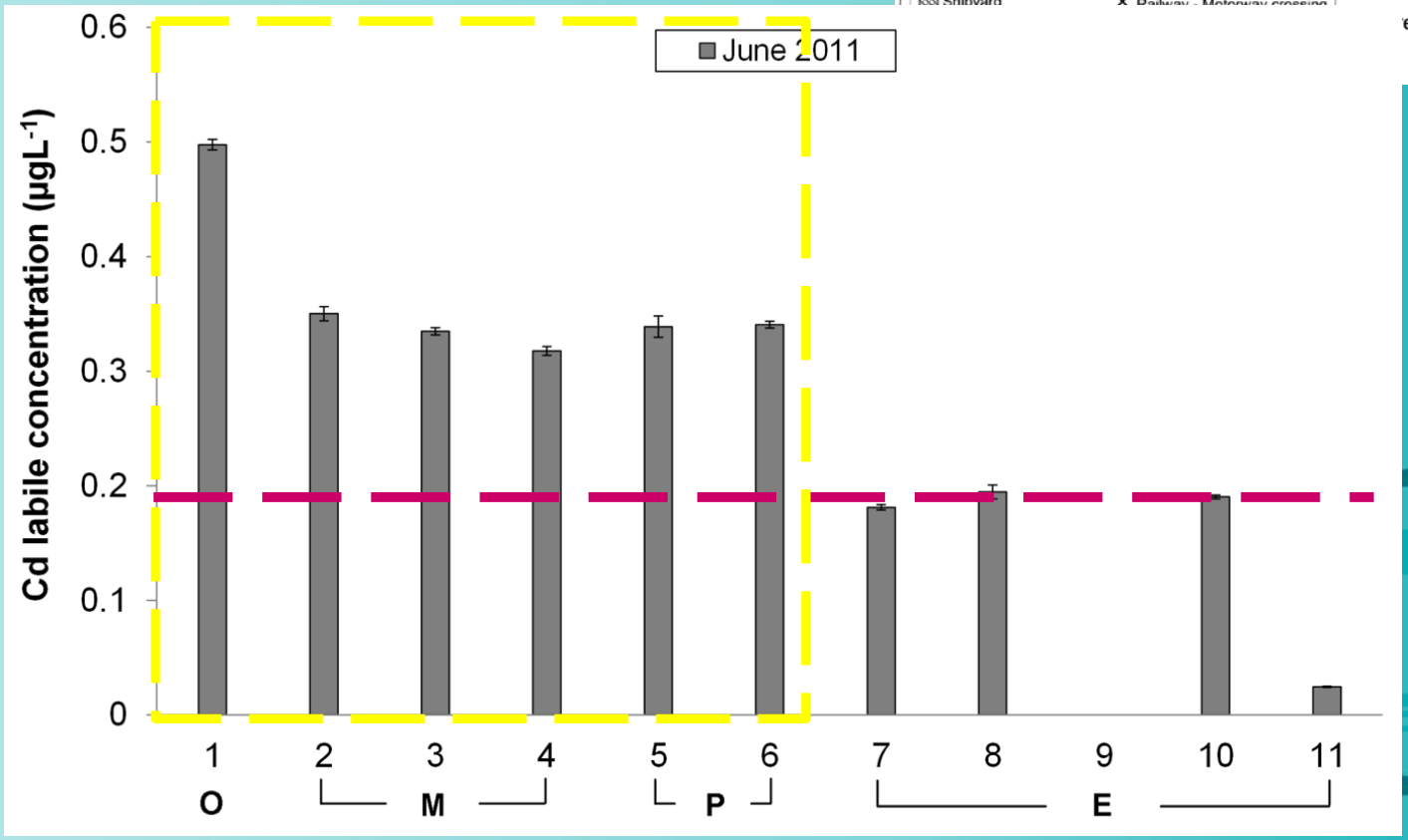
RESEARCH Open Access

A new approach to using Diffusive Gradient in Thin-films (DGT) labile concentration for Water Framework Directive chemical status assessment: adaptation of Environmental Quality Standard to DGT for cadmium, nickel and lead

Isabelle Amouroux[1*], Jean-Louis Gonzalez[2], Stephane Guesdon[3], María Jesús Belzunce-Segarra[4], Philippe Bersuder[5], Thi Bolam[5], Miguel Caetano[6], Margarida Correia Dos Santos[7], Joana Larreta[4], Luc Lebrun[8], Barbara Marras[9], Vanessa Millán Gabet[10], Brendan McHugh[11], Iratxe Menchaca[4], Florence Menet-Nédélec[12], Natalia Montero[4], Olivier Perceval[13], Olivier Pierre-Duplessix[14], Fiona Regan[15], Jose Germán Rodríguez[4], Marta Rodrigo Sanz[10], Marco Schintu[9], Blánaid White[15] and Hao Zhang[16]

Metal	EQS-DGT ($\mu g L^{-1}$)
Cadmium	0.18
Nickel	3.08
Lead	0.12





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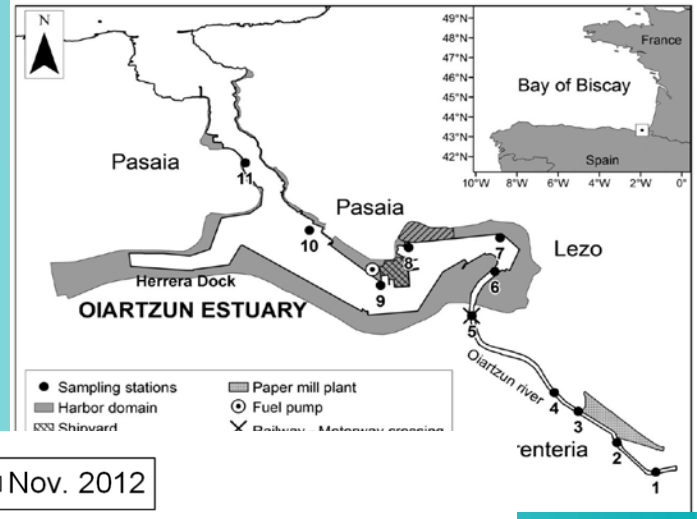

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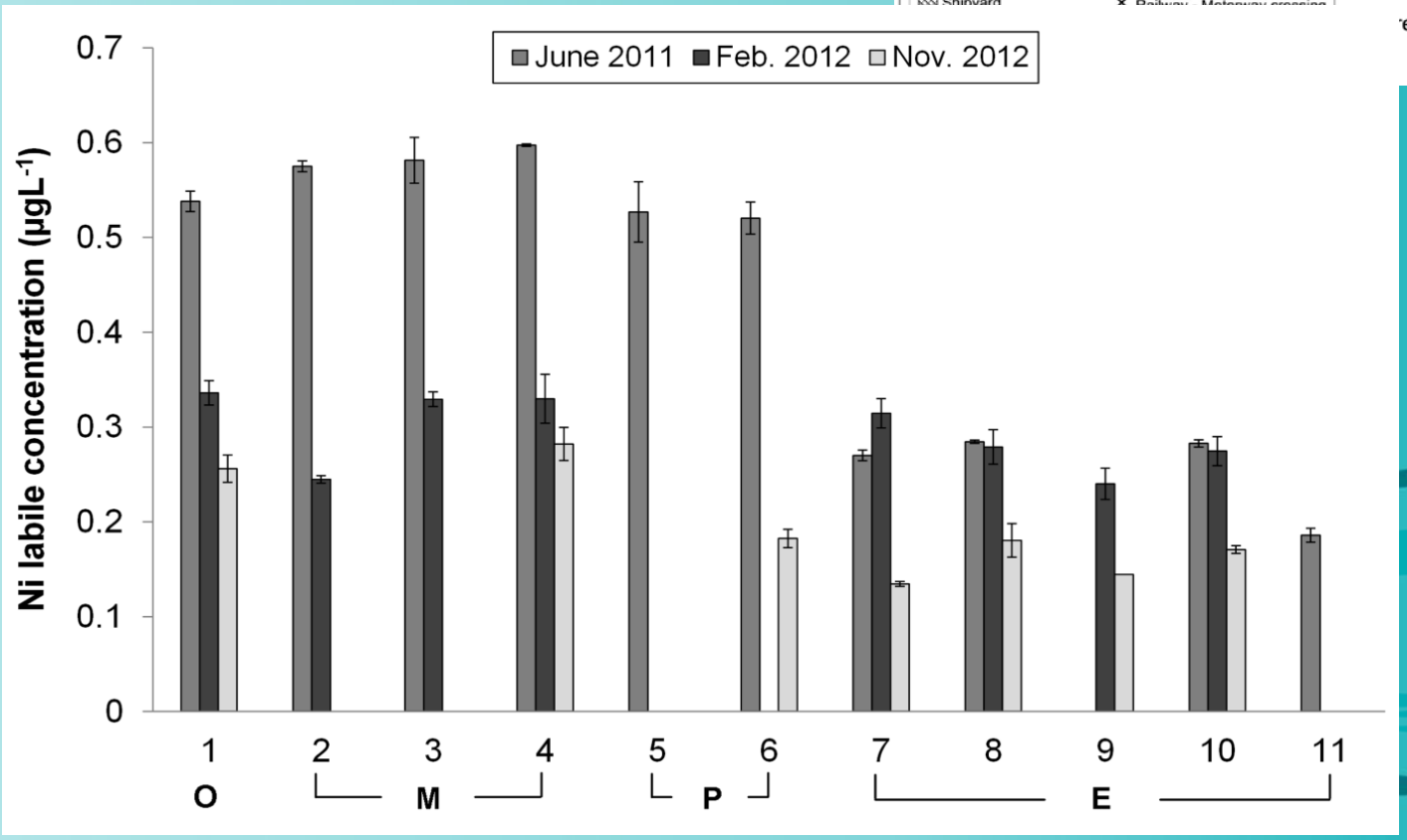

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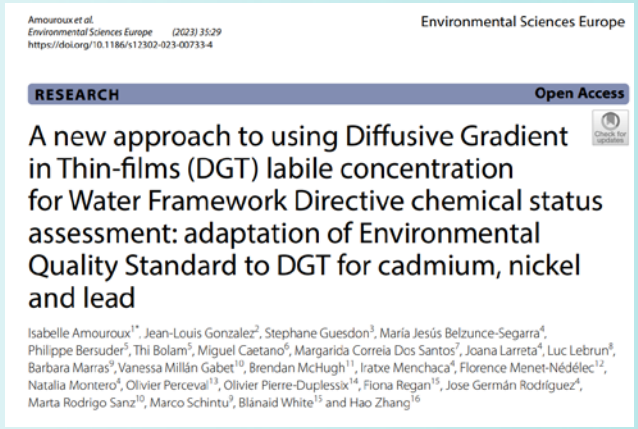
Chemical assessment of marine waters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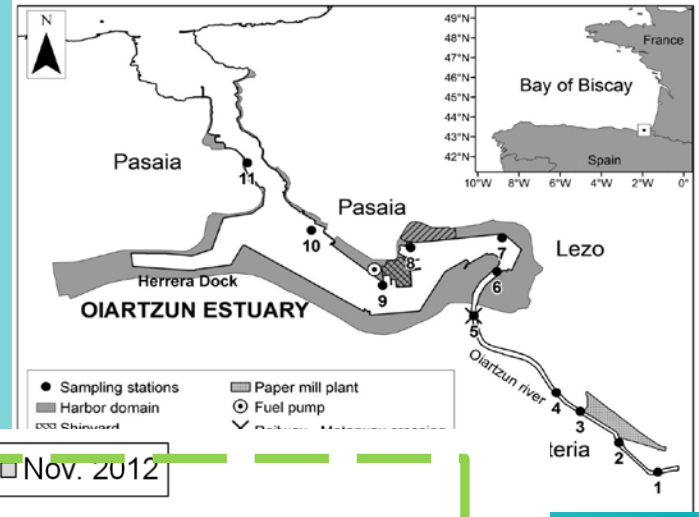

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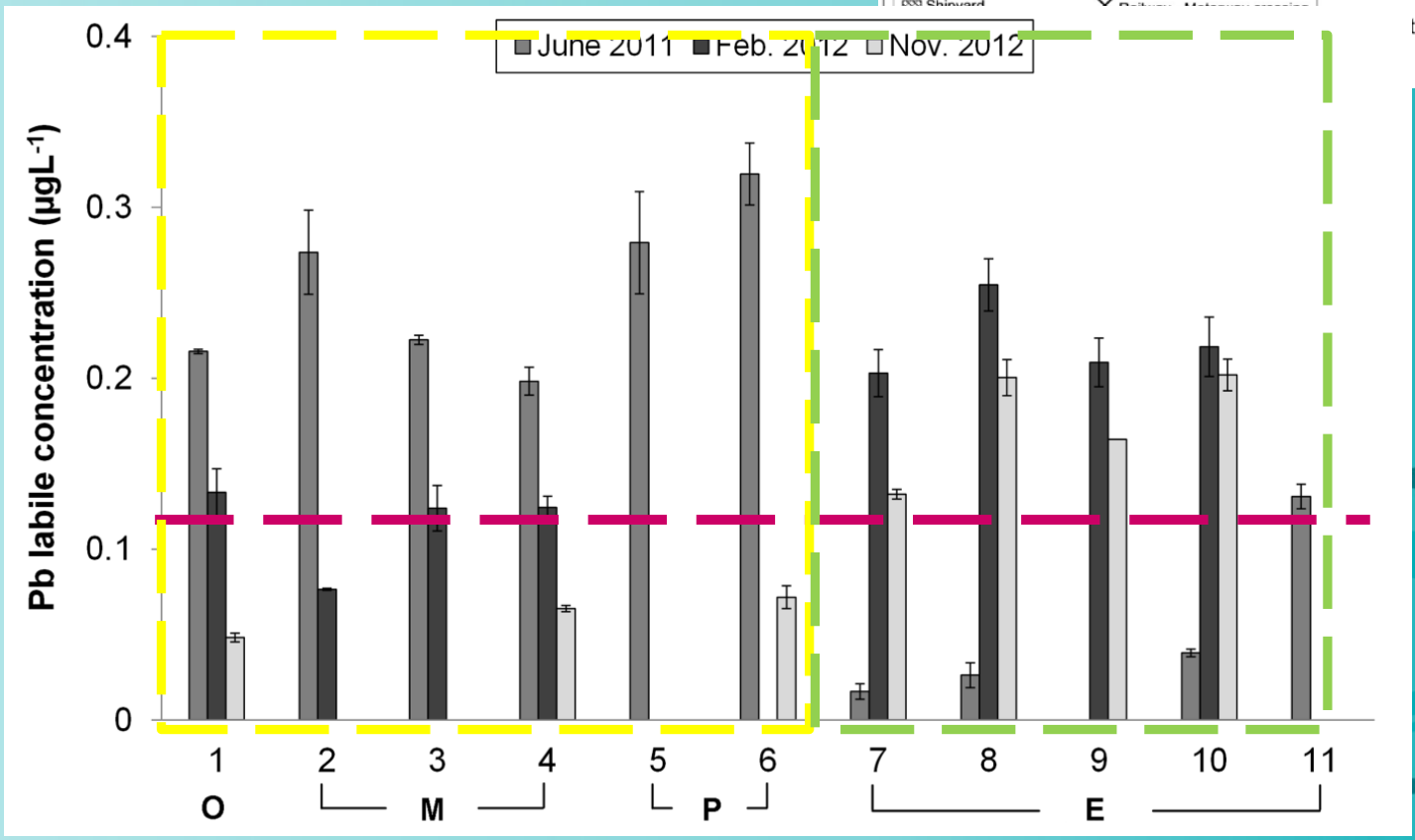

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Thank you for your attention!

Grazie mille per la vostra attenzione!

Any questions?

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