

Monitool: New tools for water quality monitoring

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Introduction, Findings, and Impact, May 2023

Introduction to Monitool



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Interreg Atlantic Area Transnational Cooperation Programme

3 years (2017-2020)

Total cost: 1.92 M€

Main objectives:

- To respond to European Directive demands for the assessment of chemical status of transitional and coastal waters, allowing the use of passive sampling devices (PSDs) in a regulatory context, enhancing the implementation of the WFD.
- To provide a robust database of dissolved and labile metal concentrations in transitional and coastal waters for adapting existing Environmental Quality Standards (EQS; 0.45 µm filtered) suitable EQS-DGT for passive sampling devices in order to evaluate the chemical status of the waters under the WFD.

MONITOOL 8 Full Partners



Università degli
Studi di Cagliari



MONITOOL 10 Associated Partners (stakeholders & end users)



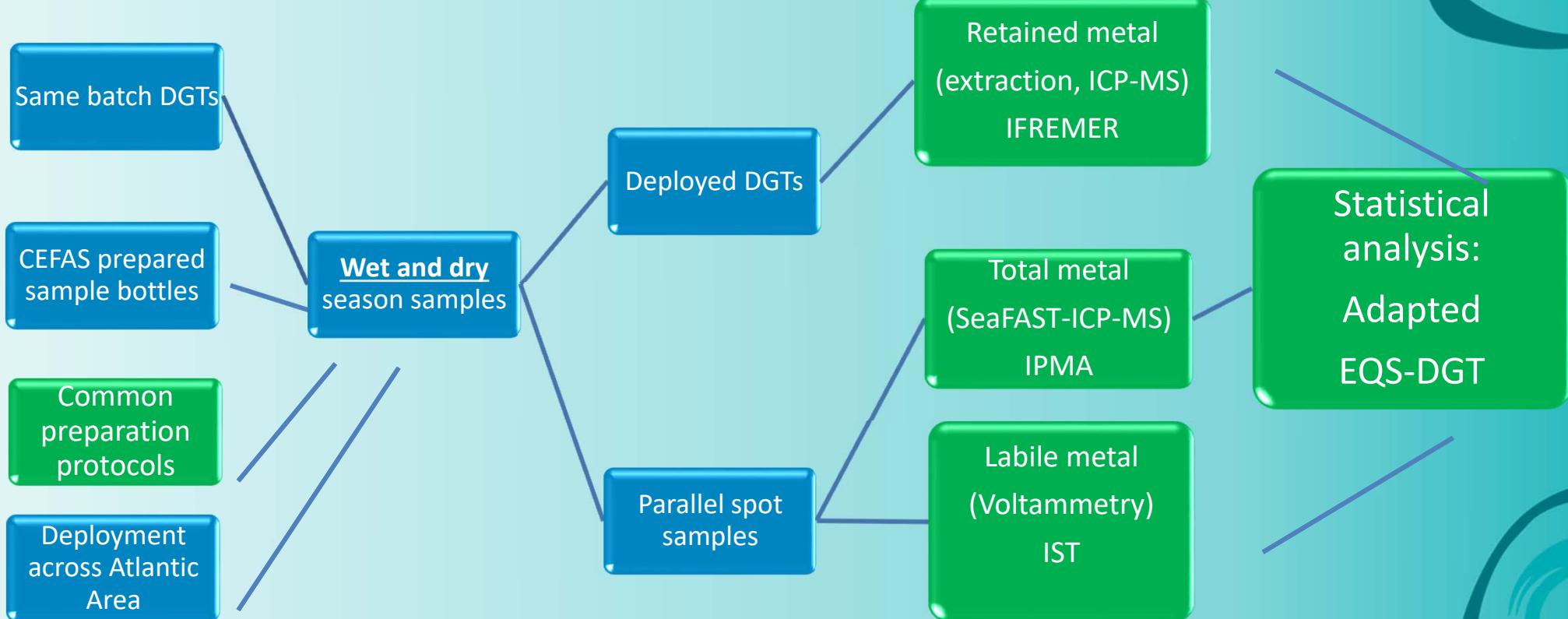
AGENCE FRANÇAISE
POUR LA BIODIVERSITÉ
ÉTABLISSEMENT PUBLIC DE L'ÉTAT



Biggest European consortium
working on DGTs

The Workplan for the Project

Communication (internal and external)



Interlaboratory study to develop and validate an expert lab network

WP5- outputs from main project

1. Protocols:

- sampling protocol
- sample processing and analysis protocol

2. Field campaigns by all participating Partners:

- co-deployment of DGTs and water sampling up to 7 Days Sampling at up to 4 sites (2 coastal, 2 estuarine) per participating partners
- wet season Jan-April 2018
- Dry season Aug-Oct 2018

3. Analysis

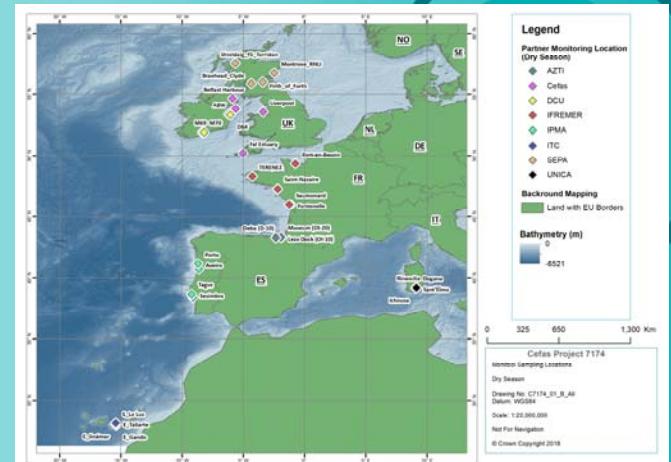
- DGTs analysis (Ifremer): A representative set of DGT metal data (labile metal concentration) obtained from the field from all Partners regions, with ~250 DGT deployed, retrieved and analysed.
- Seawater samples analysis (IPMA & IST): A representative set of dissolved and chemically labile metal concentrations data in water samples obtained from all Partners regions, with over 500 seawater samples collected and analysed

4. DGT Interlaboratory exercise:

- Completed with Ifremer deploying additional DGT to be analysed in participating partner labs, and each partner accepting DGTs for analysis in their institutions.

5. Other outputs

- 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. (<https://www.monitoolproject.eu/>).
- Five MONITOOL videos to support the sampling protocol: 'MONITOOL field Sampling - A demonstration with Jean Louis Gonzalez' and four tutorials on the use of DGTs (<https://www.monitoolproject.eu/multimedia/videos>).
- Concurrent sampling of transitional and coastal waters by DGT and spot sampling for trace metals analysis. Bersuder *et al*
- An international intercomparison exercise on passive samplers (DGT) for monitoring metals in marine waters under a regulatory context. JL Gonzales *et al*





WP 5 Extensions Outputs

- Action 1. Update of protocols – Documents completed
- Action 2. Field campaigns for DGTs, physicochemical data and water sampling in contaminated sites- AZTI, CEFAS, DCU, IFREMER, UNICA – Campaigns completed June/July 2022
- Action 3. Chemical analysis of metals in DGTs by ICP-MS (IFREMER) – Analysis completed
- Action 4. Chemical analysis of metals in water samples by ICPMS (IPMA) and by voltammetry (IST) – Analysis completed.



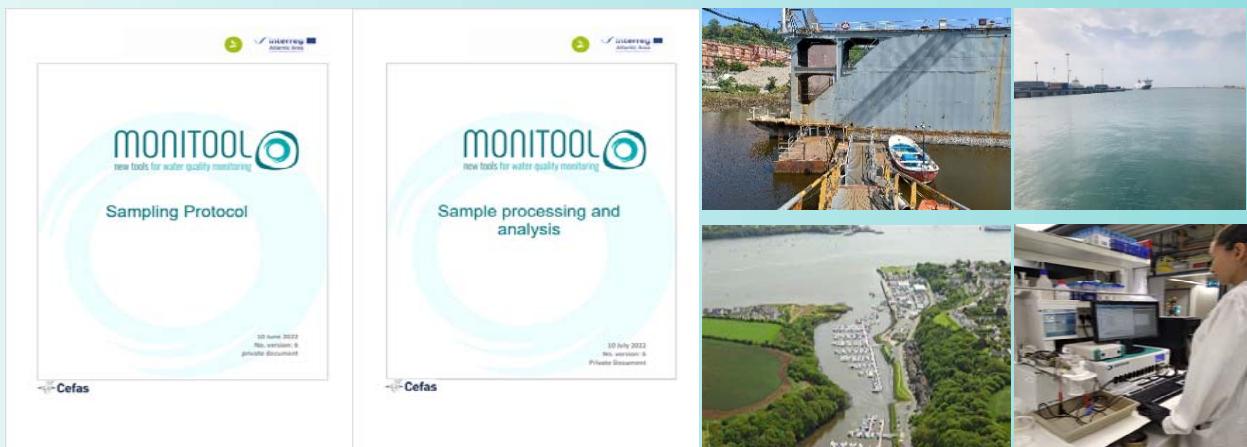
Co-deployment of DGTs and water sampling up to 7 Days
Sampling at up to two contaminated sites per partner
Partners Sampling

DGTS sent for analysis – up to 10 total (2x 3 rep, 1 spare and Biofouling)

Up to 36 sets of labile metal concentration data (Cd, Co, Pb, Mn, Zn, Ni, Cu, Fe) measured in DGT Chelex resins. A representative set of dissolved and chemically labile metal concentrations data in **water samples** obtained from all Partners regions,
~ 150 seawater samples collected and analysed.

~ 75 dissolved metal concentration data sets (WFD- Ni, Cd, Pb and Mn, Fe, Co, Cu, Zn – via ICP-MS) -and chemically labile metal data sets (Cd, Pb, Ni – via voltammetry) from field samples collected from all Partners regions.

DOC, SPM and physicochemical data collected at sites.



Findings of Monitool



Database Management and correlation studies

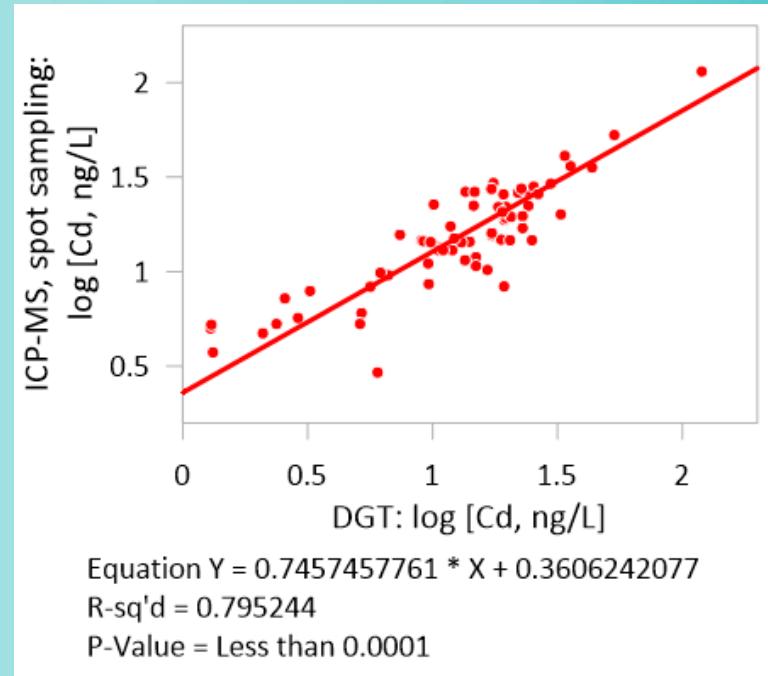
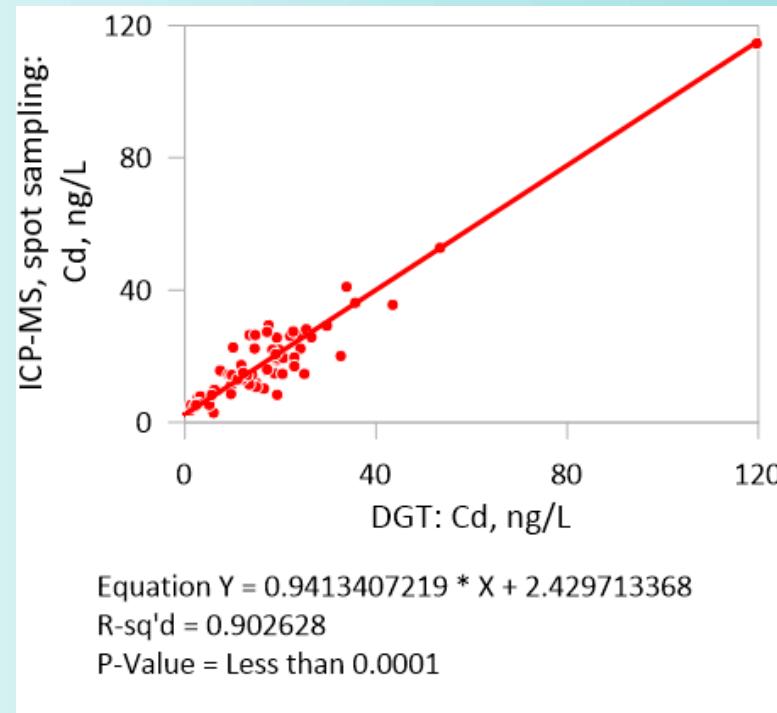
- The database was developed that allowed the compilation and interchange of all information related with physico-chemical parameters and metal concentrations for quality water assessment. Cd, Ni and Pb (classified as priority substances by WFD) were prioritised.
- The relationship between methodologies to analyse metals in waters resulted in a linear relationship.
- Environmental parameters do not explain this relationship

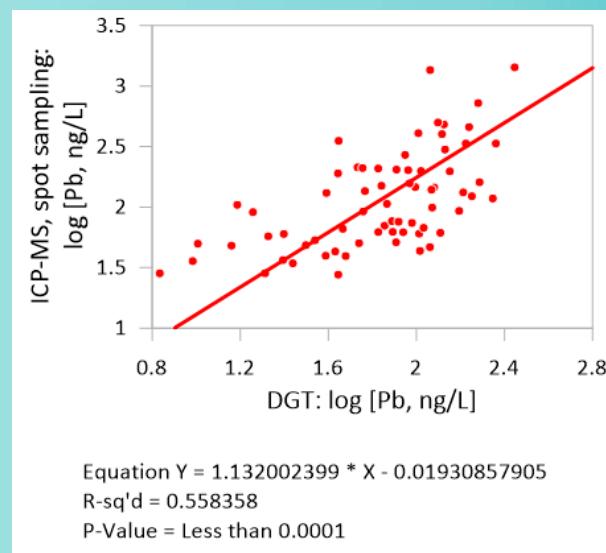
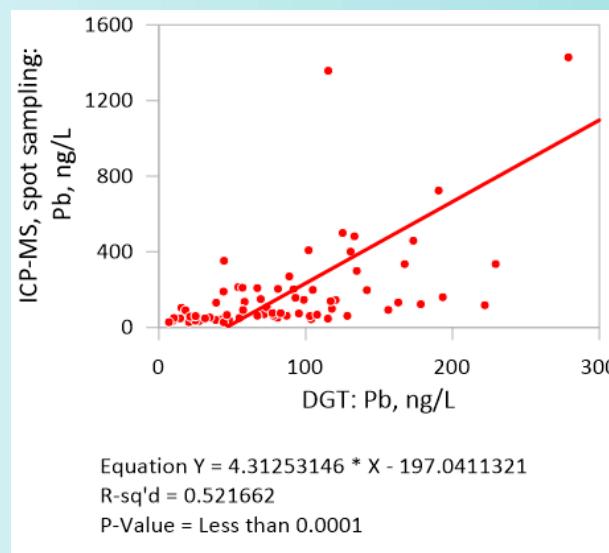
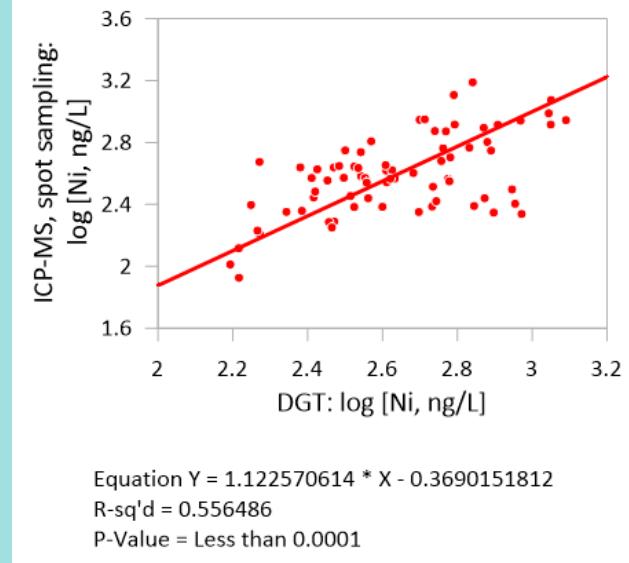
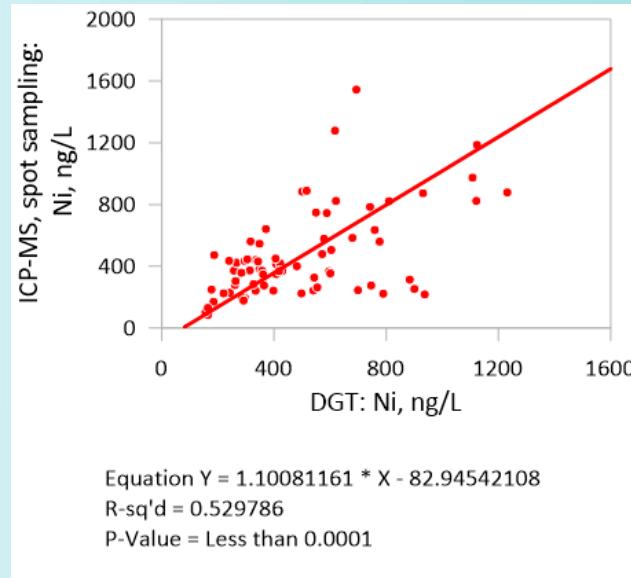
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- In Monitool extension:
 - The design of the database was improved
 - The linear relationship was improved with the new metal data obtained in highly contaminated sites.

Relationships between spot sampling and passive sampling

- exploration on untransformed data and on log-transformed data; hypothesis: there is a relationship between the methodologies---linear model II regression analyses.





How to use DGT for chemical status assessment ? EQS_{marine water} adaptation

2 options

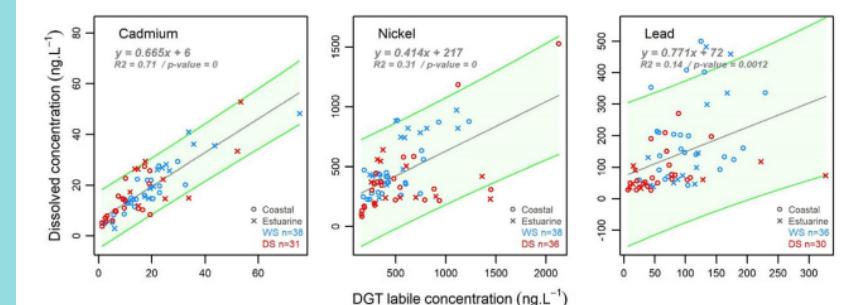
Compare DGT results to EQS_{DGT}

Adapt EQS_{marine water} into EQS_{DGT}

Substance	AA-EQS _{marine water} ($\mu\text{g}\cdot\text{L}^{-1}$)	EQS _{DGT} n°1 Linear model regression ($\mu\text{g}\cdot\text{L}^{-1}$)	EQS _{DGT} n°2 Linear Model Regression minus low Prediction interval (PI _{95%}) ($\mu\text{g}\cdot\text{L}^{-1}$)
Cadmium	0.2	0.20	0.18
Nickel	8.6	4.60	3.08
Lead	1.3	0.23	0.12

Compare DGT results to EQS_{marine water}

Predict [M] in dissolved fraction from DGT results



Amouroux et al (2023). 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. *Environmental Sciences Europe*, 35(1), 29 (12p.). Publisher's official version : <https://doi.org/10.1186/s12302-023-00733-4>, Open Access version : <https://archimer.ifremer.fr/doc/00835/94689/> , <https://rdcu.be/da2zK>

Impact of Monitool



WP3 - Capitalisation

- Action 1: Capitalization with other projects with similar goals
- Action 2: Afterlife Action Plan
- Action 3: Informing of EU policy makers of the DGT-EQSs for priority and specific metals developed within MONITOOL, to allow the use of DGTs in a regulatory context
- Action 4: Promotion of the framework of protocols and associated results database to end-users beyond the lifetime of this project

MONITOOL MAIN OUTPUTS

MONITOOL website



MONITOOL website <https://www.monitoolproject.eu>

MONITOOL
new tools for water quality monitoring

Interreg
Atlantic Area
European Regional Development Fund
EUROPEAN UNION

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Publications Log in

DGT-For Beginners

Frequently Asked Questions
Suggested readings and references
Tutorial videos

Multimedia

VIDEOS

How to use DGTs (4 videos)

Sampling campaigns

WPs Deliverables

7 Scientific papers

1 MSc Thesis

1 Chapter in book

1 Good Practice Guide

... and more.

