MONITOOL
new tools for water quality monitoring

MONITOOL: New tools for monitoring the chemical status in transitional and coastal waters under the Water Framework Directive

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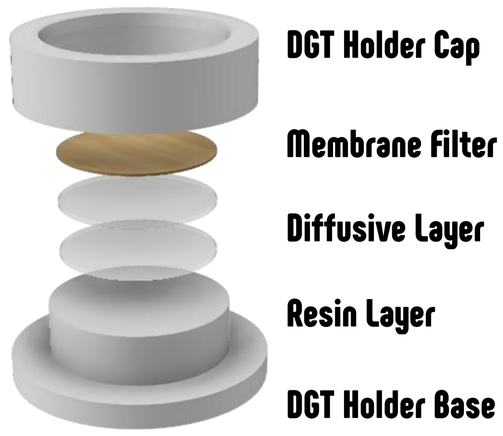
Introduction

The MONITOOL Project is based upon Directive 2013/39/EU with regards to priority metals in the field of water policy, including cadmium, nickel, and lead. Existing Environmental Quality Standards (EQS) for these methods only include biota sampling, and therefore development of new in situ solution sampling methodologies are a priority. The MONITOOL Project aims to define suitable EQS to allow for the use of Diffusive Gradient in Thin film (DGT) passive sampling devices for the monitoring of these priority metals in a regulatory context. DGT devices are composed of an ion-exchange resin, separated from solution by a diffusive ion-permeable gel layer. Their design allows for the continuous accumulation of metals *in situ*, and subsequent quantitation via methods such as ICP-MS. While many of the chemical aspects of the devices have been well studied, effects of environmental physicochemical parameters on the functionality of the devices have not been examined in detail. In MONITOOL, a five-day deployments of DGT devices, alongside spot sampling and physicochemical parameter measurement, will be conducted in both wet and dry seasons in coastal and transitional waters of the North Atlantic coast, including locations in Ireland such as Cobh and the Alexandra Basin. The data collected from these sampling campaigns will inform potential future EQS adaptations which will be developed as part of the MONITOOL Project.

DGT Device

The DGT device is self-contained in a hard plastic casing. A Chelex-100 resin layer, used to bind the priority metals, is separated from solution by a diffusive layer of polyacrylamide gel. Molecular diffusion through the diffusive layer limits transport of mass, and a concentration gradient is developed, approaching zero at the resin layer interface.



Analysis

The MONITOOL Project minimises variation between laboratories by sending all samples for analysis for designated purposes to a chosen laboratory. Triplicate and blank DGT devices are sent to IFREMER where the resin layer is isolated and the metals are extracted via immersion in nitric acid. Diluted aliquots of this solution are then taken after 24 hours and analysed by ICP-MS and the measured metal concentrations can be measured through application of well-defined mathematical models.

Spot water samples are analysed separately for their metal concentrations. SeaFAST ICP-MS filtration, pre-concentration and analysis procedures are performed by CEFAS and IPMA. Field-filtered acidified seawater samples are sent to IST where voltammetry is performed.

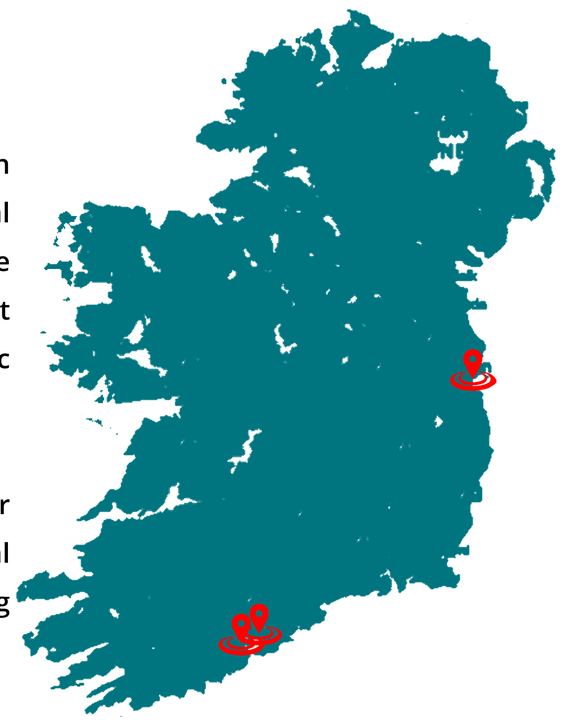
DGTs from each field campaign are sent to DCU for biofouling analysis. Other parameters of the grab samples, such as solid particulate matter and dissolved organic carbon are analysed individually by each laboratory.

Sampling & Deployments

DGT devices were deployed at coastal and transitional waterways in Ireland, at areas of potential metal pollution for five-day periods during both wet and dry seasons. Spot samples were also taken regularly alongside deployments, and *in situ* measurement of physicochemical parameters were performed during sampling.

Sampling sites in Ireland included Cobh in Co. Cork, and the Alexandra Basin in Dublin Port. Both areas have potential sources of metal pollution– the Haulbowline Island steelworks dump at Cobh, and the loading of lead and zinc onto ships for export at Alexandra Basin.

Both areas are undergoing major redevelopment projects, and are potential locations of interest for repeated sampling following the MONITOOL Project.



Project Goals

Through the tandem analysis of the DGT passive sampling devices and spot samples, the MONITOOL Project aims to define Environmental Quality Standards for the use of DGTs in Water Framework Directive compliance monitoring in the EU. Through interlaboratory exercises, the Project also aims to develop a network of laboratories in the Atlantic area proficient in analysis of these devices to support WFD monitoring.

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