Combined utilization of DGTs and bioindicators to trace chemical contamination threats on coastal ecosystems.

J. Richir [a,*], N. Luy [a], P. Serpe [a], L. Lefèbvre [a], A. Deraikem [a], G. Lepoint [a], R. Biondo [a], S. Gobert [a]

[a] MARE Centre, Laboratoire d'Océanologie, Université de Liège, Sart-Tilman, B6, 4000 Liège, Belgique

* Corresponding author. Tel.: +32 4366 2836; Fax: +33 4366 5147; Email: jonathan.richir@ulg.ac.be

Trace metal monitoring in marine organisms and their living habitats permit to trace chronic or acute contaminations of marine ecosystems due to human activities. While dissolved trace metal concentrations give us an overall and punctual view over biota contamination status, bioindicator species put their bioavailable and possible toxic fraction in an obvious. However, difficulties mainly inherent to metal measurements in seawater lead field ecotoxicologists to study marine pollution essentially through the use of bioindicators alone. The technique of diffusive gradients in thin films (DGT) for the measurement of trace metals in aqueous solutions was introduced in the mid-ninetieth by Davison and Zhang. This passive probe accumulates labile trace metal species in proportion to their bulk environmental concentrations by maintaining a negative gradient between the environment and an ion-exchange resin (Chelex). DGTs average natural water trace metal concentrations over the deployment period, concentrate them and avoid matrix interferences, notably due to dissolved salts in seawater. Their deployment in passive and experimental monitoring studies permits to reliably measure labile trace metal concentrations and, jointly analysed with bioindicators, to estimate their bioavailability to marine organisms.

This combined approach DGT-bioindicator was investigated in Calvi Bay (Corsica) through three monitoring studies. (1) DGTs were deployed in *Posidonia oceanica* bed, a Mediterranean seagrass forming dense meadows from the surface down to 40 meters depth, to study seasonal, spatial and bathymetrical variations of labile trace metal concentrations within this meadow. These concentrations were analysed jointly with *Posidonia* trace metal contents in order to quantify their bioaccumulation towards this primary producer, taking into account the seagrass biological cycle. (2) Portions of *Posidonia* meadow were also *in situ* experimentally contaminated with a mix of dissolved metals to study seagrass kinetics of pollutant accumulation and decontamination. Thanks to DGTs deployed inside contaminated mesocosms throughout experiments, *Posidonia* responses to known metal concentrations could be precisely quantified. (3) The blue mussel *Mytilus galloprovincialis* is widely used in trace metal monitoring programs. Mussels, stored in conchylicultural pouches, were transplanted for 3 months in contrasted stations of Calvi Bay (*e.g.* aquaculture farm, sewer, etc.) in parallel with DGTs. Such as for *Posidonia*, the complementary utilization of DGTs and mussels permitted to describe water contamination levels at the scale of the Bay, and their bioaccumulation towards mussels. These 3 studies demonstrate the usefulness of DGTs to monitor labile trace metals in an ecological and ecosystemic approach, in parallel with marine organisms, both indicators furnishing different and complementary informations about ecosystem functioning.