Assessment of *Mytilus galloprovincialis* to monitor 19 trace elements in the Calvi Bay

J. Richir, S. Vermeulen, R. Biondo, A. Deraikem,
M. Fassin, J.-M. Bouquegneau, S. Gobert
Laboratory of Oceanology, University of Liège ULg, Liège, Belgium

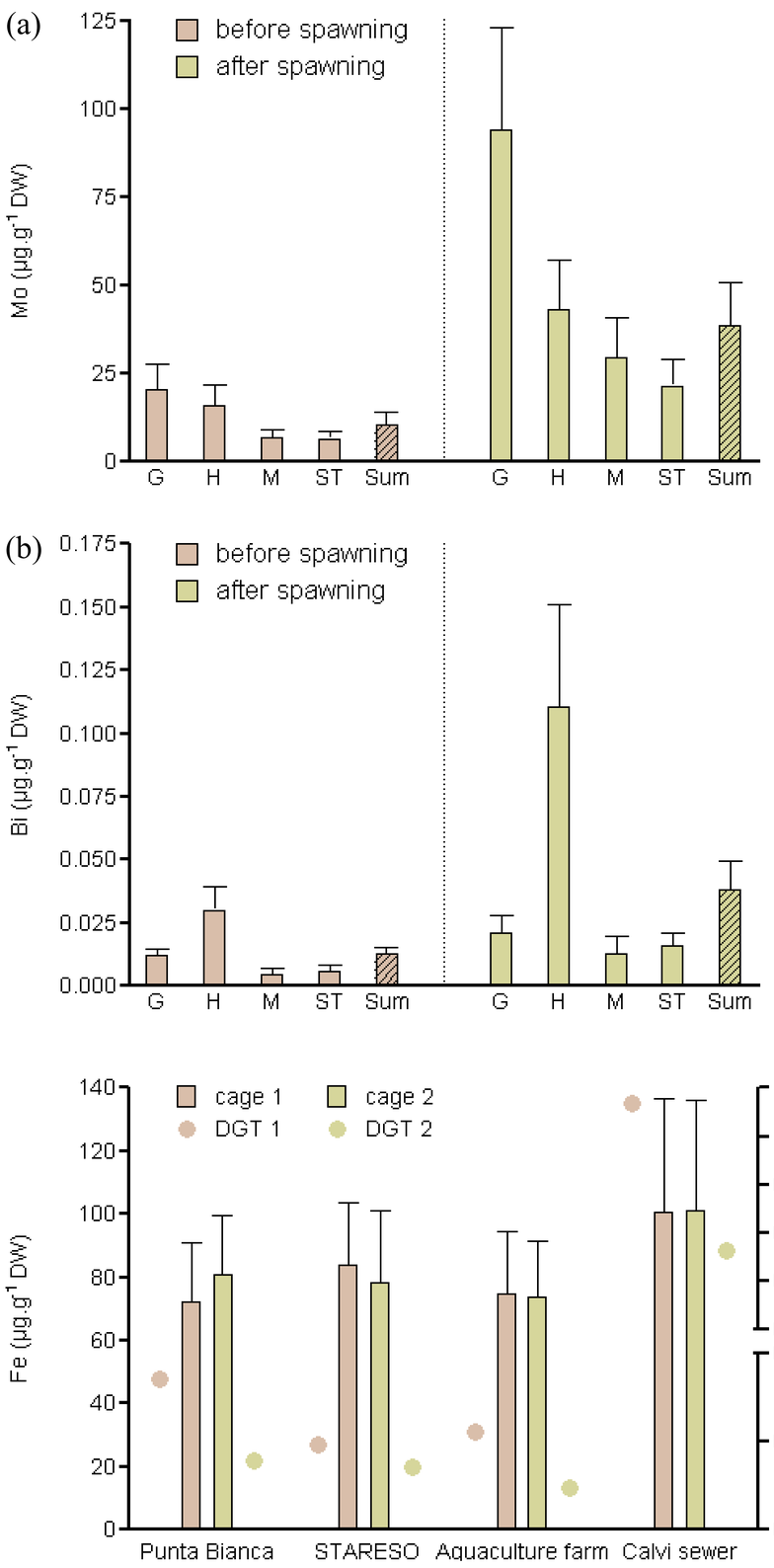
Introduction

Mussel caging with *Mytilus galloprovincialis* has been used for a long time to monitor classic trace elements (TEs: Cd, Cu, Zn, Cr, Fe, Ni, Pb) **pollution of Mediterranean coastal waters** at large (10-100km) spatial scales (1). However, its relevance as bioindicator at the scale of a bay (100m-1km) is poorly known. Moreover, levels of little studied TEs (Al, V, Mn, Sb, Sn, Ag, Mo, Se, As, Co, Be, Bi), identified as potential pollutants of coastal environments (2), have not yet been assessed in that species.

Material and methods

Mussels from the Diane pond aquaculture farm (E Corsica) were used to monitor the 19 listed TEs at the scale of the Calvi Bay (NW Corsica; fig.1). Duplicated cages (fig.2) were immersed (March to June 2010) in **4 sites** differently **exposed to moderate anthropogenic influences**: the Calvi sewer, an aquaculture farm, the Oceanographic Station STARESO, and a control site outside of the Bay (Punta Bianca). **Decontamination kinetics** (February to June 2011) and **tissue speciation** before (February 2011) and after (March 2010) spawning were also investigated. Bioavailable dissolved TEs were monitored with DGTs (Diffusive Gradient in Thin-films; chelex-type resins). TE concentrations were measured by DRC-ICP-MS.

Fig.1: Map of Corsica showing the Diane pond and the Calvi Bay (left), and zoom in the Bay area (right).



Graphs 1: Tissue speciation of Mo (a) and Bi (b) before and after mussel spawning (in µg.g^{-1} DW). G - Gills; H - Hepatopancreas; M - Mantle; ST - remaining Soft Tissues; Sum - mussels (Sum of all tissues, balanced by their respective dry weight).

Graph 2: Fe spatial variation in mussels (duplicated cages; in µg.g^{-1} DW) and water (one DGT on each cage; in µg.L^{-1}) in the Calvi Bay area. Fe bioconcentration factor = 10^5.

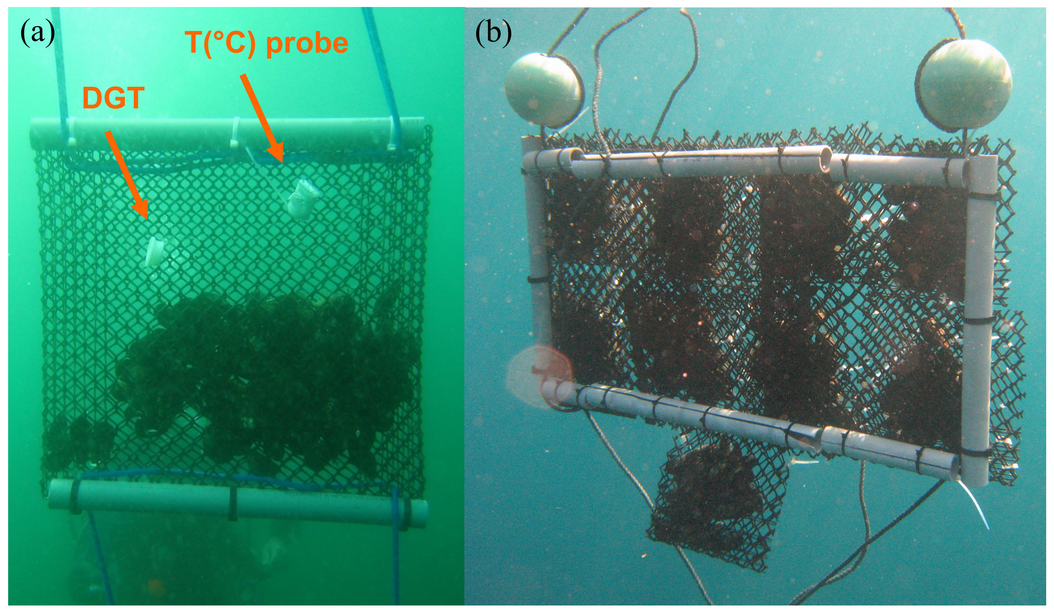
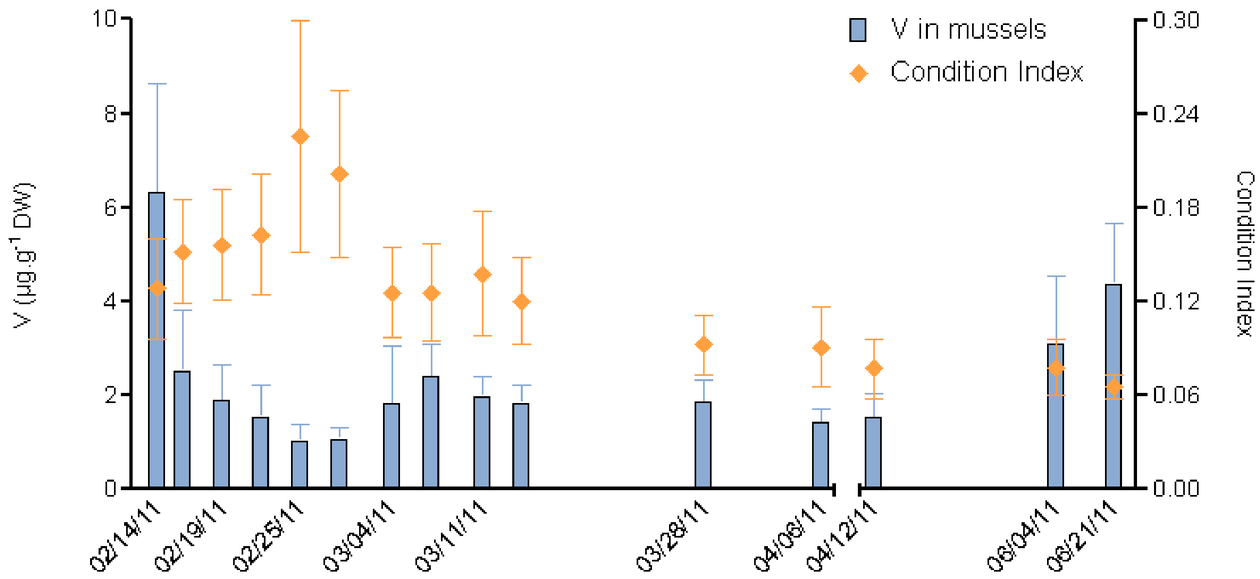


Fig.2: Mussel caging designs for spatial monitoring (a) and for contamination kinetic studies (b).

Results and discussion

- ***M. galloprovincialis*** efficiently **bioconcentrates** the 19 studied **TEs** (graphs 1-3).
- TE levels measured at the scale of the Calvi Bay present little spatial variations between sites, and demonstrate the overall **good water quality of the Bay** (graph 2).
- Decontamination kinetics show that **mussels** rapidly **equilibrate with their environment**, and thus can be considered as a good indicator of chronic and stable pollutions (graph 3).
- **Gills** preferentially accumulate Mo, Se, Cd and Zn (graph 1a), and the **hepatopancreas** the 15 others chemicals (graph 1b).
- **Mussel spawning concentrates TEs** in all soft tissues (graphs 1a-b, 3).



Graph 3: Temporal evolution of V (in µg.g^{-1} DW) in mussels transplanted from the Diane pond to the Calvi Bay. Concentrations first equillibrate with the environment; mussel spawning, traduced by a decrease of the mussel Condition Index (soft tissues DW/shells DW), concentrates V in organisms (March 2011). The 2nd increase of V concentrations (June 2011) might traduce changes of the environmental pollution status.

Conclusion

As a filter feeder, **mussels** are mainly influenced by their homogeneous pelagic environment, as opposed to benthic organisms relying upon patchy food sources (3). This might explain the little spatial variations observed at the scale of the Calvi Bay. Mussels accumulate the 12 little studied TEs, and thus is **a convincing candidate for** their **monitoring**. However, the concentration effect induced by their reproductive cycle requires using this bioindicator during its sexual dormancy.

References:
1. Andral *et al.* (2004). Marine Pollution Bulletin. 49: 704-712. **2.** Luy *et al.* (in press). Ecological Indicators. **3.** Vermeulen et al. (2011). Marine Ecology Progress Series. 422: 9-22.

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Corresponding author E-mail and bibliography:
jonathan.richir@ulg.ac.be ; http://orbi.ulg.ac.be/