

LIMPETS versus WILD MUSSELS: Tool for monitoring metals in the Canary Islands (Spain)

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Abstract

The Marine Strategy Framework Directive (MSFD, 2008/56/EC), is the main instrument for the protection of the marine environment in Europe. According to the MSFD's descriptor 8, the concentrations of contaminants should be at levels not giving rise to pollution effects.

The Spanish initial assessment of the quality status of their national marine waters by the end of 2012, for compliance with MSFD, has revealed several gaps and lack of information and knowledge regarding descriptor 8, being more pronounced in one of the five marine subdivisions of the Spanish jurisdictional waters, the Canary region (<http://www.magrama.gob.es/es/costas>).

The schedule marked by the MSFD highlight the need for the development and implementation of monitoring programs (by July 15, 2014) and measures (by 2016), to continuously assess the status of the marine environment and to verify if the Good Environmental Status is achieved or maintained. Within this framework, and in order to respond to descriptor 8 it would be crucial to include the evaluation of the levels of trace metals in all Spanish coasts.

From the early 90s, the Instituto Español de Oceanografía (IEO) use wild mussels (*Mytilus galloprovincialis*) as "biomonitors" of coastal pollution in the Atlantic and in the Mediterranean areas (CEMP-OSPAR Commission and MEDPOL-Barcelona Convention), because it is a widely distributed species, sessile and, more importantly, accumulates high levels of chemical pollutants in their tissue, reflecting the surrounding environmental conditions. These time series were used in both areas to develop the descriptor 8 in the initial assessment of the MSFD. However, the Canary Islands are not covered by a marine pollution monitoring program, because they are not included on the mentioned regional seas convention, or in other international agreements. Moreover, there is a great difficulty to find wild mussels in the Canary Islands coastal region, so it is necessary to seek for a good indicator species that could replace mussels.

The limpet, *Patella spp.* is among the considered alternative organisms. To validate its use on the Marine Strategy monitoring program it is necessary to carry out studies to assess the

suitability of these organisms as indicators of pollution, including the potential development of quality criteria for environmental assessment.

The first aim of this study was to evaluate the trace metals levels in mussels and limpets collected in different sampling sites from the Spanish Marine Pollution Monitoring Programme (Atlantic-Galicia and Northern coasts), where levels and geographical distribution of metals are well defined after many years of surveillance, so locations have been selected with a gradient of metal pollution. A second objective was to compare the trace metal concentrations in limpets from this area with those from sampling sites located on the seven Canary Islands.

Mussels (*Mytilus galloprovincialis*) and limpets (*Patella spp.*) collection was performed manually, during low tide, in the sampling sites selected from the North Atlantic subregion (Arousa, Ferrol, Suances and Fuenterrabia). In Canary Islands, limpets (*Patella spp.*) were collected by hand from 7 sites distributed along the coastal zone.

Each sample was prepared from more than 20 individuals representing the available size range existing in the sampling point. The soft tissues were separated from the shells, triturated with an Ultraturrax homogeniser and freeze-dried.

Samples were digested with nitric acid in microwave ovens (Besada et al., 2011). Selected metals (As, Cd, Cu, Pb, Zn, Cr and Ni) were analyzed with a Perkin-Elmer AAnalyst 800 spectrophotometer, equipped with a Zeeman background correction. Total mercury was determined by cold vapour technique, employing a Perkin-Elmer FIMS-400 system (SnCl₂ as reducing agent).

The quality of the chemical analyses is demonstrated by the results obtained in different intercalibration exercises that take part on a regular basis, such as QUASIMEME. The internal laboratory QC includes analyses of duplicate samples and procedural blanks as well as control charts of CRMs.

The study from the North Atlantic Spanish coast indicated that, in general, limpets showed higher levels for As, Cu, Cr and Ni than mussels. With respect to Cd, limpets presented higher concentrations in the locations from the Galician than in the Cantabrian coast.

Regarding Hg and Pb, both species showed similar levels and the same spatial distribution. In contrast to the other metals, Zn presented higher concentrations in mussels than in limpets. Also, in this area, limpets presented the same geographical distribution of target metals than mussel.

Comparing both areas (North Atlantic coast and Canary Islands), metals concentrations in limpets were clearly lower in samples from the Canarian Archipelago, except for Cd. Samples from the Galician coast (Arousa and Ferrol) presented similar values to those obtained in the limpets from La Gomera, La Palma and Hierro. Cd show a different behavior from the rest of

the metals, since the prevalent upwelling on both areas (Galicia and Canary Island) transports high quantities of this metal to the surface.

It can be concluded that limpets can be used as an indicator species of the metal levels in the Canary Islands and the results can be compared with those obtained in other Spanish regions, where mussels are used as indicator organisms. However, more research is needed to determine the spatial distribution and seasonal variation of metals, and to establish background levels and develop environmental quality criteria for this species.

References

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