Assessing the Ecological Quality of Soft-Bottom Benthos: evaluation of AMBI and M-AMBI in a marine ecosystem affected by an inorganic contamination source

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INTRODUCTION

Impacts of anthropogenic pollution on marine ecosystems are being addressed by legislation to protect and restore coastal waters. The European water framework directive (WFD 2000/60/EC) establishes a framework for the protection of all water bodies to prevent their deterioration and to ensure the achievement of *good quality status* by 2015. In response to the WFD requirements a range of biological measures have been investigated for their ability to indicate anthropogenic disturbance. The majority of this tools are based in benthic subtidal habitats and have focused on organic enrichment (Blanchet et al., 2008). The potential applicability of these indices to stressors other than organic matter is therefore unclear.

The aim of present study was to examine the useful application of two benthic biotic indices (AMBI and M-AMBI) proposed in the WFD for the classification of coastal water bodies, in an ecosystem affected by an inorganic contamination source.

MATERIALS AND METHODS

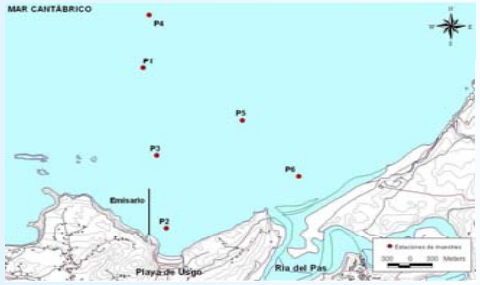


Figure 1. Map of the study area with the sampling stations

The study was carried out in the coastal area of Miengo (North Spain) where is located the Solvay Quimica S.L. outfall. Five sampling stations ran from the outfall (Figure 1). Sandy soft-bottoms characterized all these stations, which were located at different distance from the outfall.

Sediment samples were collected in May 2011 by a box corer (surface area 170 cm²; penetration depht of 15 cm). Five samples per station: 1 for the physicochemical characterization and 4 for the biological characterizacion.

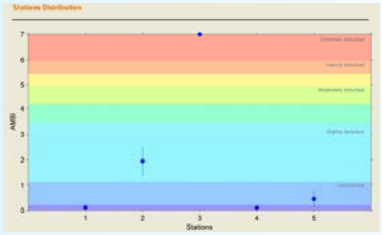
Two marine biotic indices proposed, AMBI and M-AMBI, were used, together with community descriptors (abundance, Shannon–Wiener diversity, Pielou´s evenness and Richness). Moreover, the level of calcium, organic matter and particle size of each station were measured.

Box corer dredge

RESULTS AND DISCUSSION

The analysis of the indices showed a great spatial variability in macrofaunal communities affected by the outfall. In both cases the site BS3 (the closest station to the outfall) showed the worst status because it was azoic (Table 2). The species richness was low in the whole area, and increased slightly in the sites further from the outfall (BS1, BS4 and BS5).

AMBI



The AMBI index showed good quality in all stations except in BS3 because it was azoice (maximum value of index, 7)

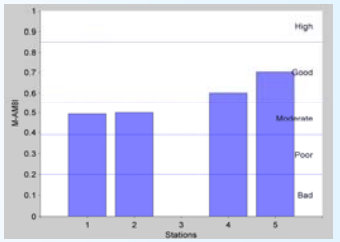
Estación	Porcentaje de la abundancia en cada grupo ecológico					Valor AMBI	Índice Biótico
	I	II	III	IV	V		
BS1	95,1	2,5	2,5	0	0	0,112	0
BS2	12,5	37,5	50	0	0	1,95	2
BS3	0	0	0	0	0	7	7
BS4	95,3	2,3	2,3	0	0	0,105	0
BS5	82,3	3,1	14,6	0	0	0,452	1

Table 1. Results of AMBI

Estación	Diversidad (H´)	Riqueza (S)	Equitabilidad (J´)	AMBI	M-AMBI
BS1	0,6	15	0,2	0,112	0,493
BS2	1,7	8	0,8	1,95	0,5
BS3	0	0	0	7	$7{,}44E^{-13}$
BS4	1,2	20	0,4	0,105	0,602
BS5	1,8	22	0,6	0,452	0,702

Table 2. Results of indices and descriptive parameters

M-AMBI



The M-AMBI index classified the stations from moderate to good quality. In this case BS3 was classfied with the worst status like with the AMBI.

Regarding to the AMBI and M-AMBI, it looks as if they could classify the sites according to their degree of pollution. However, since the site BS3 was azoic, this helps to obtain the expected results in a contaminated area, so these should be taken with caution. Moreover, since both indices are based on the pollution resulting from organic enrichment, their application in this case of inorganic pollution may not be successful, and the results. Therefore, the development of new indicator lists according to the type of pollutant may serve to improve the results obtained with organic enrichment-based indices when studying other kinds of disturbance.

CONCLUSIONS

- Both indices are able to detect the impact in the study area, but the fact that one of the stations (BS3) is azoic provided that any index shows the expected results.
- Both index are correlated very well in the study area and show the differences in the ecological status practically equal.
- M-AMBI takes a step forward in the asessment of the ecosystem integrity because combine the multivariate analisys with the species richness and the diversity.

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