

BENTHIC INDICES ON COMPARISON IN THE NORTHERN ADRIATIC SEA

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Abstract

In order to meet the requirements of the European Water Framework Directive, a new benthic index, named Daphne, has been recently developed for the Northern Adriatic Sea and it is here compared to other benthic indices used along European coasts: AZTI Marine Biotic Index (AMBI), Bentix and Benthic Quality Index (BQI). The results obtained by Daphne are consistent with the environmental characteristics of the study area and with the application of the AMBI index. Some critical points are discussed.

Keywords : *Adriatic Sea, Bio-indicators, Coastal Waters, Monitoring, Zoobenthos.*

Introduction

In coastal waters, benthic invertebrate fauna is one of the biological elements indicated by the European Water Framework Directive for the classification of the ecological quality status. To this aim several benthic indices have been developed and applied along European coasts: the AMBI (AZTI Marine Biotic Index) [1], the Bentix [2], and the BQI (Benthic Quality Index) [3].

In this work we compare the results obtained by the application on soft bottom benthic fauna, collected along the Emilia Romagna coast (Northern Italy), of all the indices mentioned above and of a new one recently proposed for the Northern Adriatic Sea [4].

AMBI and Bentix indices require the identification of all organisms to species level and the assignment, often controversial, of each species to different ecological groups (EG) on the basis of their sensitivity to pollution. The BQI tries to overcome the problem of species assignment to EG by calculating the species tolerance value by means of an objective analysis.

The new index does not consider the sensibility of each species, but it is based on six characteristics of the benthic community, which do not require in depth taxonomic expertise.

Materials and methods

Soft bottom macrobenthos was sampled in May, July and October 2004, at 8m depth, in 4 stations, Porto Garibaldi, Ravenna, Cesenatico and Cattolica, located along the Adriatic main current which runs southwards and therefore differently influenced by the trophic load carried by the Po river. Benthic samples were collected using a 0.06 m² van Veen grab; chemical-physical data were measured on an approximately weekly basis. On benthic data we calculated the Ecological Quality Ratio (EQR), defined by the Directive as the ratio of the observed index value versus the value of the same index under Reference Conditions (RC). Due to the difficulty to find unimpaired sites or historical pre-industrial data in order to define RC, we considered "virtual reference conditions", as proposed by Borja et al. [5]. We applied the Multivariate AMBI version (M-AMBI) [5], using the software AMBI 4.0 available on line, and Bentix as reported in Simboura et al. [6]. The calculation of the tolerance species value following Rosenberg's method [3] was applied to a data-set including 222 samples collected in the Northern Adriatic area.

Results

The average annual values of Daphne index increase gradually southward, from Porto Garibaldi and Ravenna to Cesenatico and Cattolica (Tab. 1). The M-AMBI follows the same trend: the lowest values of EQR were obtained in Porto Garibaldi and Ravenna, while in Cesenatico and Cattolica the EQR increased. Contrasting results were obtained using Bentix, with an EQR value lower in Cattolica than in Porto Garibaldi.

For the application of BQI, the tolerance value was calculated for about 100 species with controversial results: species known from literature to be sensitive result more tolerant than species known as opportunistic. This is probably due to the low number of samplings used to calculate the tolerance values in the Northern Adriatic (222) compared to those used along the Swedish west coast (1114).

The results obtained by Daphne and M-AMBI match the trend of the chemical-physical and structural parameters.

The ecological quality classification indicates that differences in the indices values do not always correspond to differences in the ES. The Daphne index rates the northern stations to be in moderate ES, while Cesenatico and Cattolica in good ES; the AMBI classify in good ES Porto Garibaldi, Ravenna, Cesenatico and in high ES Cattolica. The Bentix classifies in moderate ES both Porto Garibaldi and Cattolica, showing the

scarce reliability of the results.

Tab. 1. Average value of the Ecological Quality Ratio (EQR) and corresponding Ecological Status (ES) for Daphne, M-AMBI and Bentix in the 4 sampling stations.

	Porto Garibaldi	Ravenna	Cesenatico	Cattolica
Daphne				
EQR	0.49	0.54	0.62	0.68
ES	moderate	moderate	good	good
M-AMBI				
EQR	0.65	0.63	0.77	0.92
ES	good	good	good	high
Bentix				
EQR	0.49	0.39	0.50	0.46
ES	moderate	poor	moderate	moderate

Discussion and conclusion

The Daphne index provide results that are in accordance with the M-AMBI trend and with the environmental condition pattern in the area. Bentix gives contrasting results. Differently from Daphne and AMBI, the Bentix EQR was derived by the relationship between the monitoring result and the theoretical maximum value of the index, so the EQR could be underestimate. The critical point is to determine the correspondence between the EQR value and the ecological quality status. In fact, although Daphne and AMBI show a similar trend, they assess the same stations in different ES, Daphne being more severe. A more reliable definition of the quality class boundaries can be obtained using larger data sets including sites that are in very good or very bad ecological conditions.

References

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