THE USE OF BENTIX IN ASSESSING ECOLOGICAL QUALITY STATUS OF SHALLOW WATER HARD SUBSTRATE BENTHIC ECOSYSTEMS IN THE BOSPHORUS STRAIT (TURKEY)

Evrim Kalkan [1] *, S. Ünsal Karhan [2], Erhan Mutlu [3] and Miray Bekbölet [1]

[1] Department of Environmental Science, Institute of Environmental Science and Technology, Boğaziçi University, Hisar Campus, TR-34342 Bebek, Istanbul, Turkey - evrimkalkan@yahoo.com

[2] Department of Marine Biology, Institute of Marine Sciences and Management, Istanbul University, Müşküle Sok. No:1, TR-34470 Vefa, Istanbul, Turkey.

[3] Institute of Marine Science, Middle East Technical University, P.O. Box 28, TR-33731 Erdemli, Mersin, Turkey.

Abstract

For the assessment of ecological quality status of shallow water hard substrate benthic ecosystems affected by coastal sewage discharges the biotic index "BENTIX" was used. The index values revealed that sewage discharges caused serious disturbance on macrozoobenthic communities in the area investigated. Although so far it has been used for soft bottom communities, BENTIX appeared to work successfully also in hard substrates, at least for the present study.

Keywords : Zoobenthos, Rocky Shores, Sewage Pollution, Bosphorus.

Introduction

The north-western Black Sea coastal waters, transported towards the Bosphorus Strait by alongshore currents [1], are drastically polluted by large inputs of nutrients and organic matter via riverine and wastewater discharges ([2], [3]). In addition, the polluted Black Sea surface waters, before spreading into the Marmara upper layer, is further contaminated by the waste discharged into the Bosphorus Strait from the city of Istanbul by the numerous industries and approximately the 15 million population [4]. The purpose of the present study is to assess the degree of disturbance and ecological quality status (ECoQ) of shallow water hard substrate benthic ecosystems in the Bosphorus Strait using BENTIX (a biological quality index). This is the first case of applying the index in hard substrate benthic data.

Materials and Methods

The study was carried out seasonally at 15 stations from May 2004 to February 2005 in the rocky shores of the Bosphorus Strait. While 9 stations (B6, B7, B8, B9, B10, B11, B12, B13, B14), which were directly influenced by sewage, were selected as target (discharge) stations, 6 stations (B1, B2, B3, B4, B5, B15), which were rather far from discharge points, were selected as control stations. Samples, as triplicates of area of 400 cm^2, were collected from the upper infralittoral zone at the depth range of 0.5-1 m by using a spatula and fixed in 4% neutral formaldehyde solution in seawater. In the laboratory, all macrozoobenthic samples were sieved through a 0.5 mm mesh with tap water and sorted according to major systematic groups. Thereafter, all organisms were identified to the lowest possible taxonomic level and counted under stereo- and compound microscopes. For the assessment of ECoQ of the study area the biotic index "BENTIX" was calculated according to the scores of three ecological groups described by Simboura and Zenetos (2002) [5]. The determination of scores of some species which cannot be found in the score list of BENTIX were determined according to their dominance or their exclusive presence in some of the sampling sites and whether they are k-strategy or r-strategy species. Stations classified according to their ECoQ by using the classification scheme given by Simboura and Zenetos (2002) [5].

Results and Discussions

The analysis of 180 samples yielded a total of 167,537 individuals belonging to 85 taxa. The BENTIX scores of control stations, which were varied between 2.40 and 5.37, were distinctly higher than that of discharges, which were varied between 2 and 3.13 (Fig.1). Stations, which were directly affected by sewage discharges (discharge stations), were classified as heavily polluted and possessed poor ECoQ. Although station B6 was also directly affected by sewage discharge, it was classified as moderately polluted and possessed moderate ECoQ. All other stations, which were far from the discharge points (control stations), were classified as normal/pristine, slightly polluted - transitional and moderately polluted and possessed high, good and moderate ECoQ. In this sense, the BENTIX index revealed that sewage discharges cause serious disturbance on shallow water hard substrate macrozoobenthic communities in the Bosphorus Strait.
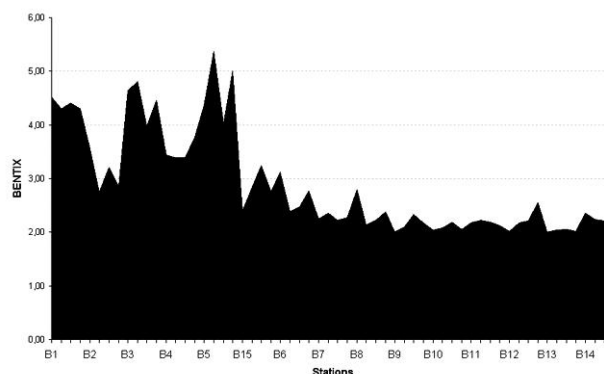

Fig. 1. BENTIX index trend in the study area.

As a very descriptive and effective tool, the BENTIX index precisely classifies the benthic communities into ecological quality classes. According to the authors who created the index, its robustness lies in the fact that it is independent of habitat type and sample size. It has therefore a potential for global application. Its effectiveness in discriminating between ecological classes is because of its ability to reflect the faunal composition in relation with the resistance of species to disturbance factors [5]. Although so far it has been used for soft bottom communities, BENTIX appeared to work successfully also in hard substrate communities, at least for the present study.

References

1 - Sur, H. I., Özsoy, E., Ünlüata, Ü., 1994. Boundary current instabilities, upwelling, shelf mixing and eutrification process in the Black Sea. *Prog. Oceanog.*, 33: 249-302.
2 - Bologna, A. S., 1985. Planktonic primary productivity of the Black Sea: a review. *Thal. Jugoslavica*, 21/22: 1-22.
3 - Mee, L. D., 1992. The Black Sea in crisis: The need for concerted international action. *Ambio*, 21 (4): 278-286.
4 - Orhon, D., Uslu, O., Meriç, S., Salihoğlu, I., Filibeli, A., 1994. Wastewater management for Istanbul: Basis for treatment and disposal. *Environ. Pollut.*, 84: 167-178.
5 - Simboura, N., Zenetos, A., 2002. Benthic indicators to use in Ecological Quality classification of Mediterranean soft bottom marine ecosystems, including a new Biotic Index. *Medit. Mar. Sci.*, 3/2: 77-111.