

IMPACT OF HUMAN AND INDUSTRIAL DISTURBANCES ON COASTAL ENVIRONMENT OF CASABLANCA (ATLANTIC, MOROCCO).

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In the last decades, marine and coastal environments of Casablanca, undergo effects of various disturbances such as sewage discharges, industrial effluents. A multidisciplinary project, supported by 'La Lyonnaise des Eaux de Casablanca, LYDEC' was undertaken to evaluate the effects of these disturbances, namely the sewage discharges, on coastal and marine ecosystems.

Five sandy beaches, constrained by sewage discharge (Petite Zenata), by a nearby industrial effluent (Grande Zenata) or by tourism activities (Ain Diab, Sidi Abderrahmane, and Sidi Rahal), were monitored by considering the saturation area. Three sampling stations by beach were monitored monthly since march 2009 for physicochemical, microbiological features and macrozoobenthos. The benthic ecological quality status (EcoQ) was assessed by single (H', AMBI, BENTIX and BOPA) and multimetric (M-AMBI) index approaches based on diversity, species abundance and the presence/absence of indicator and stress-sensitive species.

Biotic indices consistently registered responses of macrozoobenthos to organic enrichment. Accordingly, sewage discharges altered heavily intertidal macrozoobenthic assemblages at the Petite Zenata beach where opportunistic species (*Capitella capitata*, *Malacoceros fuliginosus*) dominated. The macrozoobenthic communities at the other beaches remained slightly disturbed or undisturbed. Hydrodynamics and seasons may interact with these actual disturbances in smothering/strengthening the effects of the deposition-mediated effects through dispersal/accumulation of deposits.

Ultimately, the present study aimed to establish a reference state for the Casablanca beaches that should be used as a scientifically robust approach to monitoring the environmental change in the framework of a future appropriate management approach aiming to achieve a good EcoQ within the Casablanca Waters.

Key words: Macrozoobenthos, pollution, indices, EcoQ, Casablanca.

INTRODUCTION

Casablanca is the Economic capital of Morocco; its littoral ecosystems undergo several anthropogenic disturbances due to the high intensity of human frequentation of beaches around Casablanca, also the navigation, and the implantation of harbor and the marina. The situation is worsened by the existence of many sewage discharge and industrial effluents that originate from the industrial Zones "Ain Sebaa and Zenata"; and that transport a great quantity of wastewater.

Physical, chemical and microbiological analysis of the surface water and sediments characteristics were undertaken together with the application of univariate and multivariate techniques to the biotic data in order to evaluate the effects of these disturbances namely the sewage discharges, on coastal and marine ecosystems of Casablanca.

METHODS

The study is conducted since March 2009 in 5 beaches which are constrained by:

- ⇒ Nearby industrial effluents: Grande Zenata Beach (GZ)
- ⇒ Sewage discharge: Petite Zenata Beach (PZ)
- ⇒ Tourism and human frequentation: Ain Diab (AD), Sidi Abderhmane (SAR) and Sidi Rehal (SR).

At each beach, sampling of the macrofauna was carried on the saturation zone (Bayed 2003). The replicate unit used in the study consisted of a square 25 cm x 25 cm. Samples were taken from a depth of 30 cm, using a spade. A random sampling of four replicate units was carried out at each station. The samples were filtered through a sieve of 1mm mesh size and fixed in solution of 10% formalin. In the laboratory, the macrozoobenthos was identified and counted.

At the same time, samples of water and sediments were carried too, for the physicochemical and microbiological analysis.

RESULTS AND DISCUSSION

Water characteristics

According to microbiological a chemical analysis we notice:

- ⇒ High levels of suspended solids, mainly Organic Suspended Matter, at PZ beach.
- ⇒ High levels of COD at PZ and GZ beaches showing organic enrichment.
- ⇒ No evident of metallic pollution though industrial effluents.
- ⇒ High levels of faecal bacterias at PZ and GZ in relation to sewage collector.

Sediment characteristics

Here we tried to assess the biological significance of the chemical pollution by using the approaches based on values reported by Long *et al.* (1995) and Persaud *et al.* (1992).

The results showed that the five beaches differed in sediment characteristics. The Grande Zenata beach would be touched by a metallic pollution with the highest concentrations of

As, and Ain Diab beach is contaminated by Cr and Pb while the Petite Zenata beach showed conspicuous organic matter enrichment.

Benthic macrofauna

The benthic ecological quality status (EcoQ) was assessed by H' (Vincent *et al.*, 2005), AMBI (Borja *et al.*; 2000), BENTIX (Simboura et Zenetos; 2002), BOPA (Dauvin et Ruellet; 2007) and Multivariate-AMBI (Muxika *et al.*, 2007) index approaches which are based on diversity, species abundance and the presence/absence of indicator and stress-sensitive species.

The results showed that the Assessments of EcoQs derived from H', AMBI, BENTIX, BOPA and M-AMBI indices partially matched but were in some cases contradictory.

Another approach (Blanchet *et al.*; 2008) was adopted to solve this contradiction; it consists in considering just two EcoQ status: 'Acceptable' or 'Not acceptable'. 'Acceptable' status was determined for each BI when the derived EcoQ status was 'High' or 'Good', and scored as '1'. This means that, on the managers point of view, no action has to be taken to restore the ecosystem. 'Not acceptable' status corresponded to 'Moderate', 'Poor' or 'Bad' EcoQ status, and was scored as '0'. When such an EcoQ status is derived from the biotic index, restoration measures are to be taken in order to reach 'Good' status. The scores given to each of the five Biotic indices used were summed for each station (range: 0–5). This sum of scores allowed measuring the level of agreement/disagreement between Biotic Indices.

According to those approaches, some beaches are Good and don't need restorations' actions, however others need to be restored.

CONCLUSION

This study allowed us to measure the impact of industrial effluents on the coastal area of Casablanca, and it aimed to establish a reference state for the Casablanca beaches that should be used as a scientifically robust approach to monitoring the environmental change in the framework of a future appropriate management approach aiming to achieve a good EcoQ within the Casablanca Waters.

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