TAXONOMIC AND FUNCTIONAL STRUCTURE OF SESSILE MACROBENTHOS IN THE LAGOON OF VENICE

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Abstract

The sessile benthos colonizing the wooden piles of the lagoon of Venice was sampled in July 2005 in stations characterized by different types of disturbance, in order to investigate the taxonomic and functional structure of the community. The most unexpected result was the high taxonomic richness observed in stations affected by industrial and urban discharges, that could be related to the environmental changes occurring in the lagoon.

Keywords : Adriatic Sea, Lagoons, Zoobenthos.

Introduction

We present the results of a recent survey on the sessile zoobenthos colonizing artificial hard-bottoms in the lagoon of Venice. This community has been considered a good indicator of environmental change and used in monitoring programs over the last decades [1, 2]. In this study we analyse both taxonomic and functional composition of the community, in the attempt to identify characteristic species and functional traits related to different environmental conditions.

Materials and Methods

Biological samples were collected in July 2005 in 12 stations, located in the central and northern sub-basins of the lagoon of Venice and selected as representative of different environments: F1, F2 at the continental margin, influenced by freshwater and agriculture discharges; I1, I2 in the industrial area of Marghera, where a refinery complex is located; U1, U2, U3, U4 in the urban canals of Venice; L1, L2, L3, L4 in the typical lagoon context. Sampling methods of the sessile organisms colonizing artificial hard substrates (wooden piles) are described in [2].

Two different matrices were created, i.e. a matrix of taxa × stations (average abundance over three replicates), plus a matrix of functional traits × stations, calculated according to [3]: (i) seven functional traits were selected and sub-divided into several categories, for example the trait "body form" included the categories "flat", "mound", "erect"; (ii) individual taxa were scored from 0 to 3 for their affinity to each trait category, using a "fuzzy coding" procedure; (iii) for each taxon its relative abundance was multiplied for the trait category scores, that were then summed over all taxa present at each station. Finally, the Bray-Curtis similarity between couples of stations was calculated for both matrices, and non-metric multidimensional scaling (nm-MDS) plots were generated.

Results and Discussion

A total number of 44 taxa was identified. The most frequent and abundant taxa were: Didemnidae, Ostreidae, *Mytilus galloprovincialis*, *Pileolaria militaris*, *Tricellaria inopinata* and *Ventromma halecioides*. The ascidians Didemnidae, probably of exotic origin, showed invasive character, having never been observed with such high frequency and abundance in all the previous surveys. Conversely, species once characteristic and abundant in the lagoon, in July 2005 were collected only in a few stations, suggesting that the zoobenthos is experiencing deep changes in its taxonomic composition.

Taxa richness evidently varied among stations, with minimum values at the two freshwater stations (mean richness: 5.8 ± 2.22) and maximum values at the lagoon and industrial stations (15.0 ± 3.02 and 15.0 ± 2.53, respectively). Within the group of urban stations (mean richness: 10.7 ± 4.81), over 15 taxa were observed in each replicate of U1 and U2. This is in contrast with the observations of past studies: all the urban stations in the 1990s were characterized by very simplified communities, with only a few opportunistic species [1]. Such a high taxonomic richness in stations affected by industrial and urban discharges was unexpected. The contribution of non-indigenous species has to be taken into account: invasive organisms like the bryozoan *T. inopinata* and the ascidians Didemnidae, being able to colonize even industrial and urban stations, have locally increased the taxonomic richness, but their presence is a symptom of other types of disturbance affecting the lagoon of Venice.

Fig. 1 shows the results of similarity analysis: 4 groups of stations can be detected both from the taxonomic (fig. 1a) and functional (fig. 1b) point of view. However, the constant presence of a few opportunistic species in most samples influences the results of the similarity analysis: the disturbed urban and industrial stations are no longer clearly separated from the more pristine lagoon stations, as in the past [1].

The urban stations, although being geographically close and having a relatively similar taxonomic composition (fig. 1a), display high functional dissimilarity within themselves and among other groups (fig. 1b), showing an unpredictable pattern. On the contrary, the most characteristic community is observed in stations F1 and F2, which present a set of species with peculiar traits (e.g. erect form, low protection, asexual reproduction by budding).

The environmental changes occurring in the lagoon of Venice, in particular the lowered nutrient discharge from the drainage basin and the increased frequency of the "high water" events, could be responsible for the reduction in differences of sessile benthic communities within the lagoon.
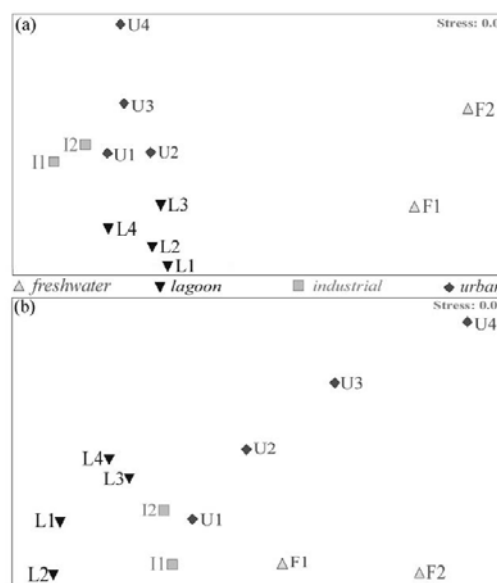

Fig. 1. Similarity analysis: nmMDS plots obtained from the taxa x stations matrix (a) and functional traits x stations matrix (b).

References

1 - Occhipinti-Ambrogi A., Birkemeyer, T., Sacchi, C.F., 1998. Indicatori ambientali in laguna di Venezia: proposta di una classificazione basata sulle comunità sessili. *Boll. Mus. Civ. St. nat*. Venezia, S49: 277-283.

2 - Sconfietti R., Marchini A., Occhipinti-Ambrogi A., Sacchi C.F.,2003. The sessile benthic community patterns on hard bottoms inresponse to continental vs. marine influence in Northern Adriaticlagoons. *Oceanol. Acta*, 26: 47-56.

3 - Bremner J., Rogers S.I., Frid C.L.J., 2006. Methods for describingecological functioning of marine benthic assemblages using biologicaltraits analysis (BTA). *Ecol. Indicators*, 6: 609-62.