DETRITAL ENRICHMENT FROM MARINE URBAN STRUCTURES AND ITS FAR-FIELD EFFECTS ON SOFT-BOTTOM ASSEMBLAGES

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Abstract

Here we report the results of a field experiment designed to identifying and quantifying possible local changes in sedimentary environments and associated assemblages related to the deposition of two common but different types of detritus produced by hard bottom species (green algae and mussels) along the coast of the north Adriatic sea.

Keywords: Adriatic Sea, Detritus, Sediments, Artificial Reefs

Coastal marine landscapes have been profoundly altered by the introduction of a variety of human-made artificial structures, such as seawalls, dykes and breakwaters, ([1], [2]). There is mounting evidence that these structures may profound change the environmental and ecological condition of the coastal ecosystem ([3], [4], [5], [6]). However, the broader ecological consequences of these man-made structures that could extend the foot print of their impact are poorly understood. These artificial structures could have important consequences for the functioning of coastal system through the spatial subsidy of detrital material that is sloughed off the artificial structure and changes productivity, nutrient cycling, detrital pathways in the adjacent soft-sediments. We designed an experiment to identify and quantify possible changes in sedimentary environments and associated assemblages related to the unnatural, considerable amount of detritus produced by hard bottom species associated to the urban structures. The study was carried out along the sedimentary coasts of the North Adriatic Sea (Italy). In this area >190 km of artificial structures, mainly groynes and breakwaters, seawall and jetties, have been built along 300 km of naturally low sedimentary shores causing severe loss and alterations of shallow sedimentary habitats [3]. We first identified and quantified the type, amount and distribution of detritus produced by dominant hard-bottom species on the structures. We then carried out a field experiment to analyse the effects of detritus from different organisms (i.e. *Ulva* spp, vs *Mytilus galloprovincialis*) on surrounding sedimentary environments and associated assemblages. We predicted different effects of these two forms of detritius because of the different nature in the organic material (specific gravity and chemical content) and the provision of shell material associated with mussel deposition. Mussels and *Ulva* were collected from artificial breakwaters located in Lido di Dante (44°22'59''N, 12° 19'19''E). Mussels were frozen for 24 hours while *Ulva* stored at 4° for 24 hours to quickly obtain fresh detritus, therefore disposed into net bags (60x60 cm, mesh size 1 cm) to be used in the experimental treatments. The experiment was set up on soft bottoms at about 50 m apart from any artificial structure and at a depth of 4 m which is similar to the depth of soft-bottoms surrounding the nearby structures. Treatments included: addition of detritus from *Ulva* spp (500 g wwt), addition of detritus from mussels (3 kg wwt), unmanipulated controls and a procedural control (empty nets). The amount of detritus in each treatment was chosen based on previous field observations. Twelve plots were established for each treatment. Sampling was done 2 days, 7 days and after 21 days after the deposition of the detritus to follow the temporal trajectories of the effects. Each time 4 plots of each treatment were randomly selected and sampled destructively. Variables measured in each plot included: soft-bottom macrofauna, macrofauna directly associated with the detritus, total organic matter, chlorophyll *a* and sediment grain size. Detritus originated from *Ulva* spp. and mussels had significant and different effects on macrofauna. These effects included both changes in the composition and distribution of the macrofauna in the sediments and effects related to the colonization of detritus by rich assemblages (particularly amphipods). Strong effects were evident 2 and 7 days after the beginning of the experiment, but weakened by 21 days. This suggests very rapid breakdown and assimilation of this material into the benthic foodweb. Some of the major changes were related to few families of amphipods that showed the highest abundance in *Ulva* treatments after 7 days of the starting of the experiment. Our study suggests that mounds of detritus produced by organisms associated to marine artificial structure can affect the structure of native soft-bottom assemblages. This effects become particularly significant if scaled up in areas, such the North Adriatic Sea, which is highly affected by marked eutrophication processes, frequent storm events and high temperature that could enhance detritus deposition around more than 300 km of coastline protected by artificial structures.

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