in benthic infauna that may have commercial consequences if the reefs are designed to attract and/or accommodate commercial species.

Ecological implications of coastal defence structures in a macro- and microtidal system

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Sea level rise due to climate change and increased storminess represents a serious threat to many coastlines, which become more vulnerable to erosion and flooding. As a result, an increasing number of permanent, rock defence structures are being built along sandy shores. These consist of sea walls, jetties, off-shore breakwaters and rock groynes. The construction of coastal defences results in the loss and fragmentation of sandy habitats, which are replaced by artificial rocky habitats. As a consequence, species typical of hard substrates are introduced in a soft-bottom ecosystem. It is thus essential to develop effective (in engineering terms) and environmentally sensitive designs of coastal defences. As a part of a large EU funded research project (DELOS, EVK3-CT-2000_00041), large-scale surveys of coastal defence structures were carried out along several macro- and microtidal shores in UK and Italy. These surveys characterised the abundance, diversity and distribution of epibiotic communities on coastal defence structures in relation to their engineering design and environmental setting. Results showed that coastal defences are extensively and rapidly colonised by epibenthic assemblages similar to those on natural rocky shores, but with reduced diversity and abundance. Significant differences in the abundance and composition of epibiota between the seaward and landward sides were observed on all the structures. Breakwater design features such as height and length of the structures and large scale environmental factors such as geographical location and tidal range also affected diversity and spatial distribution of epibiota. Not surprisingly differences were shown between Italy and UK. Ecological implications of defence structures are discussed in relation to coastal management in both microtidal and macrotidal coastlines.

Early colonization of macroalgae in an Atlantic island subtidal rocky shore: an artificial *vs* natural substrata experiment

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The early stages of colonization of macroalgae in artificial and natural substrata were followed on a rocky subtidal shore south of the Island of São Miguel (Azores). Several annual experiments were conducted from spring 2001 to spring 2003. These were designed to evaluate the importance of 1) the type of substrata, 2) the season of placement and/or clearing the substrata, and 3) the influence of sediment deposition in the patterns of

colonization (abundance of colonizing individuals) and morphotype of colonists (turf, filament, crust). Ceramic plates were placed in an artificial structure and collected monthly. Simultaneously, plots were randomly cleared in the rocky bottom and followed during the experimental period. The patterns of colonization and succession observed in both substrates emphasize the importance of the moment when the substrata is available for colonization. On the artificial substrata the crustose or prostrated forms of algae were dominant during the entire time of the experiment. Also on the natural substrata these forms of algae exhibited an initial dominance, latter being replaced by erect forms of growth which corresponded to the dominant species of the surrounding communities. Natural substrata presented a more rapid process of succession.

Algal transplantation as a potential tool for artificial reefs management

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The algal transplantation has a potential role in the repair of natural population damaged by human activities (pollution, eutrophication, habitat fragmentation). It may be applied also on artificial reefs as a mean of accelerating growth of the vegetal component or restoring algal communities (i.e. after intensive grazing of sea urchins). Artificial reefs are commonly thought to be useful tools for mitigation of anthropogenic loss or damage to natural ecosystems. Moreover the transplant of habitat forming species on artificial substrata may enhance the whole community, in that they may generate or maintain biodiversity by conditioning biotic interactions and habitat structure. A pilot study has been conducted in the Gulf of Trieste (Izola-Slovenia) on *Cystoseira barbata* (Stackhouse) C. Agardh and *Cystoseira compressa* (Esper) Gerloff & Nizamuddin in order to test different techniques for algal transplantation. A standardized protocol has been prepared to evaluate transplanted algae success. The methods employed have also appeared suitable for assessing the functional role and the spatial heterogeneity (architecture) of these habitat-forming species, both on natural and artificial substrata, by means of biological and structural indicators. The potential and the limitation of algal transplantation for habitat restoration and ecosystem management are discussed.

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