Possible effects of pebble beach nourishment on benthic assemblages

Ponti Massimo 1, De Grandis Gianluca2, Abbiati Marco3, Tombolesi Paola2

1 Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Alma Mater Studiorum University of Bologna, Via S. Alberto 163, 40123 Ravenna, IT
2 ARPAM, Agenzia Regionale per la Protezione Ambientale delle Marche - Dip. Ancona - Servizio Acque, Via C. Colombo 106, 60100 Ancona, IT

Introduction

The nourishment of sandy beaches to counteract coastal erosion and the loss of economic value is a very common practice (e.g. Handon et al., 2012; Cooke et al., 2012). The alterations of benthic assemblages at different spatial scales caused by massive interventions have been well studied and, although several authors have proposed guidelines for good practices, there is a general consensus among scientists on their ecological negative effects (e.g. Leewis et al., 2012; Schlacher et al., 2012). Despite all this, the possible effects of small nourishment projects on gravel or pebble beaches have not been well studied (e.g. Jackson et al., 2007). The pebble nourishment intervention realized in Portonovo (Ancona, IT; Fig. 1) in June 2011 offered the opportunity to study these possible effects.

Material & methods

The area of Portonovo belongs to limestones and marly limestones in pelagic facies (Palaeogene - Upper Cretaceous). The beach is made by boulders and pebbles landslide, reworked by waves, and finer sediments from surrounding areas. In June 2011, a pebble nourishment intervention was made along a small stretch of coastline, where an unaffected zone has been reserved in the middle (Fig. 1). The benthic assemblages were investigated with photographic sampling twice a year in 2 sites subjected to nourishment (A and B) and in 2 control sites (C and D; Fig. 1). The photographs were used to identify organisms by comparison with species reference collection, obtained by collected voucher specimens and macro pictures (Fig. 2). Percent cover of sessile organisms was estimated by superimposing a grid of 400 equal-sized cells (i.e. 20 x 20 cm) and identifying all taxa visible within each cell using the PhotoQuad software (Trygonis & Sini, 2012). Specimens pictures (number of taxa, S), species diversity (Shannon’s index with log base 2, J'), and the corresponding evenness component (Pielou index, J') were calculated for each replicate sample (Maguran, 2004). Differences in assemblage structure, species abundance and diversity indices, were assessed by uni- and multivariate permutational analysis of variance (PERMANOVA; Anderson & Robinson, 2001; Anderson & ter Braak, 2003).

Results

Preliminary results, concerning the firsts 2 year after the intervention, indicate a high heterogeneity among sites and modest alteration of the local benthic assemblages, not ascribable to the nourishment intervention (Fig. 3). Among the different species, only the snakelocks anemone, Anemonia viridis, shows effects, being significantly more abundant in the control sites in some sampling dates (Fig. 4).

Discussion

Although results are preliminary and more samples are to be analysed, it seems that the little nourishment intervention has not produced large effects on local benthic communities. Nevertheless, massive and frequent pebble-beach nourishments may produce greater and extended effects. Counteract the natural evolution of the coast is a losing battle from the start (Paoli et al., 2013). Despite this, short-term local economic interests tend to prevaricate management decisions. A proper integrated land use planning process, focusing on coastal protection, can be a losing battle from the start (Paoli et al., 2013).