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MAPPING AND CHARACTERISATION OF CORALLIGENOUS BIOCONSTRUCTION USING ACOUSTIC AND VISUAL INTEGRATED APPROACH

Abstract
An integrated approach, based on acoustic and visual survey techniques, has been used to map coralligenous bioconstructions along the Apulian coasts (Italy). The visual investigations proved to be essential for the identification and the characterization of such typical Mediterranean habitat.

Key-words: coralligenous, marine bioconstructions, habitat mapping, Mediterranean Sea.

Introduction
As a result of the Habitat Directive (92/43/EC), marine bioconstructions, generically indicated as "reef", have been recognized as marine habitats worthy of protection. Among Mediterranean marine bioconstructions, coralligenous undoubtedly is one of the most important in extension and biodiversity. Therefore, for some years the efforts in this context were primarily aimed to quantify and to map such bioconstructions, in order to plan an appropriate protection strategy. In this regard, the Apulian Region (south-eastern Italy) has undertaken a number of activities to map and characterize the marine bioconstructions through the BIOMAP (Biocostruzioni Marine in Puglia) project.
The present study reports the techniques used to provide a large-scale mapping and characterization of coralligenous habitats, that proved to be effective in order to represent a starting point for future mapping efforts of this bioconstructions all over the Mediterranean Sea.

Materials and methods
The surveys were carried out from March to October 2012 along the Apulian coasts (Mediterranean Sea) using vessels equipped with two high frequency (100-500 kHz) Side-Scan Sonar (SSS) systems (Klein3000 and EdgeTech 4200-FS) in order to obtain a meso-scale (*sensu* Greene *et al*., 1999) backscattering map of the seabed (Kenny *et al*., 2003; Savini, 2011). Both the SSS systems were deployed at a constant distance from the seabed equal to 10-20% of the operating range (from 200 to 100 m). The SSS data processing provided geo-referenced gray-tone acoustic images of the seafloor at 1 m resolution. The vessels were also equipped with Multibeam echosounder systems (Reson Seabat 8160 operating at 50kHz and Reson Seabat 8125 operating at 450kHz) through which bathymetric data were acquired in order to obtain morphological data. The integration of multibeam and SSS data provided a tridimensional model of the seabed, representing the variety of the different geomorphological features associated to coralligenous habitats. A total of 3150 NM have been covered by the surveys. Multibeam and SSS devices allowed obtaining, respectively, real time bathymetric maps and sonographs of the seabed. Therefore it was possible to select on-board the suitable points for visual investigations, that were instrumental to support further acoustic data interpretation (Fig. 1).

Results

The acoustic data integration led to a detailed mapping of coralligenous bioconstructions. The identification of the different acoustic signals was definitely supported by a consistent analysis of the associated video data. Data interpretation allowed knowing the morphology and the height of all the mapped bioconstructions, and therefore the identification of the main coralligenous habitats occurring along the Adriatic and the Ionian Apulian continental shelf.
Video analysis allowed the characterization of the macroscopic coralligenous community (e.g. algae, sponges, cnidarians) and the identification of several key-species protected by national and international protocols (e.g. *Palinurus elephas*, *Corallium rubrum*, *Antipathella subpinnata*), as well as alien and invasive species (e.g. *Caulerpa racemosa* var. *cylindracea*).

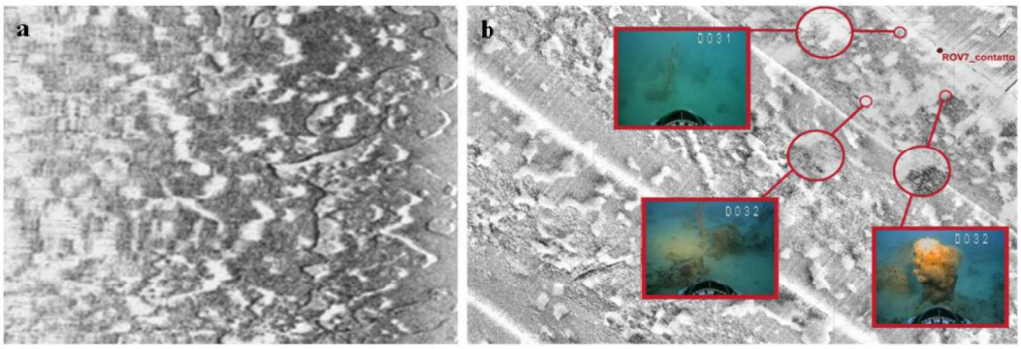


Fig. 1 – a) typical backscatter of *P. oceanica* meadow (from Savini, 2011); b) sonogram of a low and scattered coralligenous seabed with ROV ground truthing.

Discussion and conclusions

The integration of multibeam and SSS acoustic data proved to be a very sound method for the detailed mapping of coralligenous bioconstructions, providing metric and in some case decimetric morphological information about this important habitat. However, the integration between acoustic data and visual investigations was essential not only to distinguish different backscattering, but also to validate the interpretations of remote data. Despite the high resolution acoustic data, video analysis proved how difficult could be the identification of coralligenous bioconstructions based only on acoustic surveys. This is particularly true for the Apulian shallow coralligenous habitat located close to habitats with a more marked acoustic backstatter such as the *Posidonia oceanica* meadows. In fact, the acoustic signal of a shallow coralligenous, characterized by low and dense blocks and perhaps highly covered with algae or sponges, can be similar to the *P. oceanica* one (Fig. 1). In addition, the visual surveys enriched the dataset with a number of biocenotic information. The presence of certain species and their particular *habitus* could also provide useful information about the condition of the environment as well as the impacts occurring over the mapped area (e.g. fishing, diving, anchoring). Anyhow, the integrated techniques used to map the investigated habitats, have proved to be the most efficient and less invasive ones for coralligenous mapping and characterization along the continental shelf.

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