Multiscale mapping to assess the effects of coastal erosion on the *Posidonia oceanica* meadows in Alimini (Apulia Region/Adriatic Sea)

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1 . INTRODUCTION

Mediterranean Seagrasses are represented by five species, whose most representative are *Posidonia oceanica* (L.) Delile and *Cymodocea nodosa* (Ucria) Ascherson. Meadows of these two species have been also considered as priority habitat according Annex I of the EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (EEC, 1992). But the importance of these seagrassess is also due to the considerable biomass – especially *P. oceanica* meadows – that represents an obstacle that hinders and effectively dampens hydrodynamics (waves and currents) of the sea bottom (hydrodynamic forces are reduced from 10% to 75% under the leaves following Gacia et al., 1999). Very severe storms can be the cause of a very important natural issue: the massive sediment progradation of allochthonous and autochthonous sediments tends to bury the leafs of *P. oceanica*, determining its death. Project SIGIEC "Integrated Management System for Coastal Erosion" has applied an experimental technique of multiscale mapping to assess the effects (mesoscale and macroscale level) of coastal erosion over the P. oceanica meadows and in this poster we'll present the preliminary results.

2 . MATERIAL AND METHOD

2.1 Study Areas

The study has been conducted in Alimini, Southern Adriatic Sea (Apulia), in April 2015, (Fig.1).

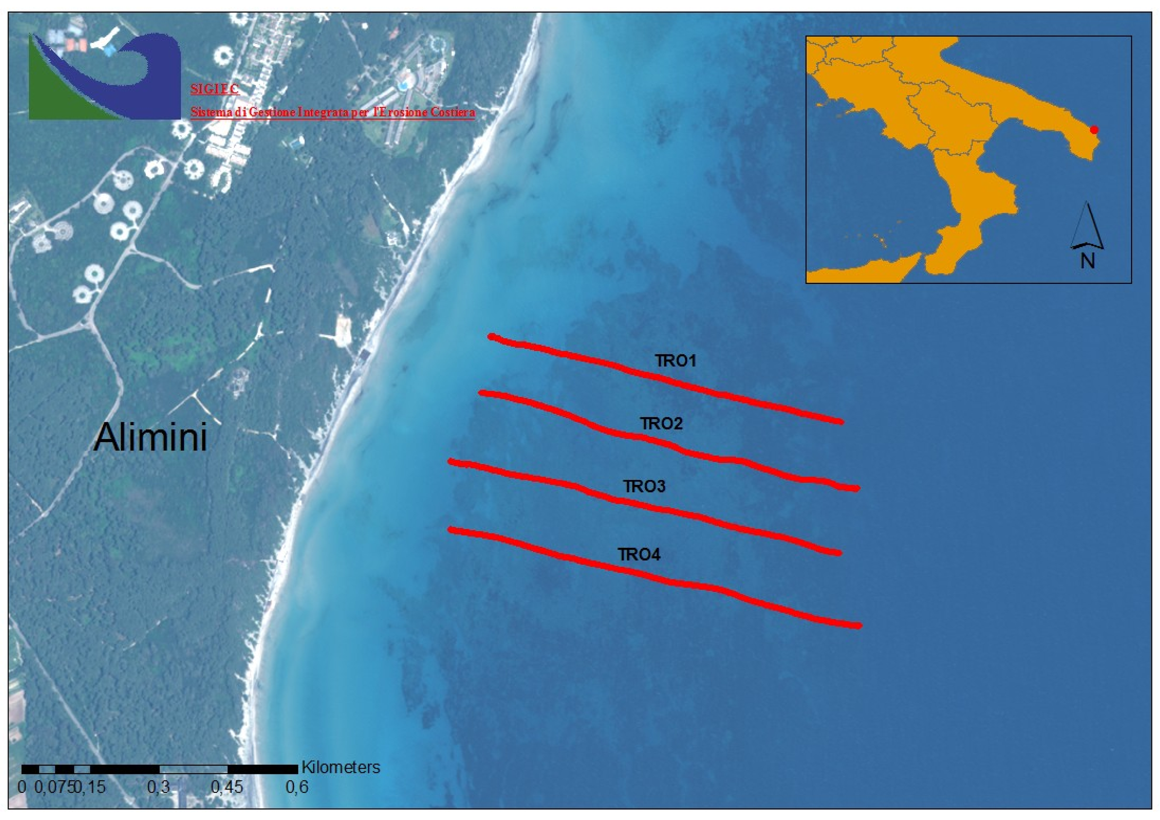

Figure 1 – Video –Photographic transects.

2.2 Sampling activity and data processing

The mesoscale level has been analysed with 4 transects ortogonal to the coastline (Fig.1) We used a towing vehicle equipped with (HD) high-definition vertical cameras, for georeferred (Fig.2) . Images were processed by Structure From Motion (SfM) algorithms that allowed us to generate 2D and 3D models for identifying and classifying physiographic and structural features of the meadow, (Fig.3 e Fig.4). Processing and image analysis has been performed trough supervised classification algorithms, using the Erdas and ArcGis 10.1 softwares. To evaluate the potential use of remote sensing in the detection of *P. oceanica* meadows, a Worldview-2 multispectral image was acquired on April 12, 2012 covering the coastal area of Alimini, (Fig.5A). The spatial resolution of Worldview-2 images is 1.8 m for the multispectral channels. Producing thematic maps of seagrass communities from remote sensing data is a multistep process.

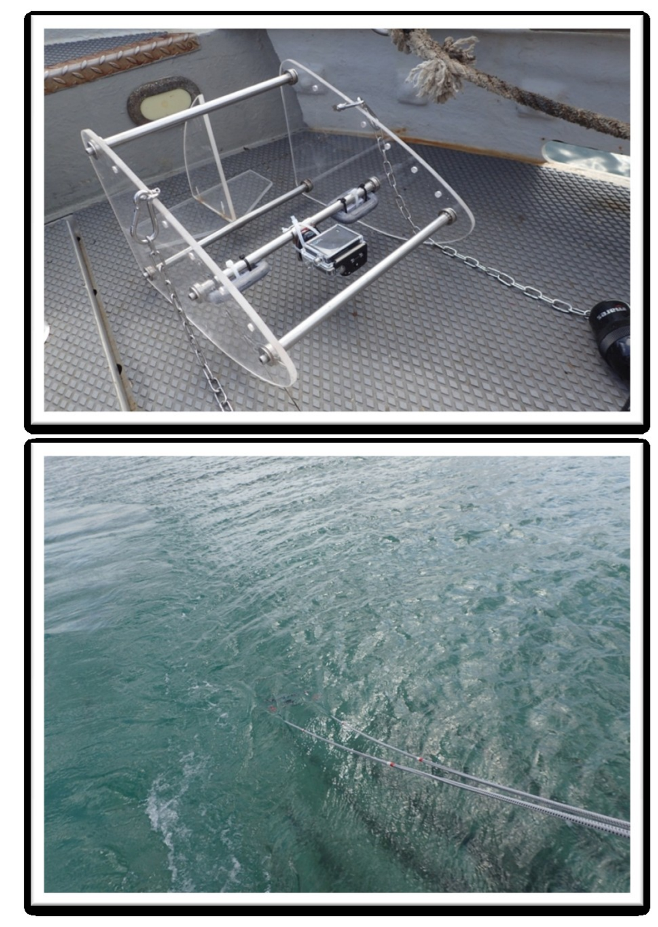

Figure 2 – towing vehicle used for the photographic transects.

3 . RESULTS

The first step consisted in building 2D and 3D models for the photographic transects and in identifyng the structural and phisiographic classes of the seagrass meadows in the study area (Fig.3 and Fig.4). The second step consisted a preprocessing phase to estimate and remove the contribution of atmosphere to the sensor measured signal (radiance to reflectance conversion) and water column noise contributions (Fig.5B). In particular, the water column correction developed by Lyzenga (1981) was applied on the atmospherically corrected Worldvew-2 image which was masked for land pixels. This method produces a depth invariant index from each pair of spectral bands of a multi spectral data set. The assumption is that the radiance ratios of two distinct benthic cover would be independent of water depth as long as the attenuation coefficients are the same in each couple bands (Pahlevan *et al*., 2006). As a result, *depth invariant index* (**DII**) was generated for each couple bands: **DII = Ln[Ri]-[ki/kj]* Ln(Rj)**

The resulting image has led to a more accurate map of seagrass distribution. In the third step, a supervised classification was applied to the combination of depth invariant index from each pair of spectral bands to classify substrate types. The choice of the training sites is the result of a preliminary stage of investigation carried out by the visual interpretation of high-resolution images WorldView-2 in RGB, emphatizing graphics, a series of images taken from underwater photographic survey representative of the morphological classes biocenotic pertaining to the *Posidonia oceanica* (Fig.5C). Different classification methods were tested and the best result was obtained with maximum likelihood classifier. The classes used for the classification are: 1) Deep water; 2) Mosaic of *P. oceanica*; 3) Bottom rocky low coverage *P. oceanica*; 4) Mostly sandy seabed; 5) Mostly rocky seabed; 6) *P.oceanica* meadows; 7) Inshore seabed. To determine the accuracy of the classified image, a confusion matrix was computed. The overall accuracy and Kappa coefficient are 76% and 0.6757, respectively, so the classification can be considered appreciable (Fig.5C).

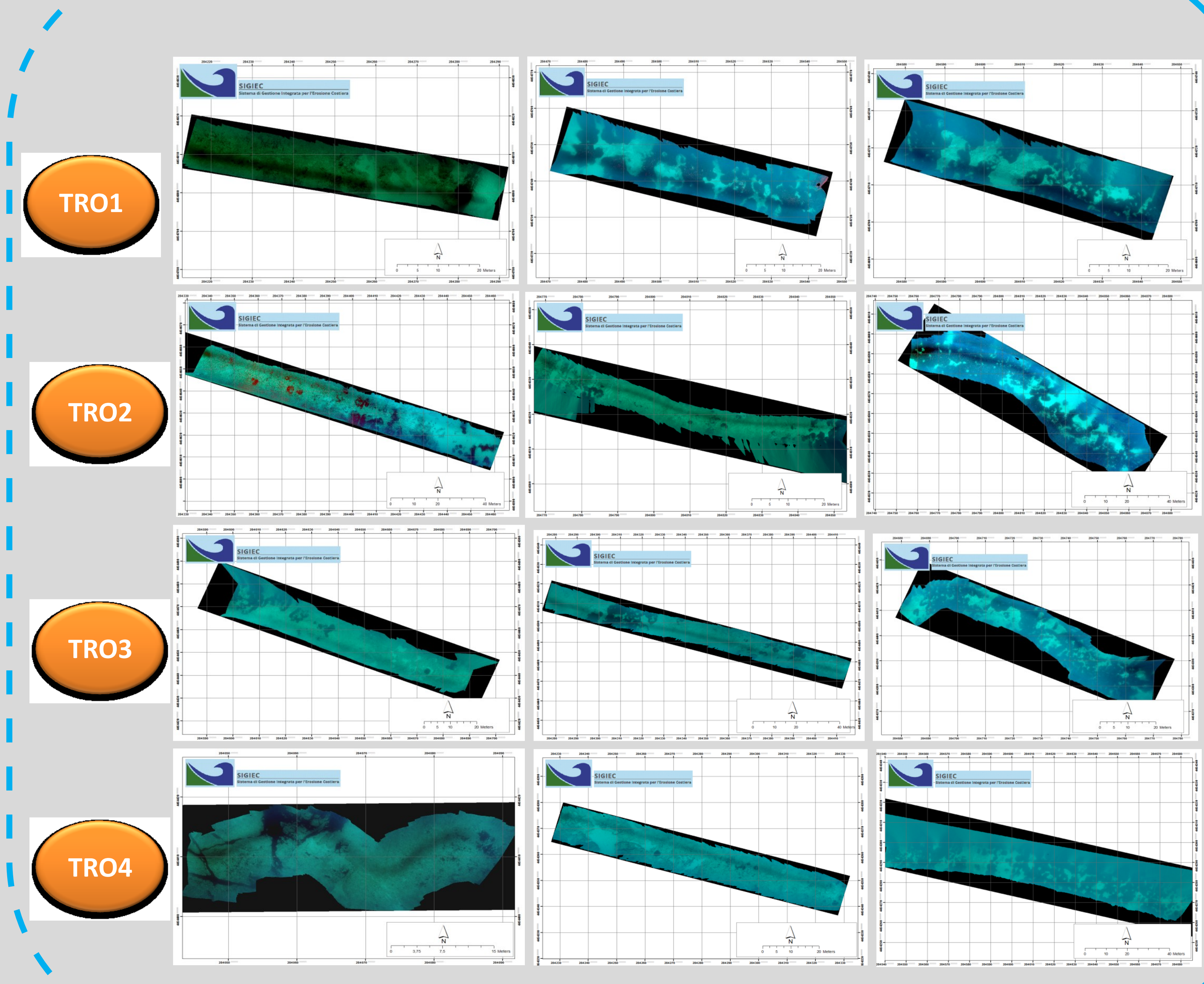

Figure 3 – 2D transects carried in the study area.

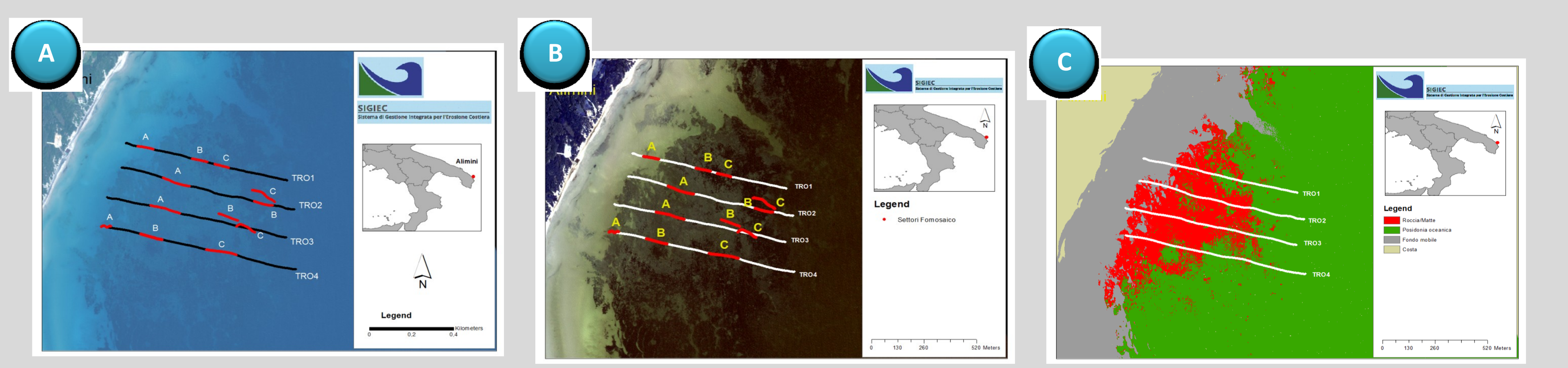

Figure 4 – Processing Worldview-2 multispectral image Region Of Interest (ROI) with ArcGis 10.1 software .

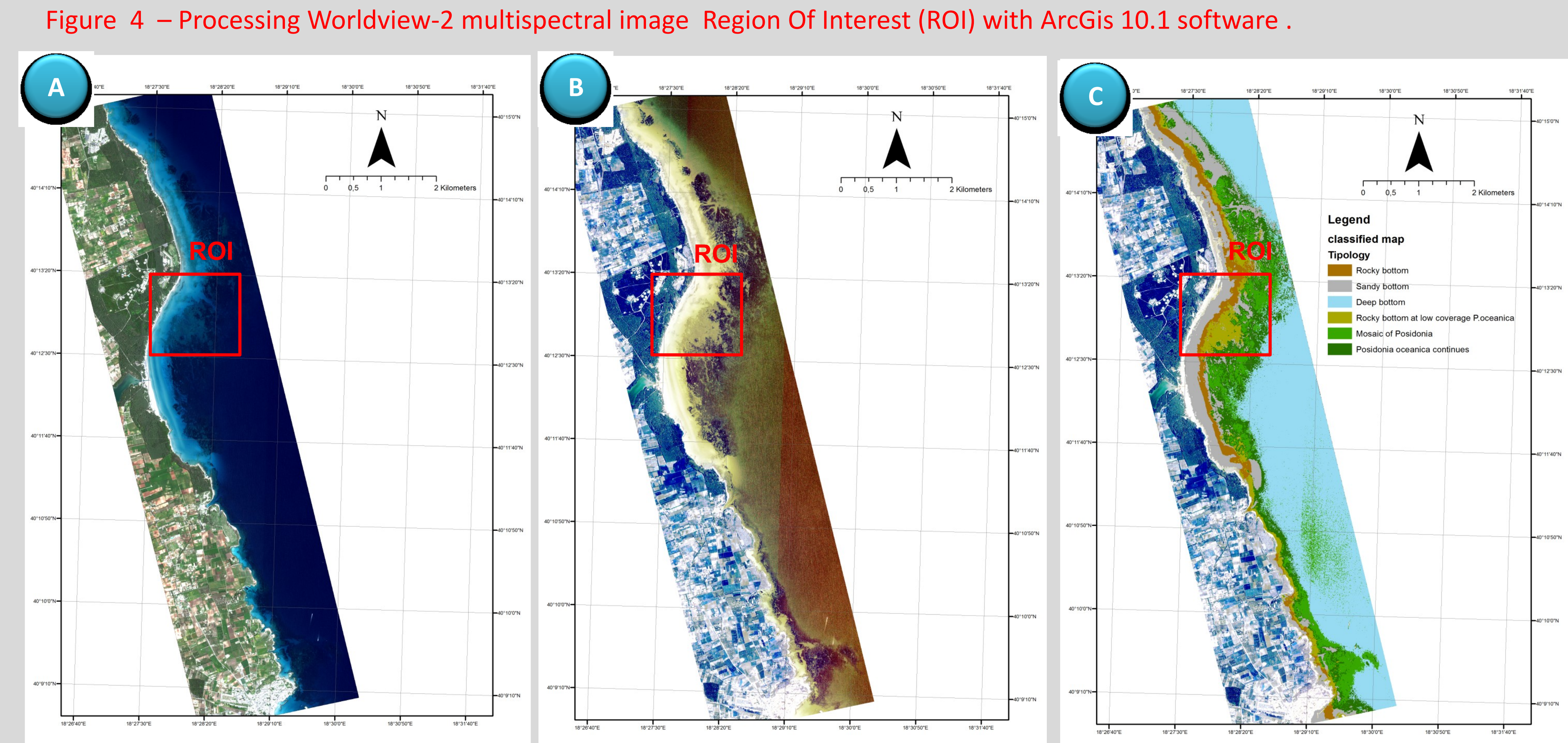

Figure 5 – Processing Worldview-2 multispectral image with Erdas software.

4 . CONCLUSIONS

The mesoscale study, by means of photo-mosaics, and macroscale study, by using multispectral satellite images allowed us to assess the structural morphology of the seabed. We've observed the prevalence of bedrock or sand in the areas closer to the coast and where the *Posidonia* meadows are declining. The multi-mapping technique, integrated with mesoscale (optical) and macroscale techniques (image analysis of satellite scenes), can be a valuable tool to support the coastal studies and to assess the state of conservation of seagrasses meadows. Finally, these results show that Worldview - 2 image classification can be a valuable method for a rapid identification of seagrass communities in shallow waters , in Particular in the first 10-15m .

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