

# CORALLIGENOUS CLIFFS IN TUSCANY: DISTRIBUTION, EXTENSION OF THE HABITAT AND STRUCTURE OF ASSEMBLAGES

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## Introduction

Coralligenous reefs are the main biogenic constructions of the Mediterranean Sea which are considered indicators of the ecological quality of coastal systems and of “seafloor integrity” by the Marine Strategy Framework Directive. The two main coralligenous morphologies are the coralligenous cliffs and platforms, the former developing in shallow waters (about 20-50 m) on vertical/subvertical rocky substrate and the latter built over horizontal substrates below 50 m depth also on detritic bottoms. The present study aims at assessing the distribution and extension of the coralligenous cliffs in Tuscany and describing the structure and the patterns of spatial variability.



Fig.2. Sampling of coralligenous cliffs

## Material and Methods

The mapping of seabed was obtained through Multibeam echosounder data coupled with video images recorded by using a Remote Operating Vehicle equipped with a high-resolution camera. Coralligenous cliffs were sampled by SCUBA divers in 11 sites (sectors of rocky coasts, Fig. 1) following the STAR procedure (Piazzini et al., 2019). In each site, two areas several kms apart were chosen. At each area, three plots of about 4 m<sup>2</sup> were randomly selected on a vertical rocky substrate at 35 m depth. In each plot, ten photographs of 0.2 m<sup>2</sup> areas were collected by a framed camera (Fig. 2). A canonical analysis of principal coordinates (CAP) on fourth root transformed Bray-Curtis resemblance matrix was performed in order to discriminate the main categories (i.e. taxa/morphological groups) contributing to dissimilarities among areas

## Results

Coralligenous cliffs were present in all study sites, with a total length of about 62.5 km and a total surface of 0.47 km<sup>2</sup>. The linear extension of the habitat may be estimated about the 20% of Tuscany rocky coast (Fig. 3).

The assemblages of continental coasts segregated from those of islands and were mostly characterized by algal turf, encrusting sponges and *Corallium rubrum*. The southern islands (Giglio, Montecristo and Formiche) were separated from the others and mostly characterized by terete and flattened Rhodophyta, *Eunicella* spp., *Paramuricea clavata* and erect bryozoans (Fig. 4). The other Island had high abundance of *Flabellia petiolata*, *Halimeda tuna* and massive sponges. Gorgona was separated from all others sites and showed a high abundance of *Peyssonnelia* spp. (Fig. 5).



Fig.1 Study sites and distribution of coralligenous cliffs

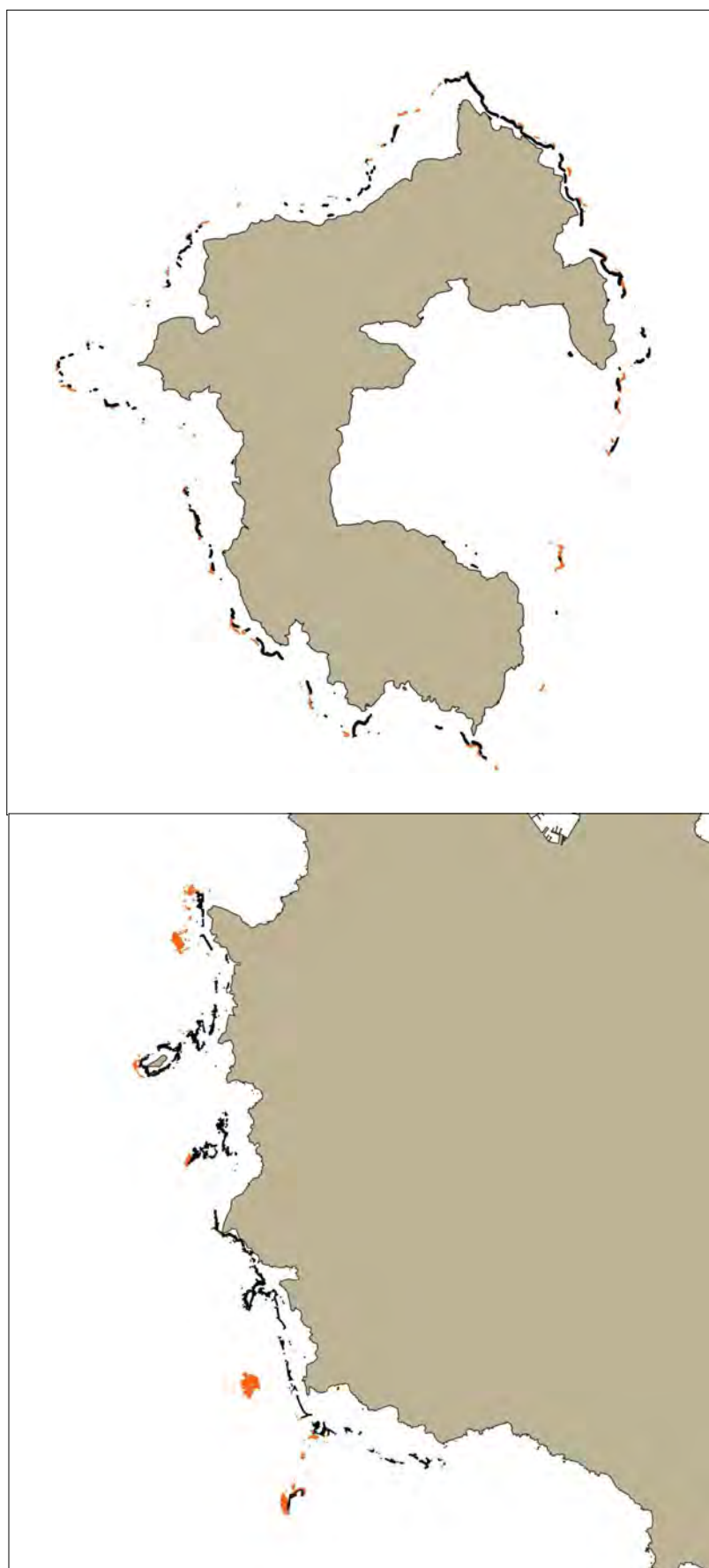


Fig.3. Distribution of coralligenous cliffs (black) and platform (orange) at Giannutri (left) and Argentario (right)

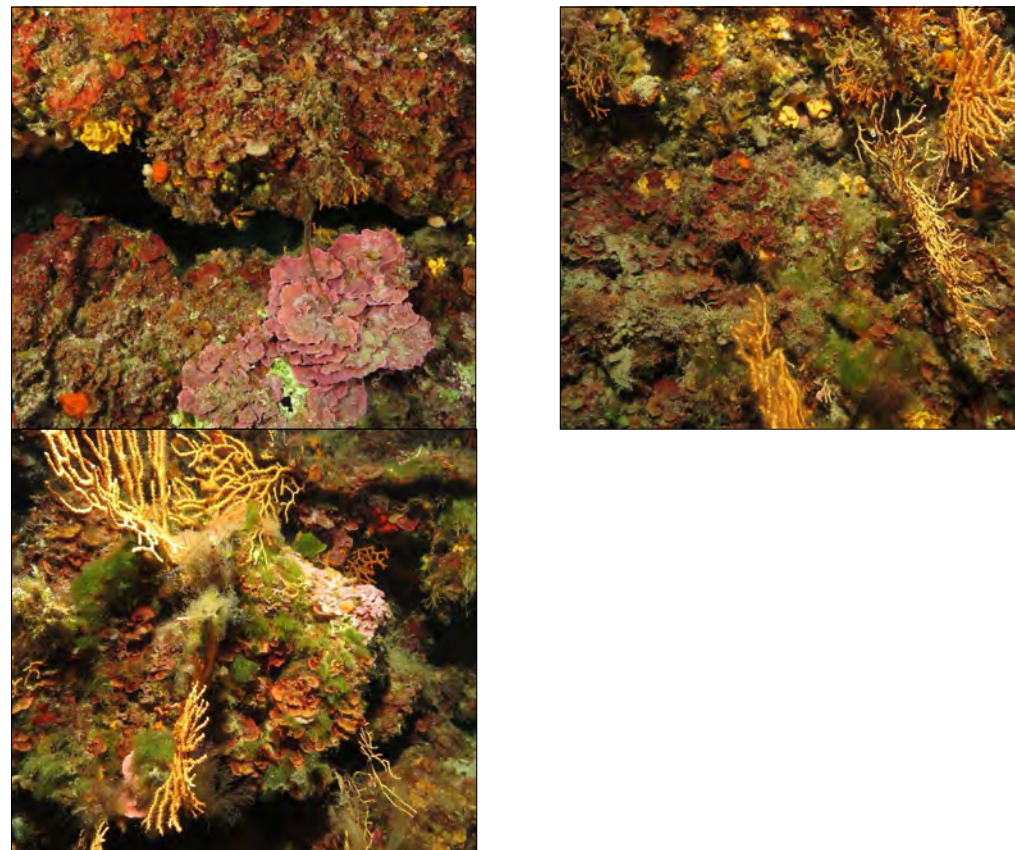


Fig.4. Images of coralligenous cliff assemblages

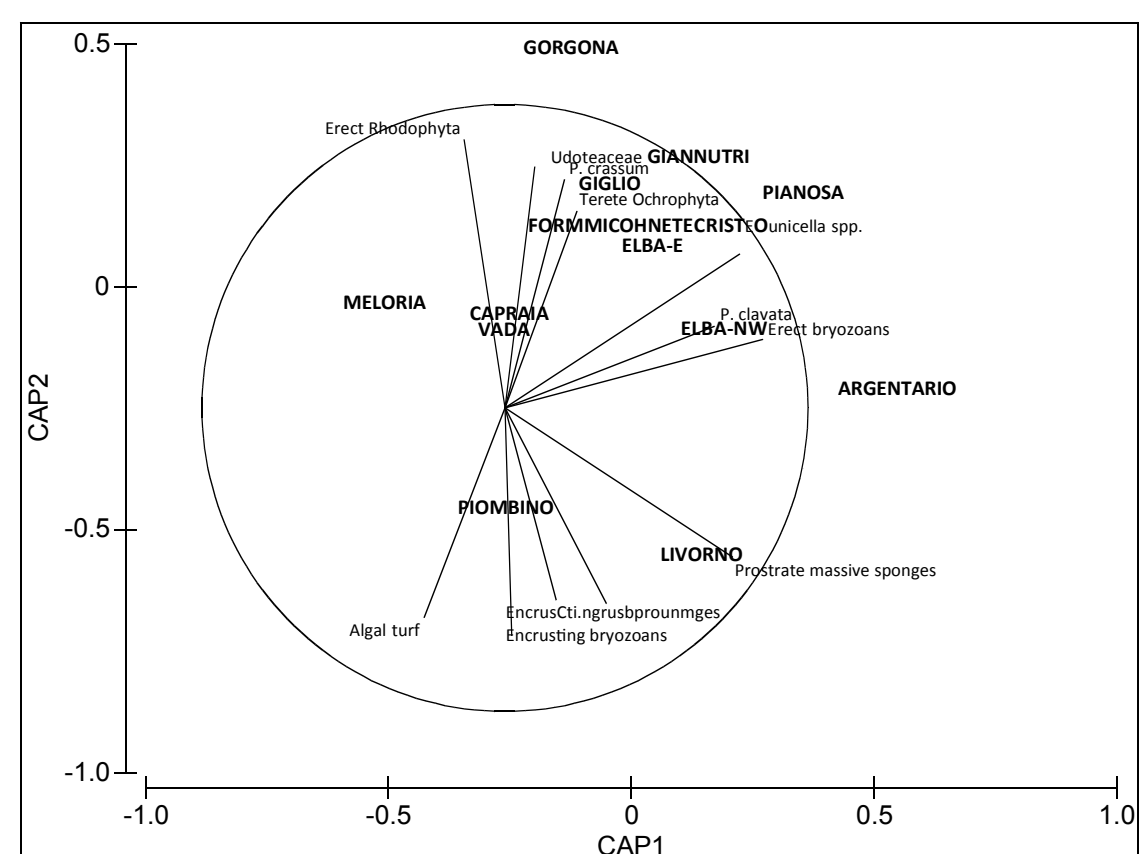


Fig.5. CAP analysis on Tuscany coralligenous cliff assemblages

## Discussion

This study compare, for the first time, the surface of coralligenous cliffs and platforms highlighting the great importance, in term of extension and biodiversity, of coralligenous cliffs within the wide geographic area considered (Tuscany). In fact, coralligenous cliffs represent a considerable part of circalittoral biogenic habitat, suggesting that its relevance could be higher than that normally emerges from seabed mapping. Moreover, results confirmed the high level of biodiversity and spatial heterogeneity of coralligenous cliff assemblages already described in other Mediterranean areas.

Coastal and continental shelf coralligenous reefs provide different ecosystem services and are subjected to different human related threats. These features combine to separate coastal coralligenous cliffs from other coralligenous habitats, such as platforms, banks and outcrops distributing on continental shelves. Thus, following the approach used in the present paper, coralligenous cliffs should be considered separately in monitoring programs, impact assessment studies and management plans

## References

Piazzini, L., Gennaro, P., Montefalcone, M., Bianchi, C.N., Cecchi, E., Morri, C., Serena, F., 2019. STAR: an integrated and standardized procedure to evaluate the ecological status of coralligenous reefs. Aquat. Conserv. Mar. Freshw. Ecosys. 29, 189-201.