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DISCLOSING THE MESOPHOTIC BIOGENIC REEFS OF THE NORTHERN ADRIATIC CONTINENTAL SHELF

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Mesophotic Biogenic Habitats (MBHs), lying in twilight conditions, have recently drawn the attention of researchers due to the opportunities offered by the implementation of underwater exploration techniques. These habitats are often considered protected from natural and anthropogenic disturbances (e.g. wave action, thermal stress, pollution, harvesting) affecting shallow habitats. Their possible role as refuges for threatened species has been hypothesised. Studies, carried out mostly in tropical areas, stressed the relevance of these habitats, but little is known about their distribution and role in temperate seas, and on their resistance and resilience to anthropogenic impacts and threats due to Global Climate Change (GCC).

Northern Adriatic MBHs are mainly represented by coralligenous outcrops scattered on the sedimentary continental shelf (Fig. 1). Recent investigations highlighted variations in species diversity at different spatial scales, ranging from single outcrops to basin. A complex geographic pattern of the most abundant species, including the main reef builders (i.e., encrusting calcified Rhodophyta) and borers (e.g., the bivalve *Rocellaria dubia* and sponges *Cliona* spp.), was found (Fig. 2 and 3; Curiel et al. 2012, Falace et al. 2015, Ponti et al. 2011).

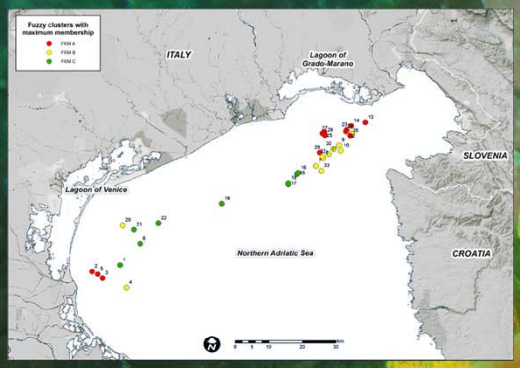


Fig 2. Occurrences of the 3 main assemblage typologies across the northern Adriatic Sea, dominated by: Type A (red dots) - encrusting sponges, bioeroders, algal turf and sediment; Type B (yellow dots) - massive sponges, *Peyssonnelia*, ascidians; Type C (green dots) - reef builders, *Polycitor adriaticus* (Falace et al. 2015).

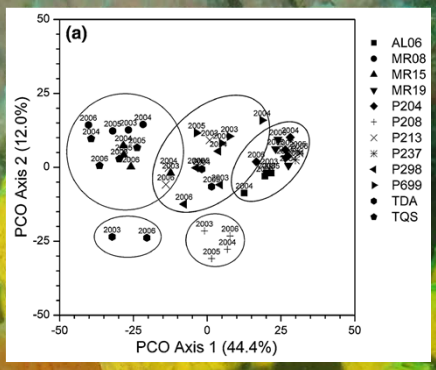
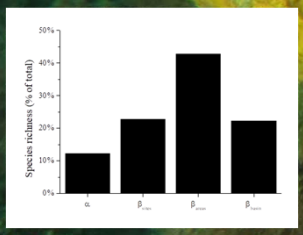


Fig 3. PCO unconstrained ordination plot based on Bray-Curtis dissimilarities of square rout-transformed epibenthic assemblage percent cover data from a sub-set of study sites off Chioggia: symbols represent sampling sites, numbers indicated sampling years, lines show clusters obtained at an arbitrary similarity level of 55% (Ponti et al. 2011).

Coralline algae (e.g., *Lithophyllum incrustans*), sponges (e.g., *Chondrosia reniformis*) and colonial ascidians (e.g., *Polycitor adriaticus*) were the drivers of the observed spatial differences, in terms of species turnover (β diversity; Fig. 4). Role of environmental parameters (e.g., depth, sedimetation) in determining spatial patterns of distribution have been tested using a large scale habitat suitability model. Diversity of benthic assemblages is driven by recruitment dynamics and asexual reproduction (Fig. 5).



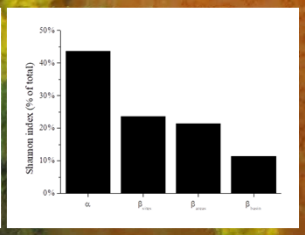


Fig 4. Additive partition of species richness (left) and Shannon's diversity index (right) across three sampling spatial scales (α: within sites; β_{sites}: among sites; β_{areas}: between areas, i.e. Chioggia and Grado; and β_{basin} at the whole basin). Values are expressed as percent of the total diversity of epibenthic species explained by each hierarchical level (Ponti et al. 2014).

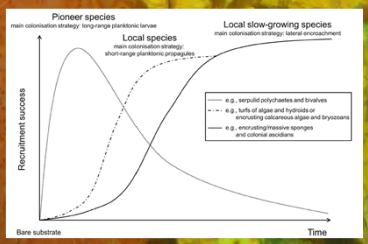


Fig 5. A conceptual model of recruitment processes on experimental tiles deployed on coralligenous outcrops off Chioggia. Species involved in the early colonisation stage largely depend on larvae availability and environmental conditions in the area. Over time colonisation by local species, living on natural substrates, become more relevant according to their life-cycle and dispersal strategies (Fava et al. 2016).

MBHs are arranged in metapopulations, potentially exposed to local extinctions due to their fragility and isolation. Connectivity among populations, bioconstruction/erosion ratio, and species responses to human threats, increasing water temperature and acidification are the core of a research project aimed at estimating resistance and resilience of these assemblages, and predicting future MBHs distribution under GCC scenarios.

Join the Resistance and Resilience of Adriatic Mesophotic Biogenic Habitats to Human and Climate Change Threats project at https://reefresearch.jimdo.com.

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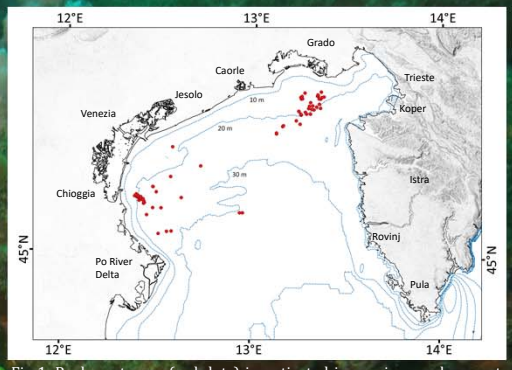

Fig 1. Rocky outcrops (red dots) investigated in previous and current research projects.

References

Curiel D, Falace A, Bandelj V, Kaleb S, Solidoro C, Ballesteros E (2012) Species composition and spatial variability of macroalgal assemblages on biogenic reefs in the northern Adriatic Sea. Bot Mar 55:625-638 doi: 10.1515/bot-2012-0166

Falace A, Kaleb S, Curiel D, Miotti C, Galli G, Querin S, Ballesteros E, Solidoro C, Bandelj V (2015) Calcareous bio-concretions in the northern Adriatic Sea: Habitat types, environmental factors that influence habitat distributions, and predictive modeling. PLoS ONE 10:e0140931 doi: 10.1371/journal.pone.0140931

Fava F, Ponti M, Abbiati M (2016) Role of recruitment processes in structuring coralligenous benthic assemblages in the Northern Adriatic continental shelf. PLoS ONE 11:e0163494 doi: 10.1371/journal.pone.0163494

Gordini E, Falace A, Kaleb S, Donda F, Marocco R, Tunis G (2012) Methane-related carbonate cementation of marine sediments and related macroalgal coralligenous assemblages in the northern Adriatic Sea. In: Harris PT, Baker EK (eds) Seafloor geomorphology as benthic habitat. Elsevier Inc., p 185-200

Ponti M, Falace A, Rindi F, Fava F, Kaleb S, Abbiati M (2014) Beta diversity patterns in northern Adriatic coralligenous outcrops. In: Bouafif C, Langar H, Ouerghi A (eds) Proceedings of the 2nd Mediterranean symposium on the conservation of the coralligenous and other calcareous bio-concretions. UNEP/MAP-RAC/SPA, Portorož, Slovenia, p 147-152

Ponti M, Fava F, Abbiati M (2011) Spatial-temporal variability of epibenthic assemblages on subtidal biogenic reefs in the northern Adriatic Sea. Mar Biol 158:1447-1459 doi: 10.1007/s00227-011-1661-3