IOCXe 2026 Conference
The 1st International Online Conference on Xenobiotics
22–23 June 2026 | Online
MDPI

Use of *Balanophyllia europaea* as a biological model for monitoring the Mediterranean coralligenous biocenosis: the SIMBIOSI project

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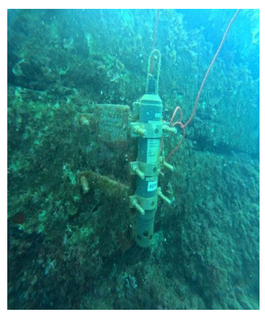
INTRODUCTION & AIM

The coralligenous biocoenosis represents an essential ecosystem, providing valuable resources and unique ecological services. However, this ecosystem is highly susceptible to the effects of climate events and human disturbances such as pollution and is at risk of disappearing unless we intensify our efforts to protect them. In this context, **the SIMBIOSI project aims to develop sensitive and effective analytical tools to determine the presence of emerging contaminants and their potential deleterious effects on the Mediterranean coralligenous biocoenosis, using the solitary, zooxanthellate coral *Balanophyllia europaea* as biological model.**

The project involves the development of a multi-level monitoring protocol through the analysis of the following parameters: i) the presence of new emerging contaminants not covered by current regulations, in the water column and in madrepore specimens; ii) the implementation of sensors on a regional scale to record chemical and physical parameters of the water. The contaminants considered are i) titanium-based nanomaterials released from sunscreens (nano-TiO2) ii) rare earth elements iii) micro and nanoplastics.

METHOD

We focused on the population located off the coast of Calafuria (Leghorn, Italy), known to be threatened by several environmental and anthropogenic disturbances. Organisms were collected over a three-month period (July–November 2025) for contaminant analysis. In July and August, mucus and surrounding water were collected for microbiome analysis.

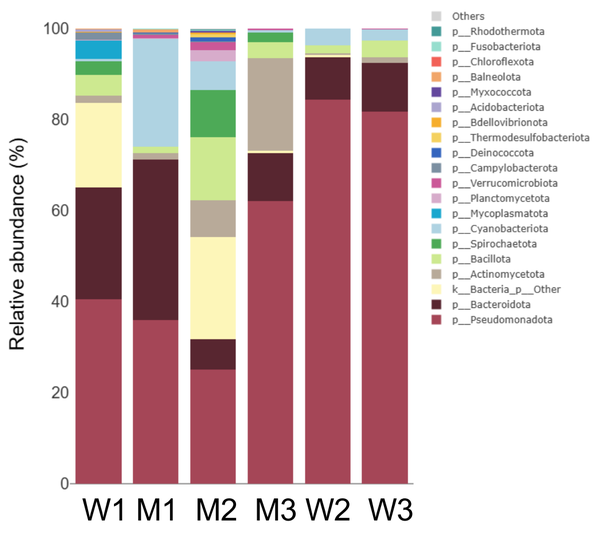


Simultaneously, chemical and physical parameters of the water were acquired using a multiparametric probe.

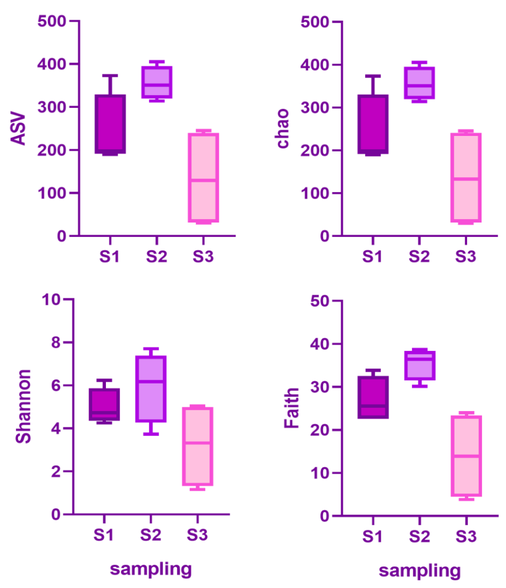
Titanium dioxide, including n-TiO2, and rare elements were analyzed using ICP-MS coupled with SEM microscopy, to evaluate their size and shape. For plastics, the monomer content of PCV (vinyl chloride) and PS (styrene) was analyzed using VOC GC/MS.

RESULTS & DISCUSSION

Results showed very low levels of rare earth elements and trace metals in corals and the absence of PVC and PS and TiO_2.



Regarding the microbial diversity of the mucus samples, analysis of the relative abundance of the identified taxonomic units revealed a variation in the prevalence of species present in the mucus samples (M) compared to the water sample (W), This confirms that organisms select a more complex microbial community than that of the surrounding environment.



Differences in species abundance were found between samples from different sampling periods. In particular, the third sampling showed the lowest levels of diversity. The results suggest that the mucus microbiota is a parameter capable of significantly changing with changes in environmental factors.

The analysis of water parameters showed a slight fluctuation of temperature and pH over time.

Period	Conducibility (mS)	Temperature (°C)	Dissolved O2 (%)	pH
July-August	37.92	24.01	97.06	8.24
November	38.11	19.47	90.66	8.29

CONCLUSION

The protocol used in our project represents a benchmark for the development of sensitive and versatile warning system for the monitoring of the Mediterranean coralligenous biocenosis.

ACKNOWLEDGEMENTS

The study was financed by European Union- Next Generation EU, Mission 4 - Component 2 - Measure 1.4 "Strengthening Research Structures and Creation of "National R&D Champions" on some Key Enabling Technologies".