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## **RESULTS OF DIFFERENT ANTHROPIC USES ON THE STRUCTURE OF VERMETID REEFS**

### **Abstract**

*The biogenic vermetid reef is a key habitat of coastal ecosystems that modifies the shoreline morphology and increases the local biodiversity. Despite its ecological relevance, rarely it is subjected to an accurate management and is often exposed to several human activities.*

*This study aims to distinguish between the effects of different typologies of anthropic uses on the physical structure of the vermetid reef. A comparison between totally protected, partially protected and strongly anthropized reefs has been done and two variables have been analysed: the substratum complexity and the density of reef-building organism.*

*Both the variables show higher values in totally and partially protected reefs, demonstrating the importance of conservation strategies for the correct management of this important bioconstruction.*

**Key-words:** Vermetid reef, anthropic uses, substratum complexity, Mediterranean Sea

### **Introduction**

A vermetid reef is an example of Mediterranean calcareous habitat formed by the association of the gastropods *Dendropoma petraeum* and the calcareous algae *Neogoniolithon brassica-florida* that cemented the mollusk shells each other. This biogenic structure modifies the morphology of rocky coasts, reduces wave-induced erosion, enhances the spatial heterogeneity and the availability of refuges and resources for intertidal biota (Chemello & Silenzi, 2011). For these important ecological roles, the vermetid reef is declared a SPAMI habitat (Specially Protected Areas of Mediterranean Importance) that needs specific conservation plans.

Nevertheless, strategies for the correct management of the vermetid reef are lacking, causing an improper conservation of the bioconstruction. Several impact sources (pollution, coastal urbanisation, tourism) threaten its ecological value (Di Franco *et al.*, 2011), but other kinds of anthropic actions, aiming to limit human disturbances on marine environments (e.g. the institution of a marine protected area), can have a positive effect on the conservation of the vermetid reef.

This study describes the results of different anthropic uses on the physical structure of the vermetid reef, by means the analysis of two variables: the substratum complexity and the density of *Dendropoma petraeum*. The number of reef-building organisms is, indeed, an important attribute that influences the structure of the substratum, creating a physical relief and may be affected by environmental stresses (Bell *et al.*, 1991).

### **Materials and methods**

The study has been conducted along the North-Western coast of Sicily (Italy) in two localities inside the marine protected area of “Capo Gallo-Isola delle Femmine” and one outside. These localities are subjected to different degrees of protection: the *A ZONE* is a fully protected area, *C ZONE* is partially protected but often attended by tourist; *PORT*

lies inside a small touristic harbour and is a strongly anthropized area.

In each locality the vermetid reef has been sampled in two different sites, far at least 100 m each other. For each site 5 replicates of each variable have been collected.

Non destructive methods have been used to collect data on the substratum complexity and the density of *D. petraeum* in the seaward edge of the reefs. Substratum complexity has been estimated inside frames of 400 cm<sup>2</sup> at a resolution of 2x2cm and described by using a topographic index. Density has been defined by counting directly the number of living specimens in quadrats of 100 cm<sup>2</sup>.

## Results

Topography differs at site level with highly variable data. Specifically we recorded similar topography mean values at *PORT* ( $0.232 \pm 0.138$  and  $0.212 \pm 0.238$ ) and at one of the two sites of *C ZONE* ( $0.315 \pm 0.246$  and  $0.369 \pm 0.288$ ); *A ZONE* exhibited the lowest value at site one and the highest at site two ( $0.15 \pm 0.092$  and  $0.98 \pm 1.09$ ).

The mean density of *D. petraeum* showed more homogeneous data at site level ( $124 \pm 50.3$  and  $103 \pm 49.8$  individuals/100 cm<sup>2</sup> for *PORT*;  $495.2 \pm 181.6$  and  $462.8 \pm 127.4$  for *C ZONE* and  $365.6 \pm 57$  and  $492 \pm 82.5$  for *A ZONE*).

## Conclusions

The habitat structure is a complex factor, determined by several variability causes.

In this study the structure of the outer edge of the biogenic vermetid reef is compared among localities subjected to different anthropic uses.

Anthropic factors are able to affect the reef structure both in a negative or a positive way. The presence of a small port reduces indeed the density of living reef-building organism together with the complexity of the substratum, while active protection, in a marine protected area, emphasize the values of these variables.

Given the ecological relevance and the low resilience of this peculiar bioconstruction and, considering also that vermetid reefs are becoming extinct in the Levantine basin of the Mediterranean Sea (GALIL, 2013), it is necessary to enhance its conservation and to implement the existing laws on the protection of this coastal key habitat and of *D. petraeum* itself, as stated in several European directives (e.g. Barcelona Convention, Habitat Directive 92/43/EEC).

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