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**PROCEEDINGS OF THE 1ST MEDITERRANEAN
SYMPOSIUM ON THE CONSERVATION OF THE
CORALLIGENOUS AND OTHER CALCAREOUS
BIO-CONCRETIONS**

15 - 16 January 2009 – Tabarka

***ACTES DU 1^{ER} SYMPOSIUM MEDITERRANEEN
SUR LA CONSERVATION DU CORALLIGENE ET
AUTRES BIOCONCRETIONS CALCAIRES***

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CORALLIGENOUS ASSEMBLAGES IN THE NORTHERN ADRIATIC CONTINENTAL SHELF

ABSTRACT

Numerous coralligenous rocky outcrops occur in the northern Adriatic Sea between 10 and 40 m in depth. Epibenthic assemblages were investigated on rocky outcrops scattered through an area of about 500 km² offshore of Chioggia and Venice. Spatial distribution and temporal variation of epibenthic assemblages were annually studied by photographic sampling from 2003 to 2006 on 12 sites randomly selected. The dominant reef-forming organisms are encrusting calcareous algae (*Lithophyllum stictaeforme*, *Lithothamnion minervae* and *Peyssonnelia polymorpha*), while the main bioeroders are boring sponges (*Cliona viridis*, *C. celata*, *C. thoesina*, *C. rhodensis*, *Piona vastifica*) and the endolithic bivalve *Gastrochaena dubia*. Assemblages showed variability both in space and time even though spatial heterogeneity was higher than temporal changes. Spatial-temporal variability of the epibenthic assemblages seemed to be related to geo-morphological features and to hydrological variables. The relative abundance of reef builders and bioeroders together with the most abundant species (massive sponge and social ascidians) appeared well differentiated between sites but showed slight temporal changes. Some taxa, such as encrusting sponges and algae, showed complex site-specific temporal trends.

KEY-WORDS: coralligenous, subtidal communities, temporal variability, spatial patterns, Northern Adriatic Sea.

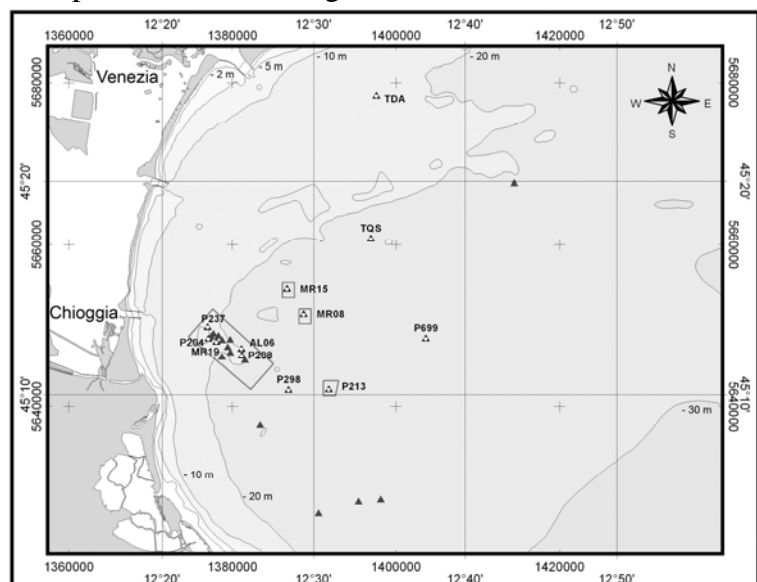
INTRODUCTION

Numerous coralligenous rocky outcrops occur in silty-sandy bottom of the northern Adriatic Sea between 10 and 40 metres in depth, ranging in size from few to thousands square metres, and raising between 1 and 4 metres from surrounding bottoms. These rocky outcrops are biogenic reef made predominantly by calcareous algae and characterized by a high biodiversity in term of epibenthic assemblages, mainly composed by filter feeders (sponges, colonial ascidians and cnidarians), endobionthic organisms and fish fauna (Casellato & Stefanon, 2008). Although these outcrops, locally named *tegnùe*, were discovered and documented in the 18th century (Olivi, 1792) their assemblages were analysed only in few locations (Gabriele *et al.*, 1999; Soresi *et al.*, 2004) and their spatial and temporal variability is little unknown. The aim of this study was to analysed regional distribution and temporal variation of the epibenthic assemblages in order to contribute to the knowledge of this peculiar coralligenous habitat.

MATERIALS AND METHODS

The study sites includes approximately 500 km² of the northern Adriatic continental shelf offshore of Chioggia and Venice (Lat. 45° 24' - 45° 04' N; Lon. 12° 23' - 12° 43' E) (Fig.1). Species reference collection was made using photographs and specimens collected on twenty six outcrops. Some new records for the northern Adriatic Sea have been reported.

Fig. 1: Map of the twelve investigated outcrops scattered in the Northern Adriatic Sea.



Epibenthic assemblages on twelve randomly selected outcrops were annually investigated using a non-destructive photo-sampling method (Roberts *et al.*, 1994), samples were collected at each site in August from 2003 to 2006. Ten photos for each site and date were haphazardly selected from all those available and analyzed superimposing a grid of 100 equal sized squares. Abundance of sessile organisms was quantified in term of percentage cover estimation. The sand-silt-clay and organic content of sediment samples, collected near the outcrops, were analysed; since hydrographical data were not available, mean daily temperature (°C) and salinity (psu) near the bottom for each sampling site and for the whole study period, were obtained from the ASHELF oceanographic model (<http://gnoo.bo.ingv.it/adricosm/>).

RESULTS

Epibenthic assemblages showed a high spatial and temporal variability with complex distribution patterns. These results are confirmed by PERMANOVA analysis that detected significant differences among sites year by year (Year X Site $p < 0.001$) and by PCO ordination plot. Cluster analysis, superimposed on the PCO plot, showed three main groups of epibenthic assemblages, which are quite stable year by year (Fig. 2). Patterns of similarity of the benthic assemblages showed a significant relationship with outcrops size (log10 transformed), distance from coast, depth, elevation and longitude. Some ecological groups like non calcareous algae and encrusting sponge showed complex site-specific temporal patterns, while other groups like boring sponges, calcareous algae, cnidarians, colonial ascidians and massive sponges had a limited temporal variability but differed between sites. In particular:

- Algal turf showed differences both in time and space, abundance increased near the coast in the wider outcrops (Fig. 3-a).
- The most abundant encrusting sponges *Dictyonella incisa* and *Antho (Antho) incostans* differed between sites. The first sponge exhibited small change in time and appeared abundant in shallower and wider outcrops, the second showed a spatial-temporal heterogeneity increasing with depth (Fig. 3-b/c).
- The boring sponge *Cliona viridis* showed a site-specific distribution with a high abundance in shallow and small outcrops as the site TDA (Fig. 3-d).
- The calcareous algae *Lithothamnion minervae* appeared constant in time but differed between sites dominating the small and far locations (Fig. 3-e).
- The ascidian *Polycitor adriaticus* was characterized by a high spatial heterogeneity with higher abundance in the small outcrops far from the coast (Fig. 3-f).

DISCUSSION AND CONCLUSIONS

The present study showed that the structure of the epibenthic assemblages changed through years and sites even if spatial heterogeneity was higher than temporal changes, as clearly shown by the ordination plot. Spatial distribution of assemblages appeared strongly correlated with the

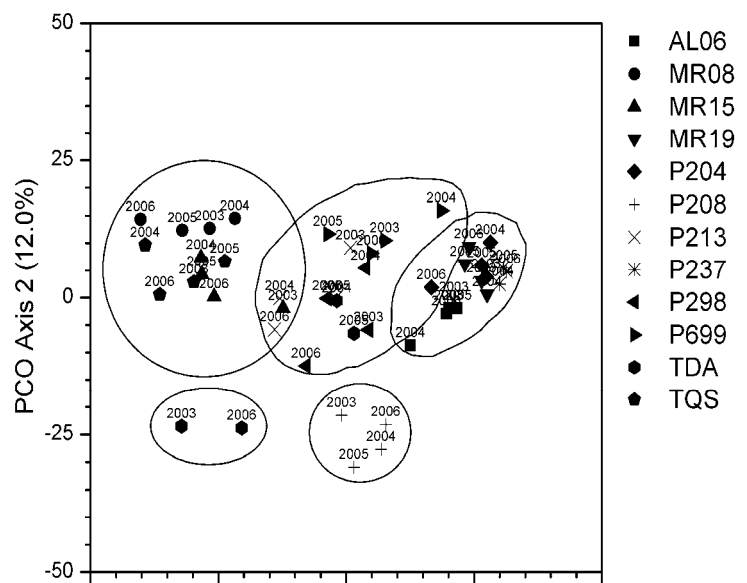


Fig. 2: PCO ordination plot based on epibenthic assemblages percent cover data.

morphological features and geographical location of the outcrops, while was less affected by the hydrological conditions. This work represents a contribution to the knowledge of biodiversity of this peculiar coralligenous habitats. It provides the bases for a better understanding of the ecological processes and could be used to develop conservation strategies including a sustainable tourism and management of fisheries.

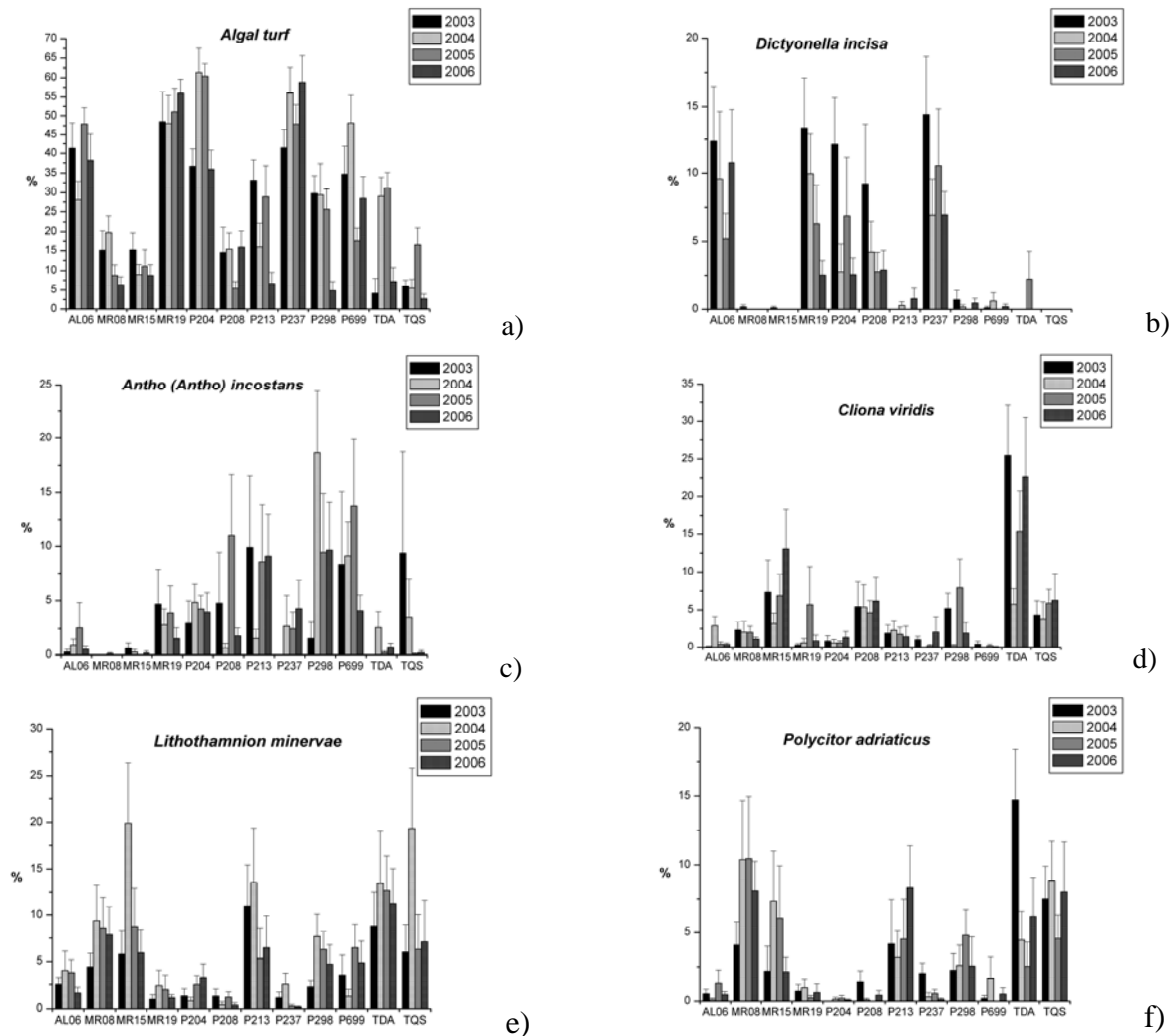


Fig. 3: Spatial and temporal trends of the most important and abundant species.

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