Possible effects of different protection levels on the epibenthic assemblages: the tegnùe of Chioggia

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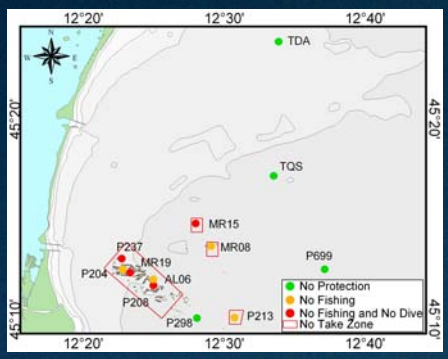
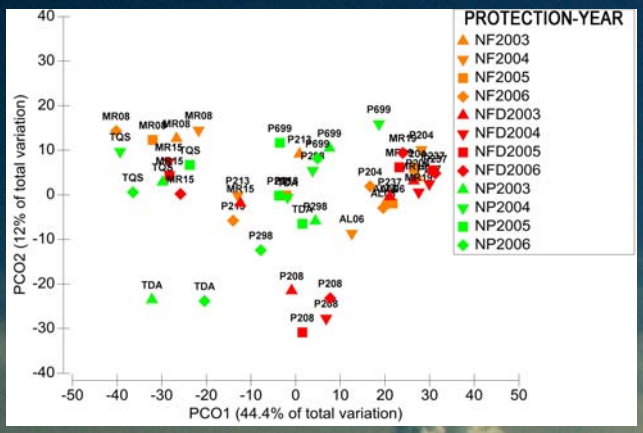
Coralligenous rocky outcrops occuring in the Northern Adriatic Sea between 10 and 40 metres in depth are locally named Tegnùe. Their size can range from few to several thousand square metres and the elevation from the sea bottom varies between 1 to 4 metres (Gabriele *et al.*, 1999). Conservation of marine habitats is often pursued by creating No Take Zone (NTZ) and Marine Protected Area (MPA) (Fraschetti *et al.*, 2002). In order to protect the habitat and the fauna of the Tegnùe, in 2002 a NTZ was established offshore Chioggia. In the NTZ of Chioggia both professional and amateur fishing are prohibited. SCUBA diving is allowed in some of the rocky outcrops and mooring buoys, close to the diving spots, are provided to prevent the impact of anchoring.



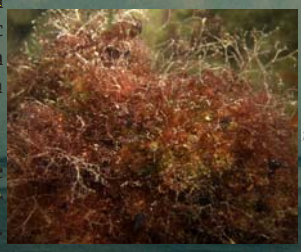


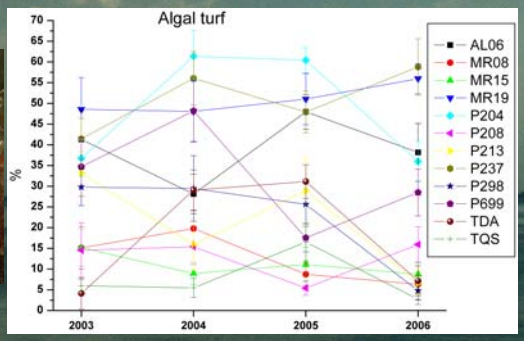
The aim of this study was to compare the species assemblages in areas with three different protection levels: no fishing and no dive (NFND), no fishing but diving (NF) and no protection (NP) outside the NTZ. Four study sites were randomly chosen for each protection level and annually investigated from 2003 to 2006. Sampling was done in August every year. In each site epibenthic assemblages were studied using photographic sampling (Meese and Tomich, 1992).

Differences in assemblage structure and species distribution among protection levels (Pr, fixed), time (Ti, fixed) and sites (Si, random, nested in Pr) were analysed by PERMANOVA and ANOVA (Anderson, 2001).

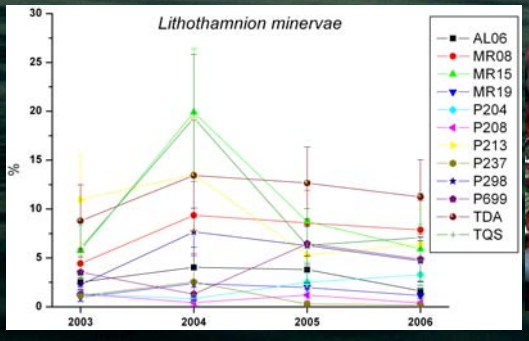
Outcrops are colonised by reef-forming encrusting calcareous algae (*Lithophyllum stictaeforme*, *Lithothamnion minervae* and *Peyssonnelia polymorpha*) and by bioeroders such as sponges (*Cliona viridis*, *C. celata*, *C. thoosina*, *C. rhodensis*, *Piona vastifica*) and endolithic bivalve (*Gastrochaena dubia*). Invertebrate species mainly included filter feeders among these: the sponges *Dictionella incisa*, *Antho inconstans*, *Tedania anhelans*, the zoantharian *Epizoanthus* spp. and the ascidians *Polycitor adriaticus*.

The analyses of the epibenthic assemblages didn't show significant differences among the three levels of protection during the four study years (PERMANOVA PrXTi $p>0.05$) considering both sessile and vagile organisms. On the contraries, differences in the epibenthic assemblages structure were found among sites within each protection in different years (PERMANOVA TiXSi(Pr) $p<0.01$), highlighting a high heterogeneity of the assemblages.





Some taxa (e.g. algal turf) showed different abundance in the interaction between time and site (ANOVA TiXSi(Pr) $p<0.01$), other species differed among sites and remained quite steady in time (e.g. *Lithothamnion minervae*) (ANOVA TiXSi(Pr) $p>0.05$; Si(Pr) $p<0.01$). None of the analysed taxa showed significant differences with the interaction among protection and time or between the different levels of protection; even species richeness (S) and diversity (H') changed in space and time (ANOVA TiXSi(Pr) $p<0.01$) but not according to the protection levels.



The reduction of fishing efforts should mainly lead to an increase of the size and abundance of fishes (Gell and Roberts, 2003) but can also limits the damage on the epibenthic assemblages due to trawling. Conversely, diving tourism can directly affect the epibenthic species, especially fragile and erected organisms (Sala *et al.*, 1996).

Epibenthic assemblages living on the subtidal outcrops offshore Chioggia showed a high variability both in space and time. The distribution patterns appeared correlated to the geographical location, distance from the shore, depth and size of the outcrops (Ponti *et al.*, 2006).

After four years following the establishment of the NTZ no clear effects of the protection were detected on these assemblages.

The effects of the protection regime could have been masked by the high natural heterogeneity of the assemblages or by the short time elapsed since the establishment of the NTZ.

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