Biol. Mar. Mediterr. (2008), 15 (1): 158-159

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# POSSIBLE EFFECTS OF DIFFERENT PROTECTION LEVELS ON THE EPIBENTHIC ASSEMBLAGES: THE TEGNÙE OF CHIOGGIA

## *POSSIBILI EFFETTI DI DIFFERENTI LIVELLI DI PROTEZIONE SUI POPOLAMENTI EPIBENTONICI: LE TEGNÙE DI CHIOGGIA*

***Abstract*** *– The effects of 3 protection levels (no fishing, no fishing+no dive, no protection) on the epibenthic assemblages of the northern Adriatic outcrops were investigated for 4 years after the establishment of a no-take zone. Any effects were detected. That could be due to the short time elapsed, the low effectiveness of fishing protection, and to the mooring systems which prevent anchoring damages.*

***Key-words:*** *outcrops, protection, sessile species, marine parks, northern Adriatic Sea.*

**Introduction** – Marine protected areas (MPA) and no-take zones (NTZ) are considered the main tool for achieving marine resources conservation and protection (Fraschetti *et al.*, 2002), a nature-base tourism and a sustainable management of fishery (Halpern and Warner, 2002). The aim of the study is to evaluate the possible effects of different protection levels on the epibenthic assemblages living on the subtidal rocky outcrops in the northern Adriatic Sea, locally known as "Tegnùe", inside and outside a NTZ.

**Materials and methods** – Tegnùe are coralligenous subtidal rocky outcrops that occur in northern Adriatic Sea bed between 10 and 40 m in depth, which range in size from few to several hundreds square meters and from 1 to 4 m in height (Gabriele *et al.*, 1999). A NTZ, permanently closed to fishing in order to protect fish stocks and natural habitats, was established offshore of Chioggia in 2002 including the most extended outcrops. Inside the NTZ mooring buoys were placed close to some outcrops to facilitate diving tourism. Since within the NTZ dives are allowed only close to the buoys, the tegnùe can be divided into 3 possible protection levels: close to fishing and dive (NFND), close to fishing but dive facilitated (NF), and outside the NTZ where there are no protection or dive facilities (NP). Four study sites were randomly chosen for each protection level. Epibenthic assemblages were annually investigated in each site in August from 2003 to 2006 using photographic sampling (Meese and Tomich, 1992). Differences in assemblage structure and species distribution between protection levels (Pr, fixed), time (Ti, fixed) and sites (Si, random, nested in Pr) were analysed by PERMANOVA and ANOVA (Anderson, 2001).

**Results** – Outcrops appeared mainly colonised by red encrusting algae, predominantly *Lithophyllum stictaeforme*, *Lithothamnion minervae* and *Peyssonnelia polymorpha*. On outcrops near the coast, algal turfs were particularly abundant. Invertebrate species mainly included filter feeders. The most abundant species were the sponges *Dictyonella incisa*, *Antho inconstans*, *Cliona viridis* and *Tedania anhelans*, the zoantharian *Epizoanthus* spp., and the ascidians *Polycitor adriaticus*.

The analyses of the epibenthic assemblages didn't show significant differences between the three levels of protection during the four study years (PERMANOVA PrXTi $p>0.05$) considering both sessile and vagile organisms, the first evaluated as percentage of covering and second as number of individuals. On the contraries, dif-

ferences in the epibenthic assemblages structure have been found among sites within each protection year by year (PERMANOVA TiXSi(Pr) $p<0.01$), highlighting a high heterogeneity of the assemblages.

Several epibenthic taxa (e.g. algal turf, *Lithophyllum stictaeforme, Epizoanthus* spp., *Gastrochaena dubia*) showed different abundance in the interaction between time and sites (ANOVA TiXSi(Pr) $p<0.01$). Some other species differed among sites but appeared steady in time (e.g. *Lithothamnion minervae, Dysidea avara*, *Cereus pedunculatus*, *Polycitor adriaticus*; ANOVA TiXSi(Pr) $p>0.05$, Si(Pr) $p<0.01$, Ti $p>0.05$). None of the analysed taxa showed differences with the interaction between protection and time or between the different levels of protection. Even species richness (S) and diversity (H') changed in space and time (ANOVA TiXSi(Pr) $p<0.01$) but not in the interaction between protection and time.

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

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

In the first four years following the establishment of the NTZ any clear effects of the protection were detected on these assemblages. The high natural heterogeneity of these assemblages could mask the positive effects of no fishing or the negative ones due to the increasing diving tourism. The lack of detectable effects could be also due to the short time elapsed since the establishment of the NTZ, where the control over the fishing activities was not yet very strict. Moreover, the mooring systems, adopted here, prevent anchoring damages, which could be relevant in diver sites.

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