Abstract – The effect of protection has been evaluated at two MPAs in Sardinia. Benthic assemblages have been sampled at locations at different protection level: intertidal and shallow subtidal samples were taken at Tavolara - Punta Coda Cavallo MPA and Penisola del Sinis – Isola di Mal di Ventre MPA, respectively. Results highlighted that assemblages in both MPAs have been significantly influenced by the geographical location rather than protection.

Key-words: protection, Sardinia, geographical location, accessibility, islands.

Introduction - Protection effectiveness of marine reserves can be judged in terms of producing higher densities and diversity of organisms. Unfortunately, two difficulties often need to be faced: (1) quantitative investigations before reserve establishment are often lacking; (2) finding experimental controls to reserve areas is not always easy and sometimes impossible: reserve areas are often unique for geographical location and/or topographical features relative to areas nearby. The biological impact of marine reserves has been reviewed by examining studies where data ‘before’ vs. ‘after’ establishment of the reserve and ‘inside’ vs. ‘outside’ the reserve were available (Fraschetti et al., 2002; Halpern, 2003). Results are encouraging and reserves of any size appear to support the predictions of many fisheries models thus producing higher densities, sizes and diversity of organisms. Also, subtidal and intertidal benthic species distribution can be affected, aside from the direct influence of protection, from a wide range of indirect effects, including trophic cascades (e.g. Sala et al., 1998; Edgar & Barrett, 1999; Castilla, 1998; Shears & Babcock, 2003). Also, humans intrude upon intertidal and shallow subtidal habitats by chronic removal of predatory gastropods, grazers and algae to support commercial activities (Lasiak, 1998; Castilla, 1999; Lasiak, 1999), harvesting bait species by recreational fishermen (Kingsford et al, 1991), by collecting shells for aesthetic purposes (Underwood, 1993) and trampling (Brosnan & Crumrine, 1994; Keough & Quinn, 1998; Milazzo et al., 2002). Furthermore, there is evidence that top predators can promote major changes in patterns of distribution and dominance of organisms on the shore (Castilla, 1999).

In this study, we compare benthic assemblages from intertidal and shallow subtidal rocky habitat at two MPAs in Sardinia: Tavolara - Punta Coda Cavallo and Penisola del Sinis – Isola di Mal di Ventre, hereafter TAV and SNS respectively. If protection has been effective one would expect large differences among assemblages occurring at different levels of protection. The different accessibility of sites sampled at each MPA, due to the geographic location, was also investigated as a further source of variation. Specifically, we expect large differences among assemblages occurring at different levels of accessibility. The hypothesis tested was that protection effect interacts with the accessibility of locations as humans happen to harvest predators, such as fishes and sea urchins in the subtidal, and invertebrates, mostly Patella spp. at the intertidal, irrespectively of restrictions.
Materials and methods – TAV and SNS MPAs are located in North-East and Central-West Sardinia, Italy (Fig. 1). They both were established in 1997 and include a surface area of about 15400 ha and 24800 ha, respectively. At TAV MPA intertidal rocky habitat was sampled in June 2006 at 9 locations: 4 sited in B zones, 4 in C zones and 1 in A zone (Fig. 1). At each location three areas were randomly chosen and in each area 10 replicates were randomly taken. Data were taken in situ using 25×25 cm quadrats and consisted of the number and size of individuals per quadrat of mobile animals (*Patella ferruginea*, *Monodonta turbinata*, *Patella rustica* and *Patella ulyssiponensis*) which are commonly harvested by humans. At SNS MPA subtidal rocky habitat was sampled in June-July 2007 at 12 locations: 2 sited in B zones, 4 in C zones, 2 in A zone and 4 out of the MPA (Fig. 1). At each location two areas were randomly chosen and in each area 10 replicates were randomly taken. Replicates consisted of digital photographs of 50×50 cm rocky surfaces quadrats at about 5 m deep. The structure of benthic assemblages was estimated by analysing images visually.

Non-metric multidimensional scaling (nMDS) was used for both data set to produce two-dimensional ordinations (Anderson & Underwood, 1997) using the Bray–Curtis similarity coefficient on untransformed data (Bray & Curtis, 1957). Multivariate (PERMANOVA and ANOSIM) as well as univariate techniques of data analyses were used to detect differences among levels of protection and geographical location.

Results – At TAV MPA a large variability among locations was found in the structure of assemblages considered (Fig. 2a). Large dissimilarities have been found between mainland and island locations. Specifically, besides the A zone which is the location with the highest density of molluscs, a significantly higher number of individuals of *Patella ferruginea* and *Patella ulyssiponensis* was found at the island locations. Also, for the former species, no individuals were found at protection level C, both at island and mainland locations.

At SNS MPA the large variability found in the structure of subtidal assemblages was not significantly influenced by protection level. Similarities among samples were
Does accessibility of locations interact with protection effect on shallow rocky habitats?

Conclusions – The results did not indicate significant differences in structure of intertidal and subtidal assemblages among locations under different levels of protection. However, protection was found to be an evident source of variation if in combination with low accessibility of locations. Overall, the contribution of protection to the variability was lower than that due to the geographical location, as dissimilarities among island and mainland locations are evident at both MPAs, disregarding the level of protection.

References


