Distribution patterns of sea urchin, *Paracentrotus lividus*, in the Miramare MPA, a preliminary study

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INTRODUCTION: Sea urchin, *Paracentrotus lividus* (Lamarck) plays an important role in structure and development of benthic communities. Indeed, their grazing activity can control algae and plant assemblages (Lawrence, 1975). Studies dealing with sea urchin population structure and dynamics are of fundamental importance in terms of both the understanding of shallow sublittoral ecosystems and the management of exploited stocks. In the Mediterranean sea, *P. lividus* has been the subject of a number of studies due to its ecological and economic value (Turon et al., 1995).

Fig. 1: Satellite image of the MPA shore showing the sample stations.

MATERIALS AND METHODS: Sampling was conducted during August 2014. After a preliminary survey, 6 sample areas with *P. lividus*, inside the MPA, were chosen (Fig.1). Three stations presented a boulders bottom, the other three a vertical wall. While snorkeling, a rectangle of 0.5 m^2 (1x0.5m) was set randomly in each sample area four times, to generate replicates. Sea urchin's size, spine excluded, was measured using a caliper while snorkeling with 1mm precision. Depth of all sampling station was between 0.5 and 2m, measured by a diving computer. Age estimates according to Grosjean et al. (1996). Statistical analysis was made with PAST™, station were compared with Tukey test.

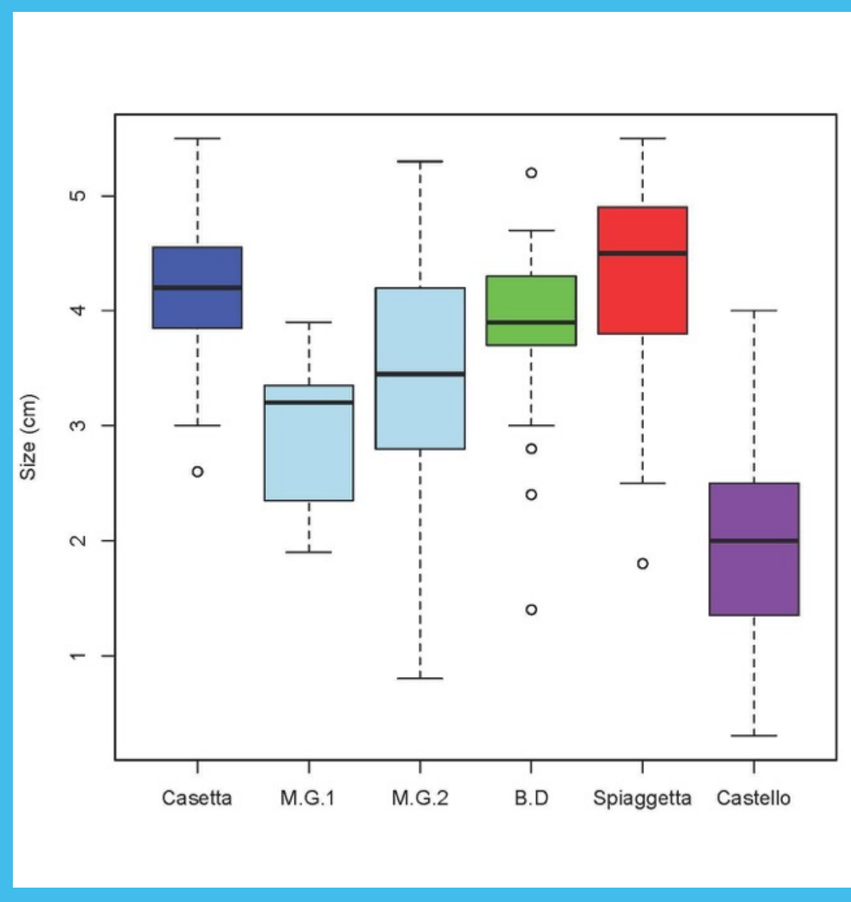

Fig. 2: boxplot of individual size (cm) measured in all stations.

RESULTS: Population's mean sizes are shown in Fig. 2. Vertical bottom is populated by smaller organisms with a greater population density than boulder areas. Difference in population structure in boulder areas and vertical wall is statistically significant ($p<0.05$**** Tukey's test, Table 1). The ages estimate shows a prevalence of young organisms in wall substrata, especially in "Castello" station, while older organisms are found only in boulders bottoms (Fig. 3).

Tukey's Q	Casetta	M.G.1	M.G. 2	B.D.	Spiaggetta	Castello
Casetta		2,03E-05	0,0004059	0,46	0,99	2,03E-05
M.G.1	8,94		0,27	0,0001077	2,03E-05	3,00E-05
M.G. 2	5,93	3,01		0,16	4,63E-05	2,03E-05
B.D.	2,55	6,39	3,38		0,17	2,03E-05
Spiaggetta	0,81	9,75	6,74	3,36		2,03E-05
Castello	15,95	7,01	10,02	13,39	16,75	

Table 1: The pairwise comparisons are based on the Tukey test. The Studentized Range Statistic Q is given in the lower left triangle of the array, and the probabilities p(equal) in the upper right. In orange significant differences.

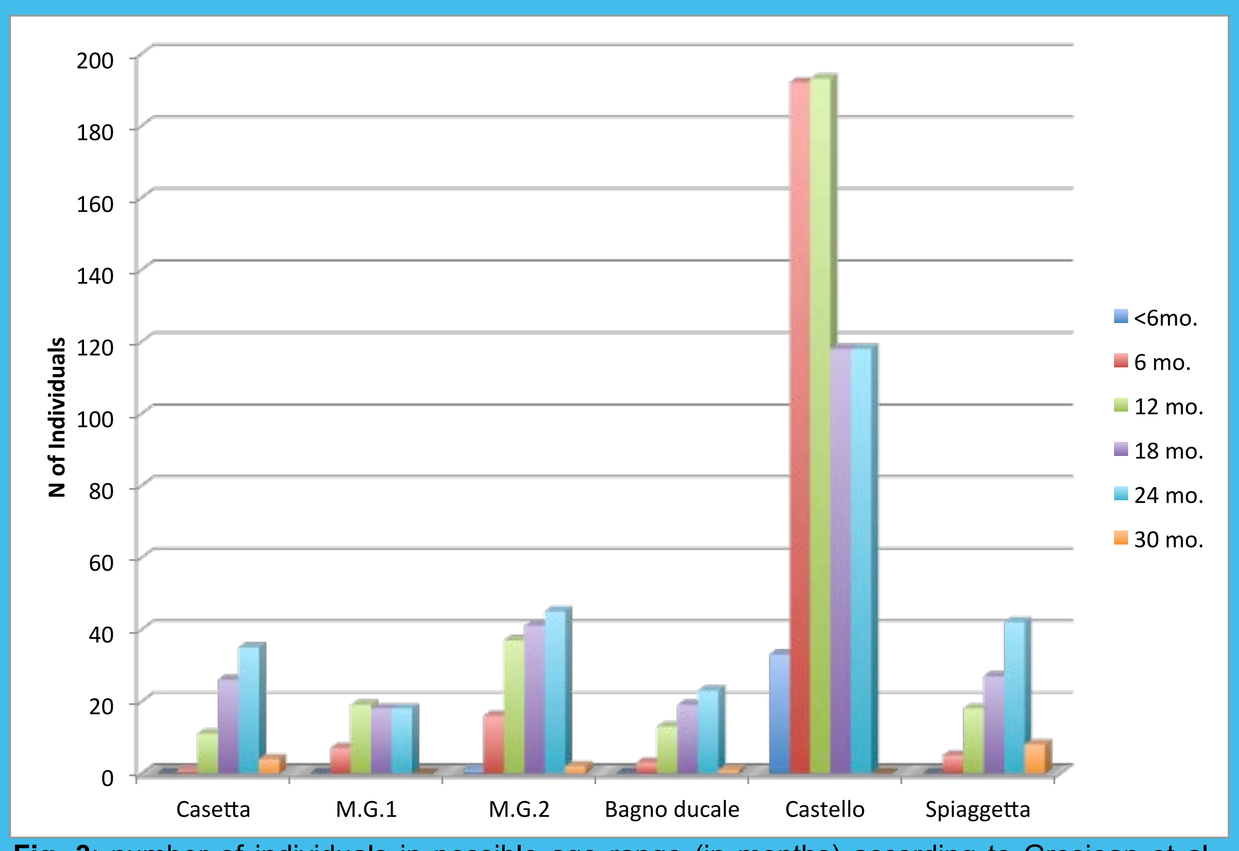

Fig. 3: number of individuals in possible age range (in months) according to Grosjean et al., (1996), in every station.

DISCUSSION: The difference shown in size structure and density suggests that *P. lividus* recruitment can be favored on vertical wall, and seems to be the most suitable environment for individuals within 1 years of age, while larger individuals prefers boulders areas in the MPA. This suggests that adults move from recruitment area for trophic reasons, or to escape from competition, a behavior already documented in several papers (Hereu, 2005). For further investigations some factors may be considered, such as algae cover and composition, that from personal observation of the authors seemed to differ from a simple turf in vertical walls, to a most complex and species-rich cover in boulders areas. Vertical wall may favor recruitment since it represents an obstacle for planktonic larvae that works better than slightly sloped boulder areas. Also the orientation of the wall compared to the currents can be a determinant factor in recruitment success. Alternative explanation of the urchin distribution, however, may involve factors such as differential mortality, episodic recruitment and possible change in size/age relationships a function of the substrate.

ACKNOWLEDGEMENTS:
Tommaso De Lorenzi, Karin Schlappa and Nika-Lavinia Jakac for helping with sampling.
Dott. Donatella Del Piero for advice and support. Special thanks to all the MPA's staff for the support and logistic during the sampling operations.
Photo by K. Schlappa.
Satellite image from Google Earth.

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