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MASS MORTALITY EVENT OF A *PARAMURICEA CLAVATA* (RISSO, 1826) (ANTHOZOA, GORGONACEA) POPULATION IN A SOUTH OF LEGHORN AREA (SUMMER 2003)

EVENTO DI MORTALITÀ IN UNA POPOLAZIONE DI PARAMURICEA CLAVATA (RISSO, 1826) (ANTHOZOA, GORGONACEA) IN UN'AREA A SUD DI LIVORNO (ESTATE 2003)

Abstract – From 2001 to 2003 a population of *P. clavata* has been studied in an area south of Leghorn, 300 m from the coast, between 26 and 32 m depth. In the summer 2003 an extended event of mortality has striken the entire population, in relation to an anomalous temperature increase. The observed relationship suggests the possibility to use *P. clavata* as a climatic-changes bio-indicator.

Key-words: *Paramuricea clavata*, *Gorgonacea*, *benthos ecology*, *temperature*, *mortality*.

Introduction - Colonial shallow-water gorgonians are a common component of the rocky benthic communities of the Mediterranean Sea. The density of a *Paramuricea clavata* population has been studied from 2001 to 2003, along the Tuscany coast. An observed mass mortality event was related to the anomalous surface temperatures recorded in 2003, which affected deeper layers of the water column. The aim of the note is to investigate the relationships between environmental parameters and the recorded event of *P. clavata* mortality, examining the possibility to use the species as bioindicator for climate-change scenarios (Stone *et al.*, 1999).

Materials and methods - The study site is situated South of Leghorn (43° 27.724' N; 10° 20.489' E), at about 300 m from the coast, between 26 and 32 m. The population was located on a coralligenous concretion descending with a slight slope, from 26 to 28 m, and then almost vertically, down to 32 m. The colonies were marked by plastic labels. The population density was directly evaluated by counting the colonies within each area (1 m²), along three vertical transects (9 m long) laid on the bottom, parallel to each other and 3 m apart. The site monitoring continued, from September 2001 to September 2003. According to the extension of superficial visible injuries, we defined two groups of colonies: "heavily-injured", with injury-cover >50% of the whole surface and "slightly-injured", when damaged surface represented <50% of the total. Temperature data of the water column were computed by the semi-monthly activity of R/V Poseidon (ARPAT), that used a multiparametric probe (Idronaut, Ocean-Seven 301). These data respectively refer to the sampling station WAT.10 (43° 28.84' N; 10° 19.03' E), that has the same depth of the study area, and to the period January 2001-December 2003.

Results - The dispersion index (I) of density, suggests a contagious distribution (I=15.02, $\chi^2=285.52$; df=19). The average value is 27 colonies/m², with a peak of 79 colonies/m², at 30 m, in the south-easternmost square of the section. Mortality analysis shows the transition from a light, maybe normal, stress condition to a mass mortality event. In October 2001 the "seriously damaged" colonies (>10 cm) were 4%, but in October 2002 they increased to 14%, showing the total necrosis of their tissues and the consequent death in April 2003. Moreover the "slightly damaged" colonies

(>10 cm) were 3% in October 2001, reaching 10% in October 2002. The analysis of the monthly averages of temperatures at station WAT.10 highlights the thermal anomaly that interested the entire Mediterranean Basin in the summer of 2003, with respect to the past two years. The average temperature at the surface was as high as 25.8 °C, with a record of 28.4 °C at the end of August. At the end of the first week of September 2003, the entire population of about 1700 colonies (80% of which, between 5-35 cm) was heavily damaged. Their fans had completely changed their colour from bright red to grey, showing extended necrosis of the coenosarc and a total absence of polyps.

Conclusions - During the three years of the study, sea water temperature showed an increasing trend, both at the sea surface as well as at 30 m. The high surface temperatures recorded in August 2003 constitute a basin-scale anomaly, which affected deeper layers of the water column and the thermocline limit during the following months. At the study site, the combination between the hot surface and the lowering of the thermocline level (under 30 m) caused an increase of 5 °C where the population lives, overcoming the tolerance limits of *P. clavata*. After exclusion of the other environmental parameters, the observed mortality event of September 2003, appears to be related with the sea-water temperature increase. Similar phenomena were observed in the Ligurian Sea by Bavestrello *et al.* (1994) and by Cerrano *et al.* (2000) and in tropical areas, among others by Harvell *et al.* (2001). The recorded event of *P. clavata* mass mortality indicates that such species is extremely sensible to raising temperatures, thus we suggest the use of this species as a relevant indicator for climate-change scenarios, at least at the Mediterranean basin scale.

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