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## **POPULATIONS STRUCTURE OF RED CORAL (*CORALLIUM RUBRUM* LINNAEUS, 1758) IN THE AREA OF THE DUGI OTOK ISLAND (EASTERN ADRIATIC SEA)**

### **ABSTRACT**

The aim of this preliminary study was to quantify the abundance of red coral (*Corallium rubrum* Linnaeus, 1758) in the coralligenous from four sites in the area of the Dugi Otok Island at depths from 30 to 60 m. Two of the studied populations were located in a protected area (Telašćica Nature Park). Highly branched colonies were observed at all four sites during the study. Comparing the population structure of investigated sites in the area of the Dugi Otok Island, significant differences were detected between no protected sites and the sites in the Telašćica Nature Park. Basal diameter, maximum height and branch numbers were significantly higher in populations from Telašćica Nature Park. Depth was also found to have a significantly positive effect on maximum height. The largest colonies were found deeper and exceeded 30 cm height.

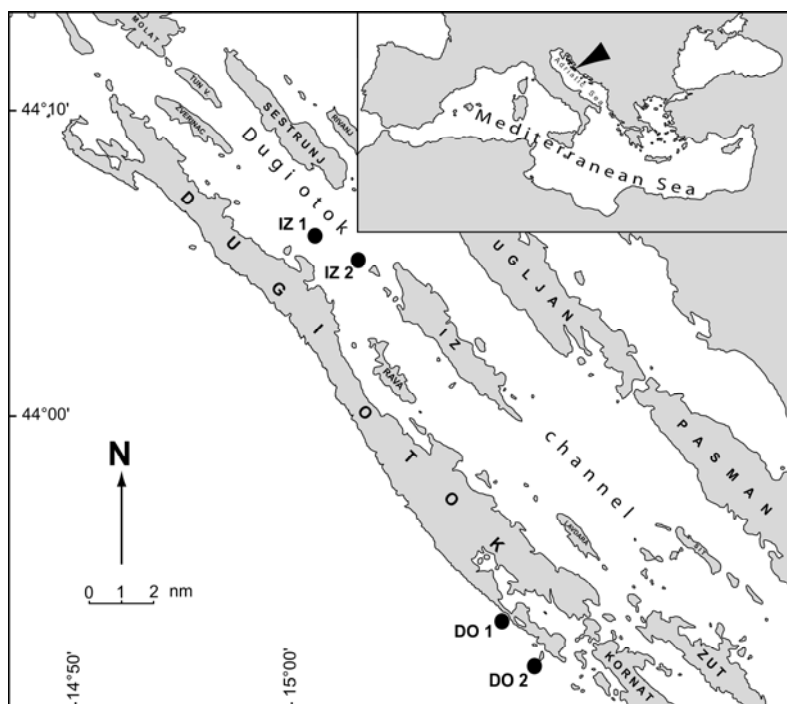
**KEY-WORDS:** Anthozoa, Red coral, *Corallium rubrum*, Adriatic Sea, Mediterranean Sea.

### **INTRODUCTION**

The condition of red coral populations in the eastern Adriatic Sea was insufficiently studied. Although large scale mortality events (mostly by thermal anomalies) have been documented, harvesting is the major source of disturbance in red coral populations in the Adriatic Sea. Amongst the anthozoans, red coral (*Corallium rubrum* Linnaeus, 1758) is exploited commercially in almost all Mediterranean countries and its stocks have strongly declined in most areas, mainly in shallow waters. Red coral is typically associated with the animal dominated communities growing in dim light conditions that characterize the smaller cavities, vertical cliffs and overhangs. Demographic studies have been a valuable tool to determine the state of octocoral populations (Santangelo *et al.*, 2004; 2007). In red coral the size/age structure has been found to be shifted towards young individuals by lacking older and larger ones (Santangelo *et al.*, 2004). Luckily, there are some places where red coral populations are still untouched.

### **MATERIALS AND METHODS**

The research presented here was carried out in the central part of the eastern coast of the Adriatic Sea. In the past the sea around Dugi Otok Island has not been a subject of extensive scientific research and only scarce information on the marine benthos has been available (Kružić, 2007). The southern part of Dugi Otok Island is protected area (Telašćica Nature Park). Four locations around the Dugi Otok Island were selected; two in the Telašćica Nature Park (DO 1 and DO 2) and two near the Iž Island (IZ 1 and IZ 2) (Fig. 1; Tab. 1.). Samples were collected by SCUBA diving on rocky bottom between 30 and 60 m depth. At all four stations red coral grows on semidark overhangs or in crevices forming small and disperse patches. A 25 cm x 25 cm quadrat was used to count colony density. The biometry of red coral was studied more by photographic sampling than collecting. Collected specimens were first preserved in 4% formalin and later transferred to 70% ethanol. Statistical analysis and statistical graphics were performed using Statistica 7.1 for Windows. All collected samples of red coral from the investigated stations are deposited in the research collection at the Department of Zoology, Faculty of Natural Sciences in Zagreb.



**Fig. 1: Map of the Dugi Otok Island showing the location of the sites studied.**

**RESULTS**

The sea temperature measured at depths of investigated stations near Dugi Otok ranged from 11.7 °C in winter to 12.4 °C in summer and near Iž Island from 12.9 °C in winter to 15.3 °C in summer. Highly branched colonies were observed at all four sites during the study (Tab. 2.). The population abundance from the studied sites ranged from 5.83 to 18.62 colonies per m<sup>2</sup>. Comparing the population structure of investigated sites in the area of the Dugi Otok

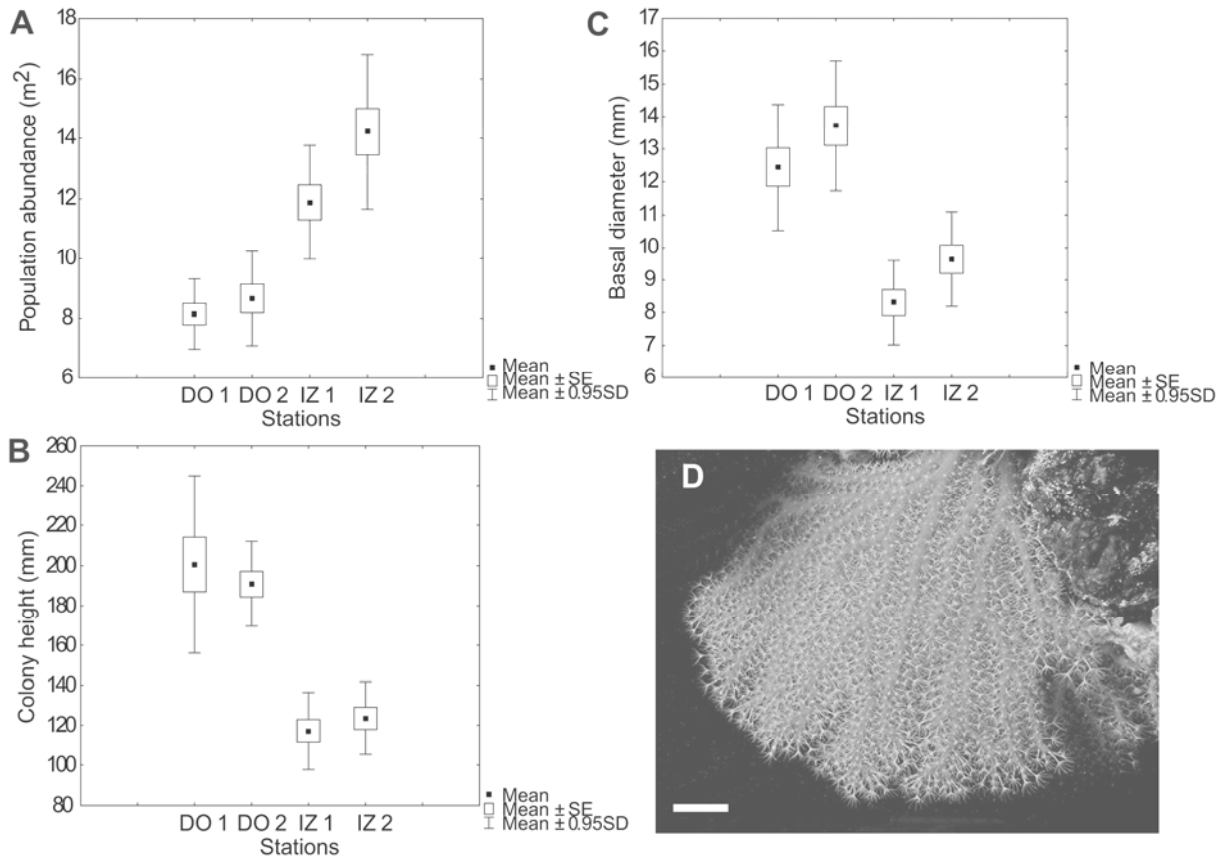
Island, significant differences (ANOVA,  $p < 0.001$ ) were detected between no protected sites (Iž Island) and the sites in the Telašćica Nature Park (Fig. 2A, B, C.). Basal diameter, maximum height and branch numbers were significantly higher in populations from Telašćica Nature Park. Depth was also found to have a significantly positive effect on maximum height. The largest colonies were found deeper and exceeded 30 cm height. The basal diameter from the studied sites ranged from 6.62 to 17.46 mm. A sign of predation has been observed in studied colonies of *C. rubrum*, mostly by gastropod *Pseudosimnia carnea* (Poiret, 1789).

**Tab. 1: Sampling stations with coordinates and depth range.**

| Sampling areas          | Coordinates            | Depth range (m) |
|-------------------------|------------------------|-----------------|
| Dugi Otok Island (DO 1) | 43°52'58"N 15°09'57" E | 56-60           |
| Dugi Otok Island (DO 2) | 43°51'56"N 15°10'50" E | 57-59           |
| Iz Island (IZ 1)        | 44°06'05"N 15°00'21" E | 30-32           |
| Iz Island (IZ 2)        | 44°05'01"N 15°02'56" E | 36-38           |

**Tab. 2: Differences in branch numbers of different orders among investigated red coral populations.**

| Sampling areas          | Mean branch number ± SD |           |           |           |
|-------------------------|-------------------------|-----------|-----------|-----------|
|                         | Primary                 | Secondary | Tertiary  | Quartiary |
| Dugi Otok Island (DO 1) | 3.8 ± 2.1               | 4.7 ± 3.1 | 2.8 ± 1.7 | 1.2 ± 1.6 |
| Dugi Otok Island (DO 2) | 3.5 ± 2.5               | 5.1 ± 3.9 | 2.3 ± 1.9 | 0.9 ± 1.1 |
| Iz Island (IZ 1)        | 2.6 ± 1.9               | 2.7 ± 1.9 | 1.7 ± 1.0 | 0.3 ± 0.7 |
| Iz Island (IZ 2)        | 2.8 ± 2.4               | 3.1 ± 2.4 | 1.8 ± 1.9 | 0.1 ± 0.6 |



**Fig. 2: Mean values of population abundance (A), colony height (B) and basal diameter (C) of the red coral populations from the investigated stations. D. Red coral colony from the station DO 2 (Bar = 2 cm).**

### CONCLUSIONS

The objective of this preliminary research was to increase knowledge on the population structure of red coral in the Adriatic Sea and to use these data to evaluate the efficiency of current management strategies of this endangered species. The red coral populations near the Iž Island grow in much shallower water than they do in the Telašćica Nature Park. The deeper populations from investigated sites in the Telašćica Nature Park showed higher biometrical values, but lower population abundance. These preliminary results may help to better understand the significant differences in the vertical distribution of red coral in different regions of the Mediterranean.

### ACKNOWLEDGMENTS

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