ESTABLISHMENT OF THE PROTECTED PARTS OF THE KOSTRENA MUNICIPALITY AQUATORIUM

M. Arko-Pijevac [1] *, Č. Benac [2], M. Kovačić [1], M. Kirinčić [1], Ž. Gržančić [3]

[1] Natural History Museum Rijeka, Rijeka, Croatia - * primuzri@ri.tel.hr
[2] University of Rijeka, Faculty of Civil Engineering, Rijeka, Croatia
[3] Učka Nature Park Public Institution, Lovran, Croatia

Abstract

The sublittoral of the Kostrena Municipality Aquatorium was studied by geomorphological, sedimentological and biological researches. 35 species of macroalgae and 196 species of macrofauna were recorded, alongwith 9 benthic biocoenoses with several developed associations of green algae and facies of corals and sponges. It has been proposed that the submarine area of Kostrena should be proclaimed a national monument, with a special law.

Keywords: Marine protection area, Benthic biocoenology, Geology, Northern Adriatic Sea

Introduction

This programme covered geomorphological, sedimentological and biological researches into the sublittoral to evaluate the littoral and sublittoral zones of a part of the Kostrena Municipality Aquatorium. The investigated area is situated on the northern part of the Rijeka Bay (the northern Adriatic Sea), strongly affected by domestic and industrial waste. Five locations have been chosen to propose a protection program for this interesting coastline.

Methodology

Five transects were investigated from the surface to 40 m depth, in July-August 1999, by direct observations using SCUBA diving techniques. Temperature and of light intensity were measured. *In situ* observations and notes were supplemented with photodocumentation. The most common species were determined in the field. The species that required more detailed analysis were collected and identified in the laboratory. Benthic communities were classified according to Pérès and Picard (1), and Bellan-Santini *et al.* (2). The composition of the fish assemblage was investigated by visual census (3).

Results and Discussion

The Kostrena coast is predominantly formed in Carbonaceous Upper Cretaceous and Paleogenic rocks. The submarine relief is diversified. The basic characteristic is a submarine precipice, up to 70 m from the coastline. Its peak is at 15 m, and its foot at 30 to 35 m depth. On the exposed parts of the shore, where the erosive impact of the waves is significant, the sea bottom is predominantly rocky, even as deep as 10 to 15 m. At the bottom, the spurs of a carbonate rocky base can often be seen, which is elsewhere covered by sliding shelly sand layer, less than 1 m thick and of loose consistency. Closer to the shore, in the wave belt, above the basic rocky mass, pebbles can be seen, and sporadically even beaches, which consist of sliding gravel. Real cliffs are formed through erosive wave impact, and at their foot, at the steep submarine slopes formed from rolled-off material, submarine screes are created. Small-grain sandy sediments are situated under submarine slopes. In the deeper submarine areas, at depths greater than 35 m, the bottom is mildly sloping, almost levelled. At the surface there is a fluid glutinous mud.

The biological researches showed the presence of 35 species of macroalgae and 196 species of macrofauna (Cyanophyceae 1, Rhodophyta 13, Phaeophyta 9, Chlorophyta 9, Porifera 24, Cnidaria 15, Nemertina 1, Echiurida 1, Sipunculida 1, Mollusca 44, Annelida 10, Crustacea 32, Tentaculata 5, Echinodermata 10, Tunicata 4, Pisces 49). Nine benthic biocoenoses were recorded with several developed associations of green algae and facies of corals and sponges: biocoenosis of supralittoral rock, biocoenosis of upper mediolittoral rock, biocoenosis of the lower mediolittoral rock, biocoenosis of infralittoral algae (association with *Acetabularia acetabulum*), association with *Halimeda tuna* and association with *Dasycladus vermicularis*), praecoralligenous aspect of coralligenous biocoenosis (facies with *Eunicella cavolinii;* facies with *Parazoanthus axinellae*), coralligenous biocoenosis, the biocoenosis of semi dark caves (facies with *Verongia cavernicola*), the biocoenosis of coastal detritic bottom and the biocenosis of scree. According to the Mediteranean Action Plan (MAP) list, facies *Eunicella cavolinii* and 8 floral and faunal species are classified as especially valuable. Individual and poorly developed specimens of brown algae point to the degraded condition of the surface layer up to 3 m in depth (*Fucus virsoides* and *Cystoseira* sp.)

A total of 49 fish species were recorded during SCUBA diving. The fish species assemblage and their abundance depended on habitat and greatly varied with depth, even within the depth range of the infralittoral zone. Most of the bottom was made of steep rocky slope. Usually bare or with poorly developed algal cover. Therefore, small, epibenthic species (families Gobiidae, Blenniidae, Tripterygidae) were well represented. On the contrary, small labrids of genus *Symphodus* were rare. Devastation of fish community by anthropic factors (fishing and disturbance) was evident by disappearance of larger species of rocky habitat (*Labrus* spp., *Sciena umbra*, *Scorpaena scrofa*) and by presence of only small and medium sized specimens of several *Diplodus* species (*D. puntazzo, D. sargus, D. vulgaris*). Trophic structure of the fish assemblage showed richness of mesocarnivores and microcarnivores, a low number of herbivores and omnivores, and absence of macrocarnivores.

Most identified crustaceans are Decapoda (27 taxa), 6 of which are recorded as rare species (*Periclymenes ametisteus, Alpheus macrocheles, Pagurus sculptimanus, Xanto pilipes, Herbstia condiliata, Pinotheres pinotheres*). Crustaceans were found from the supralittoral biocoenosis of hard beds and rocks (*Chthamalus stellatus, Chthamalus depressus, Balanus perforatus, Pachigrapsus marmoratus, Ligia italica*) to the coralligenous biocenosis in lower infralittoral zone (*Galathea strigosa, Munida rugosa*) at 40 m depth.

Faunistic and floristic data point to the well preserved biodiversity in the Kostrena Municipality Aquatorium, suggesting the necessity of protection measures. The purpose of establishing the protected area is to preserve highly valued communities as centers for the entire restoration of species in biocoenoses. The protected sea and submarine areas are statutory defined (the Constitution of the Republic of Croatia, declaration on environmental protection in the Republic of Croatia, Enviromental Protection Act, Preservation of Natura Act) and documents on spatial planning (Spatial Plan of the Primorsko-Goranska County). The form and degree of protection of maritime environments depend on the existing state (state before the protection programme is introduced). Is important that the internationally recognised and internationally set categories are used, enabling easier implementation of protection and better integration into national and international system of protected areas of the same category. According to the proposals submitted in environmental plans prepared by the Primorsko-Goranska County and the Municipality of Kostrena, it has been propounded that the submarine park of Kostrena should be proclaimed a national monument pursuant to the effective law.

References

1 - Pérès, J.M. and Picard, J., 1964. Nouveau manuel de bionomie benthique de la mer Méditerranée. *Rel. Trav. Stn. Mar. Endoume,* 47: 5-137.

2 - Bellan-Santini, D., Lacaze, J.-C. and Poizat, C., 1994. Les biocénoses marines et littorales de Méditerranée: synthèse, menaces et perspectives. Muséum National d'Histoire Naturelle, Paris, 246 p.

3 - Bortone, S. A., Kimmel, J. J. and Bundrick, C. M. 1989. A comparison of three methods for visually assessing reef fish communities: time and area compensated. *Northeast Gulf Sci.,* 10 (2): 85-96.