

ENVIRONMENTAL CHARACTERISATION AND MACROBENTHIC COMMUNITIES OF THE NORTHERN ADRIATIC "PAGURO" WRECK

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Abstract

The "Paguro" drilling platform wreck has today come to constitute an artificial reef of particular interest. The aim of this study has been to characterise this habitat and to investigate the distribution of macrobenthic communities in relation to the main chemical and physical parameters of the water. For this purpose, a graphic three-dimensional reconstruction of the wreck has been made, direct samples of macrobenthos have been taken, and, finally, photographic transects have been performed. The data thus obtained have been subjected to statistical analysis.

Key-words : Artificial Reefs, Zoobenthos, Biodiversity, GIS, Adriatic Sea

Introduction

Artificial reefs, whether intentionally constructed (such as, for example, pyramids of concrete blocks and cages) or accidentally created by wrecks, not only substantially contribute to enhance biological coastal resources but also permit the exploitation of marine coastal eutrophication, as numerous studies carried out world-wide have shown (1, 2, 3, 4, 5, 6).

The area covered by the present research is that of the AGIP "Paguro" drilling platform wreck. The platform sank 12 miles offshore from Ravenna (Adriatic Sea) on September 29, 1965 owing to the eruption of underground methane gas. The wreck currently lies on a 24-m deep pelitic soft bottom.

Regarding the Northern Adriatic, several studies have been conducted on first fouling stages (7, 8) and on the mussel's communities (9). Unfortunately, however, know exhaustive studies as so far been made on the macrobenthic communities of the artificial substrata at the climax stage.

The wreck provides refuges and burrows which afford protection to the reproducing organisms, to the juvenile forms of many species, and to Crustacea during moulting. It also constitutes an ideal environment for the spawning of Cephalopoda and Gastropoda. These reefs represent an attraction centre for esteemed fish (tertiary consumer), thanks to the protection and abundant nourishment afforded by them, and moreover become an important tourist attraction.

Material and Methods

The study has entailed several phases beginning with initial area recognition followed by submerged structures surveying and by subsequent sampling. The area surveying was carried out both from the sea surface using a GPS receiver, a Side Scan Sonar and an Echosounder and underwater employing a tape measure and a depth gauge. Twenty-four direct samples and five photographic transects were taken for the purpose of identifying and defining the benthic communities colonising the area as well as their distribution as a function of the more salient environmental parameters. The samples were obtained by scraping off all organism from 20 x 20 cm quadrates. The photographic transects include 55 pictures for a total usable covering area of about 7.8 m².

Discussion

The survey permitted the graphical reconstruction both of the original platform and of the present wreck (Fig. 1). Gas eruption has created a crater about 10 metres in depth so that the metallic structures raise up to a height of 8 to 34 metres below the surface. The three-dimensional model of the wreck was then entered, according to its actual position, in a digital cartography obtained by the geographical information system (GIS), on the basis of which it was possible to highlight the interactions between communities and environment and to follow their development over time.

Amongst the more important environmental parameters taken into consideration are the meteomarine ones (wind, current, wave) and chemical and physical ones such as temperature, dissolved oxygen, salinity, pH, etc.. All these parameters were closely monitored over time.

Direct samples were taken on areas of standard size in order to study the benthic communities on the basis of preliminary visual and photographic evidence (10). Moreover, vertical photographic transects were made according to the cartographic literature of benthic communities (11). These transects permitted to extend the information derived from the samples to a wider area and to identify the transitions from one community to another along the vertical gradients. Analysis

of the samples yielded interesting information, revealing in fact an unusual situation, not wholly falling within the parameters of traditional bionomic classifications (12). In fact organisms typical of infralittoral and circalittoral hard bottoms were here found to be associated with other organisms which normally populate various types of soft substrata. A possible explanation is that these organisms on the wreck may be able to exploit the organic and inorganic debris of the microhabitat which accumulate in crevices of the wreck structure and among the shells of mussels, found between -8 and -12 m, and those of oysters, encountered between -12 m and the bottom (Fig. 1). Typical organisms found in the samples include the common brittle star *Ophiothrix fragilis*, the polychaetes which are characteristic of detrital environments (*Harmathoe spinifera*, *Marphysa sanguinea*, *Polydora ciliata*, *Nereis succinea*, etc.) and of hard bottoms (*Syllis hyalina*, *Serpula vermicularis*, *Pomatoceros triqueter*, etc.), the decapods (*Alpheus* sp., *Pisidia longimana*, *Pilumnus hirtellus*, etc.), the isopod *Janira* sp. and the amphipods *Corophium sextone* and *Microdeutopus similis*. As it was to be expected, numerous bivalve species, amongst which the prevalent ones included *Mytilus galloprovincialis* and *Crassostrea gigas*, barnacles (*Balanus trigonus*), sponges, anthozoa (in particular *Epizoanthus arenaceus*) and sipunculida, were also found.

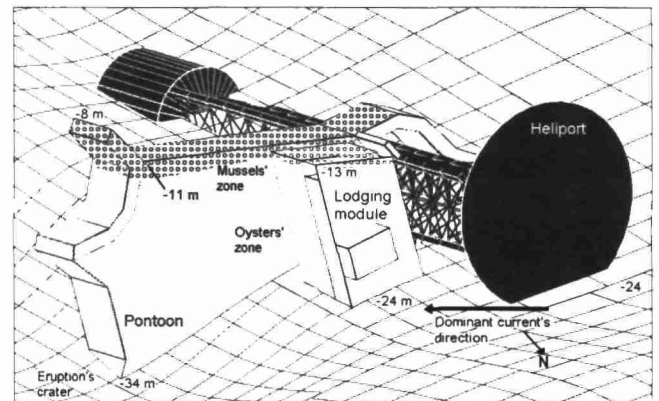


Fig. 1 - Graphic three-dimensional reconstruction of the wreck obtained with a computer using CAD software integrated in a Geographical Information System. The highest biodiversity is observed in more exposed walls to the current of the lodging module.

All data were processed by non-parametric multivariate analysis (13, 14). One of the most interesting aspects which emerged from statistical analyses is the interpretation of community distribution as a function of the different environmental variables considered. Amongst these variables, the most significant ones were found to be oxygen and salinity, which vary with depth, and exposure to dominant currents (Fig. 1). These findings agree with those of other authors (15). Amongst the hypotheses formulated, there is the possibility for the mobile organisms such as echinoderms and crustaceans to avoid the risk of anoxia which may occasionally occur near the bottom, even in this area which is so far from the coast, by migrating along the structures (Fig. 2).

The "Paguro" wreck can therefore be considered an interesting example of an artificial reef characterised by a high biodiversity and by a complex community distribution pattern. By furnishing a considerable surface area for the colonisation of sessile organisms, the wreck's structures permit an increase and diversification of algae and