ARTIFICIAL REEFS IN CANARY ISLANDS: AN OVERVIEW OF THEIR PRESENT SITUATION

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ABSTRACT

Since 1989, the Canarian Autonomous Government promoted the construction of artificial reefs aiming to enhance artisanal fisheries in shallow coastal areas of the Canary Islands. At present time, four artificial reef are deployed on sandy/rocky bottoms between 18 and 26 m depth in Lanzarote, Gran Canaria and La Palma Islands. The design of those reefs presents two different approaches. In Gran Canaria (GC) and La Palma Islands (P), they are build with five different types of concrete modules (from 1.2 to 8.5 m.t.) inside a rectagular surface of 24,000 m^2 with 84 modules in GC, whereas in P there are 52 modules in a triangular surface of 15,300 m^2. In the other hand, the two reefs of Lanzarote Island were constructed with 35/34 concrete modules of only one alveolar type (9.1 m.t.) in a rectangular surface of 9,800 m^2 respectively.

The diversified habitat provided by the artificial reef complexes of Gran Canaria and La Palma enhanced the settlement and later development of more fishes and benthic species compared to the modules of Lanzarote artificial reef complexes. Nevertheless, it is necessary to point out the constant disturbance of illegal fishing in the reef domain which determined an understimation of fish production. The future development of a broader artificial reef program in Canary Islands should obtain a compromise among local fishermen activities, oceanographic characteristics of the selected site and modules design in order to achieve more successful results.

1. INTRODUCTION

Several artificial reefs have been constructed in the Canary Islands with the main objetive of increasing the production of coastal fisheries. All reefs were done through the Multi-annual Guidance Programme (MAGP 1987-1991; 1992-1996) of the Spanish Government with the financial support of the European Union [1] & [2]. Since 1989, the Canarian Autonomous Government promoted four artificial reefs in shallow coastal areas of Lanzarote (2 Artificial reef complexes), Gran Canaria and La Palma Islands. However, the background of man-made or artificial reefs in the Canarian Archipelago predates this public iniciative. Local fishermen communities deployed non-used boats and other materials in selected areas, where fish tend to concentrate naturally, and in 1981 an artificial biotope was created with diverse material from the Air Force Base in Gran Canaria Island [3].

In this contribution the main results obtained from each artificial reef complex will be comment, together with practical problems encountered since their deployment as well as other topics related with the future development of a broader artificial reef program in Canary Islands.

2. DESCRIPTION

At present time, four artificial reef are deployed in Lanzarote, Gran Canaria and La Palma Islands, on sandy/rocky bottoms between 18 and 26 m depth. The artificial reef complexes located in La Palma and Gran Canaria Islands were contructed in July 1991 and November 1991 respectively, whereas those of Lanzarote Island were build in June 1993.

Near to the Southernmost point of Gran Canaria Island (Punta de Maspalomas), one artificial reef complex with 84 concrete modules of 5 different types (Fig. 1) was deployed at 20 m depth and 2.2 miles from the coastline, inside a rectangular surface of 24.000 m^2. Before the deposition of the concrete blocks, a oceanographical and biological assessment of the selected area was carried out between November 1990 and March 1991, in order to obtain the baseline level of the overall area [2]. After the deposition of all modules, three-years study of the benthic communities associated was done between Nov-'91 and Feb-'95 [3].

In the Western coast of La Palma Island another artificial reef complex with 52 concrete modules of similar types as in Gran Canaria's reef, was deployed between 17 and 19 m depth, partially on rocky bottom and partially on muddy bottom, inside a in a triangular surface of 15.300 m^2.

The main characteristics of the 5 different modules used in Gran Canaria and Las Palma artificial reefs are as follow: a) C1 modules are cubic concrete modules of 2x2 x2 m, with stacked bricks in the central part, a weight of 6.5 m.t. and have a volumen of 2.2 m^3 of volumen; b) TC modules are rectangular concrete base of 4x2x0.25 m with many stacked ceramic boxes (20x30x40 cm), a weight 6.2 m.t. and have a volumen 4.7 m^3; c) T6 modules are rectagular prismes of 5x3x2 m compossed of 6 tubes united by two concrete rings, a weight 8.3 m.t. and have a volumen of 13.3 m^3; d) C3 modules are rectangular concrete modules of 3.7x1.6x1.6 m with semiclosed walls made of small bricks, a

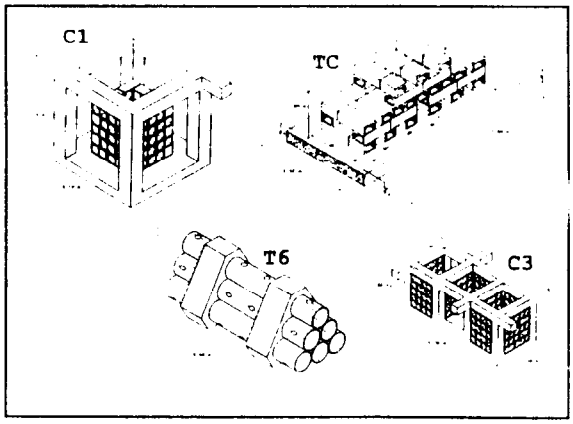

Fig. 1.- Type of modules from artificial reef complexes in Gran Canaria and La Palma Islands.

weight of 8.5 m.t. and have a volumen of 9.2 m^3; and e) anti-trwaling modules are small concrete blocks of 1x0.8x0.8 m with 4 protrunding arms of 0.5x0.25x0.25 cm, a weight of 1.9 m.t. and a volumen of 0.8 m^3 (all included in Fig. 1 except the anti-trawling unit).

The artificial reef complexes of Lanzarote Island were located closed to the Eastern and South-eastern coastslines. They have 35 and 34 concrete modules respectively of a single type (Fig. 2). These units are located in regular rows inside a rectangular surface of 9,800 m^2 respectively. Their dimensions are as follow: 3.1x2.6x2.6 m, a weight of 9.1 m.t. and a volumen of 19.2 m^3.The artificial reef complexes of Lanzarote Island were located closed to the Eastern and South-eastern coastslines. They have 35 and 34 concrete modules respectively of a single type (Fig. 2). These units are located in regular rows inside a rectangular surface of 9,800 m^2 respectively. Their dimensions are as follow: 3.1x2.6x2.6 m, a weight of 9.1 m.t. and a volumen of 19.2 m^3.

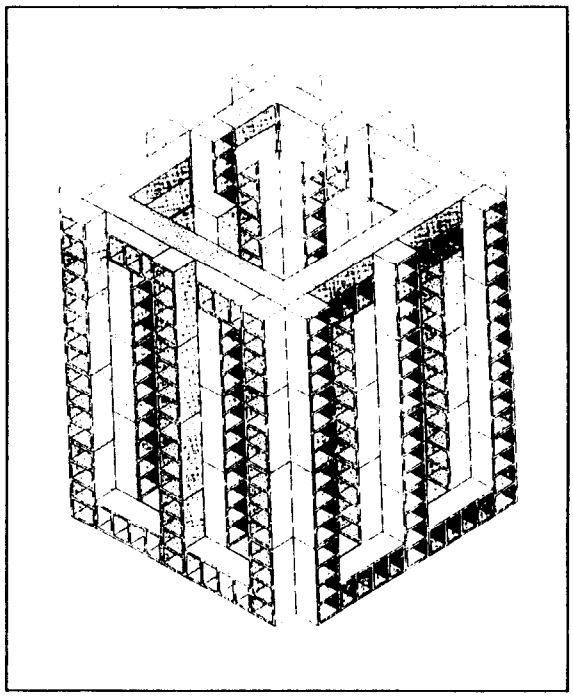

Fig. 2.- Type of module from artificial reef complexes in Lanzarote Island.

Around all artificial reef complexes a protected area had been defined, in which any fisheries activity was prohibited during the first three years after placement of the concrete modules.

Besides, the structure of the first artificial biotope created in 1981 with airplanes debris and other metallic compounds are almost destroyed, with a rather flat profile, not protruding from the surrounding sandy bottom.

3. RESULTS

In La Palma artificial reef, the structure of benthic communities is dominated by crustose macroalgae and bryozoa, with some hydroids species more abundant in the edges with higher current speeds. In the modules placed on the rocky substrate, the long spined sea urchin Diadema antillarum is present in high densities, where in those units located on the sandy bottom, the presence of this amphiatlantic species is less important. Besides, the structure of the icthyological communities is rather similar to those encountered in any other canarian rocky bottom occupied by D. antillarum populations. Nevertheless, it is necessary to mentioned the improvishment of the fauna due to an almost constant illegal fisheries in and around the reef area [5]. Very few rocky-bottom species, such as Serranus atricauda, Diplodus spp. or Sparisoma cretense were observed.

The combined effect of a bad selection of site placement for the reef complex (to close to the coastline, with strong swell action) and a high rate of sedimentation in the surfaces of the reef modules prevented the development of more complex benthic communities.

In the case of the artificial reef complex in Gran Canaria Island, its is important to mentione the rather diverse benthic communities observed in the modules after 2 years of placement with very few individuals of the sea urchin D. antillarum in the all area. Later, a demographic bloom of this omnivorous species resulted in a drastic improvishment of benthic species, with only few hydroids, bryozoans and mollusca species

encountered. During the first two years the icthyofauna was compossed by resident species coming from nearby hard substrate habitats (S. atricauda, S. cretense, Diplodus spp., Scorpaena maderensis, Balistes carolinensis) as well as juvenile produced in the reef units (S.cretense. Apogon imberbis, Thalassoma pavo) together with medium-size and large pelagic predatory fishes (Pseudocaranx dentex, Seriola spp.). The latter fishes used the reef area as a feeding area with a diverse range of fish prey. Since the rapid development of high densitities of D. antillarum populations, very few juvenile fishes were observed in the area, whereas in the case of adult fishes, the fish compossition and biomass (only of commercial fishes) remained almost unchanged [6]. Nevertheless, there is a slow decrease in total fish biomass. The triggering factors leading to the rapid increase of D. antillarum densitities is not determined, but it seems to be related to a strong fishing pressure in the reef area during the second year after placement.

With respect to the artificial reef complexes located in Lanzarote Island, the analysis of the data obtained until now is still in progress [7], but it is possible to make some comparisons with other artificial reefs. The benthic communities are less developed probably due to a higher amount of sand abrassion and the homogenity of the modules, with only one type of microhabitas and few sheltered areas. Large predatory fishes (mainly Seriola spp.) have been observed regurlarly in the surroundings of these reef areas. Until now, very low illegal fisheries have been observed in these areas.

In all the reef complexes, specially in Gran Canaria Island, species of cephalopods (such as Octopus and Sepia) used the small holes and crevices as hatchery grounds mainly in late spring and summer months.

4. DISCUSSION

The site selection is a primer factor for the future success of any artificial reef project. The bad placement of the artficial reef in La Palma Island was a important constrain to the potential development of the associated biota.

The effects of the different artificial reefs were evident, specially in those located far from rocky substrates. Evidence for this assumption came from the comparison of previous fish compossition, typical of sand-plain habitats [4], [6] & [8]. The change in the structure of the communitites after the demographic bloom of D. antillarum populations mainly affected the benthic communities, but was not so dramatic with respect to commercial fish biomass, although total recruitment of juvenile fishes was reduced since that time.

The presence of large pelagic predatory fishes, such as yellowtail species seems to be related with the specific profile of the reef units, specially in Lanzarote Island, which have units with larger height compared to those of Gran Canaria and La Palma Islands [9] & [10]. By the contrary, the reef design of the units used in the latter mentioned islands are occupied by a larger number of benthic species (from crustacea to cephalopods), due to the presence of different microhabitats of various sizes.

The fisheries regulations in coastal waters of Japon promoves the control of local communities over the artificial reefs located in their surroundings [11]. This closer control seems to be a powerfull tool for a better care of artisanal fisheries. Illegal fisheries have a mask effect of the total production from the artificial reef area.

There is a clear need of "information transfer" among the different people involved in further development of coastal fisheries. It is desirable a more close collaboration among fishermens, politicians and technical personnel to obtain a better understanding of artificial reef behaviour in the Canarian waters.

5. ACKNOLEGDEMENTS

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