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Résumé

On a étudié la colonisation des blocs de cendres de charbon provenant des centrales thermoélectriques en comparaison avec des blocs de béton. Les meilleurs résultats ont été obtenus avec les blocs de cendres qu'on pense utiliser pour la construction des récifs artificiels.

The construction of artificial habitats by sinking residual or purpose-built bodies on sea bottoms makes it necessary to ascertain whether they are compatible with marine ecosystems and in compliance with environmental protection laws of the country concerned.

ENEL - The Italian Electricity Board - has started a research program with the aim of monitoring the use of coal ash derived from its thermoelectric power plants as a component of blocks for artificial habitats whose construction is planned along the Italian coast line (SAMPAOLO and RELINI, 1991).

After preliminary laboratory tests were completed, an experimental installation was designed and constructed in the area of the Torrevadali power plant (80 Km NW of Rome).

Two reef models - each made by assembling pyramids of 225 20x20x20 cm blocks - were submerged in two tanks (10x2x1,5 m) with running sea water (water flow: 3-5 cm/s).

The ash blocks were composed to 52.1 % of fly ash, 26.1 % of bottom ash, 5.2 % of hydrated lime and 16.6 % of water, while concrete blocks were made of pozzolanic cement, sand and gravel. The main aims of this study are to obtain data about the behaviour of such materials and the interaction between the blocks and marine organisms, in particular the macrobenthos.

The observations were made at 3, 6, 9, 12, 15, 18, 21 and 24 months starting from 4 April 1990. At the moment of the examination the 6 sides of each cubes were photographed and described separately. Settlement was assessed by means of cover indices and the wet weight of the biological material scraped off each side. Subsequently the dry and ash weights were determined.

During the course of the observations the settlement on the ash blocks proved greater in quantity and better in quality than that in concrete. On ash blocks 60 species were found, compared to 50 on concrete. In particular on the ash blocks Algae together with the Serpulids are dominant components during the whole cycle of observations; on the other hand Corallinaceae and Spirorbids reach a maximum in 9-month associations, and then fall in the year long associations. Sponges, Gasteropods and Bivalves are always represented in low numbers, while Ascidians, which show a reasonable settlement on substrata immersed for 3 months, (3 M June '90), decrease to sporadic presences as the length of the period of immersion increases. Always present, however, are the colonies of encrusting Bryozoans with less marked seasonal fluctuations than the non-encrusting Bryozoans.

As already mentioned, on the concrete blocks, the associations are reduced and Algae, Corallinaceae, Serpulids and Spirorbids are the dominant components; Sponges are less represented than on the ash blocks; Gasteropods and Bivalves settle in small quantities, while the settlement of encrusting Bryozoans is greater especially on the half-year blocks. The colonies of the non-encrusting Bryozoans are particularly evident on the three-month blocks where Ascidians are missing although they are abundant on the corresponding ash substrate. The biomasses confirm the qualitative and quantitative differences expressed in the cover indices between the association which settle on the ash blocks and those on the concrete cubes.

Moreover, the increase in fouling with the increase of length of the period of immersion is much more evident and gradual for the ash blocks than for concrete, at least up to 15 months of immersion.

During the 24 months of observations, it was found that the accumulation of fouling (total wet weight), was greater on the ash-based substrata for all period of immersion except on the blocks exposed for 21 months, where there was an inversion. Furthermore, still considering the average weight values of all the blocks under examination, an increase in the accumulation of biomass was found up to 15 months, than a considerable reduction up to 21 months - a phenomenon due more to environmental factors than to the materials under examination.

At 18 months (Sept. '91), the biomass values are lower than those found at 12 months (Mar. '91), and even the value at 21 months (Dec. '91) is similar to that found on the substrata after 3 months' immersion (June '90). Such quantitative reductions could be seen in relation to a reduction in the presence of Algae and to a Summer crisis (high temperature in August) with the consequent high mortality affecting also a proportion of the animal component. On substrata immersed for 24 months there is a definite recovery in the biomass values; these reach values close to those obtained after the first year of study.

In conclusion, ash-based materials seem to be more suitable for the settlement of the macrobenthos. Since other studies have shown only a slight release of polluting metals and a weak bioaccumulation, these materials can be used for the construction of artificial reefs.

REFERENCES

- SAMPAOLO A. & RELINI G., 1991.- Coal ash for artificial habitats in Italy. Fifth int. Conf. Aquatic Enhancement, Artificial Habitats for Fisheries. Long Beach CA. Proceedings in *Bull. Marine Science* (in press).