

LONG-TERM PHOTOGRAPHIC RECORDS
FROM THE ARTIFICIAL REEFS OF MONACO (1980-1985)

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Résumé

La colonisation de deux récifs artificiels dans la Réserve sous-marine de Monaco a été suivie par des relevés photographiques pendant six ans. Après une première phase de peuplement pionnier et une deuxième de dominance de la part d'un petit nombre d'espèces, la communauté devient complexe et semblable à celle des falaises naturelles après 5-6 ans d'immersion. Ce processus paraît se dérouler, à -30 m, plus lentement qu'à -8 m.

The animal populations settled on the artificial reefs of the submarine reserve of Monaco have been studied for six years by different methods (Balduzzi et al., 1985). Annual photographic records on permanent test areas allowed an ecological characterization of the communities, with useful information about colonization trends. After six years it is possible to outline the evolution of the populations on reef elements at 8 and 30 m depth (Fig. 1).

- 8 m reef. After a year of immersion (1980) a dense population of numerous species of algae (*Padina*, *Dictyota*, *Acetabularia*) has been observed. In the second year large specimens of *Codium* characterized the algal population, and calcareous algae began to appear. The animal populations were characterized by epiphytic forms, mainly hydroids (*Dynamena*, *Orthopyxis*). In the following years the dominance of *Codium* diminished and also the red algae became a characterizing element. After five years (1984) the red algae and *Codium* colonized a great part of the available substratum. Specimens of sponges (*Crambe*), hydroids (*Eudendrium*) and bryozoans (*Sertella*) directly settled on the reef were present.

- 30 m reef. Brown algae and serpulids (*Filograna*) characterized the populations of the first year. After two years hydroids (*Clytia*) and calcareous algae showed a sharp dominance. This stage of colonization was followed by the settlement of a more complex population. After six years (1985) some specimens of encrusting sponges (*Spirastrella*) began to cover other organisms; also massive specimens of sponges appeared (*Reniera*, *Ircinia*). As for erect bryozoans, *Sertella* was already present since the second year, whereas *Pentapora fascialis* appeared only later.

As it was expectable, colonization was different at the two considered depths. The algae predominated on the 8-m reef, while animal populations predominated at 30 m. After some years, the fauna and flora of the reefs tend to assume similar features to those found on natural rocky substrata under similar conditions, i.e. vertical rocky walls that are present in the vicinity of the reserve, with an abundant sessile fauna. The hard substrata present within the reserve are mainly horizontally developed and their populations have contributed little to the colonization of the reefs.

Settlement dynamics was slow and gradual, according to the "facilitation" model of community development: the pioneer species "pave the way" for other species, up to a climax which, at Monaco, probably has been reached at 8 m (where the situation in 1984 was almost identical to that of 1985), but not at 30 m.

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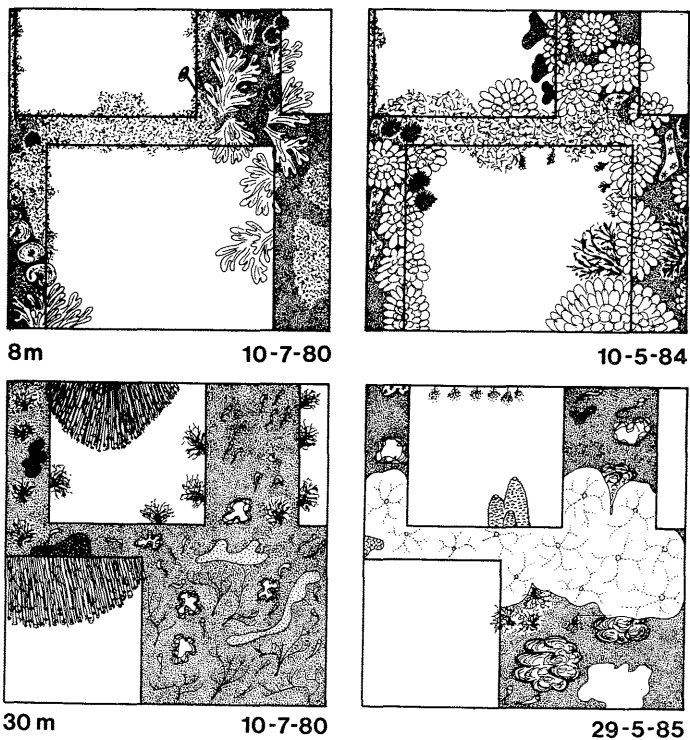


Fig. 1. Diagrams of some phases of the settlement of benthic communities on the reefs at the two considered depths (see text for explanations).

A METHOD FOR IN SITU VOLUME MEASUREMENTS OF MASSIVE SPONGES

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Résumé

Une méthode est présentée pour évaluer les variations de volume des Eponges massives au moyen d'un appareil qui permet le relevé simultané des hauteurs sur un réseau de points couvrant le plan de l'Eponge entière. Les données de chaque observation sont élaborées par l'ordinateur pour reconstruire l'évolution tridimensionnelle de l'Eponge.

The temporal evolution of hard bottom sponge populations in shallow waters has been studied, up to date, by survey techniques involving the construction of maps (Sarà, 1970) or photographic methods (Pansini & Pronzato, in press). Both techniques consider outline changes only, and volume variations are not appreciated. Vertical growth is negligible in encrusting forms, but three-dimensional measurements better describe the surface shape and volumetric development of massive forms, such as big horny sponges.

Measurements of volume variations were attempted during culture of commercial sponges (Moore, 1908; Crawshaw, 1939), but in these cases the specimens were not under natural conditions since they were cut into pieces to induce regeneration; the volume was measured by empirical methods and it was impossible to record changes in shape.

The technique here described is based on the use of a multiple height recorder (the prototype allows 100 measurements from a surface of 900 square cm) providing information on the three-dimensional shape of the studied sponge (fig. 1). The outline of the sponge is recorded by photographic methods using a reticle in which the intersections correspond to the points measured by the multiple height recorder.

Volume and outline measurements can be elaborated by computer representing the sampled specimen in a three-dimensional space, from different points of view.

It is also possible to divide the specimen by intersecting planes, and the volume between them can be calculated. The data of each observation can be stored into a data-base and the temporal evolution of the morphology of the specimen can be visually reconstructed by animation-like techniques.

Photographic records, furthermore, allow to discriminate the possible causes of variation in volume, such as epizoism, predation, degeneration and so on.

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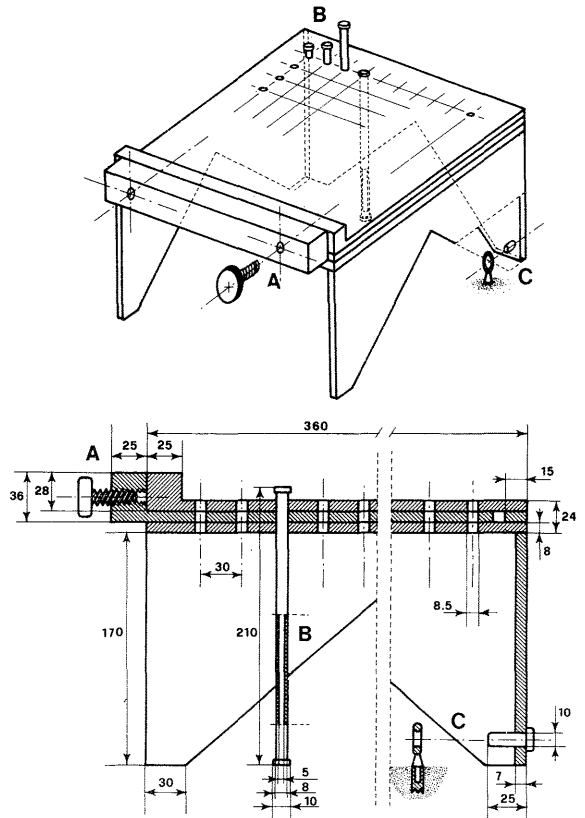


Fig. 1. Multiple height recorder: three-dimensional view (above), longitudinal section (below). A: traction device of central mobile portion for locking the height recorders. B: height recorder made of polythene with aluminum core. C: fastener for the maintenance of the position during the repetition of the measurements. Dimensions in mm.