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JOINT RESEARCH PROGRAM

Final Report

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ECOLOGY OF A CORAL REEF COMPLEX AND OF AN INSHORE LAGOON

NEAR SHARM OBHUR, RED SEA. (JEDDAH, SAUDI ARABIA)

edited by

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III.4.- SOFT BOTTOM MACROFAUNA

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III.4.1. INTRODUCTION.

In the coral reef ecosystem most of the scientific investigations are concerning the Scleractinian corals and the associated hard bottom communities. However, a limited number are dealing with the soft bottom communities, such as the studies of :

Salvat and Renaud Mornant (1969) ; Taylor and Lewis (1970) ; Gibbs et al., (1971) ; Renaud Mornant et al., (1971) ; Stephenson and Williams (1971) ; Thomassin (1969 & 1978a) ; Yonge (1972) ; Holm (1978).

In terms of quantitative composition, the contributions of Plante (1967) and Le Fur (1973 & 1976) are to be considered.

The soft bottoms of the Red Sea were investigated by Por et al., (1966), Fishelson (1971) and Bertrand Otte (1980).

Amongst the main characteristics and properties of the soft bottoms are the following :

- The microbial activity which is responsible for the mineralization of the organic detrital compounds and the releasing of nutrients and dissolved organic matter in the medium.
- The fact they are often settled by seagrass beds which play a role that cannot be disregarded in the primary productivity and in the oxygen production.
- The soft bottom fauna is a source of food for a significant number of reef fishes which are feeding on the sediments, specially at night (*Plectorhynchus, Lethrinus, Monotaxis, Parupaneus* etc.) Most of them are species of commercial value.

The soft bottoms are distributed throughout the morphological structures of the reefs. However, the places where they are covering wide areas are mostly located in the lagoons and the back reef zones (Thomassin,1978a). The lagoons and the back reef zones are often almost closed in and are always characterized by a very reduced hydrodynamism. Therefore,

the soft bottom macrofauna is particularly exposed to pollution since these areas can act as pollutant traps.
The soft bottom macrofauna has been investigated both from a qualitative point of view (faunistic composition) and from a quantitative point of view (species abundance and biomass).
Sediments have been sampled on the Transect in 5 stations situated as follows :

Station 1 - Center of the lagoon of the fringing reef at a depth of 4 metres.

Station 2 - "Lagoon" at the foot of the inner slope (3 metres).

Station 3 - Sandy spread at the foot of the drop off in the fringing fore reef zone (outer slope) at a depth of 26 metres.

Station 4 - Sandy pockets (1 to 5 m wide) of the offshore platform at a depth of 18 metres (Eliza Shoals).

Station 5 - Sandy bottom of the almost-lagoon of the Shaab al Kabir reef, at the western extremity of the Transect (depth 8 m).

III.4.2. MATERIALS AND METHODS.

III.4.2.1. SAMPLING.

Samples have been collected by diving with an air lift sucker (Barnett & Hardy, 1967 ; Thomassin,1978b) equipped with a 2mm mesh sized net-bag (Photo 2).

The sediment is sampled inside a metallic crown frame driven into the soft bottom. The average volume of sediment sampled inside the frame is about 50 liters.

III.4.2.2. SORTING.

The sorting of the sediment has been made by hand after coloration in Rose Bengal.

III.4.2.3. BIOMASS.

Biomass measurements have been made on wet animals which were preserved in 4% formaline solution. Dry weights have been estimated by using correction formulas (Thorson, 1957).

In most of the cases the dry weight corresponds to 20% of the wet weight. The method allows to preserve the animals for further uses (for example control of identification) which would be impossible with dried animals.

For bivalvia, tissues have been carefully separated from the valves before being weighted. The shells of gastropods and the tubes of Polychaets were broken in small pieces and then separated from the tissues. No decalcification process has been used.

III.4.3. RESULTS.

Since the number of species inhabiting the west Indo-Pacific soft bottoms is likely higher than 3,000, our present work has been limited to identify the prominent and ecologically significant species in order to define the main communities, accordingly with Holme (1978).

Special attention has been payed to the quantitative aspects (biomass).

III.4.3.1. TENTATIVE DEFINITION OF THE MAIN COMMUNITIES.

Three different soft bottom communities have been found in the Transect area :

- Community of very fine and sometimes muddy sands located in the shallow and very sheltered areas (almost-lagoon of Shaab al Kabir reef and back reef zone of the fringing reef). The waters are turbid and the environmental factors such as temperature and dissolved oxygen exhibit rather important variations (Fig. 29).

- Community of the fine sands of the sandy spread located at the foot of the drop off on the outer slope of the fringing reef. The environmental conditions are much more stable than those which are prevailing in the previous community (Fig. 30).

- Community of coarse sediments located in places under fairly turbulent hydrodynamic conditions.

These communities are respectively characterized by the following species :

a) - Community of the very fine sand of the lagoons and back reef zones.(Samples 1, 2 and 5).

In the fringing reef lagoon the community is typically marked by the presence of a big burrowing shrimp *Callianassa* sp. which produces wide and dense fields of mounds and funnels. Unfortunately we didn't succeed in catching specimens of the shrimp.

Polychaets are usually abundant but the fauna is dominated by Molluscs. Bivalvia (*Tellina* cf. *triradiata* and other Tellinidae, *Pitar affinis* and *Tapes litteratus*[1]) as well as Gastropods (*Rhinoclavis vertegus, Strombus gibberrulus, Nassariidae* sp., *Cerithium* sp.) are well represented.

We have noted the presence of large numbers of dead young specimens (less than 1mm) of *Pollinices* cf. *mamilla* (more than 200 per square metre).

A Scaphopod was also found, *Dentalium* sp. as well as numerous Crustaceans (Alpheida, Amphipoda and Pagurida) and the irregular Echinoid *Fibularia ovulum*.

b) - Community of the fine sand of the sandy spread of the fringing reef's outer slope.(Sample 3).

Three species are representative of the community : the Gastropod *Terebra maculata*, the bivalve *Lyoconcha picta* and the irregular Echinoid *Clypeaster humilis*. The species need clean, fine sand (Thomassin, 1978a). Other components of the community are Polychaetes and a small number of Crustaceans.

Note 1 : *Tapes litteratus* has only been found near the inner slope and probably comes from the inner reef flat where it is more abundant.

During winter, when the lagoon is colder than the open sea, dense turbid and relatively cold waters are flowing over the reef flat at high tides and are falling along the drop off down to the sandy spreads. Therefore, the community is subject to stress-conditions which might explain the absence of the Gastropod *Conus tessulatus* usually abundant in the fine clean sands.

c) - Community of coarse sediments. (Sample 4).

The dominant species are Gastropods (*Cerithium* cf. *nesioticum*, *Polinices simiae* and *Conus arenatus*) and Bivalves (*Tellina* cf. *taurella*). Other taxa are poorly represented. The following Echinoderms have been found : *Eucidaris metularia* and *Ophiocomina* cf. *picta*, species which are likely coming from the surrounding coral formations.

III.4.3.2. BIOMASS MEASUREMENTS.

The biomass measurements (dry weight) listed in Table 25 are ranging from 1.1.g/m^2 (coarse sand community) to 5.4g/m^2 (community of the very fine sands of the lagoons).

TABLE 25 - Biomass of soft bottom macrofauna.

Sample n°	Location	Community	Dry weight g/m^2
1	Center of the "lagoon"	Very fine sand of lagoons	3.2
2	Fringing back reef zone	Very fine sand of lagoons	5.4
3	Outer slope of the fringing reef	Fine sand of sandy spreads	4.1
4	Offshore platform Eliza shoals	Coarse sand	1.1
5	Fringing back reef zone	Very fine sand of lagoons	4.3

All the biomasses are low. As usual, the lowest one has been found in the coarse sands community and essentially consists of the big Gastropod *Conus arenatus*.

However, for Station 1, where more than one big *Callianassa* sp. is living per square metre, the real biomass is probably 4 to 6 times bigger. To a lesser extent this is also the case for Station 3 where *Callianassa* mounds and funnels are much less numerous.