CORAL REEFS AND THEIR MANAGEMENT

BACKGROUND TO CORALS

The basic unit of coral is the polyp. A polyp is a sessile coelenterate individual having a hollow cylindrical body attached at one end of a mouth surrounded by tentacles at the free end.

Corals live in colonies with their living tissue as a thin layer over their calcium carbonate exoskeleton. Feeding is achieved by the use of their tentacles and the principle diet is plankton. In most species, feeding is nocturnal since this is when reef plankton is most abundant. By using this feeding method, it is clear that there is a need for proper seawater circulation above and around the reef for the two-fold purpose of carrying out efficient gaseous exchange and efficient feeding.

REEF STRUCTURE

The extensive coral reef structure is derived from hermatypic reef building corals, caIcareous algae and with sediments formed from their dead remains. Hermatypic corals deposit a heavy calcium carbonate skeleton and contain zooxanthellae. Both of these are essential in establishing the structural framework of the reef. Calcium and carbonate are obtained from food and by absorption from seawater. The zooxanthellae are symbiotic algae living in the tissues *of* the coral polyps, and the soluble metabolic products of photosynthesis produced by these symbionts pass directly into the coral tissue. The zooxanthellae intimately related to the rate *of* reef building in that they cause faster skeletal formation (calcification) during the day when photosynthesis occurs.

The effect of the reef building corals, calcareous algae and sediments formed from their dead remains result in the formation *of* a cemented, solid structure - the coral reef - which can take on various forms.

FRINGING REEFS OF BARBADOS

Fringing reefs are found around most tropical island systems. They develop close to these islands by the growth of corals and associated hydrozoans, alcyonarians and calcareous algae.

Fringing reefs are prevalent around Barbados and because of their location they are of great aesthetic value to the island. More importantly, their location makes them an important barrier for beach protection and stability.

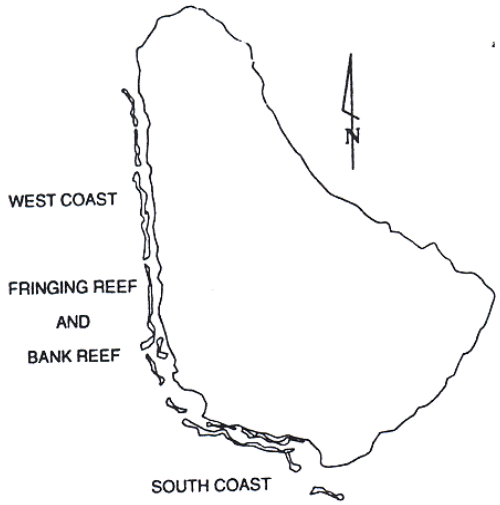

Fig. 1 The location of Fringing and Bank Reefs around Barbados

These latter features are of vital importance since the reefs dissipate the extensive and continual wave energy that acts on the beach. The reefs also have another important role in that they act as the feeding, shelter, breeding and nursery areas of many groups of commercially important fish species.

BEACH PROTECI1ON

Most reefs have a spur and groove system which extends along the reef flat and some distance down the reef slope. This system is often extensively wide and long, depending on the reef slope.

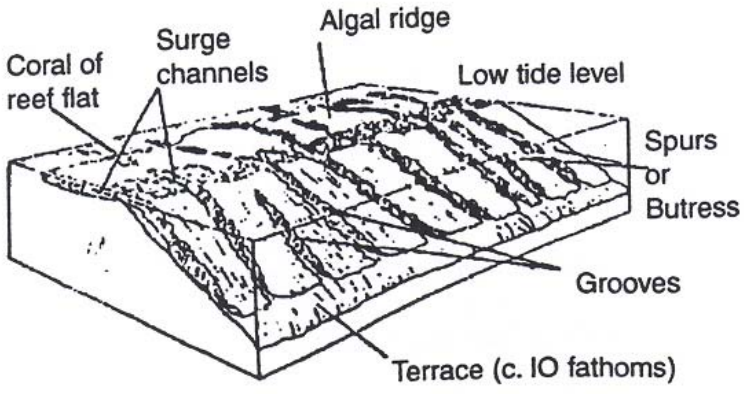

Fig. 2 Reef Structure

The spur and groove system appears to be formed by erosion reinforced by the prolific seaward growth *of* corals on the groove. The overall result *of* this spur and grove system is self-reinforcing. Incoming waves cause extensive surges along the groove resulting in

the re-suspension of sediment and the continual movement *of* reef rubble prevents effective coral growth. Less turbulent waters experienced in the spur region allow coral growth which reduces turbulence further.

In effect the spur and groove system of the reef structure acts primarily as a dissipator of the continual wave energy operating on the coastal shoreline. By dissipating wave energy before it reaches the shore the beach is protected from extensive wave action.

CORAL REEF MORTALITY

The reef systems around Barbados are very susceptible to several factors due to their proximity to the shoreline. They are especially affected by:

1. **Pollution (sewage disposal, wastewater, land runoff, chemical and industrial discharge)**
   Major concern in Barbados since it results in an increase in the nutrient concentration (eutrophication) in the nearshore area and the ultimate death of the reef.

2. **Anchorage**
   When yachts and boats anchor offshore their anchors often land on reefs resulting in immediate localized reef damage. After anchoring further damage can occur caused by the dragging effect *of* the chain and anchor as boat drifts slightly with the current.

3. **Standing on the reefs by divers and snorkelers**

   This has serious effects since the offender resting on the reef crushes the vulnerable and delicate coral polyps under feet.

4. **Harvesting corals for commercial sale and mementos**
   This is an illegal practice still in operation and although it is a small portion of the reef it still has the effect of removing some *of* the natural protective features necessary for beach stability.

5. **Dynamiting fish**
   An illegal practice with severe repercussions. It not only kills all manner of aquatic life in the immediate area but it has the compounding effects of reef damage (weakening and/or cracking of the reef thus reducing its protective nature to the beach.

6. **Tidal emersion**
   The amount of damage experienced varies according to the degree or exposure at low tide and the degree of light intensity, (which may cause the corals extrude their zooxanthellae). The end result is that the uppermost tissue of the coral reef is

repeatedly killed so that colonies increase in width but not height. Long term sea level rise will also have such an effect.

7. **Storm damage**
   Can affect coral down to the moderate depths. The damage caused by tropical storms and hurricanes depend on their intensity and distance from the reefs.

8. **Thermal pollution**
   Found frequently in areas where industries use water for cooling their systems. The used water is returned to the environment at elevated temperatures compared to the ambient. The elevated temperature has immediate impacts on fringing reefs and may cause large-scale fish kills, plankton die-offs and marked changes in species composition in the affected waters.

MANAGEMENT STRATEGIES

Because of their vital role in the prevention of beach erosion several management strategies can be devised by government so that protection of the reef is achieved. These include locating sewage outfalls well beyond nearshore habitats and reef systems; prohibition or the release of industrial effluent in the nearshore region; the establishment of marine parks, the prohibition of live coral removal from coastal areas for any purpose other than *bona fide* research, prohibition of anchoring on reefs, prohibition of fishing by use or dynamite as well as fishing in well known breeding and nursery areas.

SUMMARY

The intricate and delicate nature of coral reefs makes them not only aesthetically pleasing but also structurally provides natural and extremely effective means of beach protection. Protection is achieved by the reef spur and groove system acting as a dissipator of the continual wave energy which occurs on the coastal shoreline.

There are several contributors to coral reef mortality. The most significant of these is the deterioration in coastal water quality - a feature which is noticeable along some of the Barbados coastline. The problem of reef mortality is compounded by the increased effect of wave energy on the beach system which results in a net loss of sand from the beach.

At present the CZMU has undertaken a reef survey programme, the first of which was initiated in 1987 to provide baseline data on the present status of the reefs along the west and south coast of Barbados. This comprehensive report provided a basis from which all future reef monitoring can be compared.

However it is clear that the best and most effective way to preserve the reef system around the island is to try and reduce the high level nutrient input into the nearshore and thus attain a state of healthy coastal waters.

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