REHABILITATION OF DEGRADED CORAL REEFS: THE USE OF ARTIFICIAL REEF BLOCKS

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Throughout the tropics coral reefs have in recent years been under various types of natural and man-induced pressure. In the Caribbean "white head-band" and "black-band" disease has decimated large areas of coral and hurricanes such as David, Gilbert and Hugo have caused considerable damage to shallow water coral reefs. In the Indian and Pacific Oceans the Crown-of-Thorns starfish has temporarily wiped out reefs leaving just the dead white coral skeletons behind. Meanwhile man has in some areas indulged in mining coral reef flats for building material and aggregate and, in others on dynamite fishing to leave behind an underwater desert of coral rubble. Sewage and agricultural runoff have also taken their tolls of coastal reefs. To top it all, worldwide there have been anomalous sudden rises in sea temperature which have caused corals to "bleach" (lose their symbiotic algae) and if bleaching is severe, subsequently die (even though the temperature changes are just 2-4 C and last only a few months).

With many scientists predicting both rising sea-level and an increasing frequency and power of tropical storms, any damage to nearshore natural sea-defences such as coral reefs is of concern. It is of especial concern when the damaged reefs fail to recover, erode away and leave shorelines open to increased wave attack. In the Maldive Islands in the Indian Ocean some mined reefs have shown negligible recovery over 20 years. With islands only 1.5 m above the high tide mark, having healthy reefs which can (1) slowly grow upwards as sea-level rises, (2) provide nearshore sea-defence services and (3) continually generate sediments to maintain beach profiles, is of paramount importance. The Maldives thus provide a fitting site for experiments on how best to rehabilitate degraded coral reefs and speed their recovery to full health.

These experiments are being carried out by a team from the Centre for Tropical Coastal Management Studies (CTCMS) of the University of Newcastle upon Tyne, U.K. under funding from the Natural Resources and Environment Department of the Overseas Development Administration. In collaboration with the Ministry of Fisheries and Agriculture and Ministry of Public Works and

The experiment will use three types of artificial structures to discover precisely what factors promote reef recovery. CTCMS biologists have collaborated with consulting engineers Posford Duvivier and Hydraulics Research Limited to decide on structures which fulfill both the needs of the biological experiments and can survive the wave climate on the reef flat. The different structures stabilise the mobile rubble surface to varying degrees and provide varying degrees of topographic diversity to attract fish. Without herbivorous fish to graze the algae growing on the reef surface the corals probably cannot settle; also other colonial animals and calcareous algae which cement reefs, binding rubble together, are hindered from growing. The experiment aims to discover exactly which factors are really important in promoting coral resettlement and growth.

The largest experimental structures are three sets of fifty 1m cube SHED blocks manufactured by Shephard Hill, at the next level are three lots (approx. 50 m^2 of Armorflex 220 concrete matting held down by flooring slabs (Fig. 2). At the deep end there are 50m^2 patches of chain-link fencing held down by paving slabs. Over three years, colonisation of these three types of artificial structures by fish and corals will be monitored. At the same time various smaller scale experiments will be carried out to determine the detailed mechanisms and biological and physical interactions which are involved in reef rehabilitation.

The SHED blocks amount to small artificial reefs, themselves providing cover for reef fish to live in and lots of surfaces for corals and other sessile animals to colonise. The Armorflex-220 will consolidate the dead rubble surface and provide limited shelter for small fish and good surfaces for coral colonisation. The chain-link fencing and paving slabs should provide a few scattered solid nodes which corals can colonise and limited stabilisation of the reef surface. Using three types of structure, unstabilised control sites and various smaller experiments CTCMS researchers hope to discover precisely what makes one reef recover and another not. At the present time the reef emplacement is underway and we expect to have all the artificial reef structures in position by December 1990.

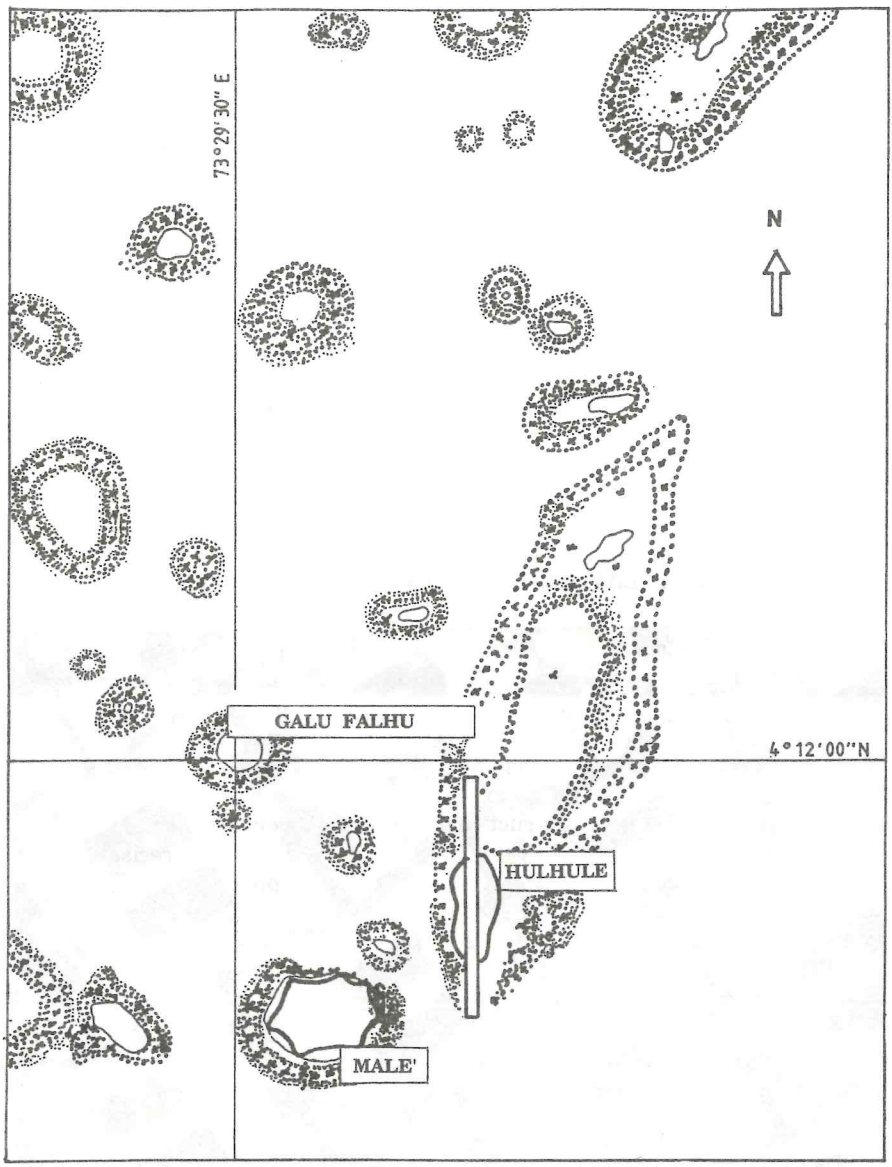

FIG.1 LOCATION OF GALU FALHU