ECOLOGY OF CORAL ASSEMBLAGES ON CONTINENTAL ISLANDS IN THE SOUTHERN SECTION OF THE GREAT BARRIER REEF, AUSTRALIA.

Thesis submitted by

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Robert van Woesik
10 December 1991

DEDICATION

This thesis is dedicated to my mother and father: to her for her eternal optimism, and my father who taught me to view nature with an open mind, ensuring unlimited scope for research and the maintenance of a humble approach.

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ABSTRACT

This study assessed the distribution of coral assemblages on coral reefs fringing continental islands between 20°S and 23°S on the Great Barrier Reef, Australia. Two questions were investigated. What is the composition and distribution of the coral assemblages and how are they influenced by ambient environmental conditions and episodic disturbance events, both natural and anthropogenic?. The study was conducted at four island groups; the Whitsunday (20°00'S), Cumberland (20°30'S), Northumberland (21°00'S), and the Keppel Islands (23°00'S).

Sixteen coral assemblages which recurred largely as a function of habitat and regional conditions were identified. Direct gradient analysis of 102 taxa and eight environmental gradients indicated that variation in coral composition was correlated with depth, exposure, tidal amplitude, distance from the mainland and the presence of seasonal macrophytes.

There was a lack of fringing reef development in the vicinity of 21°S and a restricted range of coral growth forms and species. Reef decline was not constrained by latitude, as fringing reefs were prolific at 23°S, but significantly correlated with extreme tidal fluctuations (10m); which induce high turbidity and reduce the euphotic zone. Major framework builders, massive and branching corals, dominated reefs north of 21°S but significantly declined at 21°S. Fast-growing, plate-like, encrusting and columnar forms dominated reefs at 21°S, suggesting coral growth rates and reef accretion are not directly related. High turbidity appears to have influenced coral composition and coral morphology to such a degree that poor reef development has occurred through the Holocene period.

Biological assemblages are also a product of episodic disturbances. Two case studies examined effects of disturbance; a major flood and the discharge of secondary sewage. The prolonged reduction in salinity, associated with the 1991 Queensland floods (cyclone'Joy'), caused a considerable decline in live coral biomass in the Keppel Islands. The dominant coral genus *Acropora* was most affected. Shallow corals in the Whitsunday Islands suffered minimal mortality, however many deep water pocilloporids (eg. *Seriatopora hystrix*) were killed. Low light levels associated with the monsoonal conditions may have caused the mortality.

Acropora spp. and pocilloporid corals appear most vulnerable to physico-chemical stress. Mild disturbance events (as in the Whitsunday Islands) tend to eliminate monospecific stands of these opportunistic corals. Suppressing space monopolisation by periodic exclusion may be

essential in maintaining regional diversity over long time scales. Large disturbances (Keppel Islands) tend to reduce regional diversity.

Effects of sewage on the coral assemblages at Hayman Island were investigated. Results suggest an impact 20-40 m from the outlet. Elevated nutrient levels reduced coral cover, suppressed colonization and induced community instability. It is important to understand the scale of impact from such influences as the inshore environment is most susceptible to anthropogenic interference.

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