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

Thesis submitted by

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in March 1992

for the degree of Doctor of Philosophy

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Biology

at

James Cook University of North Queensland

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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.



## CONTENTS

<b>Chapter 1. INTRODUCTION.</b>	
1.1 Rationale and objectives	1
1.2 Factors affecting coral distribution - Physical parameters	2
1.3 Factors affecting coral distribution - Biological parameters	7
1.4 Episodic disturbances	9
1.5 Anthropogenic impact	10
<b>Chapter 2. PHYSICO-CHEMICAL ENVIRONMENT OF THE STUDY AREA.</b>	
2.1 Location	11
2.2 Geology	11
2.3 Reef geomorphology	11
2.4 Oceanography	16
2.5 Climate	19
2.6 Major river systems	20
2.7 Nutrients	21
2.8 Suspended sediments	21
2.9 Overview of study area	22
<b>Chapter 3. METHODS</b>	
3.1 Interpretation and analysis of multivariate data	27
3.2 Field methods for regional study (chapters 4 and 5)	30
3.3 Data analysis for regional study (chapter 4)	32
3.4 Analysis of regional data on coral abundance, size and morphology (chapter 5)	33
3.5 Natural disturbance: the January 1991 floods (chapter 6)	34
3.7 Anthropogenic disturbance: effects of secondary sewage (chapter 7)	35
<b>Chapter 4. REGIONAL VARIATION IN CORAL DISTRIBUTION</b>	
4.1 Introduction	41
4.2 Overall composition	41
4.3 Regional variation in benthic assemblages	47
4.4 Environmental gradients	49
4.5 Recurrent coral assemblages	56
4.6 Discussion	64
<b>Chapter 5. REGIONAL VARIATION IN CORAL ABUNDANCE, SIZE AND MORPHOLOGY</b>	
5.1 Introduction	67
5.2 Coral abundance and morphology	68
5.3 Colony size and environmental gradients	74
5.4 Comparative reef growth	77
5.5 Discussion	78

**Chapter 6. NATURAL DISTURBANCE: THE JANUARY 1991 FLOODS.**

6.1 Introduction .....	83
6.2 Reef composition .....	84
6.3 Conditions during the floods .....	87
6.4 Flood impact .....	87
6.5 Discussion .....	94

**Chapter 7. ANTHROPOGENIC DISTURBANCE: EFFECTS OF SECONDARY SEWAGE.**

7.1 Introduction .....	100
7.2 Results .....	101
7.3 Discussion .....	107

**Chapter 8. DISCUSSION AND CONCLUSIONS. .... 117****References cited ..... 123**

Appendix 1. Location of islands and sites .....	140
Appendix 2. Coral composition, abundance and colony size at each site .....	149
Appendix 3. Estimates of percent cover for gross benthic components at each site .....	162
Appendix 4. Environmental variables .....	164
Appendix 5. Summary tables. Frequency of occurrence and mean abundance for each taxa for each region .....	168
Appendix 6. Pre and post flood data, Keppel Islands .....	172
Appendix 7. Pre and post flood data, Whitsunday Islands .....	177
Appendix 8. Benthic assemblages 1986 and 1988, Hayman Island .....	209
Appendix 9. Nutrient data for the Whitsunday Islands .....	221

## LIST OF FIGURES

Figure 2.1 The study area. Whitsunday, Cumberland, Northumberland and Keppel Islands. . . . .	12
Figure 2.2 Geomorphology of three fringing reef types . . . . .	13
Figure 2.3 Aerial photographs of three major fringing reef types . . . . .	14
Figure 2.4 Tidal fluctuations along the Great Barrier Reef . . . . .	18
Figure 2.5 Catchment area of the Fitzroy River . . . . .	18
Figure 2.6 Discharge from the Proserpine/O'Connell Rivers, 1990 . . . . .	23
Figure 2.7 Nutrient species ( $\text{NO}_3$ , $\text{NH}_4$ , $\text{Si(OH)}_4$ ) from the Proserpine/O'Connell River . . . . .	24
Figure 2.8 Nitrite ( $\text{NO}_2$ ) concentrations varying with distance from the mainland . . . . .	25
Figure 2.9 Nutrient species ( $\text{PO}_4$ , $\text{Si(OH)}_4$ ) and suspended solids and tidal amplitude . . . . .	26
Figure 3.1 Location map of the Fitzroy River and the Keppel Islands . . . . .	39
Figure 3.2 Study sites on the Keppel Islands . . . . .	39
Figure 3.3 Hamilton Island study sites . . . . .	40
Figure 3.4 Hayman Island study sites . . . . .	40
Figure 4.1 Aerial photographs showing varying degrees of fringing reef development . . . . .	44
Figure 4.2 Regional variation in hard coral and macroalgal cover . . . . .	46
Figure 4.3 Schematic representation of 125 study sites positioned in terms of similar coral composition and abundance . . . . .	58
Figure 4.4 2-D representation of major coral assemblages . . . . .	59
Figure 4.5 Photographic plate of 8 major coral assemblages . . . . .	61
Figure 4.6 Photographic plate of 8 major coral assemblages . . . . .	62
Figure 4.7 General position of coral assemblages, both by habitat and region . . . . .	63
Figure 5.1 Regional variation in the abundance and size of all hard corals . . . . .	69
Figure 5.2 Regional variation in the abundance size of fast growing corals . . . . .	70
Figure 5.3 Regional variation in the abundance and size of massive corals . . . . .	71
Figure 5.4 Regional variation in the abundance and size of arborescent corals . . . . .	72
Figure 5.5 Regional variation in the abundance and size of soft corals . . . . .	73
Figure 5.6 Schematic biplot of 125 sites and significant environmental variables, based on similarity in coral abundance, composition and size . . . . .	76
Figure 5.7 High turbidity in the Northumberland Islands . . . . .	81
Figure 5.8 Encrusting morphologies for <i>Acropora hyacinthus</i> and <i>Porites</i> spp. . . . .	82

Figure 6.1a Study sites on the Keppel Islands. b. Relative abundance of six major taxa in the Keppel Islands . . . . .	85
Figure 6.2a Study sites in the eastern Whitsunday Islands. b. Relative abundance of the six major scleractinian families . . . . .	86
Figure 6.3 Fitzroy River discharge inundating the Keppel Islands, 2/1/91 . . . . .	88
Figure 6.3 Bleached <i>Acropora formosa</i> at Great Keppel Island during February 1991 .	88
Figure 6.4 Vertical profile of Keppel Island reefs displaying flood damaged zones .	89
Figure 6.5 Frequency of flood events from the Fitzroy River for 103 years . . . . .	99
Figure 7.1 Percent cover of major benthic components from 20m line transects . . .	109
Figure 7.2 Coral assemblages at increasing distance from the sewage discharge . .	110
Figure 7.3 Schematic 2-D illustration of a Multi-dimensional Scaling (MDS) analysis undertaken for both spatial and temporal data simultaneously	111
Figure 7.4 Relative change in local colonization and mortality between the two observation periods . . . . .	112
Figure 7.5 Temporal comparison of damage estimates for massive <i>Porites</i> spp. . .	113
Figure 7.6 Temporal comparison of damage estimates for caespitose <i>Acropora</i> spp.	114
Figure 7.7 Growth rates of six <i>Porites</i> spp., Hayman Island . . . . .	115
Figure 7.8 Fluorescent images and X-radiographs from six <i>Porites</i> cores, Hayman Island . . . . .	116
Figure 7.9 Scanned electronmicrographs along the cross-section of two <i>Porites</i> spp.	117