

COMPARISON OF ZOOXANTHELLAE CHARACTERISTICS OF REEF-
BUILDING CORALS OFF TERENGGANU

YUEN YEONG SHYAN

FACULTY OF APPLIED SCIENCE AND TECHNOLOGY
UNIVERSITI PUTRA MALAYSIA TERENGGANU
TERENGGANU
2000

COMPARISON OF ZOOXANTHELLAE CHARACTERISTICS
OF REEF-BUILDING CORALS OFF TERENGGANU

YUEN YEONG SHYAN

FACULTY OF APPLIED SCIENCE AND TECHNOLOGY
UNIVERSITI PUTRA MALAYSIA TERENGGANU
TERENGGANU
2000

1100024265

COMPARISON OF ZOOXANTHELLAE CHARACTERISTICS OF REEF-
BUILDING CORALS OFF TERRENGGANU

Firstly, I would like to thank my supervisor, Mr. Jiew-Hock Chiew for his help, support, guidance and patience throughout my project. I also would like to extend my appreciation to Dr. Chan Eng Hong and other SEATHU volunteers for their help during my sampling in Chang Hatt.

BY

I am very grateful to Pt. Karim Mohamed and En. Mohamed bin Binlong for their assistance in some of my dives. I would like to express my gratitude to my dive teachers, Huey Lee, Tan Chong, Marvyn and Sabarin Mustafa. Thanks also to the SCUBA Dive staff, Along Ann and Phana Jo who willingly helped us during each of our repeating trip to Chang Hatt. Special thanks also go to Mr. Ahmad Izzat.

YUEN YEONG SHYAN

This project report is submitted in partial fulfillment of the requirements for the Degree of

Bachelor Science (Marine Science)

My deepest gratitude goes to my family for their love and support during my days in university. Special thanks go to Wey Seng, Li Pei, Huey Fen and Ching Young for their support and encouragement throughout my university life.

Last but not the least, I would like to thank my friends Miza Yee, Choon Han, Khai Fui, Pei...

Faculty of Applied Science and Technology

UNIVERSITI PUTRA MALAYSIA TERENGGANU

2000

ACKNOWLEDGEMENTS

Firstly, I would like to thank my supervisor, Mr. Liew Hock Chark for his help, support, guidance and patience throughout my project. I also would like to extend my appreciation to Dr. Chan Eng Heng and other SEATRU volunteers for their help during my sampling in Chagar Hutang.

I am very grateful to Pn. Kartini Mohamad and En. Mohamed bin Embong for their assistant in some of my laboratory works. I would like to express my gratitude to my dive buddies : Huey Lee, Tan Choong, Mariyati and Baharim Mustapha. Thanks also to the SCUBA Unit staffs, Abang Aziz and Abang Jo who willingly fetched us during each of our sampling trip to Chagar Hutang. Special thanks also go to Mr. Affendi from Univesiti Malaya who provided much information and references regarding this study. Without their help, this study would not have been possible.

My deepest gratitude goes to my family for their love and support during my days in university. Special thanks go to Wey Siang, Li San, Huey Fen and Ch'ng Yoong for their support and encouragement throughout my university life.

Last but not the least, I would like to thanks my friends Shien Yen, Choon Sean, Kian Fatt, Peik Lee, Hai Yean, Wai Cheng, Eyean Peng, Ling Kuen and others for their support, help and friendship throughout my university life.

ABSTRACT

A comparative study on the zooxanthellae characteristics of 5 reef-building corals species off Terengganu was carried out from June until September 1999. The results showed that zooxanthellae density and photosynthetic pigment concentration in $\mu\text{g.cm}^{-2}$ were higher for corals in deeper water compared to those in shallow water. However, photosynthetic pigment concentration when expressed as $\mu\text{g.cell}^{-1}$ showed no obvious relationship between the two depths. An exception occurred in *Montipora aequituberculata* where chlorophyll a, c and carotenoid concentration per cell were found to be lower in deeper water.

Zooxanthellae diameter was found to range from 7.0 μm to 9.1 μm . Only *Montipora aequituberculata* exhibited larger zooxanthellae diameter in 5m depth compared to those from 15m depth.

Coral growth form appeared to have some effect on zooxanthellae characteristics especially in *Favia speciosa* and *Fungia repanda*. *Favia speciosa* had the highest zooxanthellae density and photosynthetic pigments per unit surface area ($\mu\text{g.cm}^{-2}$) in deeper water. Similar relationship was found in *Fungia repanda* together with higher chlorophyll c and carotenoid per unit surface area ($\mu\text{g.cm}^{-2}$) compared to other corals except *Favia speciosa*.

The variations in zooxanthellae characteristics indicate possible genetic differences of the zooxanthellae in different species of corals and even within the same coral species from different depth. It may also be due to zooxanthellae adaptation towards different environment.

ABSTRAK

Kajian perbandingan ciri-ciri zooxanthellae dari 5 jenis batu karang di luar perairan Terengganu telah dijalankan dari Jun hingga September 1999. Keputusan yang didapati menunjukkan bahawa ketumpatan zooxanthellae dan kepekatan pigment fotosintesis dalam unit $\mu\text{g.cm}^{-2}$ adalah lebih tinggi dalam batu karang yang hidup di air yang lebih dalam berbanding dengan batu karang di perairan yang cetek. Manakala pigment fotosintesis dalam unit $\mu\text{g.cell}^{-1}$ tidak menunjukkan hubungan yang jelas di antara kedalaman air dengan species batu karang. Tetapi pengecualian berlaku pada *Montipora aequituberculata* di mana klorofil a, c dan karotenoid per sel didapati lebih rendah di perairan yang lebih dalam.

Diameter zooxanthellae didapati berukuran daripada $7.0\mu\text{m}$ hingga $9.1\mu\text{m}$. Hanya *Montipora aequituberculata* menunjukkan diameter zooxanthellae yang lebih besar pada kedalaman 5m berbanding dengan batu karang yang sama pada kedalaman 15m.

Rupa bentuk batu karang nampaknya mempunyai kesan ke atas ciri-ciri zooxanthellae terutamanya bagi *Favia speciosa* dan *Fungia repanda*. *Favia speciosa* mempunyai ketumpatan zooxanthellae dan pigment fotosintesis per luas permukaan ($\mu\text{g.cm}^{-2}$) yang paling tinggi di perairan yang lebih dalam. Hubungan yang sama dijumpai pada *Fungia repanda* dengan kandungan klorofil c dan karotenoid per luas permukaan ($\mu\text{g.cm}^{-2}$) yang lebih tinggi berbanding dengan batu karang yang lain kecuali *Favia speciosa*.

Perubahan dalam ciri-ciri zooxanthellae menunjukkan kemungkinan wujudnya perbezaan genetik pada zooxanthellae dalam batu karang yang berlainan species serta pada species yang sama di kedalaman yang berbeza. Ia juga kemungkinan disebabkan oleh penyesuaian zooxanthellae terhadap persekitaran yang berbeza.

ACKNOWLEDGEMENTS	ii
ABSTRACT	iv
CONTENTS	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF APPENDICES	xi
LIST OF ABBREVIATIONS	xiii
1.0 INTRODUCTION	1
2.0 LITERATURE REVIEW	5
2.1 Roles Of Zooxanthellae	5
2.2 Morphology And Species Of Zooxanthellae	8
2.3 Zooxanthellae Density	11
2.4 Zooxanthellae Photosynthetic Pigments	13
2.5 Loss Of Zooxanthellae	14
2.6 Coral Health Monitoring Using Zooxanthellae Characteristics	15
3.0 METHODOLOGY	19
3.1 Sampling Sites	17
3.2 Coral Sample Collection And Preservation	17
3.3 Seawater Parameter	21
3.4 Histology	22
3.5 Zooxanthellae Isolation	22
3.6 Zooxanthellae Disease Determination	23
3.7 Zooxanthellae Density Determination	23
3.8 Zooxanthellae Photosynthetic Pigments Determination	24
3.9 Statistical Analysis	25