



UNIVERSITI PUTRA MALAYSIA

**ECOLOGY OF SCLERACTINIAN CORALS IN THE WATERS OF PORT
DICKSON AND THEIR TOLERANCE TO SEDIMENTATION**

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By

LEE YOKE LEE

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfillment of the Requirements for the
Degree of Master of Science**

January 2005



This thesis is dedicated to my beloved parents and brothers
I love you Mom, Dad, Sherman and Sherwin.



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

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January 2005

Chairman: Professor Mohd. Ibrahim Haji Mohamed, Ph.D

Faculty: Environmental Studies

This study was conducted in two parts, field data collection and laboratory experiments. Coral reef surveys were done using Line Intercept Transect and Random Sampling Method while an 8-month sedimentation rate monitoring programme was conducted along the coast of Port Dickson at Batu 7, 8, 9 and Tanjung Tuan using sediment traps. Laboratory experiments were conducted on 12 specimens of *Porites lutea* and *Favites abdita* respectively using the Buoyant Weighing Technique to monitor coral growth rates during Suspended Sediment Experiments (SSEs). The corals were also subjected to burial experiments to estimate their sediment tolerance and sediment rejection abilities. The sedimentation rates in Port Dickson and Tanjung Tuan were high, ranging from $59.61 \pm 17.57 \text{ mg cm}^{-2} \text{ day}^{-1}$ to $220.61 \pm 145.52 \text{ mg cm}^{-2} \text{ day}^{-1}$. Sediment type was predominantly silt and clay fractions. X-ray diffraction analysis indicated that these fine sediments were transported into the coastal environment through rivers. Percentage clay ranged between $18.72 \pm 4.45 \%$ and $33.81 \pm 7.19 \%$; silt between $12.28 \pm 9.95 \%$ and



41.17 ± 4.46 %; sand between 29.1 ± 5.31 % and 46.83 ± 8.94 %; and organic matter between 1.81 ± 1.64 % and 19.14 ± 16.03 %. Coral reef surveys conducted on the reef flat of Tanjung Tuan have found *Porites* spp. to be the most abundant coral type with a percentage cover of 42.57 %; followed by *Goniastrea* spp. at 20.87 %; *Favites* spp. at 9.81% and *Favia* spp. at 7.84 %. Overall live coral cover for all four stations was poor; ranging from 11.7 % to 16.8 %. Dead coral cover was between 4 % and 20.25 % while macroalgae cover was very high; ranging from 27.3 % to 57.3 %. Results from SSE 1 and 2 show that there was no significant difference in the mean growth rates between the treatment and control groups for both *Favites abdita* and *Porites lutea*. In BE 1, *Favites abdita* specimens survived burial better than *Porites lutea* specimens because they were able to manipulate and reject particles of sand from their surfaces. However, all specimens in the treatment group for both species were unable to survive BE 2.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

**EKOLOGI BATU KARANG SCLERACTINIA DI PERAIRAN PORT DICKSON
DAN TOLERANSI MEREKA TERHADAP SEDIMENTASI**

Oleh

LEE YOKE LEE

Januari 2005

Pengerusi: Profesor Mohd. Ibrahim Haji Mohamed, Ph.D

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Kajian ini telah dilakukan dalam dua bahagian iaitu pengumpulan data di lapangan dan eksperimen di makmal. Kajian ke atas batu karang dilakukan menggunakan teknik 'Line Intercept Transect' dan 'Random Sampling' manakala pengukuran kadar sedimentasi dilakukan selama lapan bulan di stesen Batu 7, 8, 9 dan Tanjung Tuan dengan menggunakan perangkap sedimen. Eksperimen di makmal dilakukan ke atas batu karang spesies *Porites lutea* dan *Favites abdita* dengan menggunakan teknik 'Buoyant Weight' untuk menentukan kadar pertumbuhannya sepanjang Eksperimen Sedimen Terampai (SSE). Eksperimen melitupi batu karang dengan sedimen juga dilakukan untuk mengganggu keupayaan mereka untuk menolak sedimen dan tahap toleransinya terhadap sedimen. Didapati bahawa kadar sedimentasi Port Dickson (PD) dan Tanjung Tuan adalah tinggi dengan julat dari $59.61 \pm 17.57 \text{ mg cm}^{-2} \text{ hari}^{-1}$ ke $220.61 \pm 145.52 \text{ mg cm}^{-2} \text{ hari}^{-1}$. Kelodak dan tanah liat adalah sedimen halus yang dominan di perairan PD. Peratusan tanah liat adalah di antara $18.72 \pm 4.45 \%$ dan $33.81 \pm 7.19 \%$; bagi kelodak ialah antara $12.28 \pm 9.95 \%$ dan $41.17 \pm 4.46 \%$; pasir antara $29.1 \pm 5.31 \%$ dan $46.83 \pm$



8.94 %; dan bahan organik antara 1.81 ± 1.64 % dan 19.14 ± 16.03 %. Analisis pembelauan sinar-x menunjukkan bahawa sedimen halus dibawa ke perairan persisiran pantai oleh sungai. Batu karang genus *Porites* spp. terdapat dalam bilangan yang terbanyak di Tanjung Tuan dengan peratusan litupan sebanyak 42.57 %; diikuti dengan *Goniastrea* spp. sebanyak 20.87 %; *Favites* spp sebanyak 9.81 % dan *Favia* spp. sebanyak 7.84 %. Litupan batu karang yang hidup secara keseluruhannya adalah rendah dengan peratusan antara 11.7 % dan 16.8 %. Peratusan batu karang yang mati adalah di antara 4 % dan 20.25 % manakala litupan alga makro adalah sangat tinggi dengan julat dari 27.3 % hingga 57.3 %. Data dari SSE 1 and 2 menunjukkan bahawa tiada perbezaan yang ketara antara min kadar pertumbuhan bagi kumpulan eksperimen dan kawalan untuk *Favites abdita* and *Porites lutea*. Dalam BE 1, spesimen *Favites abdita* berjaya menolak sedimen dari permukaan mereka dengan lebih baik berbanding spesimen *Porites lutea*. Walau bagaimanapun, kesemua spesimen bagi kedua-dua spesies batu karang mati ditimbus dalam BE 2.

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations that have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

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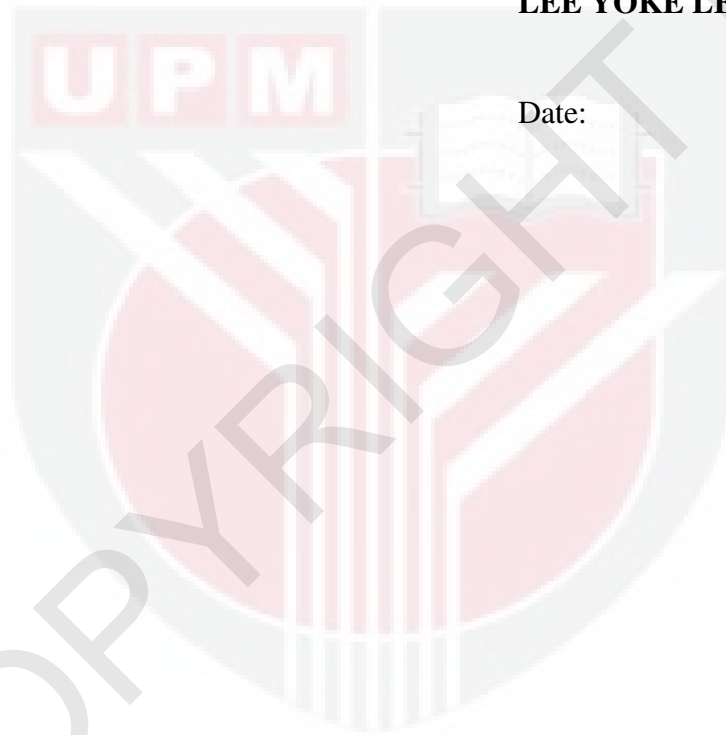


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GLOSSARY

Aragonite	A form of calcium carbonate secreted by Scleractinian corals
Coenosteum	Thin horizontal plates between corallites
Corallite	The skeleton of an individual polyp
Ceroid corals	Massive corals that have corallites sharing common walls
Fringing reefs	Reefs that occur adjacent to a shoreline
Hermatypic coral	Reef-building corals; corals that have photosynthetic plants living symbiotically within their tissues
Intratentacular budding	Daughter corallites that row from the inside wall of parent corallites, usually by division of the parent corallite
Massive corals	Colonies which are broadly similar in all dimensions (have a small surface area to volume ratio) and are mostly solid beneath the surface
Mesentrial filaments	Coiled filaments packed along the inner margins of the inner margins of the mesenteries. They help extend surface area of the mesenteries and extruded through the mouth in response to stress
Micro-atoll	A colony shaped like an atoll because low tide level permits only lateral growth
Paliform lobes	Upright skeletal rods or plates at the inner margin of septa formed by upward growth of the septum
Plocoid colonies	Colonies which have conical corallites with their own walls
Polyp	An individual coral including soft tissues and skeleton
Reef flat	The flat intertidal parts of reefs that are exposed to

	wave action
Reefs	Limestone platforms of shallow tropical seas built by corals, coralline algae and other photosynthetic organisms or symbionts
Scleractinian corals	Corals which have limestone skeletons and which belongs to the order Scleractinia
Sedimentation rates	Deposition by settling of a suspended material per unit of time as measured in sediment traps
Septa	Radial skeletal elements projecting inwards from the corallite wall
Tentacle	Tubular extensions of the polyp. The interior of tentacles is continuous with the coelenteron
Terrigenous sediment	Lithogenous; derived from weathering of rocks at or above sea level
Zooxanthellae	Photosynthetic algae (dinoflagellates) that can occur symbiotically in animal tissue