DESCRIPITION OF EARLY DEVELOPMENT IN GIANT CLAM, *TRIDACNA MAXIMA* (RODING, 1798) AND THE DETERMINATION OF PHYSIOLOGICAL BEHAVIOUR OF ADULT AS A RESPONSE TO TEMPERATURE

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2011

Description of early development in giant clam, tridacna maxima (roding, 1798) and the determination of physiological behaviour of adult as a response to temperature / Heng Wei Khang

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By

Heng Wei Khang

Research report submitted in partial fulfillment of the requirements for the degree of Bachelor of Science (Marine Biology)

Department of Marine Science
Faculty of Maritime Studies and Marine Science
UNIVERSITI MALAYSIA TERENGGANU
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DEPARTMENT OF MARINE SCIENCE
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DECLARATION AND VERIFICATION REPORT

FINAL YEAR RESEARCH PROJECT

It is hereby declared and verified that this research report entitled:

Description of Early Larval Development in the Giant Clam, *Tridacna maxima* (Röding, 1798) and the Determination of Physiological Behaviour of Adults as a Response to Temperature by **Heng Wei Khang**, Matric No. **UK 17087** have been examined and all errors identified have been corrected. This report is submitted to the Department of Marine Science as partial fulfillment towards obtaining the Degree **Bachelor of Science (Marine Biology)**, Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CITES	-	Convention on International Trade in Endangered Species
IUCN	-	International Union for Conservation of Nature
SST	-	Sea Surface Temperature
°C	-	Degree Celsius
m	-	Metre
cm	-	Centimetre
e.g.	-	*exempli gratia*
mM	-	Millimole
ml	-	Millilitre
et al.	-	*et alia*
%	-	Percentage
UMT	-	Universiti Malaysia Terengganu
N	-	North
E	-	East
mm	-	Millimetre
l	-	Litre
µm	-	Micrometre
ppt	-	part per thousand
°	-	Degree
min	-	Minute
$NaHCO_3$	-	Sodium Bicarbonate
FSW	-	Filtered seawater
rpm	-	Revolutions per minute

SL	-	Shell length
wwt	-	Wet weight
PVC	-	Polyvinyl Chloride
DO	-	Dissolved oxygen
h	-	Hour
s	-	Second
µmol	-	Micromole
m^2	-	Meter square
PAR	-	Photosynthetic Active Radiation
P_n	-	Net primary production
P_g	-	Gross primary production
R	-	Respiration
RLC	-	Rapid Light Curve
mg	-	Milligram
ANOVA	-	Analysis of Variance
Ind.	-	Individual
SD	-	Standard deviation
ECM	-	Extracellular matrix
kg	-	Kilogram
ca.	-	*circa*
P_{max}	-	Maximal photosynthesis production
Δ	-	Delta
i.e.	-	*id est*
g	-	gram

LIST OF APPENDICES

ABSTRACT

Population of giant clam has been decreasing severely in many regions due to harvesting and stress-induced bleaching. Mariculture studies have been directed to focus on artificial spawning induction, rearing of larvae and relationship of zooxanthellae to host nutrition. However, data for this purpose is specifically lacking in Malaysia especially for *Tridacna maxima*. This study was done to describe the artificial spawning induction events in broodstocks using Serotonin and the early life development from embryo to larvae morphologically. Furthermore, was to determine the physiological behaviour of adults as a response to temperature in terms of photosynthesis and respiration. Three trials were conducted using 1 ml of 2 mM serotonin hormone to induce spawning in four different broodstocks. Sperm were released after 1-2 min after injection and lasted for about 10 min while eggs released took place after about 13 min and lasts about 45- 75 min. After fertilization, the survival and growth of larvae collected were followed until pre-metamorphosis stage. Larval survival was 21.62 % at day 2 and 0.11 % at day 4. On day 6 whole batch of culture collapsed because of bacterial contamination. Size of unfertilized eggs was 102.78 ± 2.78 μm and reached larvae size of 145.56 ± 8.08 μm on day 6. Increase in total shell length and width length is more noticeable compared to hinge length. Morphological study was carried out using light compound microscope. Description of eggs, embryo, trochophore, veliger and regressive ova were discussed. On the other hand, three different sizes of adult giant clams were maintained in 26 °C, 28 °C and 30 °C water, and exposed to natural sunlight. Gross primary production as obtained by measuring the changes in dissolved oxygen (DO) during start and end of every 30 min for 24 h. Respiration measurements were taken at night. All physiological

measurements were related to wet weight, including shell. Temperature range of 26 to 30 °C has no significant effect on the primary production of zooxanthellae. However, primary production at 28 °C was relatively higher. All clams regardless of size had higher stress at 30 °C but lower stress at 26 °C. This study provided description for identification of *T. maxima* larvae and proved the feasibility of 26- 30 °C as the range of culture temperature. Small clams are optimally reared under high irradiance at 28 °C to avoid higher stress at 30 °C. For adult higher irradiance is better.

DESKRIPSI PERKEMBANGAN AWAL KIMA, TRIDACNA MAXIMA (RÖDING, 1798) DAN PENENTUAN PERILAKU FISIOLOGI OLEH KIMA DEWASA SEBAGAI TINDAK BALAS TERHADAP SUHU

ABSTRAK

Kerang gergasi (kima) populasi telah semakin berkurangan secara mendadak di banyak lokasi akibat daripada exploitasi dan pemutihan disebabkan oleh tekanan suhu. Kajian marikultur telah bertumpu kepada pembiakan aruhan, pembelaan larva dan hubungan antara "zooxanthellae" dengan nutrisi kima. Namun, data bagi tujuan tersebut adalah kurang di Malaysia terutamanya pada *Tridacna maxima*. Kajian ini dilakukan untuk menggambarkan tindak balas scenario induk terhadap rangsangan suntikan Serotonin dan perkembangan morfologi daripada embrio ke peringkat larva. Selanjutnya, untuk menentukan perilaku fisiologi oleh kima dewasa sebagai tindak balas terhadap suhu dari segi fotosintesis dan respirasi. Tiga percubaan telah dijalankan dengan menggunakan 1 ml serotonin dengan kepekatan 2mM bagi mengaruh pembiakan ke atas empat induk yang berlainan. Sperma dilepaskan 1-2 min selepas suntikan dan berterusan selama kira-kira 10 min manakala telur dilepaskan lebih kurang 13 min selepas suntikan dan berterusan selama kira-kira 45- 75 min. Selepas persenyawaan, kemandirian and pertumbuhan larva diikuti sehingga tahap pra-metamorphosis. Peratus kemandirian larva adalah 21.62 % dan 0.11 % masing-masing pada hari ke-2 dan hari ke-4. Pada hari ke-6, kesemua larva telah mati akibat daripada pencemaran bakteria. Saiz telur yang belum disenyawakan adalah 102.78 ± 2.78 μm dan kemudian mencapai saiz larva iaitu 145.56 ± 8.08 μm pada hari ke-6. Peningkatan panjang keseluruhan dan lebar cangkerang larva adalah lebih ketara

berbanding panjang garisan engsel. Kajian morfologi telah dilaksanakan dengan menggunakan mikroskop cahaya. Penerangan tentang telur, embrio, trokofor, veliger dan telur merosot turut dibincangkan. Di samping itu, tiga individu kima dewasa yang berlainan saiz didedahkan dalam air yang bersuhu 26 °C, 28 °C serta 30 °C di bawah pancaran matahari. Pengeluaran primer kasar diperolehi daripada perubahan kandungan oxygen terlarut dalam 30 min untuk seharian. Pengukuran respirasi dilakukan pada waktu malam. Kesemua pengukuran fisiologi adalah berkait dengan berat basah, termasuk cangkerang. Lingkungan suhu daripada 26 hingga 30 °C mempunyai kesan yang tidak ketara ke atas pengeluaran primer oleh "zooxanthellae". Namun, pengeluaran primer adalah lebih tinggi pada 28 °C secara perbandingan. Kesemua kima menghadapi tekanan yang lebih tinggi pada 30 °C tetapi tekanan yang lebih rendah pada 26 °C. Kajian ini menyediakan penerangan bagi pengenalan larva *T. maxima* serta membuktikan kebolehan dan kesesuaian 26- 30 °C sebagai lingkungan suhu untuk pengkulturan. Kima saiz kecil adalah sesuai untuk dibela bawah pancaran cahaya yang tinggi pada 28 °C bagi mengelakkan tekanan tinggi pada 30 °C. Manakala bagi kima saiz besar, dedahan pancaran cahaya yang tinggi adalah digalakkan.