



UNIVERSITI PUTRA MALAYSIA

***THERMAL CONDITIONS OF A MEDIUM-SCALE TROPICAL ENCLOSED
HATCHERY FOR GIANT FRESHWATER PRAWN, *Macrobrachium rosenbergii*
De Man***

AHMAD KAMIL BIN KAMARUDIN

FP 2012 52



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De Man

By

AHMAD KAMIL BIN KAMARUDIN

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

December 2012

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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December 2012

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Faculty: Agriculture

This research was undertaken to study the indoor thermal conditions of a medium-scaled enclosed tropical freshwater prawn hatchery and their relationships with the larval rearing water temperature using *in situ* measurements and IES Virtual Environment software simulations. A typical enclosed prawn hatchery in Ipoh, Perak, Malaysia was chosen for the study. The results showed that the indoor air and water temperatures remained above upper comfort (30.7 °C) for human and optimal (30 °C) limit for prawn larval growth, respectively, for almost all daytime and beyond the hatchery operational period. The high temperatures were unfavourable for the workers' comfort and prawn larval growth and survival especially during hot days.

Two follow-up studies were conducted to improve the thermal conditions of the hatchery using the simulation software. In the first experiment, the performances of

several insulation materials were studied. The results showed that the installation of roof insulation gave a cooler indoor thermal environment and provided a suitable water temperature or improved water thermal condition for the prawn larviculture. Although all tested insulation materials performed equally, the results suggested the reflective aluminium foil was the best roof insulation for the hatchery.

In the second experiment, the performances of roof design (the original and an alternative jack roof with or without reflective aluminium foil, RAF) in improving the thermal conditions of the hatchery were evaluated. The results showed that the jack roof provided a massive improvement on the indoor thermal environment of the prawn hatchery close to the upper human acceptable thermal limit (34 °C). The installation of RAF to the jack roof further reduced the indoor air temperatures to a totally acceptable level for the occupants during daytime. Therefore, the combination of jack roof and reflective aluminium foil was recommended to achieve acceptable indoor thermal conditions for the workers while successfully maintaining the optimal thermal requirements for larval growth and survival.

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

**KEADAAN TERMAL SEBUAH PUSAT PENETASAN UDANG GALAH,
Macrobrachium rosenbergii De Man, TERTUTUP TROPIKA BERSKALA
SEDERHANA**

Oleh

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Penyelidikan ini telah dijalankan bagi mengkaji keadaan termal dalaman sebuah hatcheri udang galah tertutup tropika berskala sederhana dan hubungannya dengan suhu air ternakan larva menggunakan pengukuran secara *in situ* dan perisian simulasi IES Virtual Environment. Sebuah hatcheri udang galah tertutup di Ipoh, Perak, Malaysia telah dipilih untuk kajian ini. Keputusan kajian menunjukkan suhu udara dan air di dalam hatcheri masing-masing melebihi had keselesaan untuk manusia (30.7 °C) dan had optimum untuk tumbesaran larva udang (30 °C). Suhu yang tinggi amat tidak bersesuaian untuk keselesaan pekerja dan tumbesaran dan kemandirian larva udang terutamanya ketika hari-hari yang panas.

Dua kajian susulan telah dijalankan bagi memperbaiki keadaan termal hatcheri tersebut dengan menggunakan perisian simulasi. Dalam eksperimen pertama, prestasi bagi

beberapa bahan penebat telah dikaji. Keputusan menunjukkan pemasangan penebat bumbung memberikan persekitaran termal dalaman yang lebih sejuk dan menyediakan suhu air yang sesuai atau memperbaiki keadaan termal air untuk penternakan larva udang. Walaupun semua bahan penebat yang dikaji menunjukkan prestasi yang setara, lapisan aluminium pemantulan adalah penebat bumbung terbaik untuk hatcheri tersebut.

Dalam eksperimen kedua, kesesuaian rekabentuk bumbung (yang asal dan bumbung bicu sebagai alternatif dengan atau tiada foil aluminium pemantulan, RAF) dalam memperbaiki keadaan termal hatcheri telah dinilai. Keputusan menunjukkan bumbung bicu memberikan penurunan persekitaran termal dalaman hatcheri udang yang amat besar menghampiri had kebolehterimaan suhu tertinggi untuk manusia (34 °C). Pemasangan RAF pada bumbung bicu selanjutnya mengurangkan suhu udara dalaman ke tahap penerimaan yang sepenuhnya untuk penghuni ketika waktu siang. Oleh itu, rekabentuk kombinasi bumbung bicu dan lapisan aluminium pemantulan telah dicadangkan bagi hatcheri ini untuk mencapai keadaan termal dalaman yang boleh diterima oleh pekerja, di samping dapat mengekalkan keperluan termal yang optimum untuk tumbesaran dan kemandirian larva.

ACKNOWLEDGEMENTS

Bismillahi rahmani rahim
Assalamualaikum warahmatullahi wabarakatuh.

In the name of Allah, the Most Gracious, the Most Merciful. Alhamdulillah, all praises to Allah for the strengths and His blessing in completing this thesis. This dissertation would not possible without the guidance and the help of several individuals who in one way or another contributed and extended their valuable assistance in the preparation and completion of this study.

First and foremost, my utmost gratitude to my supervisor Prof Dr. Mohd Salleh Kamarudin, whose sincerity and encouragement I never forget. His invaluable help of constructive comments and suggestions throughout the experimental and thesis work have contributed to the success of this research. All the knowledge and spirit in doing the academic research would guide me to be a successful researcher in the future.

I also would like to express my appreciation to my co-supervisor, Prof Datuk Dr. Ar. Elias@Ilias Salleh for his supervision and knowledge about this topic. My special gratitude to Assoc. Prof. Dr. Sabarinah Sh. Ahmad for her precious support and assistance especially for the technical terms related to this study and the contribution on the thesis preparation and writing.

My appreciation is also goes to Mr. Ridzuan Mat Husein, the owner of Kg. Kepayang Prawn Hatchery and his staff for the access and cooperation during the data collection process.

Sincere thanks to my group members, Emy Yusliza and Mr. Remly for the cooperation and the support during my study. My special acknowledgement also goes to Noor Intan Suryani Ngatiman and Sis. Izzah for their help and contribution on the completion of this thesis. To all Aquaculture Department's staff, my highly appreciation for your assistances and cooperation during my candidature as a master student.

Last but not least, I would like to express my utmost appreciation to my beloved parents, Hj. Kamarudin Abdul Aziz and Umi Kalsom Ja'afar and my family for the precious support and encouragement during my study. Also not forgotten, to my friends for the continuous support till to the successful finished of my study. To those who indirectly contributed in this research, your kindness means a lot to me. Thank you very much.

Ahmad Kamil Kamarudin, 2012.

I certify that a Thesis Examination Committee has met on 20 December 2012 to conduct the final examination of Ahmad Kamil bin Kamarudin on his thesis entitled “Thermal Conditions of a Medium-Scale Tropical Enclosed Hatchery for Giant Freshwater Prawn, *Macrobrachium rosenbergii* De Man” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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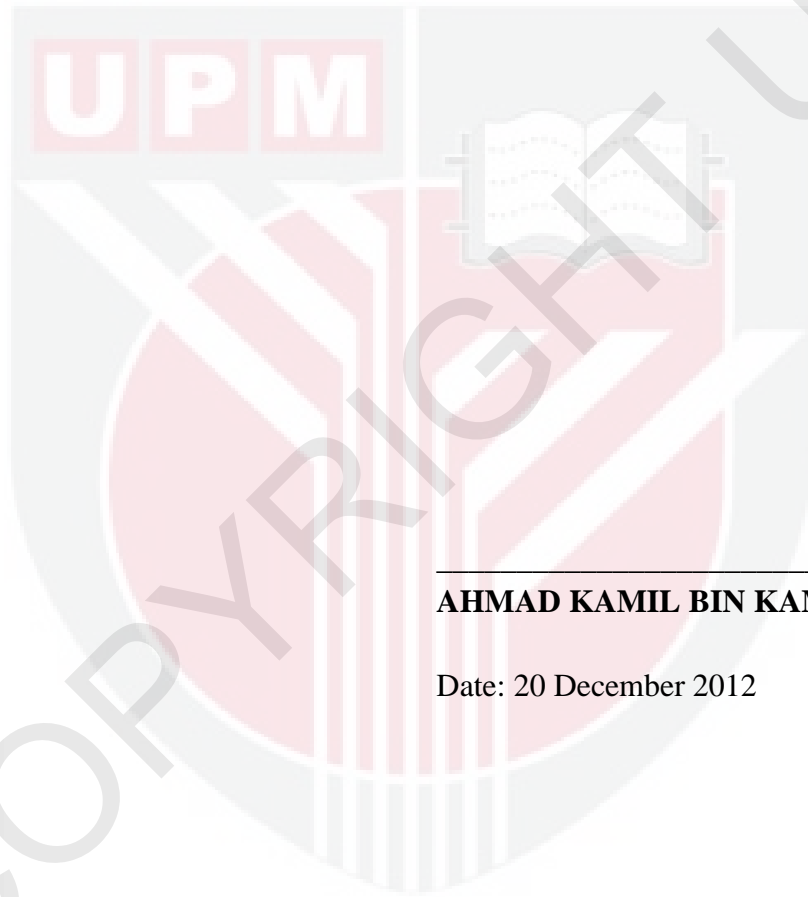
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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



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Date: 20 December 2012

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