

**LIPOFUSCIN LEVELS IN THE EYESTALKS FOR AGE ESTIMATION OF  
BLUE SWIMMING CRAB, *Portunus pelagicus* FROM SETIU WETLANDS,  
TERENGGANU, MALAYSIA**

**HILMI BIN MAT GHANI**

**Thesis Submitted in Fulfilment of the Requirements for the Degree of Doctor of  
Philosophy in the Institute of Tropical Aquaculture  
Universiti Malaysia Terengganu**

**2018**

## DEDICATION

*Dedicated this thesis to:*

*My father, Mat Ghani bin Ab Rahman*

*My beloved mother, Ruhani bt harun*

*My passionate wife, Nurul Ain binti Mohd Aris and childrens and lastly,*

*My supervisors, Professor Dr. Mhd Ikhwanuddin Bin Abdullah, and*

*Professor Emeritus Dr Mohd Azmi bin Ambak,*

*For all their inspiration, sacrifice, endless love and guidance.*

**ABSTRACT**

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfilment of the requirements for the degree of Doctor of Philosophy

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**Co-Supervisor** : **Professor Emeritus Mohd Azmi bin Ambak, Ph.D**

**Institute** : **Institute of Tropical Aquaculture**

Population studies on blue swimming crab, *Portunus pelagicus* are needed to provide exploitation rate and, other biological and fisheries information. Lipofuscin (LF) levels in eyestalks of *P. pelagicus*, were examined for age related assessment. Lipofuscin index (LI) on 10 pairs of right and left eyestalk (20 samples) from samples of 80mm carapace width (CW) yielded paired-sample student-t test analysis showing LI significantly higher ( $n = 10$ ,  $p < 0.001$ ) in the upper part of male and female eyestalks (39.49 for males & 38.22  $\mu\text{g}/\text{mg}(\text{protein})$  for females) as compared to lower part of male and female eyestalks (19.3 for males & 19.91  $\mu\text{g}/\text{mg}(\text{protein})$  for females). Comparison between right and left eyestalks for males and females showed significant difference at  $p = 0.05$ . Effects of preservation were measured on 20 wild samples, 7 to 8 cm CW. Ten samples were analyzed for LF concentration immediately after collection and another 10 after freezing at  $-80^{\circ}\text{C}$  for two weeks with LI significantly higher for both males and females in the frozen samples ( $p < 0.05$ ). The effect of salinity was measured

in seven treatments at different salinities (10ppt, 15ppt, 20ppt, 25ppt, 30ppt, 35ppt, and 40ppt). 25ppt is the salinity optimum for LF accumulation in both males (58.99  $\mu\text{g}/\text{mg}$  (protein)) and females (57.69  $\mu\text{g}/\text{mg}$  (protein)). LI-Age relationship was determined on samples cultured at a hatchery, with LF extracted monthly for a year period. Correlation analysis between males and females for LI-Age showed no significant difference at  $p = 0.05$  and a positive linear relationship of LI and age for both males and females with the regression line  $\text{LI} = 3.5908(t) - 2.4058$ ;  $R^2=0.8071$ . LI-CW showed no significant difference between males and females at  $p = 0.05$ . The mathematical description of *P. pelagicus* growth using the von Bertalanffy growth function (VBGF) demonstrated a relationship  $L_t = 11.6802 (1 - e^{-0.1343(t - -1.7626)})$ . Growth parameter estimation using the Chapman method was  $L_\infty = 11.6808$  cm;  $K = 0.1343 \text{year}^{-1}$  and  $t_0 = -1.7626$ . This study has provided a guideline for the most suitable site on the eyestalk for extraction, the optimum salinity for LF accumulation, the relationship of LI and age, the relationship of CW and LI, and the growth parameter and age structure of the *P. pelagicus* population.

## ABSTRAK

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk Doktor Falsafah

### **TAHAP LIPOFUSCIN DALAM TANGKAI MATA UNTUK MENENTUKAN UMUR KETAM RENANG BIRU, *Portunus pelagicus* DARI TANAH BENCAH SETIU, TERENGGANU, MALAYSIA**

**HILMI BIN MAT GHANI**

**2018**

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Kajian dinamik populasi *P. pelagicus* di Setiu Wetlands, Terengganu diperlukan untuk menyediakan kadar eksploitasi dan, maklumat biologi dan perikanan. Tahap Lipofuscin (LF) dalam tangkai mata ketam renang biru, *Portunus pelagicus*, dikaji untuk penilaian berkaitan umur. Indeks Lipofuscin (LI) pada 10 pasang tangkai mata (20 sampel) daripada sampel lebar cangkerang 80mm (CW) menghasilkan analisis ujian pasangan-t sampel yang menunjukkan LI jauh lebih tinggi di bahagian atas tangkai mata jantan dan betina ( $n = 10$ ,  $p < 0.001$ ). Perbandingan antara tangkai mata kanan dan kiri untuk jantan dan betina menunjukkan perbezaan yang signifikan pada  $p = 0.05$ . Kesan pembekuan telah diukur pada 20 sampel liar, 7 hingga 8 cm CW. 10 sampel dianalisis untuk kepekatan LF segera selepas penyampelan dan 10 lagi selepas pembekuan pada  $-80^{\circ}\text{C}$  selama dua minggu dengan LI jauh lebih tinggi untuk kedua-dua jantan dan betina dalam sampel beku ( $p < 0.05$ ). Kesan kemasinan diukur dalam tujuh rawatan pada kadar yang berbeza (10ppt, 15ppt, 20ppt, 25ppt, 30ppt, 35ppt, dan 40ppt). Ujian anova satu arah menunjukkan perbezaan yang signifikan LI dalam kemasinan

yang berbeza untuk jantan dan betina *P. pelagicus* ( $p < 0.001$ ). Hubungan LI-Umur ditentukan pada sampel yang dibela pada pusat penetasan, dengan LF diekstrak secara bulanan untuk tempoh 1 tahun. Analisis korelasi antara jantan dan betina untuk LI-Umur menunjukkan tiada perbezaan yang ketara pada  $p = 0.05$  dan hubungan linear positif LI dan umur bagi kedua-dua jantan dan betina dengan garis regresi  $LI = 3.5908(t) - 2.4058$ ;  $R^2 = 0.8071$ . LI-CW tidak menunjukkan perbezaan yang signifikan antara jantan dan betina pada  $p = 0.05$ . Deskripsi matematik pertumbuhan *P. pelagicus* menggunakan fungsi pertumbuhan von Bertalanffy (VBGF) menunjukkan hubungan  $L_t = 11.6802 (1 - e^{-0.1343(t - -1.7626)})$ . Anggaran parameter pertumbuhan menggunakan kaedah Chapman adalah  $L_\infty = 11.6808$  cm;  $K = 0.1343 \text{ year}^{-1}$  dan  $t_0 = -1.7626$ . Tesis ini telah memberi garis panduan untuk lokasi yang paling sesuai di tangkai mata ketam untuk pengekstrakan, kemasinan optimum untuk pertumbuhan, hubungan LI dan umur, hubungan CW dan LI, dan parameter pertumbuhan dan struktur umur populasi *P. pelagicus* di kawasan tanah bench Setiu.