

**POPULATION BIOLOGY OF RED CLAW
CRAYFISH *CHERAX QUADRICARINATUS* (VON
MARTENS, 1868)(DECAPODA:PARASTACIDAE)
IN SUNGAI MACAP, JOHOR, MALAYSIA.**

ABDUL WAHAB BIN ABDULLAH

**Thesis is Submitted in Fulfilment of the
Requirement for the
Degree of Master of Science in the
School of Fisheries and Aquaculture Sciences
Universiti Malaysia Terengganu**

Oct 2012

This thesis is exclusively dedicated to my beloved family; my wife and my three children.

Abstract of this thesis is presented to the Senate of Universiti Malaysia Terengganu in fulfilment of the requirement for the degree of Master of Science.

**POPULATION BIOLOGY OF RED CLAW CRAYFISH
CHERAX QUADRICARINATUS (VON MARTENS, 1868)
(DECAPODA:PARASTACIDAE) IN SUNGAI MACAP, JOHOR, MALAYSIA**

ABDUL WAHAB BIN ABDULLAH

OCTOBER 2012

Main supervisor : Profesor Mohd Azmi Ambak, Ph.D
Co-supervisor : Shahreza Md Sheriff, Ph.D
School : Fisheries and Aquaculture Sciences

Red claw crayfish *Cherax quadricarinatus* (von Martens, 1868) originated from Northern Australia and Papua New Guinea and was brought in Malaysia for the aquarium industry in the 1990s. The objectives of this study are to determine the distribution and density of *C. quadricarinatus* at certain parts of Sungai Macap, to determine the morphological variations between male and female, and to examine the genetic variations between the population in Sungai Macap to other populations of *C. quadricarinatus* at selected hatcheries and pet shops. The field investigation to determine the distribution, density and morphological variations was carried out for 6 months from January to June 2011 and 3 sampling stations were chosen. For genetic variation study, besides the samples from Sungai Macap, other samples were taken from 2 hatcheries in Subang (Selangor) and Pantai Sepat (Kuantan) and also from a pet shop in Kuala Terengganu (Terengganu). This study indicates that this species is abundant near the outlet of Macap dam to Sungai Macap. The results also

showed that in terms of morphology and genetic makeup, the species of concern is *C. quadricarinatus* and this red claw crayfish population is probably sustainable at the study sites as all sizes and sex of this crayfish were collected. The total catch at the study sites was 280 crayfish individuals and the sex ratio was found to be 1.6:1(male to female). The baited trap was found to be significantly better to trap crayfish compared to non-baited ($F = 1.43$ and $p > 0.05$). The population density of red claw crayfish at Station 1 was the highest in a range from 0.18 to 1.01 individuals/m², followed by Station 2 and 3 which range from 0.09 to 0.5 individual/m² and from 0.07 to 0.37 individuals/m² respectively. Station 1 also has the highest estimate of crayfish population with maximum number of 1,053 individuals with 95% confident level. Station 1 also has the highest proportion of species caught in the crayfish trap with 9 species. Out of 280 crayfish caught, only 221 (78.9%) crayfish has normal chelipeds and were measured for morphometric comparison. Statistical analysis conducted on the characteristics measurement variables found that 9 out of 13 morphometric variables showed significant differences between male and female crayfish at $\alpha=0.05$ level. Hence the study found that at 95% confidence level, there are significant morphometric differences between male and female red claw crayfish at Sungai Macap. PCA analysis has further confirmed the differences, which are more to body size variation than shape variations. This study has also discovered that female red claw crayfish showed isometric growth and the male showed positive allometric growth in the study area, which concurred with many other studies on *C. quadricarinatus*. This study managed to extract partial mitochondrial DNA of 16S rRNA and COI gene in red claw crayfish and the size is approximately 483bp and 568bp respectively. The neutrality tests indicated

that both the 16S rRNA and COI sequences data were evolving according to neutral expectations. Both mtDNA genes produced low number of haplotype (4 haplotypes) and uncorrected pairwise sequence mean divergence of between 0.2-0.5%. This showed that the red claw crayfish within the study sites in Malaysia have a close relationship and basically there are no genetic variations among them. The NJ, ML and MP phylogenetic topology trees of both genes showed a distinct monophyly clade of the red claw crayfish *C. quadricarinatus* haplotypes which might also show less and/or no geographical associations between the red claw crayfish species-groups in Peninsular Malaysia. Thus, an assumption can be made that the Sungai Macap population, a recent introduction which was probably an accidental release from a nearby hatchery and all groups of red claw crayfish was probably distributed from a single source of distributor.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Sarjana Sains.

**POPULASI BIOLOGI UDANG KARA AIR TAWAR SEPIT MERAH
CHERAX QUADRICARINATUS (VON MARTENS,
1868)(DECAPODA:PARASTACIDAE) DI SUNGAI MACAP, JOHOR,
MALAYSIA**

ABDUL WAHAB BIN ABDULLAH

OKTOBER 2012

Penyelia utama : Profesor Mohd Azmi Ambak, Ph.D
Ahli : Shahreza Md Sheriff, Ph.D
Pusat Pengajian : Sains Perikanan dan Akuakultur

Udang kara sepit merah, *Cherax quadricarinatus* (von Martens, 1868) berasal dari kawasan utara Australia dan Papua New Guinea. Spesies ini telah dibawa masuk ke Malaysia untuk industri akuarium pada 1990an. Objektif kajian ini adalah untuk menentukan taburan dan densiti *C. quadricarinatus* di beberapa tempat tertentu Sungai Macap, variasi morfologi antara udang jantan dan betina dan untuk menentukan variasi genetik antara populasi Sungai Macap dengan populasi lain diambil dari hatceri dan kedai akuarium. Kajian lapangan untuk penentuan taburan, densiti dan morfologi telah dijalankan selama 6 bulan dari Januari hingga Jun 2011 dan 3 stesen sampling telah dipilih. Untuk kajian variasi genetik, selain sampel Sungai Macap, sampel di ambil dari 2 hatceri di Subang (Selangor) dan Pantai Sepat (Kuantan) dan juga dari sebuah kedai akuarium di Kuala Terengganu (Terengganu). Kajian ini telah mendapati bahawa spesis ini terdapat dengan banyak berhampiran laluan keluar

empangan Macap ke dalam Sungai Macap. Kajian ini juga mengesahkan spesies ini adalah *Cherax quadricarinatus* secara pengenalan morfologi dan pengesahan genetik dan mengesahkan populasi udang ini berkemungkinan mapan di kawasan kajian kerana semua saiz dan kedua jantina telah disampel di dalam kajian ini. Jumlah keseluruhan tangkapan di tapak kajian adalah 280 ekor udang dan nisbah jantina adalah 1.6:1 (Jantan:Betina). Perangkap udang yang mempunyai umpan didapati lebih signifikan di dalam keberkesanan menangkap udang kara sepit merah ini berbanding perangkap tanpa umpan ($F=1.43$ dan $p>0.05$). Densiti populasi udang ini di stesen 1 adalah yang tertinggi iaitu 0.18 to 1.01 individu/m², diikuti dengan stesen 2 dan 3 iaitu 0.09 hingga 0.5 individu/m² dan 0.07 to 0.37 individu/m². Stesen 1 juga mempunyai anggaran populasi tertinggi iaitu maksimum pada 1053 ekor udang dengan aras keyakinan 95%. Stesen 1 juga mempunyai nisbah tangkapan mengikut spesies tertinggi iaitu 9 spesies. Daripada 280 ekor udang yang ditangkap, hanya 221 ekor (78.9%) mempunyai sepit lengkap dan diukur perbandingan morfometrik. Ujian statistik yang dijalankan ke atas pembolehubah pengukuran udang dan mendapati 9 daripada 13 pembolehubah menunjukkan perbezaan yang signifikan antara jantan dan betina udang pada $\alpha=0.05$. Oleh yang demikian, kajian ini mendapati terdapatnya perbezaan signifikan antara jantan dan betina udang kara sepit merah di Sungai Macap pada aras keyakinan 95%. Analisis PCA mengesahkan lagi perbezaan tersebut di mana didapati perbezaan lebih kepada saiz berbanding bentuk badan. Kajian ini juga mendapati udang sepit merah betina ini mengalami tumbesaran isometrik manakala udang jantan menunjukkan positif alometrik dan keputusan ini adalah menyamai kajian udang air tawar yang lain. Kajian ini berjaya mengekstrak sebahagian gen 16S dan

COI dari DNA mitokondria udang kara sepit merah ini dan saiz gen 16S adalah 483bp dan gen COI adalah 568bp. Ujian neutraliti menunjukkan kedua-dua gen 16S rRNA dan COI berevolusi mengikut andaian keadaan neutral. Kedua-dua gen mtDNA ini menghasilkan hanya jumlah haplotaip yang rendah (4 haplotaip) dan min jarak perbandingan "pairwise" sekuen adalah di antara 0.2-0.5%. Ini menunjukkan udang kara sepit merah ini mempunyai perkaitan genetik yang rapat antara satu sama lain dan pada dasarnya tiada variasi genetik antara mereka. Topologi pokok filogeni untuk NJ, ML dan MP menunjukkan klad monofili yang jelas dan mungkin menunjukkan kurang/tiada perkaitan geografi antara kumpulan spesies udang kara sepit merah ini yang terdapat di Semenanjung Malaysia. Oleh yang demikian andaian boleh dibuat bahawa populasi udang kara sepit merah Sungai Macap mungkin terlepas dari hatceri berdekatan dan kesemua kumpulan udang kara ini datang dari sumber pengedar yang sama.