

**ANNUAL REPRODUCTIVE CYCLE
OF MUD CRAB GENUS *Scylla*
IN MARUDU BAY, SABAH**



NOOR AMALIA BINTI SHAIFUL KAHAR

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**BORNEO MARINE RESEARCH INSTITUTE
UNIVERSITI MALAYSIA SABAH**

2016

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OF MUD CRAB GENUS *Scylla*
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NOOR AMALIA BINTI SHAIFUL KAHAR



**THIS IS SUBMITTED IN FULFILMENT FOR THE
DEGREE OF MASTER OF SCIENCE**

**BORNEO MARINE RESEARCH INSTITUTE
UNIVERSITI MALAYSIA SABAH**

2016

UNIVERSITI MALAYSIA SABAH

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JUDUL: ANNUAL REPRODUCTIVE CYCLE OF MUD CRAB GENUS *Scylla* IN MARUDU BAY, SABAH

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Tarikh: 30 September 2016

(Dr. Annita Yong Seok Kian)

DECLARATION

I hereby declare that material in this thesis is my own except for quotations, citation, equations, summaries and references, which have been duly acknowledged.

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DEGREE : **MASTER OF SCIENCE (FISHERIES SCIENCE)**
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ABSTRACT

The knowledge on reproductive biology of wild mud crabs is crucial to understand the reproductive potential in the fisheries and aquaculture industries. The study was conducted to investigate the reproductive biology on sex ratio, maturation stages, breeding season and size at maturity of wild mud crabs *Scylla* spp. from Marudu Bay, Sabah. Monthly sampling were conducted at Marudu Bay mangrove from October 2012 to September 2013. Mud crabs obtained were transported back to laboratory for further analysis. The crabs were separated into sexes based on the abdominal flap shape and sex ratio was calculated. Morphological and histological observation of the gonad were done to determine the maturation stages and the gonadosomatic index (GSI) and the oocytes size. Size at maturity when 50% of the crabs was sexually mature (SM₅₀) were also estimated. A total of 1874 crabs were caught comprises of three species of mud crabs; *Scylla tranquebarica*, *S. paramamosain* and *S. olivacea*. On average, relatively more male crabs caught compared to female crabs; with ratio 2.05:1, 1.17:1 and 2.51:1 for *S. tranquebarica*, *S. paramamosain* and *S. olivacea* respectively. The oocyte size and GSI for *S. tranquebarica*, *S. paramamosain* and *S. olivacea* were almost at similar ranged from 0.64 to 10.70%, 29.19 to 201.33 μ m. Crabs were classified into immature and mature stages based on gonadal maturation. Five stages in female; stage I and II as immature and stage III to V as mature crabs. While three stages in males; stage I and II as immature and stage III as mature crabs. There also sub-adult crabs found without gonadal development. Based on this maturation classification, all stages of crabs can be found. On monthly basis, it was found that in *S. tranquebarica* an average of 39.9% and 25.6% for female and male crabs recorded as young crabs. While mature *S. tranquebarica* crabs were found at average of 28.7% and 35.0% for female and male. Both female and male *S. tranquebarica* can be found throughout the year. Percentage of mature female crabs were high in February and May, then followed by sudden decrease in March and June. The same trend was observed in male crabs. This suggest that *S. tranquebarica* in this area is continuous breeders with possible two breeding seasons. For *S. paramamosain*, majority of 61.4% and 81.7% female and male caught were young crabs. While only 5.7% and 5.1% was classified as mature female and male crabs. Different from *S. tranquebarica*, opposite pattern was observed as female crabs were found in certain months and mature male crabs can be found year round. Overall, present study suggest that the sampling area is the suitable area for sub-adult of *S. paramamosain* to reside while it can also be considered as maturation ground for *S. tranquebarica*. While for *S. olivacea*, the reproductive pattern for both female and male crabs was not clearly observed as a consequences of parasite infection that lead to insufficient number of healthy crabs (only 19 crabs for female and 61 crabs for male). Based on all crabs caught, the estimated size at maturity when 50% of the crabs was sexually mature (SM₅₀) were estimated at 94.0 mm CW for female and 99.5 mm CW for male *S. tranquebarica*, 98.9 mm CW for female and 98.4 mm CW for male *S. paramamosain* and 90.0 mm CW for female and 108.0 mm CW for male *S. olivacea*. In this present study, based on the estimated SM₅₀, 100 mm CW for female and 110 mm CW for male are suggested to be the minimum legal size landing. Information obtained in this study is important in fisheries management of mud crabs in Sabah.

ABSTRAK

KITARAN REPRODUKTIF KETAM BAKAU GENUS *Scylla* DI TELUK MARUDU, SABAH

Pengetahuan biologi pembiakan ketam bakau liar adalah penting untuk memahami potensi pembiakan dalam industri perikanan dan akuakultur. Kajian dijalankan untuk mengkaji biologi pembiakan pada nisbah jantina, peringkat kematangan, musim pembiakan dan saiz pada tempoh matang ketam bakau liar *Scylla* spp. di Teluk Marudu, Sabah. Kajian bulanan telah dijalankan dari Oktober 2012 hingga September 2013. Ketam bakau yang diperolehi dibawa ke makmal untuk dianalisis. Ketam dibahagikan mengikut jantina berdasarkan bentuk abdomen dan nisbah jantina telah dikira. Pemerhatian morfologi dan histologi gonad dilakukan untuk menentukan peringkat kematangan, indeks gonadosomatik (GSI) serta saiz oosit direkodkan. Saiz matang ketam apabila 50% daripada ketam matang juga telah dianggarkan. Sebanyak 1874 ketam ditangkap dan terdiri daripada tiga spesies ketam bakau; *Scylla tranquebarica*, *S. paramamosain* dan *S. olivacea*. Puratanya, lebih banyak ketam jantan ditangkap berbanding betina; nisbah 2.05:1, 1.17:1 dan 2.51:1 untuk *S. tranquebarica*, *S. paramamosain* dan *S. olivacea*. Saiz oosit dan GSI untuk *S. tranquebarica* dan *S. paramamosain* hampir sama iaitu dari 0.64 ke 10.70%, 29.19 ke 201.33 μ m. Dalam kajian ini, ketam bakau dikelaskan kepada peringkat tidak matang dan matang berdasarkan tahap kematangan gonad. Lima peringkat dalam ketam betina; I dan II sebagai tidak matang dan III-V adalah matang. Tiga peringkat dikelaskan pada ketam jantan; I dan II sebagai tidak matang dan III sebagai matang. Terdapat juga ketam sub-dewasa tanpa perkembangan gonad direkodkan. Berdasarkan klasifikasi ini, semua peringkat *S. tranquebarica* boleh didapati sepanjang tahun. Setiap bulan didapati secara purata 39.9% dan 25.6% ketam betina dan jantan direkodkan sebagai ketam tidak matang. Manakala bagi *S. tranquebarica* matang, purata sebanyak 28.7% dan 35.0% telah direkodkan untuk ketam betina dan jantan. Peratusan betina matang didapati tinggi pada bulan Februari dan Mei, diikuti dengan penurunan secara mendadak pada bulan Mac dan Jun. Trend yang sama diperhatikan dalam ketam jantan. Berdasarkan penemuan ini, dicadangkan *S. tranquebarica* adalah pembiak berterusan dengan dua musim pembiakan. Untuk ketam *S. paramamosain*, majoriti 61.4% dan 81.7% ketam betina dan jantan yang ditangkap merupakan tidak matang. Manakala hanya 5.7% dan 5.1% ketam betina dan jantan dikelaskan sebagai matang. Berbeza daripada *S. tranquebarica*, corak bertentangan diperhatikan dimana ketam betina hanya boleh dijumpai di dalam bulan-bulan tertentu dan ketam jantan matang boleh didapati sepanjang tahun. Kajian ini mencadangkan bahawa kawasan kajian adalah kawasan yang sesuai untuk ketam sub-dewasa *S. paramamosain* untuk tinggal dan ia juga boleh dianggap sebagai kawasan yang sesuai untuk kematangan *S. tranquebarica*. Bagi *S. olivacea*, corak pembiakan untuk kedua-dua ketam jantan dan betina tidak dapat jelas diperhatikan akibat jangkitan parasit yang membawa kepada jumlah yang tidak cukup (hanya 19 ketam untuk betina dan 61 ketam bagi jantan). Bagi *S. tranquebarica*, SMY-50 dianggarkan pada 94.0 mm CW untuk betina dan 99.5 mm CW bagi jantan, bagi *S. paramamosain*, 98.9 mm CW untuk betina dan 98.4 mm CW bagi jantan manakala bagi *S. olivacea* 90.0 mm CW untuk betina dan 108.0 mm CW for jantan. Berdasarkan SMY-50, 100 mm CW untuk betina dan 110 mm CW bagi jantan dicadangkan untuk menjadi saiz minimum pendaratan. Maklumat yang diperolehi dalam kajian ini adalah penting dalam pengurusan perikanan ketam bakau di Sabah.

ACKNOWLEDGEMENT

BISMILLAH AR-RAHMAN AR-RAHIM

Alhamdulillah, first and foremost, I am very grateful and all praises to Allah S.W.T., the Most Gracious and Most Merciful for His blessings and guidance throughout my life and for granting me knowledge to accomplish this research successfully.

I would like to acknowledge and express my sincere appreciation to my supervisors, Dr. Annita Yong Seok Kian and Mr Muhammad Ali Syed Hussein for their guidance, advice, continuous encouragement and support throughout the study. Their invaluable input such constructive comments and suggestions have contributed to the success of this research. It is my pleasure to acknowledge Prof. Dr. Rossita Shapawi as the Director of Borneo Marine Research Institute and Prof. Datin Dr. Mariam Abd. Latip, Dean of Centre for Postgraduate Studies for providing technical assistant during the study.

My sincere thanks to my sampling partner, Nurul Ain Mohd Sharif who helped me a lot during the sampling, analysing data and to all my wonderful friends, Kak Rina, Syafiqah, Fiza, Kak Husna, Wahidah, Kak Yana, kak Asra, Kang, Samsul, Masran, Ayau, Christine, Kak Ani, Thien, Kenshin, Kak Asmahani, Bell, Kak Zue, Dr. Amran Harun and Najamuddin Abdul Basri for their helps, moral support and friendships. Apart from that, special thanks to all academic and non-academic staffs of Borneo Marine Research Institute, Mr Mohd Asri, Ms Lydia, Ms Lusia, Mr Junaidi, Mr Yusdi, Mr Mail, Mr Paulinus and last but not least local fisherman, Mdm Mary Ranchangan and family for assisting in the 12 months sampling period.

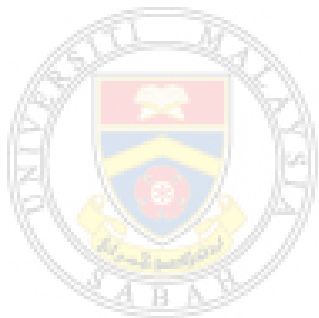
My deepest appreciation goes to my beloved mother, Norazlin Hanif, my father, Shaiful Kahar Ahmad and family for their endless love, encouragement, understanding, advice and continual moral supports which kept me motivated to finish up my master project.

The financial supports given by the Ministry of Science, Technology and Innovation (MOSTI), MyBrain Scholarship and 'Skim Elaun Khas Pembantu Pengajar' Universiti Malaysia Sabah are gratefully acknowledged.

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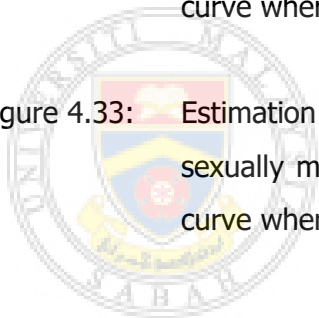
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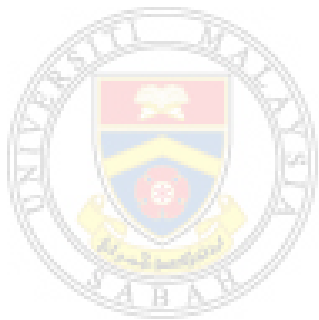
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LIST OF ABBREVIATIONS

BW	-	Body weight
CW	-	Carapace width
FAO	-	Food and Agriculture Organization of the United Nations
GSI	-	Gonadosomatic Index
PPT	-	Part per thousand
SPSS	-	Statistical Package for Social Sciences



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% - Percentage

°C - Degree Celcius

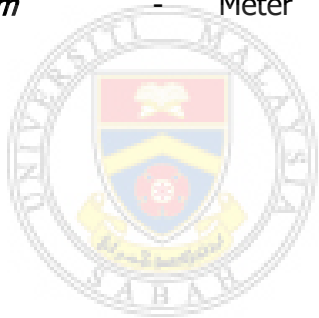
et al., - And others

g - Gram

kg - Kilogram

km - Kilometre

m - Meter



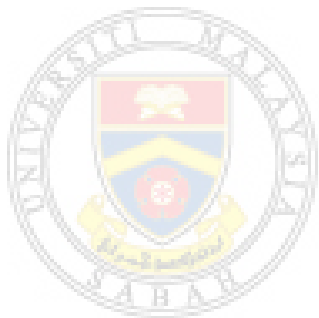
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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Mud crabs or known as mangrove crabs are belong to the genus *Scylla*. These crabs can be found in the mudflats of the littoral zones, supralittoral zones until the intertidal zones of mangrove forests throughout the Indo-Pacific region (Keenan *et al.*, 1998). Mud crabs are among the fauna that utilize mangrove areas as their habitat and feeding areas (Hill, 1975). There are four species of mud crabs; *Scylla serrata*, *S. tranquebarica*, *S. olivacea* and *S. paramamosain* and among these crabs the most common mud crabs *S. serrata* tends to be found throughout the Indo-Pacific region (Keenan *et al.*, 1998). While other species can be found throughout the South East Asia (Macintosh *et al.*, 2002). *S. tranquebarica* is often found in the South China Sea and generally associated with *S. olivacea* (Keenan *et al.*, 1998). *S. paramamosain* often discovered at the continental coast of the South China Sea towards the South of the Java Sea (Ikhwanuddin *et al.*, 2010; Ng, 1998).

Mud crabs are large edible (Overton and Macintosh, 2002) and commercially important crustaceans. They have been traditionally exploited for personal consumption (Ikhwanuddin *et al.*, 2011) and as one of the income sources for the coastal fishing communities (Overton and Macintosh, 2002). As the value and demand increase, mud crabs become one of the commercial fisheries products. In Bangladesh huge profit gained owing to the high numbers of exportation of the live mud crabs overseas such as Hong Kong, Singapore, Taiwan and also Japan (Chandra *et al.*, 2012; Mia *et al.*, 2006). Apart from that, the average annual landing of mud crabs in the Indo Pacific zones was >24,000 tones (Anon, 2005). In Kenya, the total crab landing throughout the year from 1984 to 1997 is ranged from 50 to 130 tonnes annually (Fondo *et al.*, 2010) and in Ranong Province in Thailand,