



**UNIVERSITI PUTRA MALAYSIA**

***SPAWNING SEASON AND FOOD HABITS OF *Metapenaeus ensis*  
IN THE MARUDU BAY, SABAH***

**IZZATI BINTI JAMAL**

**FP 2013 89**

**SPAWNING SEASON AND FOOD HABITS OF *Metapenaeus ensis* IN THE  
MARUDU BAY, SABAH**

**IZZATI BINTI JAMAL**

**DEPARTMENT OF AQUACULTURE**

**FACULTY OF AGRICULTURE**

**UNIVERSITI PUTRA MALAYSIA**

**SERDANG, SELANGOR**

**2013**

**SPAWNING SEASON AND FOOD HABITS OF *Metapenaeus ensis* IN THE  
MARUDU BAY, SABAH**

**IZZATI BINTI JAMAL**

**158751**

**This project report is submitted in partial fulfillment of the requirements for the  
Degree of Bachelor of Agriculture (Aquaculture)**

**DEPARTMENT OF AQUACULTURE**

**FACULTY OF AGRICULTURE**

**UNIVERSITI PUTRA MALAYSIA**

**SERDANG, SELANGOR**

**2013**

**CERTIFICATION OF APPROVAL**  
**DEPARTMENT OF AQUACULTURE**  
**FACULTY OF AGRICULTURE**  
**UNIVERSITI PUTRA MALAYSIA**

Name of student : Izzati binti Jamal  
Matric number : 158751  
Programme : Bachelor of Agriculture (Aquaculture)  
Year : 2013  
Name of supervisor : Dr.S.M Nurul Amin  
Title of project : Spawning season and food habit of *Metapenaeus*  
*ensis* in the Marudu Bay Sabah

This is to certify that I have examined the final project report and all corrections have been made as recommended by the panel of examiners. This report complies with the recommended format stipulated in the AKU4999 project guidelines, Department of Aquaculture, Faculty of Agriculture, Universiti Putra Malaysia.

Signature and official stamp of supervisor and co - supervisor

\_\_\_\_\_  
Dr. S.M Nurul Amin  
Supervisor  
Date:

\_\_\_\_\_  
Prof Dr. Aziz b. Arshad  
Co - supervisor  
Date:

## ACKNOWLEDGEMENT

Thank you to the Almighty Allah (S.W.T) for giving me the strength and patience to complete my final year research project. It was a greatness time and memorable journey throughout my academic study. Even though sometimes I felt hard to face it. I am grateful and would like to express my heartfelt gratitude to my supervisor Dr. S. M. Nurul Amin for his countless hours of reviewing experimental protocols, helping to develop my scientific methodology, guidance and valuable advice throughout the course of my study. This research would not be possible without the support of my supervisor.

I am also thankful to Dr. Roushan Ara and my senior master student, Mohammad Azim, who helped me while executing my research. They kept an eye in the progress of my work and always were available when I needed their advice. Besides that, I would to thanks some lab assistance for their helps during my lab works. Furthermore, I extend my appreciation to my final year project coordinator Prof Assc. Dr. Yuzine Esa for his supervision and coaching in writing up my thesis. I would also like to express thankful to my friends Yumnihadi Yusoff, M. Afiq, Najihah, Hapizah and Hazwanni for their countless hours of helping my laboratory works.

Last but certainly not least, I would like to thank my family, especially I am indebted to my dear mother Puan Juliah binti Ishak for their love encouragement and support.

I dedicated my work to them.

## ABSTRACT

Study on the spawning period of penaeid prawns, *M. ensis* was conducted from December 2012 to September 2013. The objectives of the study are estimate the spawning period, food habit of *M.ensis*. To clarify the food habits of *Metapenaeus ensis*, the gut content of *M.ensis* samples was collected in the Marudu Bay Sabah, examined the stomach content of 200 specimens collected monthly using gill nets and three layer nets. Each *M.ensis* sample was dissected to collect the male, female gonad and stomach. The spawning period of *M.ensis* was estimate started in February to April and July to August with higher GSI value in September (3.56%) and lowest spawning season in May (0.02%). The higher relative condition factor ( $K_n$ ) recorded in June (3.23%), estimated the maturation of the gonad of *M.ensis*. Analysis based on dietary overlaps showed that the *M.ensis* prawn assemblage comprised 9 food guilds (polychaetes (33 %), sand and mud (16 %), phytoplankton (11.9 %), appendages of crustacean (11 %), plant matter (8.62 %), debris (8%), animal derivative (5%) zooplankton (1.4 %), and unidentified food item (0.43 %). Polychaete is the most dominant food item ingested. On the basis of food composition found in the stomach, it can be conclude that *M.ensis* is omnivorous.

## ABSTRAK

Kajian ke atas musim pembiakan oleh udang penaied, *M.ensis* telah dijalankan dari Disember 2012 hingga September 2013. Objektif kajian adalah untuk menentukan musim pembiakan, tabiat pemakanan *M.ensis*. Untuk menjelaskan tabiat makanan *M.ensis*, sampel *M.ensis* dikumpulkan daripada Teluk Marudu, Sabah telah diperiksa kandungan perut, sejumlah 200 spesimen dikumpulkan setiap bulan menggunakan jaring insang dan tiga jaring lapisan. Setiap sampel *M.ensis* telah dikumpul dibedah untuk mengambil gonad jantan, betina dan perut. Tempoh mengawan daripada *M.ensis* dianggarkan bermula pada bulan February ke April dan Julai ke Ogos dengan nilai yang lebih tinggi GSI pada bulan September (3.56%) dan musim mengawan paling rendah pada bulan Mei 0.02%. Faktor keadaan relatif ( $K_n$ ) yang lebih tinggi mencatatkan pada Jun (3.23%), dianggarkan kematangan gonad *M.ensis*. Analisis berdasarkan pemakanan menunjukkan bahawa udang *M.ensis* dibahagikan kepada 9 kategori utama makanan terdiri daripada polychaetes (33.01%), pasir dan lumpur (16.17%), fitoplankton (11.88 %), kumpulan krustasea (11.26%, bahan tumbuhan (9.26 %), serpihan (8.09%), komponen haiwan (5.02%) zooplankton (0.84% ), dan bahan makanan yang tidak dikenali (0.43 %). Dari segi peratusan, bahan makanan yang paling utama bagi *M.ensis* adalah polychaete (33 %). Berdasarkan komposisi makanan dijumpai di dalam perut, ia boleh disimpulkan bahawa *M.ensis* adalah omnivor dalam tabiat makanannya.

## TABLE OF CONTENTS

<b>Contents</b>	<b>Page</b>
<b>ACKNOWLEDGEMENT</b>	i
<b>ABSTRACT</b>	ii
<b>ABSTRAK</b>	iii
<b>TABLE OF CONTENTS</b>	iv
<b>LIST OF TABLES</b>	vi
<b>LIST OF FIGURES</b>	vii
<b>LIST OF ABBREVIATIONS / SYMBOLS</b>	viii
<b>1.0 INTRODUCTION</b>	1
<b>2.0 LITERATURE REVIEW</b>	5
2.1 Taxonomy of <i>Metapenaeus ensis</i>	5
2.2 Morphology	7
2.3 Habitat and description	11
2.4 Characteristics of <i>Metapenaeus ensis</i>	12
2.5 Water quality	13
2.6 Reproduction	13
2.7 Food habits	16



<b>3.0 METHODOLOGY</b>	18
3.1 Study of site	18
3.2 Sampling procedure	20
3.3 Laboratory measurement	21
3.4 Gonad identification and GSI calculation	21
3.5 Stomach examination	22
3.6 Stomach content analysis	22
3.7 Statistical Analysis	23
<b>4.0 RESULTS AND DISCUSSIONS</b>	24
4.1 Overall composition of prey items	24
4.2 Percentage frequency of occurrence ( $F_{pi}$ )	32
4.3 Percentage numerical abundance ( $C_i$ )	36
4.4 Spawning season	37
4.5 Condition factor	40
4.6 Food items in the stomach contents of <i>Metapenaeus ensis</i>	41
<b>5.0 CONCLUSIONS</b>	47
<b>REFERENCES</b>	48



## LIST OF TABLES

		Page
Table 1	Food and Agriculture Organization (F.A.O) names are listed	5
Table 2	Summary type of food items in <i>M.ensis</i>	25
Table 3	Overall mean percentage of food habits of <i>M.ensis</i> in the Marudu Bay, Sabah	26
Table 4	Monthly percentage frequency of occurrence ( $F_{pi}$ ) of food items in 200 guts of <i>M.ensis</i> in the coastal waters of Kota Marudu Bay, Sabah.	28
Table 5	Monthly percentage of numerical abundance ( $C_i$ ) of food items in 200 guts of <i>M.ensis</i> in the coastal waters of Kota Marudu Bay, Sabah.	33

## LIST OF FIGURES

		Page
Figure 2.2a	Lateral view of <i>Metapenaeus ensis</i>	9
Figure 2.2b	<i>Metapenaeus ensis</i> (Penaeidae). a, lateral view; b, petasma; c, thelycum; (after Hall,1962)	10
Figure 2.2c	<i>Metapenaeus ensis</i>	11
Figure 2.6a	life stages of <i>M.ensis</i>	16
Figure 3.1a	Location of the sampling site (Marudu Bay,Sabah)	20
Figure 4.1a	Percentage of major groups of diet composition in <i>M.ensis</i>	28
Figure 4.2a	Average percentage frequency of occurrence ( $F_{pi}$ ) of food items in the stomachs of <i>M. ensis</i>	30
Figure 4.2b	Monthly percentage frequency of occurrence ( $F_{pi}$ ) of food items in the stomachs of <i>M. ensis</i>	33
Figure 4.2c	Monthly percentage numerical abundance ( $C_i$ ) of food items in the stomachs of <i>M. ensis</i>	36
Figure 4.3a	Average for overall percentage numerical abundance ( $C_i$ ) of food items in the stomachs of <i>M. ensis</i>	38
Figure 4.4a	Temporal changes in Gonado-somatic index (GSI) for <i>M. ensis</i> in Marudu Bay, Sabah.	39
Figure 4.4b	Condition factors of <i>M.ensis</i> from coastal area waters of Kota Marudu during December 2012 to September 2013	40
Figure 4.6a	Sand and mud	42
Figure 4.6b	Phytoplankton, Diatom	40
Figure 4.6c	Polychaete	41
Figure 4.6d	Appendages of crustacean;	42
Figure 4.6e	Unidentify items	43

## LIST OF ABBREVIATIONS / SYMBOLS

$F_{pi}$	Frequency of occurrence
$C_i$	Numerical abundance
%	Percentage
cm	centimeter
m	meter
GSI	Gonado-somatic Index
BW	Body weight
TL	Total length
SL	Standard length
$\Sigma$	Sum
N	North
E	East
°	Degree of magnitude
$K_n$	Condition factor

## CHAPTER 1

### INTRODUCTION

Food and Agriculture Organization (FAO's) attempts to establish clear cut distinctions for these terms where "prawns" refer to freshwater creatures, while shrimp refer to their marine and brackish water (Csavas, 1988). Common usage has often resulted in reference to large shrimp as "prawns" and to small shrimp as "shrimp" regardless of the salt content of their habitat.

The greasyback shrimp (*Metapenaeus ensis*) is a commercially important, brackish-water crustacean species (Chu et., 1995). It is a bottom-living species and can be found inshore at depths of < 3m and offshore at depths of >65m. It occurs on muddy bottoms in estuaries and coastal waters, including river, canals, and swamps (Ministry of Fisheries, 1996; Holthus, 1980), at salinities of 5 to 30 ppt (Kungvankij and Chua, 1986). There is high demand for this species in Vietnamese markets and in many countries throughout the world because of the high quality of its meat (Liao and Chao, 1983). It is believed that *M.ensis* spends most of their adult life in brackish waters and return to the sea several times during their lives to breed. But very few migrate between the extremes of sea water and fresh water. (Attygalle,1994).

According to De Haan, (1850) *Metapenaeus ensis* is commercially important in Southern China (Tseng & Cheng, 1982). This species is widely distributed in the Indo-Pacific (Macintosh, 1982) mainly south-east Africa (De Freitas, 1986 and Forbes & Benfield, 1986a), Asian countries, Thailand, Singapore, Taiwan, Java (Macintosh, 1982), in Japan (Ota, 1949 and Kubo, 1955) and in Australia (Racek, 1970). Locally, *M. ensis* is widely distributed throughout the territorial waters of Hong Kong, with the postlarval and juvenile stages occurring in the Pearl River estuary and adults in deeper waters of oceanic salinity (Cheung, 1959, 1964). *M. Ensis* is distributed over a wider region an occurs in the Indian and West Pacific Oceans, Sri Lanka, Malaysia, southest China and Japan (Holthus 1980, Grey *et al.* 1983), as well as in northen coastal waters of Australia (Somers, 1994a). “*Metapenaeus ensis*” contribute significantly to the commercial fishery of Sri Lanka (Attygalle,1994). It is also the target species of the tidal shrimp ponds at Mai Po. The biology of *M. ensis* has been studied in Japan by (Ota, 1949) under the name of *Metupenaeus monoceros* (De Haan, 1850) which, according to (Hall, 1958), is a junior synonym of *M. ensis*. *Metapenaeus ensis* is cultivated in many S.E. Asian countries using tidal trapping.

Sabah is the state of Malaysia that is mainly bordered by vast coastline and approximately 4315 km. However, no published report of *Metapenaeus ensis* species in Sabah especially along Marudu Bay coastal area before.

Marudu Bay in the state of Sabah is situated at the tip of Borneo Island, and at the southern limit of the Coral Triangle whose waters hold the highest diversity of fish, mollusks, crustaceans and marine plant species in the world. During my observation, the fisheries sector is an important source of employment for the local people at Kota Marudu. They are very dependent on the fisheries sector and these are impacting the Marudu Bay coastal communities economically.

Study of food habits is fundamental importance in understanding the rate of growth, population concentration, gonadial maturation and other metabolic activities. In general penaeid prawns have been described as 'omnivorous scavengers' or detritus feeders (Nandakumar, 1998). However, may be regarded a definitive expression of their food habits. Analysis of the stomach contents of more specimens are needed, as well as additional underwater observation of their actual food. In general, since so little is known of the food habits in this prawn at Kota Marudu, decision was made to carry out the research. More field work, particularly on the species was planned, however the present report is based on the examination of the stomach contents. This study is an attempt to investigate the stomach contents, food habits and spawning season of a population of *M. Ensis*. By the ends of this study, the foods habits of this species whether it is carnivorous, herbivorous or omnivorous and the pattern of its food will be determined.

An analysis of the spawning season and food habits of this prawn species are important for the ecological at the Marudu Bay and can be used as a reference for the next future study on the spawning season of this species.

This study is limited only for *Metapenaeus ensis* that are distributed around Marudu Bay waters. Thus, the study purpose based on the following objectives:

1. To determine spawning period by using GSI and condition factor  $K_n$ .
2. To identify the stomach content of *Metapenaeus ensis*.
3. To determine the temporal variation of food habits in *Metapenaeus ensis*.



## REFERENCES

- B. S. & Tseng, C. K. (Eds) (1980), Biological Workshop: The Marine Flora and Fauna of Hong Kong. Morton, Hong Kong: Hong Kong University Press. Pp; 285-313
- Csavas, I., (1988) Shrimp Farming development in Asia. In: Shrimp '88, Conference Proceedings. INFOFISH, Kuala Lumpur, Malaysia. Pp. 63-94.
- Cheung, T. S. (1959). Distribution of penaeid prawns in the waters around Hong Kong. In Preprints International Oceanographic Congress, New York No. 1: 224-228.
- Cheung, T. S. (1964). Contributions to the knowledge of the life history of *Metapenaeus ensis* and other economic species of penaeid prawns in Hong Kong. *J. Appl. Ecol.* 1: 369-386.
- Chopra, B.N., (1939). Some food prawns and crabs of India and their fisheries, *J. Bombay nat. Hist. Soc.* 4(2), 221-234
- Chu KH, Chen QC, Huang LM, Wong CK (1995). Morphometric analysis of commercially important penaeid shrimps from the Zhujiang estuary, China. *Fisher. Res.* 23: 83-93.
- C.V. Kurian, V.O. Sebastian (1976) Prawns and prawn fisheries of India. Cochin University India. Pp. 53-55, 93
- Dall W, Hill BJ, Rothlisberg PC, Staples DJ (1990) The biology of the Penaeidae, 8. Life history. *Adv mar Biol* 27: 283-314
- Dore, I. And Frimodt, C., (1987). An illustrated guide to shrimp of the world. Osprey Books, Huntington, N.Y. 229 pp.
- G. Nandakumar and R. Damodaran, (1998). Food and feeding habits of the speckled shrimp *Metapenaeus monoceros* (Fabricius), Central Marine Fisheries Research Institute, Cochin-682014, 40(1&2): 30-43
- George, M.J., (1959) Notes on the bionomics of the prawn *Metapenaeus monoceros* Fabricius. *Indian J. Fish.*, 6(2): 268-79
- George, P.C. and M.J. George, (1964) On the location of a possible spawning area for the penaeid prawn, *Metapenaeus monoceros* Fabricius off Cochin. *Curr. Sci.*, 33(8): 251-2

- George, M.J., (1962) On the breeding of penaeids and the recruitment of their postlarvae into the backwaters of Cochin. Indian J.Fish., 9(1):110–6
- George, M.J., (1963) Note on an abnormality in the penaeid prawn *Metapenaeus monoceros* Fabricius. J.mar.biol.Ass.India., 5(1):145–6
- Hall, D. N. F. (1958). Distinction between *Metapemus monaceros* Fabr. and *M. ensis* De Haan. Ann. Mag. Nat. Hist. 13( 1): 537-544.
- Hall, D.N.F. (1962). Observation on the taxanomy and biology of some Indo-West Pacific Penaeidae (Crustacea, Decapoda). Colonial Office Fish. Publ.17:1-229.
- Holthuis LB (1985). Shrimps and prawns of the world, an annotated catalogue of species of interest to Fisheries. FAO species catalogue, P. 1.
- Hossain, M. Y., Ahmed, Z. F., Leunda, P. M., Jasmine, S., Oscoz, J., Miranda, R., & Ohtomi, J. (2006). Condition, length–weight and length–length relationships of the Asian striped catfish *Mystus vittatus* (Bloch, 1794)(Siluriformes: Bagridae) in the Mathabhanga River, southwestern Bangladesh. Journal of Applied Ichthyology. 22(4), 304-307.
- Jayasankar, P. (1990). Sillaginids fishes of Palk Bay and Gulf of Mannar with an account on the maturation and spawning of Indian sand whiting, *Sillago sihama* (Forsskal). Indian Journal of Fisheries. 38(1):13-25
- Jesse D. Ronquillo,June (1993) Faculty of FisheriesToshio Saisho, College of FisheriesOxford Journals., Journal of Plankton Research .,Early developmental stages of greasyback shrimp,*Metapenaeus ensis* (de Haan, 1844) (Crustacea, Decapoda, Penaeidae) (Pp. 1177-1206)
- JOHN E. RANDALL (2004) Food Habits Of Reef Fishes Of The West Indies Hawaii Institute of Marine Biology University of Hawaii, Honolulu and Bernice P. Bishop Museum, HonoluluPp 665
- King, J. E. (1948). A study of the reproductive organs of the common marine shrimp, *Penaeus setiferus* (Linnaeus). Biol. Bull
- K.H. Chu,Y.K. Tam, C.K. Chung, W.L. Ng (1993). Morphometric relationships and reproductive maturation of the shrimp, *Metapenaeus ensis*, from commercial catches in Hong Kong Fisheries ResearchVolume 18, Issues 3–4, December, Pages 187-197
- Kubo, I. (1955). Review of the biology and systematics of shrimps and prawns of Japan. In Proc. Indo-Pacif: Fish. Coun. No. 6: 387-398.

- Kungvankij P, Chua TE (1986). Shrimp culture: Pond design, operation and management, FAO, P.65.
- Macintosh, D. J. Muir, J. F. & Roberts, R. J. (Eds). (1982). Fisheries and aquaculture significance of mangrove swamps, with special reference to the Indo-West-Pacific region. In Recent advances in aquaculture: 5-85 London: Croom Helm.
- Michael Dockery And Stephen Tomkins Brine Shrimp Ecology The British Ecological Society Homerton College Cambridge Pp:114
- Ministry of Fisheries (1996). Vietnam fisheries aquatic resources, published by agricultural housing of Vietnam, P.615.
- Mohan, M. V. and Sankaran, T. M. (1988). Two new indices for stomach content analysis of fishes. *Journal of Fish Biology*. 33: 289-292
- Ota, S. (1949). A research on *Merapenaeus monoceros* (Fabr.). *Chosashiryō* 18: 1-18.
- Panikkar, (1952). Possibilities of further expansion of fish and prawn culture practices in India, *Curr.Sci.*21, 29-33.
- Panikkar, N.K. and R.G. Aiyar, 1939 Observations on breeding in brackish water animals of Madras. *Proc.Indian Acad.Sci.(B)*, 9(1):343-64
- P.J. Crocos; Y. C. Park; D. J. Die; K. Warburton; F. Manson., Reproductive dynamics of endeavour prawns, *Metapenaeus endeavouri* and *M. Ensis*, in Albatross Bay, Gulf of Carpentaria, Australia
- Racek, A. A. (1970). Indo-west Pacific penaeid prawns of commercial importance. In *Coastal aquaculture in the Indo-Parijic Region*. Pillay, T. V. R. (Ed.). London: Fishing News (Books) Limited. : 152-172
- Srivatsa, K.R., (1953) A survey and comparative analysis of the prawn (shrimp) fishery of the Gulf of Kutch in Saurashtra in Western India. Saurashtra, Government of Saurashtra, India, Department of Industries and Supplies
- SIU-FALI EUNG, The population dynamics of *Metapenueus ensis* (Crustacea: Decapoda:Penaeidae) in a traditional tidal shrimp pond at the Mai Po Marshes Nature Reserve. The Swire Institute of Marine Science, The University of Hong Kong, Cape D'Aguiar, Shek O, Hong Kong, Hong Kong 242,77-96
- Tseng, W. Y. & Cheng, W. W. (1982). The economic shrimps of Hong Kong. In *Proc. of the First International Marine*

T. S. Cheung (1964) Journal of Applied Ecology Contributions to the Knowledge of the Life History of *Metapenaeus ensis* and Other Economic Species of Penaeid Prawns in Hong Kong. Vol. 1, No. 2 (Nov.), pp. 369-386

Weatherly, A.H. and Rogers, C. (1978). Some aspects of age and growth. In: Ecology of Fresh Water production. Editor: S.D. Gerking. Published by: Blackwell Scientific Publications, Oxford. p. 63-64.

Wu Qinse, (1993). International symposium on shrimp culture in Asia-Pacific Region, The China Society of fisheries, Zhanjiang Fisheries College, Beijing, China, Pp54.

Web :-

The free encyclopedia [http://en.wikipedia.org/wiki/Metapenaeus\\_ensis](http://en.wikipedia.org/wiki/Metapenaeus_ensis)

Adapted from The Uncommon Guide to Common Life on Narragansett Bay. Save The Bay, (1998). <http://www.edc.uri.edu/restoration/html/gallery/invert/sand.htm>.

D.N.F., (1962). Observations on the taxonomy and biology of some Indo-west Pacific Penaeidae (Crustacea, Decapoda).— Colonial Office Fisheries Publications 17: 1-229

*Metapenaeus ensis* (De Haan, (1844) [in De Haan, 1833-1850]) [http://www.metapenaeus\\_ensis.my](http://www.metapenaeus_ensis.my)