UNIVERSITI PUTRA MALAYSIA

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FP 2006 17

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By

MOHD ZAFRI BIN HASSAN

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

November 2006

Specially dedicated to my beloved parents

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the Degree of Master of Science

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MOHD ZAFRI BIN HASSAN

June 2006

Chairman : Annie Christianus, PhD

Faculty : Agriculture

The present study was conducted to describe the morphological differences between *P. nasutus* and *P. conchophilus,* to describe and classify the histology of oocyte and spermatogenic cells of mature *P. nasutus* and to observe the seasonal patterns of the gonadal stages in twenty specimens of *P. nasutus* and *P. conchophilus* from Maran. In order to signify the species differences, twenty specimens of Thai-origin *P. conchophilus* from a cage culture at Sungai Pahang near Pekan, Pahang, Malaysia were also examined. The morphometric measurements were presented in percentage of standard length (%SL), predorsal length (%PDL) and head length (%HL). Based on the classification results, all *P. nasutus* specimens were different from *P. conchophilus* in both populations, in terms of snout length, eye diameter, lower and upper jaw length.

A total of 205 *P. nasutus* were caught during the study period, from October 2004 to September 2005 for the gonadal stages study of *P. nasutus*. Nine distinctive

oocytes stages observed in the study were from oogonia to late vitellogenesis. Six microscopic oocytes developmental stages were assigned for the studied ovaries of *P. nasutus*, namely resting, maturing, mature, spawning, running and spent stages. Further, microscopic observation on the 'whole-section' of the testes revealed that four testicular development stages could be distinguished namely early spermatogenesis, spermatogenesis, maturation and spent stages. In this study, it was found that the female and male *P. nasutus* were reproductively active at the beginning of rainy season which commenced in the middle quarter of 2005, from March to September coincided with the South-West monsoon. The study also revealed that *P. nasutus* exhibits a single-modal spawning season in a year, with multiple release of eggs during a single period. Such condition showed that *P. nasutus* is a multiple-spawner as supported by the group-synchronous oocyte development of the ovary. However, spawning did not commence synchronously within the population with the obvious presence of various female and male reproductive stages within a single sampling month.

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

MORFOLOGI DAN PERINGKAT PERKEMBANGAN PEMBIAKAN *Pangasius nasutus* DARI SG. PAHANG DI DALAM DAERAH MARAN, PAHANG, MALAYSIA

Oleh

MOHD ZAFRI BIN HASSAN

Jun 2006

Pengerusi : Annie Christianus, PhD

Fakulti : Pertanian

Kajian ini telah dijalankan untuk menerangkan perbezaan morfologi antara *P. nasutus* dan *P. conchophilus,* menghurai dan mengkelaskan histologi oosit dan sel-sel spermatogenik bagi *P. nasutus* matang dan seterusnya untuk melihat corak bermusim untuk peringkat-peringkat gonad bagi *P. nasutus*. Dua puluh spesimen *P. nasutus* dan *P. conchophilus* dari Maran, Pahang telah dikaji. Untuk melihat perbezaan spesies, dua puluh spesimen *P. conchophius* berasal dari Thailand tetapi dikultur dalam sangkar di Sungai Pahang, dekat Pekan, Pahang, Malaysia, turut dikaji. Ukuran-ukuran morfometrik diberikan dalam bentuk peratusan panjang piawai (%SL), panjang pra-dorsal (%PDL) dan panjang kepala (%HL). Berdasarkan keputusan pengkelasan, semua specimen *P. nasutus* adalah berbeza dari *P. conchophilus* pada kedua-dua populasi, terutamanya dari segi panjang muncung, diameter mata, panjang rahang bawah dan atas.

Sejumlah 205 spesimen *P. nasutus* ditangkap sepanjang waktu kajian yang bermula dari Oktober 2004 sehingga September 2005. Sembilan peringkat kematangan oosit telah diperhatikan dalam kajian ini adalah dari peringkat oogonia sehingga peringkat akhir vitellogenesis. Enam peringkat perkembangan oosit yang diperhatikan secara mikroskopik untuk keseluruhan ovari *P. nasutus* dibahagikan kepada kepada peringkat rehat, sedang matang, matang, bersedia untuk membiak, sedang membiak dan selesai membiak. Berdasarkan pemerhatian mikroskopik bagi keseluruhan testis *P. nasutus* menunjukkan terdapat empat peringkat perkembangan testis yang dapat dikenalpasti iaitu, spermatogenesis awal, spermatogenesis, kematangan dan selepas pembiakan.

Kajian ini mendapati, betina dan jantan *P. nasutus* adalah aktif membiak pada permulaan musim hujan yang bermula pada suku pertengahan tahun 2005, dari Mac sehingga September serentak dengan musim monsun tenggara. Kajian ini juga mendapati, *P. nasutus* mempunyai satu musim pembiakan khusus dalam satu tahun, yang dapat dilihat dengan pelepasan telur yang berperingkat-peringkat pada sesuatu tempoh masa. Keadaan ini menunjukkan bahawa *P. nasutus* merupakan pembiak yang melepaskan telurnya secara berperingkat-peringkat yang jelas dapat dilihat dari perkembangan oosit secara serentak dalam dua atau tiga kumpulan di dalam satu-satu ovari. Walaubagaimanapun, pembiakan tidak berlaku serentak di dalam populasi berdasarkan kehadiran pelbagai peringkat perkembangan reproduktif betina dan jantan semasa penyampelan di dalam satu-satu bulan.

ACKNOWLEDGEMENTS

In the name of Allah, the Lord that I always put my belief in. Thanks to my parents and siblings for being my pillars and strength all my life.

I would like to express my deepest gratitude to the chairman of my supervisory committee, Dr. Annie Christianus for her tremendous encouragement, financial assistance on the research expenses and camaraderie throughout the study period. Not forgetting, many thanks to my co-supervisors Assoc. Prof. Dr. Siti Shapor Siraj and Assoc. Prof. Dr. Siti Khalijah Daud for sharing their invaluable expertise, ideas and comments on the research conducted and write-up. Thanks to UPM for the scholarship and granting me study leave off my duty at UPM Bintulu Campus.

The study could not have completed without the support and co-operations from many parties, namely Assoc. Prof. Dr. Khir Bejo and his lab assistant Saipu for allowing and helping me to use facilities in the Pathology Laboratory, Faculty of Veterinary UPM; Assoc. Prof. Dr. Mohd Salleh Kamaruddin for his permission to use Aquatic Biotechnology Laboratory, Faculty of Agriculture UPM, En. Jasni Yusof at the UPM hatchery, En. Mat Piah and his family for their friendly entertainment on the lodging and helping hands during sampling activities; and last but not least, million thanks to my all-time friends Ikram, Sazahar, Halim and Saufi to whom I owe their time and energy very much.

I certify that an Examination Committee has met on 28 November 2006 to conduct the final examination of Mohd Zafri Bin Hassan on his Master of Science thesis entitled "Morphology and General Reproductive Stages of *Pangasius nasutus* from Sg. Pahang in Maran District, Pahang, Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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Date: 8 March 2007

DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

MOHD ZAFRI BIN HASSAN

Date: 15 February 2007

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Analysis of Variance	ANOVA
Body weight	BW
Celsius degree	°C
Centimeter	cm
Department	Dept.
Fatsomatic index	FSI
Gonadosomatic index	GSI
Gut repletion index	GRI
Gram	g
Head length	HL
Hepatosomatic index	HSI
Kilogram	kg
Meter	m
Milimeter	mm
Micrometer	µm
Percent	%
Predorsal length	PDL
Standard deviation	SD
Standard length	SL
Universiti Putra Malaysia	UPM

CHAPTER ONE

INTRODUCTION

1.1 Background of Patin buah in Malaysia

Patin buah, a vernacular river catfish name for *Pangasius nasutus* in Malaysia, is one of the favourite food fish and commands a good price in the local market. Information on this native fish is lacking probably attributed to the dominant interest in the other patin, *Pangasius hypopthalmus*, a catfish of Thai origin introduced to Malaysia for aquaculture purpose. Popularity of the native patin buah then had been brought up by the recent awareness of its economic value and the declining of its population in the Pahang River.

The occurrence and distribution of *P. nasutus* in Malaysia are literally not conclusive. Catfishes are known to occupy habitats ranging from upland streams to large river channels and to seasonal floodplain lagoons (Winemiller and Kelso-Winemiller, 1996). Therefore it is not a surprise that *P. nasutus* was known to occur in the Pahang River where the richness of the biodiversity is at its best among the rivers in Malaysia (Haslawati *et al.,* 2004). Roberts and Vidhthayanon (1991) also reported the occurrence of this species in Chenderoh Dam, Perak.

A number of species of the family Pangasiidae are of great economical importance in Southeast Asia (Hung *et al.*, 2004) and have high potential for aquaculture in Malaysia. At present, the wild catch of patin buah (*Pangasius nasutus*) and patin muncung (*Helicophagus wandersii*) demands as much as RM 50kg^{-1} and RM 100kg^{-1} in the market, respectively. Due to its white and tender flesh, Pangasiid catfish was ranked among the top five preferred species for five consecutive years in terms of consumer preferences in Malaysia (Fisheries Annual Report, 2002).

1.2 Statement of problems

Recently, the decline in the abundance of patin buah in the local rivers has been reported. In fact, it is supported by the declining numbers in landing data of the species in Maran, a district along the Pahang River, which is known for patin buah (Department of Fisheries, 2004). The first successful artificial propagation however, was reported by the local Department of Fisheries in March 2004 after several years of attempt at propagating it. Despite the success, however continuous fry supply however cannot be guaranteed due to low survival rate of repeated attempt.

P. conchophilus that is found in the vicinity of Pahang River was recently brought in from Thailand by the Cambodian immigrants residing in Pekan, Pahang (Haslawati *et al.*, 2004). Due to its resemblance to *P. nasutus*, it was named by

the local people as ‘patin buah Kemboja’ (Cambodian patin buah). These two species are commonly mistakenly misidentified for each other due to morphological features of both species (Roberts and Vidthayanon, 1991).

Although induced breeding has been successful, studies on the reproductive biology of the species sampled from its natural environment are crucial so as to gain insight and more understanding on the species. Even for fish that has been established in a farming system, the information on the reproductive aspects including the absolute and relative fecundities would be helpful to ensure a continuing success in its culture (Ali, 1993). These guidelines also constitute major approach towards establishing biodiversity management as well as breeding programme (Corriero *et al.*, 2003; Utoh *et al.*, 2003; Micale *et al.*, 1996; Legendre, 1986).

1.3 Significance of the study

The population of *P. nasutus* is currently declining. In the present situation, the marketable supply patin buah is entirely dependant on the wild catch. This increases the chances for the fish to be over-exploited. Effort at culturing this species has never been attempted and the population silently decreasing. Therefore, a study on the gonadal cycle of the species is necessary as an initial step towards husbandry management.

Reproductive biology has served numerous advantages in the study of a particular species or population. Manosroi *et al.* (2003) stated that in order to conserve a threatened Mekong giant catfish *P. gigas*, maturation induction by hormone injection and seasonal endocrine regulation expressed as gonadosomatic index (GSI) are crucial. Knowledge in the reproductive biology can also lead to a better understanding and advantage in breeding a particular species before being introduced for aquaculture purposes (Hassin *et al.,* 1997). Temporal difference in reproductive maturity at individual level allows an efficient broodstock management (Dahle *et al.*, 2003).

The study on annual cycles in the gonadal stages of wild animals will provide baseline information on body composition, which is useful in the evaluation of quality and physiological condition of animals before being cultured (Craig *et al.*, 2000). Conservation, catch size restrictions, controlled fishing seasons or improvements of breeding technologies in hatcheries can be inferred from the study.

1.4 Objectives

The main objective of this study is to describe the distinctive morphological characteristics of the native *P. nasutus* and to differentiate these characteristics from those of the introduced *P. conchophilus*. Apart from that, monthly observation and assessment on the gonadal activity of *P. nasutus* caught from its