EGG COLLECTION AND BIOTELEMETRY STUDIES OF TIGER GROUPER, *Epinephelus fuscoguttatus* IN BROODSTOCK TANK

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THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER

BORNEO MARINE RESEARCH INSTITUTE
UNIVERSITI MALAYSIA SABAH
KOTA KINABALU
2007

UNIVERSITI MALAYSIA SABAH

BORANG PENGESAHAN STATUS TESIS@

JUDUL : Egg Collection and Biotelmetry Studies of Tiger Grouper, *Epinephelus fuscoguttatus* in Broodstock Tank

IJAZAH : Sarjana Sains (Akuakultur)

SESI PENGAJIAN : 2003/2004

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HA HOU CHEW
PS03-004-002
8 OCTOBER 2006

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ACKNOWLEDGEMENTS

I would like to express my sincere grateful acknowledgement to my supervisors, Prof. Dr. Shigeharu Senoo and Dr. Yukinori Mukai, Borneo Marine Research Institute, for their invaluable suggestions, guidance and encouragement throughout the study period. A special acknowledgement to Prof. Dr. Ridzwan Abdul Rahman, the Director of Centre for Research Management and Conference (the former Director of Borneo Marine Research Institute) for his support and encouragement to complete this research project successfully.

I thank Universiti Malaysia Sabah for the assistantship. I would like to express my gratitude to Prof. Datuk Dr. Mohd. Noh Dalimin, Vice-chancellor, Universiti Malaysia Sabah and Prof. Dr. Saleem Mustafa, Director of Borneo Marine Research Institute, for their encouragement and assistance.

I wish to heartily express my indebtedness to Dr. Sitti Raehanah Muhd. Shaleh for her meaningful comments and advice on my writing. I extend heartfelt thanks to Mr. Abentin Estim for his advice on the statistical analysis. I also extend my thanks to Mr. Norazmi Osman, Mr. Henry Lipan and all the staff of Fish Hatchery, Borneo Marine Research Institute for their assistance and co-operation. My sincere appreciation is also extended to Ms. Sow Sok Hui, Ms. Nguang Siew Ing, Mr. Zamzairi Mohd Jawi, my friends, colleagues and well-wishers for their valuable input (directly or indirectly) for the successful completion of the thesis.

Last but not least, a special note of thanks to my parents and Ms. Ng Bee Hong for their patience, encouragement, support and understanding in my absence.

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ABSTRACT

This study was performed to get basic knowledge of egg collection in tiger grouper, *Epinephelus fuscoguttatus* through natural spawning in a 150-ton broodstock tank. The chosen 18 *E. fuscoguttatus* were transferred from the net cage into the broodstock tank. Water quality (temperature, dissolved oxygen, pH and salinity) was measured twice per day and the *E. fuscoguttatus* were fed with trash fish. An egg net was set up in the broodstock tank to collect the eggs of *E. fuscoguttatus* every month. Biotelemetry experiment on *E. fuscoguttatus* was conducted to measure the depth where the fish stayed in the broodstock tank and the fish body temperature to understand their behaviour during spawning. Data loggers were able to record the water depth and the temperature at 2-minute intervals continuously for 30 days. Data loggers were inserted into the abdomen of a female and a male. Approximately 105 million eggs were collected from July 2004 until October 2004. Spawning occurred in July (46 million eggs), August (24 million eggs) and October (35 million eggs) 2004. The biggest egg diameter (0.880 mm) with the highest fertilization rate (95.2%) was considered the best egg quality among the 3 spawnings. The fertilization rate of this study was considerably higher than other studies, which seemed to be because of the water depth of the broodstock tank. In each spawning period, *E· fuscoguttatus* spawned for 5-6 consecutive nights in the broodstock tank. The spawning occurred at midnight (11pm-1am). On the other hand, from the water parameter results, spawning could occur at 27.4 °C ± 1.1 °C (mean ± SD), dissolved oxygen 6.26 mg/L ± 0.41 mg/L, salinity 31.4 ppt ± 0.9 ppt and pH 7.88 ± pH 0.19. On average, the females swam to the water surface between 1.2 times/night and 3.8 times/night during the spawning periods. However, it was only 0.6 times/night during the non-spawning periods. The results of the data logger show *E. fuscoguttatus* spawned at the water surface with an extreme changes of body temperature. From this study, the 150-ton broodstock tank with 3 m depth is suitable for the egg collection of *E. fuscoguttatus* through natural spawning. This broodstock tank system and management, such as the water temperature 24.4-31.7 °C, the salinity 30-33 ppt, the DO 5.03-6.97 mg/L, the pH 7.32-8.37 and the mean of feeding rate 1.8%, can be recommended as a guideline to other hatcheries for the constant collection of *E· fuscoguttatus* eggs. The data logger is introduced as a new tool to improve the understanding on fish behaviour, in order to develop the aquaculture in Malaysia.

ABSTRAK

PENGUMPULAN TELUR DAN PENGAJIAN BIOTELEMETRI DENGAN DATA LOGGER TERHADAP KERAPU HARIMAU, Epinephelus fuscoguttatus DALAM TANGKI INDUK

Kajian ini bertujuan untuk memperolehi pengetahuan asas tentang pengumpulan telur ikan kerapu harimau, Epinephelus fuscoguttatus melalui pembiakan semula jadi dalam tangki induk ikan berkapasiti 150-tan. Sebanyak 18 ekor induk E. fuscoguttatus yang terpilih dipindahkan dari sangkar terapung ke dalam tangki induk ikan. Kualiti air (suhu, oksigen terlarut, pH dan saliniti) disukat dua kali sehari dan induk E. fuscoguttatus diberi makan ikan baja. Jaring dipasang dalam tangki setiap bulan untuk mendapatkan telur E. fuscoguttatus. Kajian biotelemetri ke atas E. fuscoguttatus dijalankan untuk mengukur suhu badan dan kedudukan induk ikan semasa berada dalam tangki. Data logger mampu mencatat suhu dan kedalaman air pada selang 2-minit selama 30 hari berterusan. Data logger dimasukkan ke dalam abdomen seekor induk betina dan jantan masing-masing. Sejumlah 105 juta telur telah dikumpul sejak dari Julai 2004 hingga Oktober 2004. E. fuscoguttatus mengawan pada bulan Julai (46 juta telur), Ogos (24 juta telur) dan Oktober (35 juta telur) 2004. Diameter telur yang terbesar (0.880 mm) dengan peratusan persenyawaan tertinggi (95.2%) merupakan quality telur yang terbaik antara ketiga-tiga waktu mengawan. Peratusan persenyawaan telur dalam kajian ini lebih tinggi daripada kajian lain, dan ini bermungkinan dipengaruhi oleh faktor kedalaman air dalam tangki induk ikan. E. fuscoguttatus bertelur selama 5-6 malam berterusan pada setiap kali mengawan pada waktu tengah malam (11pm-1am). Rekod parameter air menunjukkan bahawa E. fuscoguttatus mengawan pada suhu 27.4 °C ± 1.1 °C (min ± sisihan piawai) , oksigen terlarut 6.26 mg/L ± 0.41 mg/L, saliniti 31.3 ppt ± 0.9 ppt and pH 7.88 ± pH 0.19. Secara purata, ikan betina berenang sebanyak 1.2 kali/malam dan 3.8 kali/malam ke permukaan air semasa mengawan, dan hanya 0.6 kali/malam semasa tidak mengawan. Data logger menunjukkan bahawa E. fuscoguttatus mengawan pada permukaan air dengan perubahan suhu badan yang mendadak. Daripada kajian ini, tangki induk ikan 150-tan dengan kedalaman 3 m adalah sesuai untuk pengumpulan telur E. fuscoguttatus secara semula jadi. Sistem tangki induk ikan ini dan pengurusan seperti suhu air 24.4-31.7 °C, saliniti 30-33 ppt, oksigen terlarut 5.03-6.97 mg/L, pH 7.32-8.37 dan purata kadar pemberian makanan 1.8%, boleh diperkenalkan sebagai panduan kepada pusat penetasan ikan lain untuk mendapatkan telur E. fuscoguttatus yang berterusan. Data logger diperkenalkan sebagai alat baru dalam kajian perlakuan ikan untuk perkembangan bidang akuakultur di Malaysia.

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KEY WORDS

Tiger grouper, *Epinephelus fuscoguttatus*, Egg collection, Biotelemetry study, Data logger, Broodstock tank.

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LIST OF ABBREVIATIONS

am	ante meridian
BC	body circumference
BH	body height
BW	body weight
BWd	body width
cm	centimetre
cm^3	cubic centimetre
CPS	carp pituitary suspension
DA	data acquisition
DO	dissolved oxygen
eggs/ml	eggs per millilitre
F	female
FSH	follicle-stimulating hormone
g	gram
g/ml	gram per millilitre
g/L	gram per litre
GnRH	gonadotropin-releasing hormone
GtH	gonadotropin hormone
HCG	human chorionic gonadotrophin
HL	head length
HPS	homoplastic pituitary suspension
ID	identity
IM	intramuscular
IP	intraperitoneal
IU	international units
IU/kg	international units per kilogram
kg	kilogram
kg/m^3	kilogram per cubic metre
km	kilometre
km^2	square kilometre
L	litre
LH	luteinizing hormone
LHRHa	luteinizing hormone-releasing hormone analogue

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M	male
m	metre
m^3	cubic metre
mg/L	milligram per litre
ml	millilitre
ml/kg	millilitre per kilogram
mm	millimetre
MT	metric tons
pH	hydrogen ion concentration
pm	post meridian
ppm	parts per million
ppt	parts per thousand
RM	Ringgit Malaysia
SD	standard deviation
SL	standard length
TL	total length
µm	micrometre
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CHAPTER 1

INTRODUCTION

1.1. Aquaculture Development in Sabah

The Malaysian Government is encouraging fish farming and facilitating more integrated development of aquaculture zones in the country (Karim, 2003). The government has identified several locations as aquaculture zones and provided infrastructure for aquaculture development. Pulau Gaya is one of the aquaculture zones in Sabah (Sadovy, 2000). There is great potential for aquaculture development in Sabah because it has a suitable climate and strategic geographical features. Sabah fisheries are estimated to have a rapid growth in future with the increase in marine aquaculture activities and seafood processing industries (Department of Fisheries Sabah, 2002).

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More than three-quarters of Sabah's boundaries abut the sea, the South China Sea on its west coast, the Sulu Sea on its northeast coast and the Sulawesi Sea on its southeast coast (Figure 1.1). It has a long coastline of approximately 1,600 km, extending along about 73,600 km^2 of coastland. The total territorial waters of Sabah cover around 55,000 km^2 (Department of Fisheries Sabah, 1997).

Abundant fishery resources can be found in the wide expanse off shore of Sabah. In 2000, Sabah fishery production was 215,187 metric tons (MT) at value RM876 million (Department of Fisheries Sabah, 2002). From 1996 to 2000, the total landed marine fish increased from 180,100 MT to 202,900 MT (Figure 1.2).

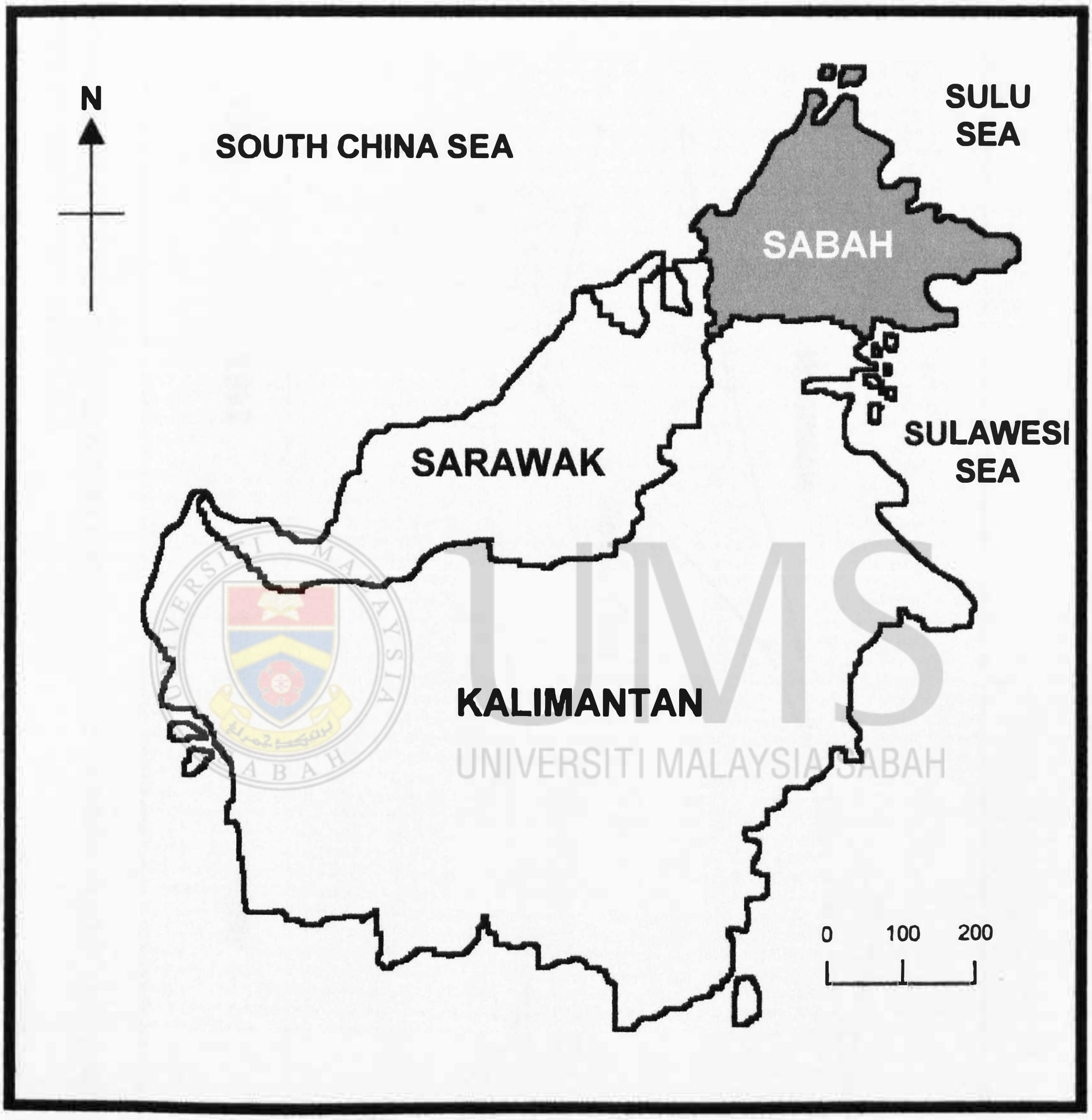

Figure 1.1 The state of Sabah in Northern Borneo borders the South China Sea on its west coast, the Sulu Sea on its north-east coast and the Sulawesi Sea on its south-east coast. It has approximately 1,600 km coastline and 55,000 km^2 total territorial waters.

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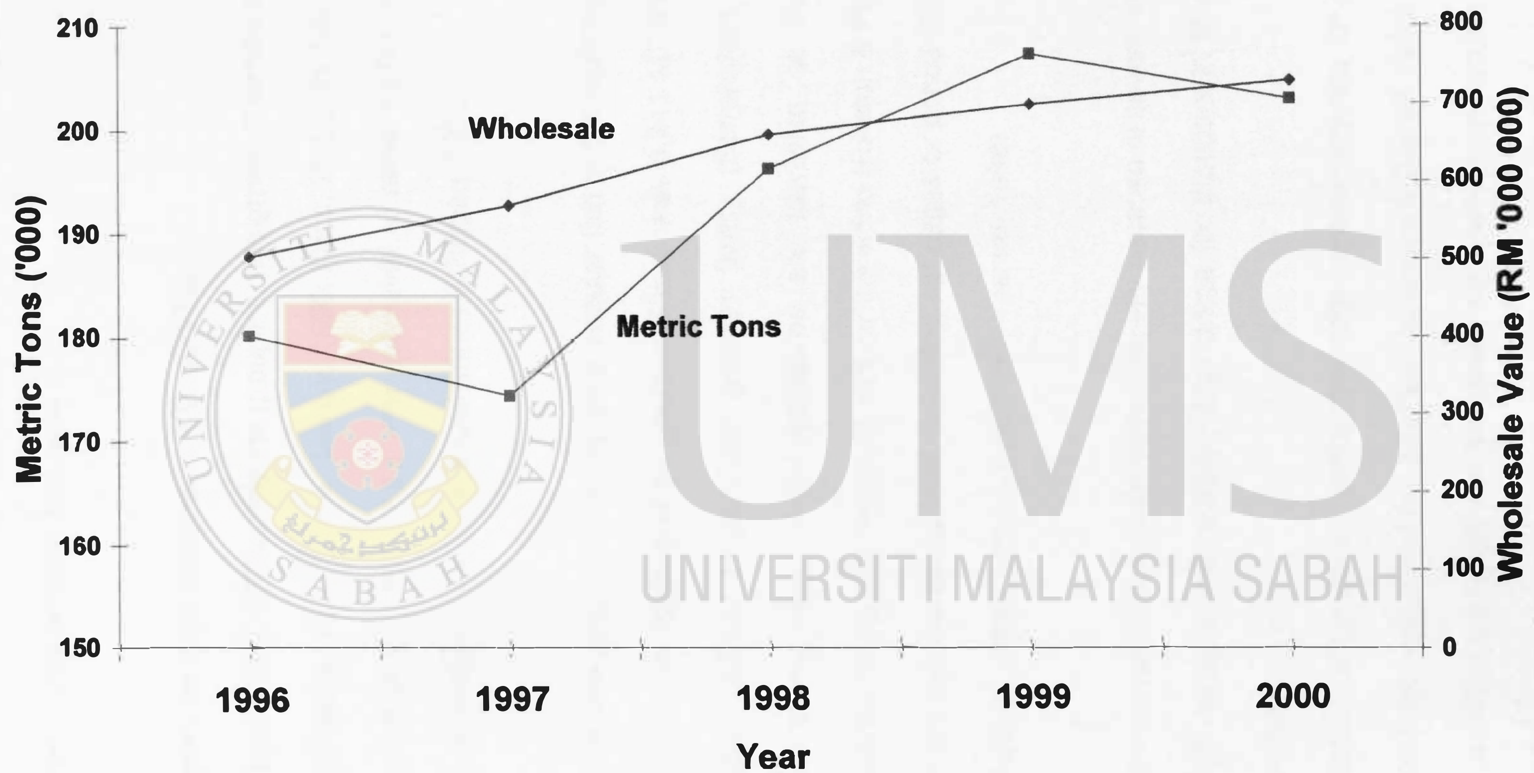

Figure 1.2 Annual Marine Fish Landings in Sabah from 1996-2000. The total landed marine fish and the wholesale values were increasing from 1996-2000.

(Source: Department of Fisheries Sabah, 2002)

Within these years, the totals of landed marine fish in 1997 and 2000 slightly decreased. However, the wholesale values of landed marine fish were increasing since 1996, because the landed marine fish, particularly the groupers (Family: Serranidae) had higher demand and price.

1.2. Groupers as High Commercial Table Fish

The demand for live fish, particularly the groupers, has grown markedly in the last two decades (Calumpong, 1993; Lee & Sadovy, 1998; Anon, 2001). In 1997, the volume of live fish traded in Southeast Asia was estimated at about 53,000 MT, including approximately 30,000 MT of groupers (Johannes & Riepen, 1995).

In Sabah, the groupers are the most popular fish in the seafood restaurants. In year 2000, the total landing of groupers in Sabah was 6,241 MT (Department of Fisheries Sabah, 2002). Among the grouper family (Serranidae), the genera *Epinephelus, Plectropomus,* and *Cromileptes* are identified as the high-value commercial fish and have been cultured all over the world (Ralston & Polovina, 1987). The groupers are commonly cultured in floating net cages or ponds (Chuah & Teng, 1977; Sugama *et al.,* 1999; Chou & Lee, 1997; Yashiro, 1998).

Grouper aquaculture has developed rapidly because of several factors:

a. High demand and relatively high prices for groupers in local and export markets,
b. Environmental impact associated with capture fisheries for groupers and other high-value reef fish species (Johannes & Riepen 1995), and
c. It is widely accepted that increased aquaculture production of high-value reef fish species will reduce the pressure on wild stocks by providing an alternative product source (Phillips *et al.,* 1997).

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