EFFECTS OF DIFFERENT CONCENTRATION OF *Nannochloropsis oculata* ON THE SURVIVAL AND GROWTH OF SEA BASS, *Lates calcarifer* LARVAE

HANI SANDRAWATI BINTI MUSLI

THIS DESERTATION IS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE DEGREE OF BACHELOR OF SCIENCE WITH HONOURS

AQUACULTURE PROGRAMME
SCHOOL OF SCIENCE AND TECHNOLOGY
UNIVERSITI MALAYSIA SABAH

April 2007

BORANG PENGESAHAN STATUS TESIS@

JUDUL: EFFECTS OF DIFFERENT CONCENTRATION OF Nannochloropsis oculata ON THE SURVIVAL AND GROWTH OF SEA BASS, Lates calcarifer LARVAE

Ijazah: Sarjana Muda Sains dengan kepujian (AKUAKULTUR)

SESI PENGAJIAN: 2004 / 2007

Saya HANI SANDRAWATI BINTI MUSLI
(HURUF BESAR)

mengaku membenarkan tesis (LPS/Sarjana/Doktor Falsafah)* ini disimpan di Perpustakaan Universiti Malaysia Sabah dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hakmilik Universiti Malaysia Sabah.
2. Perpustakaan Universiti Malaysia Sabah dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (/)

[ ]	SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
[✓]	TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
[ ]	TIDAK TERHAD	

Disahkan oleh

(TANDATANGAN PENULIS)

(TANDATANGAN PUSTAKAWAN)

Alamat Tetap: Jabatan Perlindungan Hidupan Liar, Wisma Budaya, Beg Berkunci 2078, 88999, KK

Nama Penyelia

Tarikh: 8 Mei 2007

Tarikh:

CATATAN: * Potong yang tidak berkenaan.
** Jika tesis ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh tesis ini perlu dikelaskan sebagai SULIT dan TERHAD.
@ Tesis dimaksudkan sebagai tesis bagi Ijazah Doktor Falsafah dan Sarjana secara penyelidikan, atau disertasi bagi pengajian secara kerja kursus dan penyelidikan, atau Laporan Projek Sarjana Muda (LPSM).

DECLARATION

I hereby declare that this dissertation is based on my original work except for certain citations, quotations and summaries, which have been duly acknowledge.

23 March 2007

HANI SANDRAWATI BINTI MUSLI

HS2004-3295

AUTHENTICATION

Signature

1. SUPERVISOR

   (PROF. DR. SHIGEHARU SENOO

2. EXAMINER 1

   (DR. SUJJAT AL-AZAD)

3. EXAMINER 2

   (DR. NORMAWATY MOHD. NOOR)

4. DEAN

   (SUPT/KS PROF MADYA DR. SHARIFF A.K OMANG

AKNOWLEDGEMENTS

This dissertation has accumulated many debts of gratitude throughout its completion. I would like to express my sincere appreciation to Prof. Shigeharu Senoo who has been a great help especially in constructive advice and valuable suggestion. I also would like to thank all all research assistant and hatchery workers that help me during my experiment.

ABSTRACT

Nannochloropsis oculata were cultured in sea bass, *Lates calcarifer* larval rearing water under different concentrations which were 0.0 Million cells/ml (control), 0.5 Million cells/ml, 1.0 Million cells/ml, 1.5 Million cells/ml, 2.0 Million cells/ml and 4.0 Million cells/ml in order to determine the optimum survival and growth level for sea bass larvae. The interaction between water quality and levels of survival and growth were also measured. The survival was highest in green water with 1.0 Million cells/ml concentration, which is as high as 90.33% while the lowest survival was in green water with 0.0 Million cells/ml concentration, providing only 26.67% survival rate. The growth for sea bass larvae was highest in green water with 4.0 Million cells/ml concentration, achieving a length of 0.85 cm.

ABSTRAK

Nannochloropsis oculata dikultur dalam air kulturan siakap, *Lates calcarifer* dalam kepekatan yang berlainan iaitu 0.0 Juta cells/ml, 0.5 Juta cells/ml, 1.0 Juta cells/ml, 1.5 Juta cells/ml, 2.0 Juta cells/ml dan 4.0 Juta cells/ml untuk mengetahui kepekatan optima yang sesuai bagi meningkatkan kemandirian dan tumbesaran ikan siakap. Parameter kualiti air turut diukur bagi mengenalpasti hubungkaitnya dengan kemandirian dan tumbesaran ikan. Kemandirian tertinggi tercapai dalam kepekatan 1.0 Juta cells/ml dengan peratus kemandiran 91.4% manakala tahap kemadiran terendah didapati dalam kepekatan 0.0 Juta cells/ml dengan 25.7%. Tumbesaran tertinggi didapati berada pada kepekatan 4.0 Juta cells/ml dengan saiz 0.85 sm.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABREVIATIONS

°C	degree Celcius
%	percentage
cm	centimeter
dAH	day After Hatch
DO	dissolved oxygen
mg/l	milligram per liter
Million cells/ml	million cells per milliliter
mt	metric tonne

CHAPTER 1

INTRODUCTION

1.1 Introduction to *Nannochloropsis oculata*

In the field of aquaculture, particularly fish hatchery, larval rearing has been the most important stage in increasing quality and productivity of fish. Green water culture in larval rearing is an alternative way of increasing the larval quality which has been common practiced in most part of the world (Navarro and Amat, 1992).

The term 'green water' defines the water containing micro algae which manifest as green colour appearance of the water. *Nannochloropsis* is a marine micro alga commonly cultivated in fish hatcheries as a feed for rotifers and to create a 'green water effect' in larval tanks (Fulks and Main, 1991).

In green water, due to the presence of algae, larvae tend to be more active and feed better (Tucker, 2000). Besides, excreted algal compounds are proven to produce positive effect, such as regulating and controlling bacterial contamination, pro-biotic effects and immune stimulation properties (Tucker, 2000).

Being micro algae, *Nannochloropsis* are cultured in larval rearing water because of the importance in enrichment of feed for larvae and the beneficial nutrient contents it provide. *Nannochloropsis* has also been proposed as a good source of the important dietary polyunsaturated fatty acid due to its high content of eicosapentanoic acid (EPA) (Zittelli, 1999).

1.2 Justification of Study

In commercial aquaculture, green water containing *N. oculata* used in larval rearing has proven to be beneficial compared to the clear water rearing technique. Although beneficial, the optimum level has not yet being estimated nor clarified.

In this study, varies concentration of *N. oculata* are applied to sea bass larval rearing water to measure the survival and growth of the larvae under different concentration from 2 dAH to 14 dAH

1.3 Objective of Study

The objectives of this study are:

1) To study the effect of *N. oculata* on the growth and survival of sea bass, *Lates calcarifer* larvae.

2) To study the optimum level of *N. oculata* on the growth and survival of sea bass, *Lates calcarifer* larvae.

3) To improve the rearing technique of sea bass, *Lates calcarifer* larvae based on the water parameters.

CHAPTER 2

LITERATURE REVIEW

2.1 *Nannochloropsis oculata*

The ability of *Lates calcarifer* to spawn in captivity following lunar rhythm is a gross advantage to aquaculture industry. Apart from this advantage, the larvae suffer from nutritional deficiencies, cannibalism and diseases. Adding of micro algae, *Nannochloropsis oculata* that high in HUFA and EPA in rearing tank in turn can gives better nutritional effects to the fish by nutrifies the larvae feed, rotifer, *Brachionus plicatilis*. *Nannochloropsis sp.* (Eustigmatophyceae) had the highest total lipid (16.1% of dry weight), 20:4n-6 (3.9% by weight of total fatty acids) and 20:5n-3 contents (17.8%, as weight percentage of total fatty acids) (Mourente, 1989).

N. oculata is not colorless but green in color that provides shady environment to the larvae. Besides, *N. oculata* prevents direct sunlight that consist ultraviolet rays from directly penetrates through the larvae body. This penetration may cause fatal to the larvae which body is not yet pigmented.

Even though there are also other micro algae such as *Tetraselmis sp.* that being used in aquaculture, it is impossible for the rotifer to consume because the cell size of *Tetraselmis sp.* is large thus might resulting zero digestibility. *Pavlova sp.*, meanwhile, is not produce by hatcheries as if the production is very difficult.

Action of excreted algal compounds represents a positive effect, as are regulating and controlling bacterial contamination, probiotic effects and immune stimulation properties (Richmond, 2004)

Despite that, biochemically, it can remove ammonia, generate oxygen and maintain high pH level. In addition, hormonally, it could release anti-bacterial and growth promoting substances. While other benefits, could include promoting normal bacterial flora in larval gut, behaviour stimulation and improving feeding and digestion (Tucker, 2000).

2.1.1 Classification

Phylum	Eukaryotes
Class	Eustigmatophycae
Genus	***Nannochloropsis***
Species	***oculata***

Source: www.fao.org

Table 2.1 Classification of *Nannochloropsis oculata*

2.1.2 *Nannochloropsis oculata* in larval rearing

Algae are introduced in the larval rearing tanks at concentrations of 0.5 Million cells/ml to 1.5 Million cells/ml in many commercial operations (Bromage and Roberts, 1995). Food capture might be enhanced by algal attenuation, diffusion, or dispersion of light, possibly because prey is more visible (Naas, 1992) or because the larvae can orient better (Tucker, 2000).

Based on the FAO, the blooming of the phytoplankton may cause high mortality to the larvae if the water cannot be changed in time caused by the sedimentation on the bottom of the tank. Cleaning purposes such as bottom cleaning should be done but it will stress the larvae during siphoning the dirt that containing waste, uneaten feed and decayed plankton.

2.2 Sea bass, *Lates calcarifer*

In Malaysia, this species locally called as Siakap or some may called as Selunsung. In the other parts of the world, it is also known as Asian sea bass, Barramundi, Giant Sea Perch and Bloch. Sea bass can be easily identified by its elongated silver black color body and has unique eye that will appear red in dark. Originated from Asian Ocean, it is widely distributed through Pacific Ocean (Barnabe, 1990).

Sea bass, *Lates calcarifer,* is one of species that been introduced to aquaculture. Tucker, (2000), suggest that in order of the fish to be useful in aquaculture, fish must survive, resist diseases, develop normally, convert food efficiently, grow reasonably fast, and reproduce.

This species is not just fulfill those criterions but has unique characteristic where it can be cultured in freshwater, brackish water and salt water. Based from the world aquaculture production during 1996 (FAO, 1998) sea bass contributed to aquaculture production of 4, 763 mt in freshwater, 10, 233 mt in brackish water and 888 mt in salt water.

This species is very important to Malaysia which had been the third highest producer with 2365 mt based on the FAO on 1998 after Taiwan, 6981 mt and Thailand, 3750 mt. In comparison with these three countries, Malaysia, geographically, has high opportunity to increase the production of this species in the future.

Sea bass has been qualified to be culture for many reasons. It is an omnivorous species that will influence its growth to be fast. Furthermore, it also has highly tolerances to low DO. The demand for this species is also high because of the good taste.

2.2.1 Classification

Table 2.2 Classification of sea bass

Kingdom	Animalia
Phylum	Chordata
Subphylum	Vertebrata
Class	Actinopterygii
Order	Perciformes
Suborder	Percoidei
Family	Centropomidae
Species	***Lates calcarifer***

Source: www.fao.org

2.2.2 Larvae rearing

The conditions that been applied to National Seafarming Development Centre, Hanura, Teluk Betung, Lampung, on the first two weeks, the larvae is reared in the indoor phase whereas the water exchange is about 10-20%. The salinity is maintained at 28-30 ppt. During this phase, micro algae are applied to the rearing tank. Larvae are given rotifer, *Brachionus plicatilis* as feed starting after the yolk sac absorption until 10 dAH. The intake is according to the size of the larvae. On the 11 dAH, the larvae are given Brine shrimp nauplii, *Artemia salina*. The data shows that the increase intake as the days.

2.3 Water quality

2.3.1 pH

pH is the negative logarithm of the hydrogen ion concentration in water and therefore is an index of acidity (Tucker, 2000). Measurements are on scale of 1 (very acidic) to 14 (very alkaline) where at pH of 7 is neutral (Tucker, 2000).

2.3.2 Temperature

Temperature plays an important role in larvae rearing. Based on the study by FAO Corporate Document Repository, temperature affects the growth and survival of the sea bass larvae. Within the temperature ranges between 26–32 °C survival rates increased as the temperature increased. Slow growth and poor survival rate were observed when the larvae were kept at 26 °C or below.

2.3.3 Salinity

On the study based on the effects of salinity to the growth and survival on sea bass larvae that conducted in Seafarming Development Center, Hanura, Teluk Betung, Batu Lampung, the salinity in larval tanks should be maintained at 28-30 ppt on 1-7 days, which the survival rate is 90% and continued until 8-14 days with the survival of 80%.

CHAPTER 3

MATERIALS AND METHODS

3.1 *Nannochloropsis oculata*

Seawater micro algae *Nannochloropsis oculata* is chosen in this study because it is believe to give positive reactions to sea bass larvae.

N. oculata were obtained from the hatchery of University Malaysia Sabah. The *N. oculata* were cultured in two tonne tank and enriched with fertilizer. It is collected in a bottle using filter, and stored in a refrigerator. The purpose cold storage method is to maintain a good condition of the *N. oculata.*

3.2 Research parameters

Research parameters that been used in this study is dissolved oxygen, pH and temperature.

3.2.1 Treatments of *Nannochloropsis oculata*

Six treatments are applied in these experiments. There are; 0.0 million cells/ml, 0.5 million cells/ml, 1.0 million cells/ml, 1.5 million cells/ml, 2.0 million cells/ml, and 4.0 million cells/ml. 0.0 million cells/ml is the control treatment whereas no *N. oculata* are added. Each of the treatment is replicated into three. Totally 18 aquariums was used.

3.3 Experimental Design

3.3.1 Experiment Preparation

The aquariums were filled with filtered sea water from the incubation tank and filled with 20 larvae per liter so each aquarium has 140 larvae. Then *N. oculata* were added to the aquariums according to its treatment which are 0.0 Million cells/ml, 0.5 Million cells/ml, 1.0 Million cells/ml, 1.5 Million cells/ml, 2.0 Million cells/ml, and 4.0 Million cells/ml. Each aquarium is supplied with aerators.

REFERENCE

Barnabe, G., 1990. Rearing bass and gilthead bream. In: Aquaculture. Vol.2, Ellis Horwood Publication, New York.

Bromage, N.R., and Roberts, R. J., 1995. Broodstock Management and Egg and Larval Quality. Blackwell Science.

FAO, 1998. World Aquaculture Production. Vol.2, Yearbook of Fishery Statistics, Capture Production.

FAO, 1989. National Seafarming Development Center, Hanura, Teluk Betung Lampung, Indonesia.

Fulks and Main, 1991. Handbook of Microalgal Culture, Biotechnology and Applied Phycology. Blackwell Science

Maurente, G,. 1989. Aquaculture 105

Naas K.E, 1992. Aquaculture 101

Navarro, J.C., and Amat, F., 1992. Aquaculture 101

Richmond, A.(eds.), 2004. Handbook of Microalgal Culture, Biotechnology and Applied Phycology. Blackwell Science

Tucker, J.W., 2000. Marine Fish Culture. 2nd ed. Kluwer Academic Publishers

Zittelli, C., 1999. Handbook of Microalgal Culture, Biotechnology and Applied Phycology. Blackwell Science