EFFECTS OF DIFFERENT STOCKING DENSITIES ON GROWTH AND SURVIVAL OF ASIAN SEA BASS (*Lates calcarifer*) JUVENILES

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DECLARATION

I declare that this dissertation is the results of my own independent work, except where otherwise stated.

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ABSTRACT

This experiment was conducted to study the effects of different stocking densities of Asian sea bass (Lates calcarifer) juvenile on growth and survival. The juvenile's sea bass were stocked at 4 different stocking densities with constant seven liters of filtered sea water. The treatments were including 1 juvenile/L, 5 juveniles/L, 10 juveniles/L and 20 juveniles/L with three replicate for each treatment. 30 day after hatch of juveniles were used in this experiment. The experiment lasted for three weeks. Green water (*Nannochloropsis oculata*) was added to each treatment to protect the juveniles from strong sunlight. These juveniles were fed *Artemia* twice a day in the morning and evening. The feeding was giving enough according to their densities. The results showed that there has significant difference among four treatments ($P < 0.05$) on growth of total length and body weight but there was no significant different ($P > 0.05$) on survival in Asian sea bass (*Lates calcarifer*) juveniles when analyses with one-way ANOVA. Juveniles which were stocked at 35 juveniles/L showed the highest growth of 1.45 ± 0.28 cm on total length and 0.059 ± 0.03 g on body weight, while the survival of this treatment was 100%, compared to other treatments. Therefore, 35 juveniles/L was the best stocking that can be suggested in juvenile rearing of Asian sea bass (*Lates calcarifer*).

ABSTRAK

Eksperimen ini di jalankan untuk mangkaji kesan perbezaan penstokan densiti ikan siakap juvenil kepada pembesaran dan kadar kemandirian. Ikan siakap juvenil ini distokkan dalam stok densiti yang berbeza-beza dengan tujuh liter air masin yang telah ditapiskan. Stok ujian ini mengandungi 1 juvenil/L, 5 juvenil/L, 10 juvenil/L dan 20 juvenil/L dengan mempunyai 3 replikat pada setiap ujian. Juvenil yang berumur 30 hari selepas menetas digunakan dalam eksperimen ini. Eksperimen ini dijalankan dalam tempoh tiga minggu. Air hijau (*Nannochloropsis oculata*) telah ditambahkan kepada setiap stok ujian untuk melindungi juvenil daripada cahaya matahari yang terik. Juvenil ini diberi makan *Artemia* dua kali sehari iaitu pada waktu pagi dan petang. Makanan akan diberikan secukupnya bergantung kepada stok densiti. Keputusan menunjukan perbezaan signifikan kepada pertumbuhan pada panjang badan dan berat ($P < 0.05$) tetapi tidak ada perbezaan signifikan ($P > 0.05$) kepada kadar kemandirian ikan siakap (*Lates calcarifer*) juvenil di antara keempat-empat stok ujian apabila diuji dengan ANOVA satu hala. Juvenil yang distok dalam 35 juvenil/L menunjukan pertumbuhan yang terbaik untuk panjang badan, 1.45 ± 0.28 cm dan 0.059 ± 0.03 g untuk berat badan, manakala 100% untuk kadar berbanding dengan stok densiti yang lain. Oleh sebab itu, 35 juvenil/L merupakan stok densiti terbaik yang boleh dicadangkan dalam pengkulturan juvenil ikan siakap Asia (*Lates calcarifer*).

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LIST OF ABBREVIATIONS

^0C	degree Celsius
%	percentage
cm	centimeter
DO	dissolve oxygen
kg	kilogram
g	gram
mg	milligram
GDP	Gross Domestic Product
HCG	Human Chorionic Gonadotrophin
FSH	Follicle Stimulating Hormone
LH	Leutinizing Hormone
dAH	day after hatch
L	liter
ppt	part per thousand
SPSS	Statistical Package for Social Science

CHAPTER 1

INTRODUCTION

1.1 Status of the aquaculture sector

In Malaysia, the fisheries sector plays an important role in providing fish as a source of food and protein (Department of Fisheries Malaysia, 2003). In 2002, it contributed about 1.6% to the National Gross Domestic Product (GDP) and also provided direct employment to 81,994 fisherman and 21,774 fish culturist. This sector involves 17,589 fish culturist with the total covered area of 7,319.75 hectares (Department of Fisheries Malaysia, 2003).

Aquaculture in Malaysia has its beginning in the early twentieth century with the culture of the Chinese Carp in ex-mining pool. In the mid 1930's, shrimp trapping ponds developed as a major industry in the Southern State of Johor. The culture of blood clam, Anadara Granosa, began sometimes in 1948. the semi intensive culture of freshwater fishes and extensive culture of the cockles (blood clams) dominated the 1950's and 1960's (Ang, 1990).

1.2 Potential for aquaculture development

Aquaculture is now a substantial worldwide production supplying an important proportion of the fish and shellfish consumed. A sustainable approach to the development, management and regulation of aquaculture can ensure that both the environment and industry provide long-term economic and social benefits. Aquaculture can become a sustainable industry supplementing the food supply from capture fisheries.

In Malaysia, aquaculture is considered as a new developed economic sector. The Government of Malaysia had formulated the National Agriculture Policy 1984 for the development of agriculture. The Malaysian Government aims to develop both new areas such as marine, forest, rivers, estuaries, lagoons, brackish water area and inland where there made much needed value added profit. (Ang, 1990).

Aquaculture recommends great socio-economic benefits and many countries are looking at ways in which to either develop their existing aquaculture industry or to provide in new production.

1.3 Constrain to aquaculture development

The major constraints that affect the local culturist are the high cost and lack of fish fingerlings. With the sharp increase in the number of cage culture farms over the recent years, supply of fish fingerlings from the local coastal water was no longer sufficient. To assemble the demand, alternative sources of supply had to be found.

Thailand and Philippines were chosen as alternative sources of supply due to their close proximity to Malaysia. The price increase three to four times over the last few years because of fingerlings imported rather than locally caught.

Although aquaculture offers relief to our over-stressed natural fish resources, it also can impact on the environmental. Impacts on the environment can include water quality, chemo-therapeutant use, eutrophication, biodiversity, animal health, human health and effects of interbreeding among wild stocks.

Since the marine environment has complex physical, chemical, and biological forcing features that effect the native microflora, research that asses the effect of petroleum hydrocarbon pollution on naturally occurring phytoplankton collections are required in order to understand the relationship between their biology and pollution (Chase,1999).

Aquaculture operation also can spread parasites and disease to wild marine species. For example, the migration of wild salmon between freshwater and seawater normally keeps sea lice, the seawater parasite. Farmed salmon spend all times in coastal areas, which increase their chances of getting parasites.

1.4 Asian sea bass (*Lates calcarifer*)

Asian sea bass is an important aquaculture species in many South-East Asian countries. Asian sea bass can be distributed in China, Taiwan, Japan, Papua New Guinea and Australia. (Pillay, 1990).

Natural habitat for this species is in coastal water, estuarine, lagoon and it also can survive in turbid water. Asian sea bass is belongs to family Centropomidae. While the genus is *Lates*, and the species of sea bass is *Lates calcarifer*. Because of sea bass has been cultured in many countries, so that they have many common names. The common names for this sea bass are Giant sea perch, Barramundi, Pla kapong for Thailand, Kakap for Indonesia and Siakap for Malaysia.

The Asian sea bass is a carnivorous, euryhaline species in sea water. It can be cultured even in fresh water and brackish water. Because of these Asian sea bass is a carnivorous, their cultivation is dependent upon adequate supply of trash fish and compound feeds (Pillay, 1990).

1.5 Advantages of *Lates calcarifer*

Asian sea bass is a commercially important aquaculture species in Australia and South-East Asia. The production of Asian sea bass in Australia has increasingly for the past 15 years and this development is expected to continue (Kungvankij, 1986).

There are many advantages for culturing Asian sea bass. The main advantage is, this species is euryhaline species. Because of this factor, they can culture and can survive in fresh water and brackish water.

This species is also tolerant of a wide range of salinities and water quality. Asian sea bass has a high growth rate which is about 800g in 8 months. Asian sea bass has been successfully cultured in South-East Asia such as Thailand, Singapore, Malaysia, Indonesia, Taiwan and Hong Kong and Australia for many years (Kungvankij, 1986), due to their high market value in Australia and also in large cities in Asia.

Asian sea bass also have good price for live product for restaurant trade which is about (US$2-4 in Thailand and US$ 2-6 in Malaysia and Taiwan). Because of this factor, it is well defined and optimistic market position and because of the restriction in supplies, the sea bass become much interest in the farming (Bromage and Roberts 2001). Asian sea bass has strong international demand as fresh-chilled product.

Asian sea bass has been cultivated for many years in brackish water ponds and in recent years in floating cage, but there is a lack of documented information on growing out phase. Grow out phase is performed into 2 phases which is juvenile phase and adult phase.

1.6 Problem in culturing *Lates calcarifer*

The major problem in culturing this sea bass is their cannibalism habits. Usually, cannibalism is occurring during juvenile phase. So that, sea bass juvenile has to be frequently graded and separate according to size. This action purpose is to minimize losses among sea bass juvenile. Besides, cannibalism behavior is one of the major causes that cause of high mortality. This mortality is attributing by stocking density, disease infection and feeding and water quality.

The first sorting should start at the second week because during this period the bigger fish can eat the smaller ones (Kungvankij, 1986). Stocking the same size of fish will reduce the rate of cannibalism. Thus, the survival rate will be increased and the growth rate of the fish could also be higher.

1.7 Objectives of this study

These researches have several objectives such as:

i) To determine the optimum stocking densities of sea bass juveniles.

ii) To do research either the different of stocking densities affects the growth and survival rate.

iii) Improving the technique culture of sea bass.

CHAPTER 2

LITERATURE REVIEW

2.1 Description of *Lates calcarifer*

Phylum: Chordate

Sub-phylum: Vertebrata

Class: Pisces

Sub class: Teleostomi

Order: Percomorphi

Family: Centropomidae

Genus: Lates

Species: *Lates calcarifer*

Asian sea bass has been placed under several families by various authors in the past such as Serranidae, Latidae and many more. However, Centropomidae is the commonly accepted family (Tattanon, T and Maneewongsa, S, 1982).

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