EFFECT OF DIFFERENT STOCKING DENSITIES ON GROWTH AND SURVIVAL OF PATIN (*Pangasius hypophthalmus*) LARVAE

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THIS DISSERTATION IS SUBMITED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR BACHELOR OF SCIENCE WITH HONOURS

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DECLARATION

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

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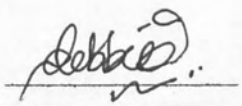

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ABSTRACT

An experiment was conducted to study the effects of different stocking densities on larvae growth and survival in Patin, *Pangasius hypophthalmus*. In this study, five treatments in triplicate were used namely; 10 tails/L, as control, and 20 tails/L, 30 tails/L, 40 tails/L and also 50 tails/L. All the larvae were cultured in small aquariums. In each aquarium, larvae of zero days after hatching were cultured accordingly to the five treatments with triplicate. The water volume of each treatment was 7000 milliliter or 7 liter. The water quality parameters were monitored, such as dissolved oxygen (DO), pH, and water temperature (°C). In addition, the growth of larvae was also recorded in each treatment. Observation of larvae behaviour (cannibalism) indicated before the larvae became juvenile. The results showed that there were significant different ($P<0.05$) on the survival rate of *Pangasius hypophthalmus* larvae when analyses with one-way ANOVA but there were no significant different ($P>0.05$) on the larvae growth rate. The treatment of 10 tails /L larvae showed the highest in mean of survival rate, whereas, the treatment in 20 tails /L larvae showed the highest mean in growth rate. Cannibalism occurs during the early larvae stage. Therefore, this study suggested the best stocking density in maintaining the growth and survival of *Pangasius hypophthalmus* larvae is to be reared in the range of 10 tails /L larvae to 20 tails /L larvae with sufficient feeding and good quality management.

ABSTRAK

Sebuah eksperimen telah dijalankan untuk mengkaji kesan perbezaan kadar pelepasan terhadap kadar tumbesaran dan kemandirian dalam pemeliharaan larva ikan Patin, *Pangasius hypophthalmus*. Dalam kajian ini, lima keadaan sampel yang berbeza dengan tiga replikasi setiapnya digunakan; 10 ekor larva/L sebagai kawalan, dan 20 ekor larva/L, 30 ekor larva/L, 40 ekor larva/L serta 50 ekor larva/L. Kesemua larva akan dikultur di dalam akuarium kecil. Pada setiap akuarium, larva dari hari sifar akan dikultur mengikut lima keadaan sampel yang berbeza dengan tiga replikasi setiapnya. Jumlah isipadu air bagi setiap akuarium adalah 7000 mililiter atau 7 liter. Kualiti air turut diuji seperti keterlarutan oksigen (DO), pH, dan suhu air (°C). Sebagai tambahan, kadar tumbesaran larva pada setiap keadaan sampel akan direkodkan. Pemerhatian terhadap perlakuan larva (kanibalism) berlaku sebelum larva menjadi juvenil. Daripada keputusan eksperimen, ia menunjukkan bahawa terdapat perbezaan signifikasi ($P<0.05$) pada kadar kemandirian larva *Pangasius hypophthalmus* apabila dianalisis menggunakan analisis ANOVA satu hala tetapi ia tidak menunjukkan perbezaan signifikasi ($P>0.05$) pada kadar tumbesaran larva. Keadaan sampel pada 10 ekor larva/L menunjukkan min kadar kemandirian tertinggi, manakala keadaan sampel pada 20 ekor larva/L menunjukkan min kadar tumbesaran yang tertinggi. Kanibalism berlaku pada peringkat awal larva. Maka, melalui kajian ini dicadangkan bahawa kadar kepadatan pelepasan yang terbaik dan sesuai untuk tumbesaran dan kemandirian yang baik pada larva *Pangasius hypophthalmus* adalah larva yang dikultur pada julat antara 10 ekor larva/L hingga 20 ekor larva/L yang disertakan dengan pemberian makanan yang mencukupi serta pengendalian yang baik.

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LIST OF ABBREVIATIONS

km^2	kilometer square
°C	degree celcius
%	percentange
m^2	meter square
L	liter
IU/kg	International Unit per kilogram
µg/ml	microgram per milliliter
mg/ml	milligram per milliliter
µg/kg	microgram per kilogram
-h	hour
cm	centimeter
mg/l	milligram per liter
CO_2	carbon dioxide
d AH	days after hatching
UV	ultraviolet
mL	milliliter
UMS	University Malaysia Sabah
DO	dissolved oxygen
SPSS	Statistical Package for Social Science
g	gram
µ	micro
ppt	past per thousand

CHAPTER 1

INTRODUCTION

1.1 Aquaculture Status in Malaysia

Malaysia is divided into two regions which is the West and East Malaysia. Peninsular Malaysia is the West Malaysia, consists of the southern portion of the Malay Peninsula and nearby islands. Malaysia is situated in the centre of South-East Asia which lies at the crossroads of the major air and sea links within the region as well as the world (Ulack, 2005).

Malaysia has a total area of about 329,758 kilometer square (km^2) and 4,400 kilometers of shorelines. Malaysia is suitable for aquaculture activities because the climate is generally warm throughout the year with daily temperatures ranging around 30°Celcius and the total annual rainfall averages around 200 centimeters. Other than that, the abundance of sunshine and rainfall account suitable for fish to spawn which rivers and swamps are naturally sheltered by forests (Ang, 1990).

'Aquaculture' is used widely for over a decade to denote all forms of culture of aquatic animals and plants in fresh, brackish and marine environments, is still used by many in a more restrictive sense. Aquaculture is generally considered as a part of fisheries science, there is now a tendency to denote the distinction between the two by using the term 'fisheries and aquaculture', because of some of the basic differences in development and management (Pillay, 2001).

Aquaculture can be defined as human activities to increase water organism production that useful for commercial and protein needs aspect in intensive way (Lokman, 1992). Aquaculture is an ancient practice, originating in China several thousand years ago (Blakely *et al.*, 1989). Aquaculture concept in Malaysia is still considered new as the aquaculture in Malaysia has its beginning in the early twentieth century with the culture of the Chinese Carps in ex-mining pool (Ang, 1990).

Aquaculture sector in Malaysia has a large potential and can contribute significantly to the total fish requirement in future. This sector has contributed about 1.37% to the Gross Domestic Product and also provided direct employment for fishermen and fish culturists in Malaysia. The industry has succeeded in achieving a steady production from its marine inshore fisheries amounting to an average of 1.08 million tones over the years (Department of Fisheries Malaysia, 2003).

According to Chuan *et al.* (1996), fish and fishery products will continue to form essential components of Malaysian diets since this sector plays an important role in providing fish as a supply of food and protein (Department of Fisheries Malaysia, 2003).

1.2 Introduction of Patin (*Pangasius hypophthalmus*)

Pangasius hypophthalmus is a native of Mekong River but it is also distributed throughout large rivers, lakes, reservoirs and ponds of Thailand, Cambodia, Vietnam, Laos, Malaysia, Indonesia, the Philippines, Burma, Bangladesh, India, Taiwan and China. This wide distribution leads to different name for this species. Usually this species is known as 'River Catfish' or 'Striped Catfish'. In Malaysia and Indonesia, this species is known as 'Patin', 'Pla Sawai' in Thailand, 'Ca Tra Yeu' in Vietnam, and 'Trey Pra' in Cambodia. In a recent systematic revision of Pangasiidae (giant catfishes), *P. hypophthalmus* is considered as a synonym of *P. sutchi* (Van Zalinge *et al.*, 2002).

Catfishes has high growth rate, very resistant and appreciated in a wide number of countries. Fingerlings production of catfish is one of the priorities of aquaculture research on the development of reliable method (De Graaf *et al.*, 2006).

There are two types of seed production that can be done for *P. hypophthalmus*; natural spawning, and artificial spawning. In natural spawning of *P. hypophthalmus*, the species will naturally spawn without any chemical or hormone usage to induce spawning. Shortage of seeds has hindered the culture of *P. hypophthalmus* on a big scale. In an

effort to increase seed production of the culture species, the artificial seed production is introduced. Artificial spawning is done to perform artificial ovulation for fish that cultivated in hatcheries. It is also made to have better eggs quality than the fish natural spawning, which sometimes cannot produce good quality of eggs.

1.2 Problems in *P. hypophthalmus* larval rearing

The problems generally encountered during larval rearing of *P. hypophthalmus* are the low survival rates of larvae after one week with two peaks of mortality occurring generally at 2 and then 5 to 7 days of age (Subagja *et al.*, 1999). According to De Graaf *et al.* (2006), the survival rate which is unreliable and varies between 0 – 60 fingerlings per meter square (m^2) per cycle is the main problem of fingerling production in ponds. Stocking density has a pronounced effect on growth of fish. High stocking densities act will hindering fish accessing to food, even at excess feeding rates (Black, 2001).

Although *P. hypophthalmus* has been cultivated for about 30 years, published information on the larval rearing of this species remains scarce (Subagja *et al.*, 1999). The study about the effects of stocking density on *P. hypophthalmus* larvae also has not yet been determined. Little biological information is available on the wild *P. hypophthalmus* stocks, as well as those of other Pangasiids (Van Zalinge *et al.*, 2002).

1.3 Objectives of Studies

This study is conducted as the study on the effects of different stocking densities on *P. hypophthalmus* has not yet been determined. The main objective of this study is to culture *P. hypophthalmus* under different stocking densities at 10 larvae per 1-litre, 20 larvae per 1-litre, 30 larvae per 1-litre, 40 larvae per 1-litre, and 50 larvae per 1-litre, respectively. The culturing will be conducted outdoor, in natural environment condition. In the previous studies for other species, red sea bream, the optimum stocking density for experimental rearing that recommended is 4000 – 5000 larvae per 500-litre tank or 10 larvae per 1-litre (Shepherd *et al.*, 1992). The aim for this study is to improve larval rearing in *P. hypophthalmus* for better survival and growth through stocking density. Therefore, the objectives of this study are;

1. To determine the possibility of stocking density affecting in Patin, *P. hypophthalmus*, larviculture and observe their best stocking densities.

2. To observe the larvae behaviour (cannibalism) during rearing period.

CHAPTER 2

LITERATURE REVIEW

2.1 Biology of Patin (*Pangasius hypophthalmus*)

Pangasius hypophthalmus is the largest freshwater Schlbeid (Pangasiid) fish that can grow up to 150 centimeters in total length and about 30 kilograms in body weight. A terminal mouth and 8–9 pelvic fin rays separate the genus *Pangasianodon* from the genus *Pangasius*. *Pangasianodon gigas* has seven dorsal fin rays and no gill rakers, while the *Pangasianodon hypophthalmus* has six dorsal fin rays and well-developed gill rakers. *P. hypophthalmus* have air-breathing organs and are obligate air breathers. This enables the fish to tolerate with poor water quality, as well as high organic matter or low dissolved oxygen levels (Van Zalinge *et al.*, 2002).

River catfish or Patin, *P. hypophthalmus,* is been classified as a fish from the systematic order of the species as below:-

Kingdom	–	Animalia
Phylum	–	Chordata
Subphylum	–	Vertebrata
Superclass	–	Osteicthyes
Class	–	Actinoptreryqii
Superorder	–	Ostariophysi
Order	–	Siluriformes
Family	–	Pangasiidae
Genus	–	Pangasius
Species	–	Pangasius hypophthalmus

P. hypophthalmus are late-in-life spawners. Sexual maturation of this species takes more than three years. Egg production increases dramatically from some 30,000 eggs for a fish of 5 kilograms to over 1,000,000 eggs for a fish of 10 kilograms. Due to the intensifying middle and small-scale fisheries targeting migratory fish, only a small percentage of fish can survive until maturity stage. Catfish are omnivorous and will accept trash fish, pellets, home-made feed formulated from agro- and fishery by-products, water plants and even animal and human wastes when cultured in ponds and cages. In Viet Nam catfish are commonly stocked in ponds with over-hung latrines. Traditionally, catfish culture systems in Viet Nam relied entirely on wild-caught fry (Van Zalinge *et al.*, 2002).

P. hypophthalmus is cultivated successfully both in ponds and floating cages in Peninsular Malaysia. Meanwhile in Sabah, *P. hypophthalmus* is stocked in ponds. Market supplies also come from the wild populations mostly found in domestic waters of the districts of Beluran and Kinabatangan. It can be easily maintained in aquarium as an ornamental fish and also aquaculture fish when in smaller size (Baidya *et al.*, 2004).

In Peninsular Malaysia, the retail price of *P. hypophthalmus* is higher than other freshwater table fish. The price is RM 10.25 per kilogram whereas, other freshwater table fish such as *A. nobilis, C. idella, P. gonionotis, O. niloticus,* and *Clarias sp.*, is around RM 4.48 – RM 6.76 per kilogram. At Sabah, the price is about RM 10 – RM 15 per kilogram (Department of Fisheries Malaysia, 1997).

P. hypophthalmus is a freshwater food fish that is a suitable species for aquaculture that has high market value and one of the most popular aquaculture fish compare to other freshwater fish such as carps, tilapia and clariids. It is popular due to increasing market demand and many attributes such as high growth rate, a flexible dietary habit because of which it accepts a wide variety of food items, high resistance to diseases, and tolerance to low dissolved oxygen level (Baidya *et al.*, 2004).

P. hypophthalmus is also known as high quality food fish which, the sweet white fleshes that is without numerous small bones makes it a consumer favourite fish. This species can easily be obtained live in the market and the culinary quality of its flesh is such that dishes suit different tastes can be prepared (Baidya *et al.*, 2004). Other that that,

it is also popular as an ornamental fish and also aquarium fish when in smaller fish (Photo 2.1).

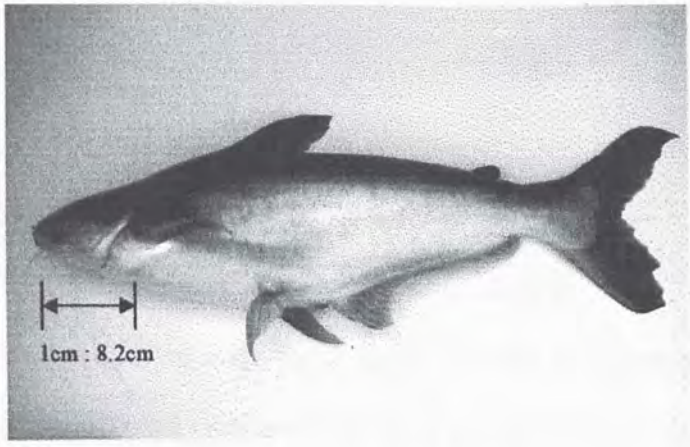

Photo 2.1 River catfish, *P. hypophthalmus*, local name is known as Patin.

2.2 Seed Production

In captivity, the *P. hypophthalmus* can takes more than three years of sexual maturation. It may well be the same as in nature. It is still unclear at what size the species reaches sexual maturity. However, the sexual maturation occurs at a minimum weight of 3 – 4 kg with a total length of 54 cm. The effect of attaining sexual maturity late in life is that relatively few individuals survive long enough to participate in spawning. Survival is determined by the levels of natural mortality and the mortality caused by fishing. Natural mortality of the larvae, fry and fingerlings is likely to be very high (Van Zalinge *et al.*, 2002).

There are two types of seed production that can be done for *P. hypophthalmus*;

i) Natural Spawning, and

ii) Artificial Spawning.

2.2.1 Natural Spawning

In natural spawning of *P. hypophthalmus*, the species will naturally spawn without any chemical or hormone usage to induce spawning. According to Van Zalinge *et al.* (2002), it was reported that fish with eggs are found in the Mekong from Stung Treng to Kandal between May and August, and particularly in June to July. The arrival of the monsoon leads to a rapid rise in Mekong water levels. This apparently triggers the actual spawning, usually in June. Subsequent sudden rises may induce spawning again for the fish. In July, its peaks are usually the most important where water current speeds are fast. The water mass from Kratie can potentially reach Phnom Penh in about three days and the delta in four days. However, the traveling time for fry and fingerlings is likely to be longer, as they seek out slower currents along the banks of the river (Van Zalinge *et al.*, 2002).

The specialised *dai* (bagnet) fishery for catfish fry and fingerlings in the Cambodian Mekong started in the first week of June in 1997 and 1998, and ended in 1997 in the last week of July, and in 1998, one month later. The major peak in fry availability was in the first week of July in both years. Similar *dais* in the Mekong delta of Viet Nam was monitored in year 1999. They found a peak in *P. hypophthalmus* abundance in the last two weeks of June and a much smaller peak a month later. This suggests that each

year spawning takes place from late May to August, with massive spawning probably happening only in the first part of June, depending on the start of the rains (Van Zalinge *et al.*, 2002).

It has been suggested that there is a lunar effect underlying the peaks in the occurrence of the larvae, as they happen together with a waxing moon. This could of course be the result of a lunar influence on the foregoing natural spawning process of this species (Van Zalinge *et al.*, 2002). The problem that usually occurs in the natural spawning is the unknown of sexual maturity stage of broodstock.

2.2.2 Artificial Spawning

Shortage of seeds has hindered the culture of *P. hypophthalmus* on a big scale. In an effort to increase seed production of the culture species, the artificial seed production is introduced. Artificial spawning is done to perform artificial ovulation for fish that cultivated in hatcheries. It is also made to have better eggs quality than the fish natural spawning, which sometimes cannot produce good quality of eggs.

The artificial spawning of *P. hypophthalmus* has been attempted in Malaysia, Thailand and also Indonesia. The seed of this species is produced in west Malaysia but when stocking demand is high, the seed will be imported from Thailand. There are different types of hormone can be used to induce breeding of *P. hypophthalmus*;

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