Growth Performance of Mahseer Fish (*Tor Tambroides*) in Different Types of Cultured Environments
ประสิทธิภาพการเจริญเติบโตของปลาเวียน ในสภาพแวดล้อมการเลี้ยงแตกต่างกัน

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Abstract

The growth performance of Mahseer fish (*Tor tambroides*) cultured in different types of environments was investigated. Four types of cultured environments were tested, namely: bamboo cages, nylon cages, screen-fishing net cages, and pen cultures for G1, G2, G3 and G4, respectively, with two replications. The experiment was conducted in the reservoir (3 rai) without controlling for external factors at Rajamangala University of Technology, Lanna, Nan from March to May 2017. Mahseer fish with initial weight and length about 61.21 ± 3.69 g and 17.40 ± 0.33 cm was used in this experiment with stocking density of 5 fish m^{-3} into cages (9 m^{-3}). Fish were randomly checked for growth performance every 30 days for a duration of 90 days. The results showed that the type of cultured environment used had a significant affect ($P < 0.05$) on growth performance, as measured by the average total weight gain, average daily weight gain and specific growth rate, but they had no significant influence ($P > 0.05$) on survival rate of fish in the four-group different cultured environments. The highest ($P < 0.05$) of these growth performances were found in fish of group 1 when compared with group 2, 3, and 4, respectively. On the other hand, the types of cage culture had significantly affected the feed conversion ratio. The lowest feed conversion ratio was found in fish of group1. Water quality parameters in each cage culture were all within the acceptable tolerance ranges for culturing of freshwater fish. The result of this study demonstrates the cage culture constructed with bamboo was recommended for the raising of Mahseer fish when considering best growth performance.

Keywords: *Tor tambroides*, growth performance, bamboo cages, cultured environments

บทคัดย่อ

งานวิจัยนี้มีจุดประสงค์เพื่อศึกษาประสิทธิภาพการเจริญเติบโตและการใช้อาหารของปลาเวียนในสภาพแวดล้อมการเลี้ยงต่างกัน จำนวน 4 ชนิด คือ กระชังไม้ไผ่ กระชังอวน กระชังมุ้งไนล่อนสีฟ้า และคอกไม้ไผ่ เลี้ยงในบ่อพักน้ำขนาด 3 ไร่ ณ มหาวิทยาลัยเทคโนโลยีราชมงคลล้านนา น่าน โดยไม่มีการควบคุมปัจจัยแวดล้อมภายนอก ตลอดระยะเวลาการทดลองระหว่างเดือนมีนาคม ถึง พฤษภาคม 2560 เริ่มทดลองใช้ปลาเวียนขนาดน้ำหนักเฉลี่ยเริ่มต้นประมาณ 61.21 ± 3.69 กรัม ความยาวเฉลี่ยเริ่มต้น ประมาณ 17.40 ± 0.33 เซนติเมตร เลี้ยงในกระชังขนาด 9 ลูกบาศก์เมตร ที่อัตราความหนาแน่น 5 ตัวต่อลูกบาศก์เมตร ให้ปลากินอาหารจนอิ่ม 2 ครั้งต่อวัน วัดการเจริญเติบโตทุก ๆ 30 วัน ตลอดการทดลอง 90 วัน ผลการศึกษาแสดงให้เห็นว่า สภาพแวดล้อมการเลี้ยงต่างกันมีผลต่อค่าประสิทธิภาพการเจริญเติบโต ได้แก่ ค่าน้ำหนักที่เพิ่มขึ้น ค่าอัตราการเจริญ เติบโตต่อวัน และค่าอัตราการเจริญเติบโต แต่ไม่มีอิทธิพล ($P > 0.05$) ต่ออัตรารอดตายของปลาเวียนทั้ง 4 กลุ่มทดลอง โดยค่าประสิทธิภาพการเจริญเติบโตของปลาเวียนพบสูงสุด ($P > 0.05$) ในปลาทดลองกลุ่มที่ 1 เมื่อเปรียบเทียบกับกลุ่มทดลองที่ 2, 3 และ 4 ตามลำดับ นอกจากนี้สภาพแวดล้อมการเลี้ยงยังมีผลต่อค่าอัตราแลกเนื้อ โดยพบสูงสุด ($P > 0.05$) ในปลาทดลองกลุ่มที่ 1 เมื่อเปรียบเทียบกับกลุ่มทดลองที่ 2, 3 และ 4 ตามลำดับ ในขณะที่ผลการวิเคราะห์การเปลี่ยนแปลงของคุณภาพน้ำในแต่ละสภาพแวดล้อมการเลี้ยงพบว่า ค่าคุณภาพน้ำทุกพารามิเตอร์อยู่ในเกณฑ์มาตรฐานสำหรับการเลี้ยงปลาน้ำจืด ดังนั้นผลการศึกษาข้างต้นสรุปได้ว่า สภาพแวดล้อมการเลี้ยงซึ่งสร้างจากไม้ไผ่และคอกมีความเหมาะสมกับการเลี้ยงปลาเวียนมากสุดเมื่อพิจารณาผลทางด้านประสิทธิภาพการเจริญเติบโต

คำสำคัญ: ปลาเวียน, ประสิทธิภาพการเจริญเติบโต, กระชังไม้ไผ่, สภาพแวดล้อมการเลี้ยง

Introduction

The Mahseer, *Tor tambroides*, also known as the Thai Mahseer, is a species that is highly valued and in high demand throughout Asia such as Indonesia, China, Malaysia, and Thailand (Nguyen et al., 2006). Previously, Roberts (1999) reported that Mahseer fish is the common name used for the genera *Tor*,*Tor Naziritor* and *Tor Neolissochilus* are in the family *Cyprinidae*. Next, Kottelat (2013) was classified this genus as: Phylum Vertebrata Subphylum Craniata Superclass Gnathostomata Series Pisces Class Teleostomi Subclass Actinopterygii Order Cypriniformes Division Cyprini Suborder Cyprinoidei Family Cyprinidae Genus *Tor* Species *Tor tambroides*. At the present, this species is one of the important species with a high potential cultivation in some areas in northern Thailand due to increase consumer demand. However, the production of *Tor tambroides* fry in Thailand is still limited due to problems especially on female brooders health that cultured in cages and pond environments during breeding season. This agreed with Dinesh et al. (2015) studied on aquaculture indices of Mahseer fish, *Tor khudree* cultured in the low lands of Kerala,South India, which the result found that the percentage survival and specific growth of *Tor khudree* were low in low lands culture. This case similar to Raina et al. (1999) research on growth performance of *Tor putitora* in manured ponds with artificial supplementary feed which the result found that a survival rate of fish were less than 55%. However, successfully aquaculture of Mahseer fish culture, earlier work

Dela Cruz (1982) has suggested that both of seed quality and rearing condition are very important to the success on freshwater fish culturing in the river or reservoir. In the same species of Thai Mahseer fish, the Golden Mahseer and Deccan Mahseer fish were studied in floating net cages in Walwhan Lake, India. The result found that the Mahseer have grown to an average of 170 g in 5 months (Food and Agriculture Organization of The United Nations, 2017). Although cage culture environments constructed with nature material has been evaluated as cage culture in some freshwater fish, but Mahseer fish in Thailand aquaculture has not documented yet. However, successful utilization of cage constructed with bamboo substitute nylon or screen-fishing net cage has been reported in rainbow trout which bamboo cage could improve weight and fish survival rate. (Dela Cruz, 1982). Therefore, this study was conducted to evaluate the impact of different types of cultured environments, rearing condition, on growth performance of Mahseer fish in Thailand aquaculture based on the best growth performance and feed conversion ratio. On the other hand, knowledge on this research could be used to improve the production in cage cultured environments of these spices which is an important commercial aquaculture species in the tropics area.

Research Objective

The aim of this study was to evaluate the impact of different types of cultured environments on growth performance and feed conversion ratio of Mahseer fish, *Tor tambroides*, in Nan province, Thailand. To examine of water quality performances in each cultured environments, rearing condition.

Materials and Methods

1. Experimental Feeds

The commercial diets that used in this study were same crude protein, 32% crude protein, and it was considered based on the essential nutrients necessary for satisfactory Mahseer fish of growth rate. Feed were supplied two times (8.00 am and 6.00 pm) in day by manual feeder until satiation, about 3% g.bw^{-1} day. The feeding rate and frequency were adopted from Tilapia fish (*Oreochromis niloticus*) (Riche et al., 2004). The uneaten feed was collect out from the cage culture after 0.50 hours from feeding time. The uneaten feeds were collected from each cage and dried them in the oven at 60°C for 20 hours. Fish samplings were monitored every 30 days to adjust the amount of feed given.

2. Experimental design

The present study was carried out at Faculty of Sciences and Agriculture Technology, Rajamangala University of Technology Lanna, Nan during March to May 2017 in Nan province which is one of the northern provinces of Thailand. This experiment was divided into four treatment groups of cultured environments with two replications each, as follows: group1: fish rearing into cage-cultured environments constructed with bamboo, group 2: fish rearing into cage-cultured environments constructed with nylon, group 3: fish rearing into cage-cultured environments constructed with screen-fishing net, and group 4: fish rearing into pens culture environments constructed with bamboo. The experimental units were Mahseer fish which purchased from farmer farm located in Nan province. Mahseer fish with an initial weight and length about 61.21 ± 3.69 g fish^{-1} and 17.40 ± 0.33 cm fish^{-1} were prepared

into 5 circular fiber tanks, at the rate of 200 fish per 3,000 liters, fed commercial diets (32% crude protein) for 30 days before allowed to release in each cultured environments as designed. A set of four rearing condition, each cultured environments had a volume of 9 m^3 was used for the rearing of Mahseer fish. Fish were stocked with density of forty-five fish per cage i.e., five fish m^{-3}. All fish in cultured condition were provided without aeration throughout the cultural period of 90 days. At the end of culturing, thirty fish per treatment groups were taken randomly.

Data Collection

1. Evaluation of growth performance of *Tor tambroides*

At the end of culturing, fish sampling were done and weighed for determining growth performance was counted them in order to calculate the survival rate by using the formula according to the method described by Basade, Kohli and Ogale (2009) as follow: Average daily gain, ADG (g/fish/day) = (Mean final fish weight – mean initial fish weight)/culture period (days), Percentage of weight gain, PWG (%) = [(Mean final fish weight – mean initial fish weight)x100]/ Mean initial fish weight, Specific growth rate, SGR (%/day) = [(ln final fish weight-ln initial fish weight) x 100]/ culture period (days).

2. Evaluation of feed conversion ratio of *Tor tambroides*

At the end of culturing, feed conversion ratio of fish in this experiment was evaluated as follows: Feed conversion ratio = Feed intake on dry weight basis (g)/mean final fish weight-mean initial fish weight.

3. Evaluation of water quality performance

The changes water quality performances were done for three times during the experimental period of 90 days. During the period of the water quality observation, fish were fed the commercial diets and uneaten diets were collected as usually, however, didn't do the water exchange. Water quality parameters, such as: dissolved oxygen, pH, conductivity, total dissolved solid, water temperature, turbidity, and salinity were recorded on weekly basis. All water quality parameters were monitored one times per day in the morning (08.00 am) by using the Horiba U-50 series water quality meter (Horiba, Japan) according to the manufacturer's guideline. While gaseous nitrogen concentration, such as: ammonia (NH_3), nitrite (NO_2^-), and nitrate (NO_3^-) were measured bi-weekly (08.00 am) until the end of experiment using LAQUA twin compact water quality meter (Horiba, Japan) according to the manufacturer's guideline.

Data Analysis

All data was expressed as mean ± standard deviation (SD) and analyzed by one-way ANOVA (analysis of variance). The Duncan's Multiple Range Test was used to determine the differences between the treatment means (Duncan, 1955). The alphabetical notations (a, b, and c) were used to mark the differences at significant level of an alpha 0.05.

Results

1. Growth performance and feed conversion ratio of *Tor tambroides*

Some parameters of growth performance of fish in each cultured environments at the

end of culturing were presented in figure 1. According to the results, at the end of culturing of experiment showed that statistical analysis were significantly different ($P < 0.05$) among treatment groups on parameter of mean final weight in each treatment groups. The values of mean initial body weights of fish were 61.45 ± 3.91, 60.89 ± 3.82, 61.08 ± 3.56, and 61.42 ± 3.45 g.bw of group1 2 3 and 4, respectively. The values of mean final body weights of fish were 128.31 ± 11.39, 93.33 ± 7.41, 103.18 ± 12.31, and 117.20 ± 13.10 g.bw of group1, 2, 3, and 4, respectively. Average daily gain (ADG) at the end of culturing of experiment was significantly different ($P < 0.05$) among treatment groups and were highest on fish in group 1 (0.74 ± 0.14 g/fish/day) followed by fish in group 4 (0.62 ± 0.16 g/fish/day), group 3 (0.47 ± 0.15 g/fish/day), and group 2 (0.36 ± 0.09 g/fish/day), respectively. The lowest specific growth rate (SGR) was observed on fish cultured in group 2 (0.47 ± 0.11 $\%day^{-1}$) and there were significantly lower ($P < 0.05$) than fish cultured in group1 (0.82 ± 0.13 $\%day^{-1}$), group 4 (0.71 ± 0.15 $\%day^{-1}$) and group 3 (0.58 ± 0.16 $\%day^{-1}$), respectively. The result on growth performance of Mahseer fish during 0-90 days showed that percentage weight gain (PWG) was high on fish cultured in group 1 (110.11 ± 24.48%) followed by fish in group 4 (92.20 ± 26.80%), group 3 (70.31 ± 24.81%), and group 2 (54.46 ± 15.66%), respectively. There were significantly different ($P < 0.05$) among treatment groups. Mahseer fish cultured in group1 showed high survival (82.23 ± 1.05%), but there were not significantly different ($P > 0.05$) among treatment groups. The lowest survival was observed on fish cultured in group 3 (80.30 ± 2.22%). Feed conversion ratio of fish at the end of experiment was not significantly different ($P > 0.05$) among treatment groups. They were highest on fish cultured in group 2 (3.99 ± 0.11) followed by fish cultured in group 3 (3.89 ± 0.07) and group 4 (3.62 ± 0.09). The lowest feed conversion ratio was observed on fish in group1 (3.51 ± 0.01).

2. Changes of water quality performances

According to the Table 1, showed that there were no significantly different ($P > 0.05$) among treatment groups on some parameters of water quality performances, such as: dissolved oxygen, conductivity, total dissolved solid, water temperature, pH, turbidity, and salinity. Some parameters of water quality performance such as pH (7.66 ± 0.02), dissolved oxygen (6.54 ± 0.01 mg l^{-1}) were highest in group 4. While conductivity (0.23 ± 0.50 ms cm^{-1}), total dissolved solid (14.05 ± 3.34 mg l^{-1}), water temperature (28.50 ± 0.02°C), turbidity (36.50 ± 10.06 NTU), and salinity (0.13 ± 0.05 ppt) were highest in group 3. However, there were not significantly different among treatment groups ($P > 0.05$). It means that type of cultured environments had no significant influence on these parameters of water quality performances. On other hand, there were significantly different ($P < 0.05$) among treatment groups on some parameters of water quality such as un-ionized ammonia (NH_3), nitrite (NO_2^-), and nitrate (NO_3^-). In aquaculture system, nitrogen in form wastes primarily originated from feeds and is of greatest concern due to their role in nutrient enrichment. The main nitrogenous compounds concern in aquaculture are gaseous nitrogen include un-ionized ammonia (NH^3), ionized ammonia (NH_4^+), nitrite (NO_2^-) and nitrate (NO_3^-). In this study, the value of un-ionized ammonia (NH_3), nitrite (NO_2^-) and nitrate (NO_3^-) of Mahseer fish cultured in different type of cultured environments, such as: bamboo cage (group 1), nylon cage (group 2), screen-fishing

net cage (group 3), and pens culture constructed with bamboo (group 4), were significantly different within treatment groups. The high gaseous nitrogen of fish excretion in water were observed on fish cultured in screen-fishing net cage (group 3) and was significantly different ($P < 0.05$) when compared with gaseous nitrogen of fish excretion in group1, 2 and 4, respectively.

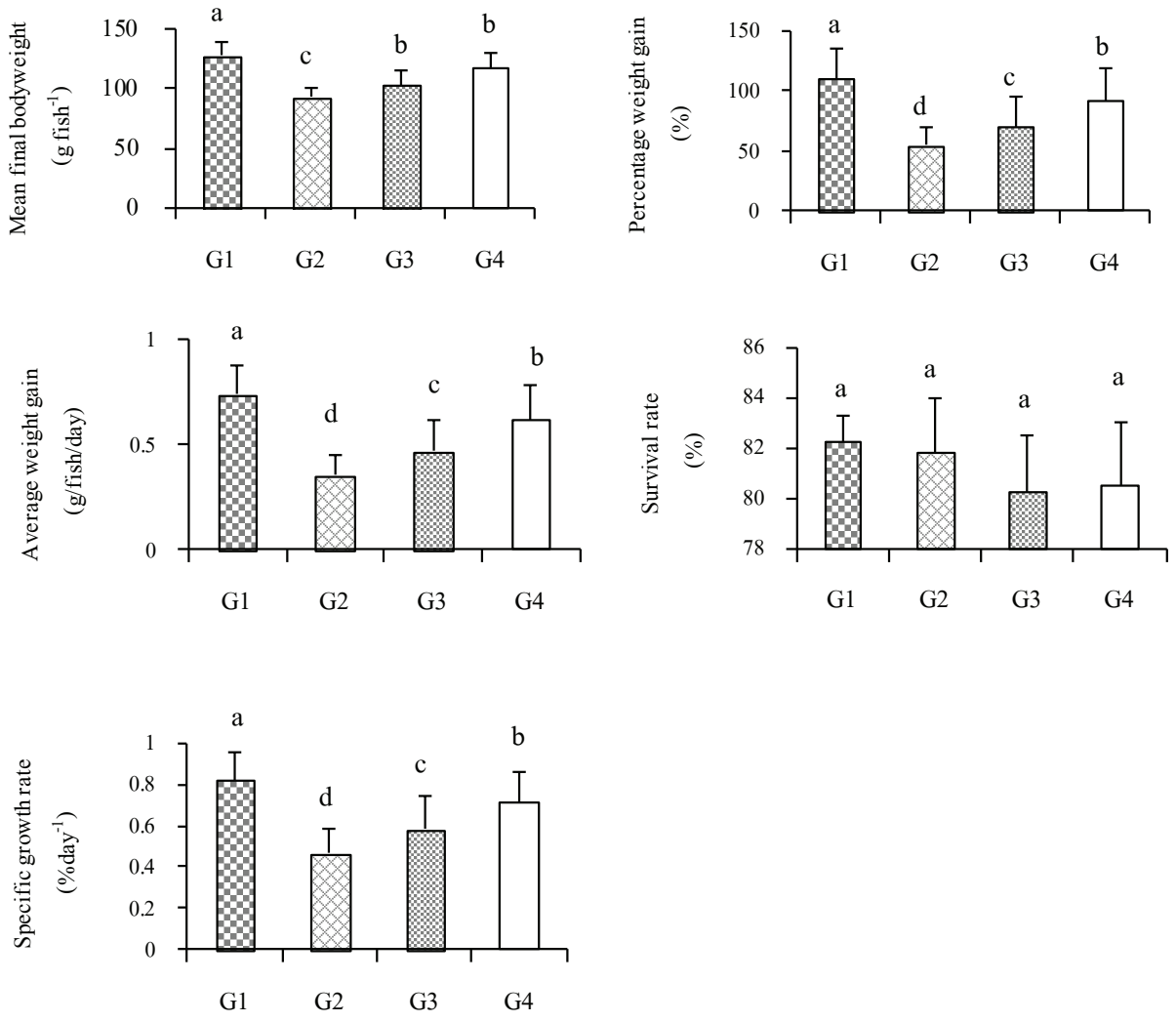

Figure 1 Growth performance of Mahseer fish (*Tor tambroides*) fed with commercial diet (32% crude protein) during the experimental period of 90 days in different types of cultured environments, such as: bamboo cage (G_1), nylon cage (G_2), screen-fishing net cage (G_3) and pens culture constructed with bamboo (G_4). Significant differences ($P < 0.05$) in the value of some parameters of growth performance (mean ± SD, n = 30 fish) of experimental fish between groups (G_1, G_2, G_3, and G_4,) are indicated with letters (a b c and d).

Discussion

Based on the results and statistical analysis showed that both values of growth performance and feed utilization were highest on fish in group 1 that fish were cultured in bamboo cage. It means that bamboo cage (G_1) was the best type of nature materials that could affected on these parameters of growth performance and feed utilization for rearing Mahseer fish if compared to another type of synthetic materials such as cage nylon (G_2) and screen-fishing net (G_3) in this experiment. There were some reasons suggest that due to floating bamboo cages which adhesive material for algae is made to fulfill the entire nutrient requirement of bottom feeders fish including Mahseer fish. This case also indicated that floating bamboo cages (G_1) and pens culture constructed with bamboo (G_4) was the best type of cage in this experiment, rather nylon cage (G_2) and screen-fishing net cage (G_3) had high growth performance of Thai Mahseer fish. Followed to the recommendation that the optimal crude protein in the commercial diet for rearing Mahseer fish should more 32% crude protein, either the fish could accepted it directly or be digested easily by this spices of fish. As supported by Islam and Tanaka (2004) reported that the optimum dietary levels of crude protein for Mahseer fish (Genus *Tor*) ranged from 32% to 45% crude protein, while factors that may be affect the dietary protein requirement including fish size, feeding rate, protein quality of amino acid composition, present of natural feeds, digestible energy, water quality, and stocking density of fish (Kohli et al., 2002). On the other hand, the study of Duangjai et al. (2017) studied on effects of Omega-3 fatty acids (from krill oil) on

Table 1

The changes of water quality performances in different type of cultured environments during culture period

Parameters	Treatment groups			
	Group 1 (bamboo cage)	Group 2 (nylon cage)	Group 3 (screen-fishing net cage)	Group 4 (pens culture)
1. pH	7.25 ± 0.01[a]	7.54 ± 0.02[a]	6.64 ± 0.01[a]	7.66 ± 0.02[a]
2. Dissolved oxygen (mg l^{-1})	6.15 ± 0.01[a]	6.44 ± 0.02[a]	6.05 ± 0.01[a]	6.54 ± 0.01[a]
3. Conductivity (ms cm^{-1})	0.13 ± 0.010[a]	0.19 ± 0.071[a]	0.23 ± 0.50[a]	0.20 ± 0.51[a]
4. Total dissolved solid (TDS) (mg l^{-1})	10.09 ± 3.52[a]	10.09 ± 2.13[a]	14.05 ± 3.34[a]	10.03 ± 2.58[a]
5. Water temperature (°C)	28.25 ± 0.01[a]	28.46 ± 0.01[a]	28.50 ± 0.02[a]	28.25 ± 0.01[a]
6. Turbidity (NTU)	31.48 ± 10.08[a]	31.50 ± 9.09[a]	36.50 ± 10.06[a]	31.60 ± 8.09[a]
7. Salinity (ppt)	0.10 ± 0.00[a]	0.10 ± 0.00[a]	0.13 ± 0.05[a]	0.13 ± 0.00[a]

Table 1

The changes of water quality performances in different type of cultured environments during culture period (Continue)

Parameters	Treatment groups			
	Group 1 (bamboo cage)	Group 2 (nylon cage)	Group 3 (screen-fishing net cage)	Group 4 (pens culture)
8. Ammonia (NH_3) (mg l^{-1})	0.15 ± 0.04^b	0.24 ± 0.07^b	1.37 ± 0.02^a	0.13 ± 0.14^b
9. Nitrite (NO_2^-) (mg l^{-1})	0.19 ± 0.05^b	0.21 ± 0.05^b	1.22 ± 0.14^a	0.25 ± 0.12^b
10. Nitrate (NO_3^-) (mg l^{-1})	12.11 ± 1.09^b	14.42 ± 2.09^b	19.51 ± 8.04^a	11.24 ± 2.07^b

Note. Number 1-7 measured by using U-50 Series water quality meters (Horiba, Japan). Number 8-10 measured by using LAQUA twin compact water quality meter (Horiba, Japan). Different a and b letters of superscripts in the same row indicate significant difference ($P < 0.05$).

sperm quality of Mahseer barb (*N. stracheyi*) brooders reared in captivity which the result found that supplementing of 0.4 g kg^{-1}diet of $omega^{-3}$ fatty acids together with commercial diet was found to be the best diet for male *N. stracheyi* fish that provided adequate required nutrients for the formation of spermatogenesis. In this experiment were observed that Thai Mahseer fish prefer floating bamboo cages than other type of cages, and well affected on water quality especially total organic nitrogen accumulation and dissolved oxygen concentration in rearing cages. Growth performance includes Average daily gain (ADG), Percentage of weight gain (PWG,%), Specific growth rate (SGR), and Feed conversion ratio (FCR) were significantly affected by cultured environments. It indicates that higher ADG, PWG, and SGR would achieved by rearing condition (bamboo cage) and feeding rate until satiation where efficient FCR (3.51 ± 0.01) were also found. It also indicates that in bamboo cage (G1) FCR were lowest but they were highest on fish cultured in group 2 (3.99 ± 0.11) where used cage constructed with screen-fishing net . This case it may be influence on efficiency of water changes in group 2 which was lower than group 1,2, and 3. It may be increasing feces in the water body in group 2 thus influence to decrease oxygen and increase total ammonium nitrogen concentration in cultured environments of group 2. This case similar to fish cultured in the rearing tank by Singh, Ebeling and Wheaton (1999), the result found that increasing feeding rate significantly influences accumulation of total ammonium nitrogen in water body. There were some reasons suggest that dissolved oxygen concentrations in water body that suitable for growth and healthiest are above 3 mg l^{-1} (Boyd & Tucker, 1998). On the other hand, this case agreed with Kulkarni (1971) also reported that Mahseer fish are bottom feeders, like other types of carps, they are omnivorous, eating not only algae and insects, but also commercial diets. This case similar to Srikanth (1986) noted that Mahseer (Genus Tor) fish could also be converted to feeding on commercial diet, which would be useful to the farmer, whenever shortages in natural food supply occur.

According to table 1, effect of difference types of cultured environments on growth performance of Thai Mahseer fish in this research showed there were significantly different ($P < 0.05$) among treatment groups on parameters of water quality performance such as pH (6.64-7.66), dissolved oxygen (6.05-6.54 mg l^{-1}), conductivity (0.13-0.23 ms cm^{-1}), total dissolved solid (10.03-14.05 mg l^{-1}), water temperature (28.25-28.50°C), turbidity (31.48-36.50 NTU), salinity (0.10-0.13 ppt), ammonia (NH_3) (0.13-1.37 mg l^{-1}), nitrite (NO_2^-) (0.19-1.22 mg l^{-1}), nitrate (NO_3^-) (11.24 -19.51 mg l^{-1}). These results agreed with some literature (Chapman, 1992) reported that the level for dissolved oxygen is above 3 mg l^{-1}, total ammonia nitrogen 0.5 to 1.0 mg l^{-1}, and Nitrite below 1.0 mg l^{-1}. The data of water performance in this study also found that it may be the end biomass of four cultured environments were not exceed as a overstocking of fish. It's mean that factors type of cultured environments had no significant influence on these parameters of water quality. This case similar to Kohli et al., (2002) found that Mahseer fish (Tor khudree) in floating cages in open waters displayed the best growth response whereas rearing in pond gave unsatisfactory growth owing to lower feed intake (Islam & Tanaka, 2004). This case, probably had correlation to increasing quality of water body in bamboo cages due to total organic nitrogen accumulation in the water body were removed by currency of water, so that it would replace by new water always. There were some reasons suggest that due to a lack of total organic nitrogen accumulation in the water body, bamboo cages was better than another one (Kohli et al., 2002). Type of cultured cage had significant affected on these parameters of feed utilization at the end of experiment. Therefore, this study can be concluded that the effect of difference types of cultured environments on water performance as waste loading were all still within the acceptable tolerance ranges for culturing of *Tor tambroides* fish in Thailand.

Conclusion

A significant effect of difference types of cultured environments in *Tor tambroides* was performed on growth performance such as mean final weight, percentage weight gain, average weight gain, specific growth rate, respectively. High mean final weight, percentage weight gain, average weight gain, and specific growth rate were appeared significantly at fish in group 1 by 128.31 ± 11.39 g, 110.11 ± 24.48%, 0.74 ± 0.14 g/fish/day, and 0.82 ± 0.13 $\%day^{-1}$, respectively, which were significantly difference to those fish that cultured in group 2 3 and 4. There also had a significant effect of cultured environments on feed conversion ratio. The best feed conversion ratio of fish indicated at group 1 (3.51 ± 0.01) which used bamboo cage as cultured environments. The survival rates of fish were observed relatively high at all treatments. Therefore, a types of cultured environments include; bamboo cage with bamboo were positively affected to growth performance and feed utilization of *Tor tambroides*. Hence, the bamboo cage constructed with bamboo were recommended for rearing of *Tor tambroides* when consider in better growth performance and feed utilization of fish.

Acknowledgment

This research was supported by The first author would also like to thank National Research Council of Thailand (NRCT) in 2017 in title of model development cage by using local materials to enhance the production of hill stream commercial fish of farmers in the watershed area, Nan. And also like to thank The Research and Development Institute of Rajamangala University of Technology Lanna for supporting our during research study period.

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