Effects of Different Stocking Density on Growth Performance of Three -spot Gourami (*Trichopodus trichopterus*) in Fiberglass Tanks

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Abstract : Effects of stocking density on growth performance and yield of three-spot gourami cultured in tanks were investigated. The experiment was carried out using a Complete Randomized Design (CRD) with three replicates. Fish with initial size of 1.05 cm-length and 0.15 g–weight were cultured in 500L fiberglass tanks, separated into four different-stocking densities (20, 40, 60 and 80 fish/tank). The fish population was then fed with 30% protein-pallet twice daily up to 4 months. Results showed that there was no significant difference (p>0.05) in final weight and length, specific growth rate (SGR), relative growth rate (RGR), feed conversion ratio (FCR) and survival rate among studied treatments. The final weight found were in the range of 2.26±0.51, 2.70±0.34, 2.73±1.09 and 3.20±0.7g in respect to the stock densities and the final length were 6.06±0.41, 5.80±0.30, 5.90±0.72 and 5.36±0.35 cm, respectively. The specific growth rate (SGR) of all treatments were not significantly different (p>0.05), and these were 2.54±0.18, 2.41±0.32, 2.38±0.06 and 2.28 ± 0.20 per day. Similar findings of no significant differences among treatments were also observed for RGR (0.0153±0.0006, 0.0167 ±0.0004, 0.0178±0.0008 and 0.0189±0.0004 cm) with the exception of FCR (2.05±0.26, 2.09±0.07, 2.18±0.09 and 2.24±0.10). In addition, the survival rate of four different-stocking densities were also not significantly different (p>0.05): 86.67±2.88 (20 fish/tank), 81.67±2.88 (40 fish/tank), 83.33±5.77 (60 fish/tank) and 80.00±5.0 (120 fish/tank).

Key words: Three – spot gourami (*Trichopodus trichopterus*), Stocking density, Growth performance

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1. Introduction

The three-spot gourami (*Trichopodus trichopterus*) has been known a labyrinth fish, referring from the two spots along each side of its body. The spot is also included together with the eyes as the third spot that resemble a third black spot, it is given the name three-spot gourami. In Thailand, the three-spot gourami normally found in marshes, swamps, canals, lowland wetlands and in particular of weed-rich pond as its habitat, breeding and protection. There are various species depends on artificial color morphs, which three-spot gourami more beautiful than the others (Wikipedia, 2012). *T. trichopterus* can be recognized by a long anal fin that is often marked with yellow-orange spots and also by a body with numerous narrow irregular oblique bars that are quite distinctive if present. The most distinctive characteristics of *T. trichopterus are* the two conspicuous lateral spots located at the caudal base (tail) and central portion of the fish.

This species is an omnivore, which requires algae-based food and insects as well as mosquito larvae. The average size of three-spot gourami is about 6-8 cm in length. Although this species is considered non-economic fish in fisheries and aquaculture system, it in fact plays an important role in meeting the nutritional requirement of local fishers in Thailand. In northeastern Thailand, consumer demand of the fish is very high. The species has also gained importance for its ornamental value as an indigenous aquarium fish and is being exported to China, Germany, Hong Kong, Japan, Malaysia, Republic of Korea, Singapore, Taiwan and USA (Tarnfid, 2013). The natural resources of this species are, however, fast declining in Thailand, due to modification of its habitats and over exploitation for human consumption as well as aquarium trade. Although considerable work has been done on their biology and life history, sufficient information on mass culture and production is not available.

From this point of view, the objectives of the present study were to investigate the effects of different stocking density on growth performance and production of three–spot gourami raised in fiber glass tank. This could provide necessary information to upgrade three-spot gourami breeding into commercial scale; create jobs and income as well as conservation of the natural fish populations.

2. Materials and Methods

All experiments were conducted at Department of Fisheries, Faculty of Agriculture and Technology, Rajamangala University of Technology Isan (RMUTI), Surin campus during June to September 2012.

3. Experimental system

The experiments were conducted in a 500 L fiberglass container system, filling 200 L water and re-circulated. Fish used in the experiments were taken from breeding hatchery with uniform in size. Initial weight and length of fish were 0.14 $\pm$ 0.02 g and 1.05 $\pm$ 0.02 cm, respectively. Group of fish in triplicate with complete randomize design, were applied to the experimental study. Four stocking density of 20, 40, 60 and 80 fish/m^2 were designed. Fish were acclimated in the experimental systems for one week prior to starting the experiment and then fed with floating ornamental fish feed and fishmeal 7-10% body weight, twice daily at 09.00 and 16.00 hr.

3.1 Experimental Procedure

Weight gain and length of fish were measured at the beginning of the experiment and subsequently every 15 days for 120 days. Feedings were canceled on the sampling date. After each measuring period, the amount of feed given was adjusted according to the biomass in each cage.

3.2 Growth Evaluation

Data on survival rate, specific growth rate (SGR), average weight and length and feed conversion ratio (FCR), were calculated. Analysis of variance (ANOVA) and Duncan's multiple range test analysis were conducted to assess differences between the samples at the level of $p < 0.05$ and express the unit as percentage to obtain normal distribution conducted by angular transformation (Chesoh, 1995).

3.3 Water Quality

Water was collected twice a month to measure dissolved oxygen (DO), pH-value, hardness, alkalinity, total ammonia, nitrite and temperature.

3.4 Economic evaluation

The economic analysis was performed to estimate all costs and income of all experiments. The economic evaluations were calculated based on the method used by Chesoh (1995)

4. Results and Discussion

4.1Water quality

Water quality indicated by an important parameters present in Table 1. The results revealed that dissolved oxygen was 4.94 - 6.90 mg/L, pH 6.75 – 8.00 mg/L, hardness 79.00 – 98.00 mg/L, alkalinity 44.00 – 58.65 mg/L detected for 16 weeks totally. There were no ammonia and nitrite detected in all treatments. The temperature was 26.60 – 27.25°C, influencing by air temperature. Water quality parameters were within ranges suitable for health and growth of general freshwater fishes (Hepher, 1967).

4.2 Effects of different stocking density on growth performance

Survival rate of fish ranged from 80.00±5.00% to 86.67±2.88%. However, these differences were not significant among treatments. The effects of stocking density on the growth of fish are summarized in Table 2.The statistical results showed that the final weight, final length and specific growth rate (SGR) of fish among treatments were not significantly different ($p<0.05$). This is in contrary to the result reported by Ko-anantakul and Chantana (1994), who found that growth and survival rates of Nile tilapia decreased with the increasing stocking densities. Wongsongsa *et al*., (1994) showed that at higher stocking density of Tinfoil Barb (*Puntius altus*), nursing in cement tanks, growth rates were lower. However, the growth performance in this study is in agreement with Chesoh and Kunral (1995), reported that the growth rate of Sepat Siam (*Trichogaster pectoralis*) nursing in cement tanks, significantly increased with the increasing stocking density.

The excellent response to high stocking density of three-spot gourami in this study may explained by environmental tolerance of the species, as well as Sepat Siam, which can be raised in fiber glass tank. In the captive environment, the population density is a limited factor for the carrying factor (Hepher, 1967). The results obtained from this study found that 80 fish/m^2 stocking density showed no different growth rate from the lower stocking densities.

This suggested that the environment conditions in the stocking density 80 fish/m^2 are still suitable for three-spot gourami. Therefore, increasing stocking density is recommended to be investigated in the future study.

4.3 Effects of different stocking density on feed conversion efficiency of fish

Feed conversion ratio (FCR) increased with increasing stocking density and highly significant among treatments ($p<0.01$). Feed conversion ratio (FCR) of 80 fish/m^2 was the lowest. Feed conversion ratio of 40 fish/m^2 was not significant different compared to 20 60 and 80 fish/ m^2, while at 20 fish/m^2 showed significantly lower ($p<0.05$) from 60 and 80 fish/ m^2. In this study, feed conversion ratio was higher at higher stocking density may be due to feed losses increased with feeding amount

4.4 Economic returns

Treatment 4 (T4, 80 fish/m^2) obtained the maximum production yield at the level of 349.67 kg/tank, followed by T3, T2 and T1 at 349.13 ± 0.26, 348.20 ± 0.73 and 347.41± 0.22 kg/tank, respectively (Table 3). Total income from selling fish, and return on investment (%) were increased with increasing stocking density and differed significantly among treatments ($p<0.01$). Stocking density of 80 fish/ m^2 was found to be sufficient for maximum economic returns in general.

5. Conclusion

Based on growth performance and highest economic return, the results of this study, it is suggested that optimal stocking density for three-spot gourami was 80 fish/m^2 young fish, cultured in fiberglass tank. This stocking density showed no significantly different in term of growth performance from the others, but provided the highest economic return in terms of Total income and return on investment.

6. Acknowledgement

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Table 1 Some major water quality parameters in fiberglass tanks

Parameter	Stocking density (fish/m^{2})			
	T1 (20)	T2 (40)	T3 (60)	T4 (80)
Dissolved oxygen (mg/L)	5.20-6.30	5.90-6.58	4.94-6.90	5.08-6.63
pH	6.75-7.65	6.80-8.00	6.82-7.32	6.90-7.53
Hardness (mg/L $CaCO_3$)	79.00-98.00	80.25-92.35	80.35-95.00	84.28-93.50
Alkalinity (mg/L $CaCO_3$)	44.00-53.50	48.00-55.60	54.00-58.65	49.00-58.50
Ammonia (mg/L)	0.00	0.00	0.00	0.00
Nitrite (mg/L)	0.00	0.00	0.00	0.00
Temperature (^{0}C)	26.60-26.75	26.70-27.15	26.60-27.15	27.05-27.25

Table 2 Growth performance and feed untilization of Three-spot gourami (*Trichogaster trichopterus*) in fiberglass tank for 4 months (120 days) (Mean±SD)

Growth parameters	Stocking density (fish/m^{2})*			
	T1 (20)	T2 (40)	T3 (60)	T4 (80)
Initial weight (g)	0.15 ± 0.02	0.15 ± 0.03	0.14 ± 0.02	0.15 ± 0.01
Final weight (g)	3.20 ± 0.75^{a}	2.73 ± 1.09^{a}	2.70 ± 0.34^{a}	2.26 ± 0.51^{a}
Initial length (cm)	1.05 ±0.04	1.05 ±0.02	1.05 ±0.03	1.06 ±0.04
Final length (cm)	6.06 ± 0.41^{a}	5.80 ± 0.30^{a}	5.90 ± 0.72^{a}	5.36 ± 0.35^{a}
Average daily growth:				
-weight (g/day)	0.025±0.006^{a}	0.022±0.003^{a}0.04	0.021±0.003^{a}	0.018±0.005^{a}
-length (cm/day)	0.042±0.003^{a}	0±0.004^{a}	0.040±0.003^{a}	0.036±0.003^{a}
Specific growth rate; SGR (%/day)	2.54 ± 0.28^{a}	2.40 ± 0.27^{a}	2.45 ± 0.21^{a}	2.25 ± 0.25^{a}
Feed conversion ratio (FCR)	2.05 ± 0.26^{a}	2.09 ±0.07^{ab}	2.18 ± 0.09^{b}	2.24 ± 0.10^{b}
Survival rate (%)	86.67 ± 2.88^{a}	81.67±2.88^{a}	83.33±5.77^{a}	80.00 ± 5.00^{a}

* Meaning the same row with different superscripts are significant different ($p<0.01$) by DMRT

Table 3 Economic return of Three-spot gourami (*Trichogaster trichopterus*) production raised in all experiments

Items/ fiberglass tank	Stocking density (fish/m^{2})			
	T1 (20)	T2 (40)	T3 (60)	T4 (80)
1. Cost (Thai; Baht)				
Fish fingerling	2	4	6	8
Fish feed	5.72±1.08	9.67±3.64	14.27±1.29	16.92±3.85
Depreciation cost	108.33	108.33	108.33	108.33
Total cost	116.05±1.08	122±3.64	128.6±1.29	133.25±3.85
3. Income (Thai; Baht)				
Total income from selling fish	88.91±0.88	167.06±1.2	255.36±1.3	327.07±1.1
Profit/kg	-258.5±0.66	-181.14±2.1	-93.87±0.78	-23.6±2.33
4. Return on investment (%)	-21.39	36.93	98.49	164.56

Figure 1 Fiber glass used in the experiment

Figure 2 Infancy weighting

Figure 3 Length measuring

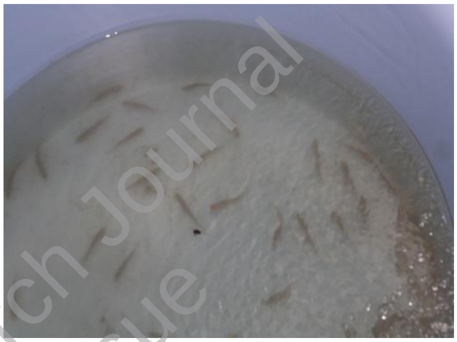

Figure 4 Three-spot gourami