Effect Stocking Density on Growth and Survival Rate of Larval Selais Fish (*Kryptopterus lais*) Cultured in Recirculation System

Agusnimar Muchtar and Rosyadi
Departement of Aquaculture, Universitas Islam Riau, Pekanbaru, Indonesia

Keywords: *Kryptopterus lais*, Stocking Density, Recirculation, Survival, Growth.

Abstract: An experiment about the effect of three stocking densities (10, 30 and 50 larvae L $^{-1}$) on growth and survival of the selais fish larvae, an important commercial species, and the source of income for the rural community was conducted at the Fish Hatchery of the Agriculture Faculty, Universitas Islam Riau, Indonesia. Three-day post-hatched larvae (0.0012±0.00 g in weight ; and 0.03±0.00 cm in length) were used as test fish that obtained from the artificial spawning of the selais fish broods. The fish larvae reared in recirculation system with a water flow rate of 0.05 L^{-1}, and fed with silkworms (*Tubifex sp*).This study used a completely randomized, non-factor design with three treatments and three replications. The best growth in weight and growth in length (of 0.87±0.00 grams and 5.39±0.49 cm, respectively) were found in the T1 (stocking density was 10 larvae L^{-1}). The highest survival rate (57.33±7.72) was attained in T1 (stocking density was 10 larvae L^{-1}) while the lowest survival (51.60%) attained in T3 (stocking density was 50 larvae L^{-1}) . Growth rate and survival rate of the selais fish larvae were inversely proportional to the density of the fish larvae.There's no significant effect of stocking density on the growth and survival of the selais fish larva ($P>0.05$).

1 INTRODUCTION

Selais fish (*Kryptopterus lais*) is a kind of freshwater fish inhabits floodplain river ecosystems (Elvyra et al., 2010), and peatland waters in the Bukit-Batu Biosphere Reserve, (Fahmi et al., 2015), an ecosystem that has unique characteristics in the Riau Province. The selais fish is an important economic commodity in Riau Province due to (1) it is very delicious food ingredient, liked by many peoples so that it become important trading commodity, (2) this fish is also a source of income for rural people because is the main source of raw materials for the fish industry, (3) these fish have the potential to be developed as economically valuable ornamental fish (Fahmi et al., 2015), (4) the selais are endemic fish that have the potential to enrich fish populations in waters (stock enhancement) and restocking to lakes and reservoirs (Rengi et al., 2013; **?**).

The population of the selais fish inhabiting freshwater in Riau Province decline continuously (Rengi et al., 2013; Simanjuntak C P. H., 2008) due to high-intensity fishing, environmental damage and the threat of the introduction of exotic fish against native species. The impact of the this decline in fish population did not only cause a decrease in fishermen's catches yield but also affects the stock of raw materials for the smocked fish industry and the income of rural people.

To overcome this problem, fish farming needs to be developed. Domestication of fish selais has been carried out through a series of studies so that these fish can be artificially spawned, have received artificial feed (Agusnimar and Rosyadi, 2013) and grow optimally in cultivated with the artificial feed in floating net cages (Rosyadi and Agusnimar, 2016) and in pond (Agusnimar et al., 2015).

Stocking density is a key factor affecting the production of cultured fish seeds, in addition to food supply and quality, genetics, and environmental conditions.

An increasing in fish stocking density can increase fish seed production however the increase in fish stocking density in culture media can reduce water quality, fish growth rate and degree of heterogeneity of live fish (Slembrouck, 2005) therefore, to increase fish larval production by increased stocking densities must be followed by the increasing of dissolved oxygen because the rate of the dissolved oxygen in water can be a barrier to the survival of fish larvae and can cause their death.

There is much larval death because there is not

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enough oxygen. The recirculation system can increase the support of the cultivation media (Kadarini et al., 2010).

The purpose of this study was to determine the effect of differences in stocking density on the growth and survival of fish larvae (*Kripthopterus lais*) which are maintained by a water recirculation system.

2 METHODOLOGY

The experiment was conducted at the Fish Hatchery of the Agriculture Faculty, Universitas Islam Riau, Indonesia, from May 10 to June 25, 2016. Three-day post-hatched larvae (mean weight 0.0012±0.00 g; mean length and 0.03±0.00 cm) were used as test fish that obtained from artificial spawning result of selected selais fish broods in total length 90-110 cm and average weight equal 100-120 gram.

Nine cylindrical plastic topless units were used as experimental containers. the capacity of each topless was 15 liters, filled with 10 liters of water A recirculation system connected to the physical filter and a water pump with a water flow rate of 0.05 L^{-1} was installed in this experiment. Fish larvae were stocked in experimental media at three different density levels: (10 larvae L^{-1} , 30 larvae L^{-1}, 50 larvae L^{-1}) . Fish larvae were fed silkworms (*Tubifex sp*) collected from Sail river in Pekanbaru. The silkworms were given to larvae using the ad libitum method. Fish growth data were taken randomly and measured at the beginning and the end of the experiment. Both weight and length were measured (nearest 0.01 g, total length of the closest cm, respectively). This study used a completely randomized, non-factor design with 3 treatments and 3 replications as follows:

Treatment 1 (T1): rearing selais larvae with stock density 10 larvae in 1liter water (L^{-1}); Treatment 2 (T2): rearing selais larvae with stock density 30 larvae in 1 liter water (L^{-1}); Treatment 3 (T3): rearing selais larvae with stock density 50 larvae in 1 liter water (L^{-1}).

The parameters observed consists of initial and final (weight and length) growth and survival fish larvae. Base on that data the performance growth and survival of selais fish larvae were calculated base on the equation :

- Weight Gain (WG) = Mean final weight – Mean initial weight
- Daily Weight Gain (DWG) = Fresh weight gain in fish (g) / t
- Specific growth rate/day (SGR) = [(Log final weight – Log initial weight) x 100] / t
- Survival rate (SR) = (Final number of fish/Initial number of fish) x 100.

Performance of the growth and survival data were analyzed by one-way analysis of variance (ANOVA) to determine the difference in density for each treatment and the least -squares difference (LSD) test was applied when significant differences were found.

The water quality parameters such as temperature, pH and DO was measured straight from the media experiment in Fish Hatchery of Agriculture Faculty, Islamic University of Riau, while ammonia was analyzed in the laboratory of the Environmental Quality of Riau University.

3 RESULT AND DISCUSSION

3.1 Growth and Survival Rate

The weight growth of selais fish larvae effected by different stocking density presented in table 1.

Table 1: The weight growth of selais fish larvae cultured on diffrent stocking density.

Parameters	Weight Growth of Selais Fish Larvae		
	T1	T2	T3
Average Initial weight (g)=ALW	0.0012±0.00	0.0012±0.00	0.0012±0.00
Average Final weight (g)=AFW	0.88±0.00	66±0.00	0.64±0.00
Wight pain (g)= WG	0.87±0.00	0.66±0.00	0.64±0.14
Daily wight rate (g) = DWG	0.04±0.00	0.03±0.00	0.03±0.01
Specific growth rate (%/day) = SGR	13.63±0.15	13.042±0.25	12.96±0.26

As shown in table 1 that the performance of growth weight of selais fish larvae was varied in different stocking densities. However base on analysis of variance we found that there were no apparent effects of stocking density (10, 30, 50 larvae L^{-1}) on the growth at the levels tested ($P>0.05$). The best wight rate (WG, DWR, and SGR, 0.87±0.00 g/day: 0.04±0.00, and 13,63 ±0.15%, respectively) was found in treatement of T1 (stocking density of 10 larvae L^{-1}) while lowest growth rate (WG, DWR and SGR: 0.64±0.14 g/day, 0.03±0.01, and 12,96 ±0.26%, respectively) was found at treatement of T3 (stocking density of 50 larvae L^{-1}).

This result indicated that the higher stocking density the slower the weight gain, daily weight rate, and specific growth rate/day. Prior research (Darmawan and Suharyanto, 2017) reported the similar effects of high stocking densities on growth of Jambal catfish (*Pangasius djambal*).

The length growth of selais fish larvae effect by diffrent stocking density presented in table 2.

Table 2: The Length Growth of Selais Fish Larvae Cultured on Different Stock Density.

Parameters	Length Growth of Selais Fish Larvae		
	T1	T2	T3
Average Initial Length (g)=ALW	0.03±0.00	0.03±0.00	0.03±0.00
Average Final Length(g)=AFW	5.42±0.49	5.31±0.02	5.20±0.24
Length pain (g)= WG	5.39±0.48	5.28+0.02	5.17+0.24
Daily Length rate (g) = DWG	0.26+0.02	0.25+0.01	0.25+0.02
Specific Length rate (%/day) = SGR	10.74+0.00	10.70+0.00	10.55+0.00

Similar with performance of the growth weight, the highest length growth (LG,DLR, and SLR, 5.39 ±0.48 cm/day: 0.26±0.02, and 10,74 ±0.10%, respectively) of selais fish larvae was found at treatement of T1 (stocking density of 10 larvae L^{-1}), while lowest length growth (LG, DLR, and SLR were 5.17±0.00 g/day : 0.25±0.02 , and 10.55±0.00%, respectively) was found at treatement of T3 (stocking density of 50 larvae L^{-1}).

It was mean that the best length growth of selais fish larvae found in the lowest stoking density. Similar findings were recorded in other reared species (Herrera, 2015; Huet, 1971) who achieved the best growth of fish larvae at lower stocking densities.

The high growth (weight and length) of fish larvae in treatment of T1 compared to T2, and T3 may be due to fish larvae maintained with low stocking density do not spend much energy to compete using more space and food. Haque et al. (Haque et al., 1984) said that the fish that were kept with the lowest stocking density provide more space, food, and less competition. So that the fish larvae in the T1 treatment (the lowest stock density of fish larvae in this experiment) have more energy to support the growth of fish larvae in the treatment of T1.

Survival rate of selais fish larvae on different stocking density was shown ini table 3.

Table 3: The Survival Rate Of Selais Fish Larvae Cultured On Different Stock Density.

Replication	Survival rate selais fish larvae(%)		
	T1	T2	T3
1	68,00	50,67	54,00
2	54,00	62,67	52,00
3	50,00	52,00	48,80
Total	172,00	163,33	154,80
Average	57,33	55,11	51,60

In table 3 was shown that the survival rate of selais fish larvae was varied (T1,T2, and T3 was 57,33%, 55,11%, and 51,60%, respectively) in different stocking densities. However base on analysis of variance we found that there were no apparent effects of stocking density (10, 30, 50 larvae L^{-1}) on the survival at the levels tested (P>0.05). The best survival rate was found in T1 (stocking density of 10 larvae L^{-1}) while lowest growth was found at T3 (stocking density of 50 larvae L^{-1}).

The results of this study also show that the survival rate of selais fish larvae is inversely proportional to stocking density. The higher stocking density, the lower the survival of fish larvae. This means that stocking density is a determining factor for the survival of fish larvae. According to Herrera (Herrera, 2015) stocking density affects survival, growth, behavior, health, water quality, food, and production.

The survival rate of fish larvae in this study was relatively low (<58%) because of the high mortality of larvae during the study. The high mortality rate of fish larvae in this experiment may be caused the test fish larvae used in this experiment were pre-larvae of selais fish (three-day post-hatched larvae mean weight 0.0012±0.00 g; mean length and 0.03±0.00 cm). while another research (Efendi et al., 2016) found that the survival rate of post- larvae of selais fish larvae feed *Tubifex sp* enriched with probiotic was reached 98%, The survival rate of selais fish larvae can be increased by giving probiotics through natural feed such as *Tubifex sp*.

3.2 Water Quality

The result of measurement on water quality parameters can be seen in table 4. The average temperature found in all treatment was the same about 26^0C-30^0C. It means the water temperature for fish larvae in all treatment was optimal. It is stated the optimal temperature for fish life is 25^0C- 32^0C (Boyd, 1989; **?**). The degree of water acidity [pH] in media culture at all treatment were ranged among 6,0-6,5. Even if the pH of the water in the research was not optimal for fish larvae, but it still supports the growth and survival of the selais fish, According to (Elvyra et al., 2010) selais fish (*K. limpok*) be able to live in the water with a little bit acidic water that ranged between 5,5-6,0. Dissolved Oxygen (DO) in this research were 5,0 – 5,2 ppm higher than the amount of the DO (3,16–3,45ppm) in the aerated container using aerator. The height of dissolved oxygen in this research caused by the using of recirculation system while the debit water that entered in research container 0.05 1/ second.

The concentration ammonia (NH3) in culture media ranged between 0.29-0,63 ppm. It means the amount of ammonia in the culture media was still in the eligibility limit on the selais fish larvae. Boyd

Table 4: The Water Quality Parameters.

Water Quality	Treatments		
Parameters	T1	T2	T3
Temperaturs (OC)	26-30	26-30	26-30
pH	5.0-6.0	5.0 - 6.0	5.0 - 6.0
DO (ppm)	5,2	5	5
Amoniak (NH3)	0,29	0,29	0,63

(Boyd, 1989) stated that the NH3 concentration with ranged between 0,6-2 ppm is still good for the fish life.

The concentration of ammonia in each treatment was treated differently. The ammonia content in treatment of T1 (0,29 ppm) is the same as the ammonia in treatment of T2, while the highest ammonia content is in the treatment of T3 (0.63). It means, the higher the stock density, the higher the ammonia content.

4 CONCLUSIONS

Base on result and discussions, there's no effect of stocking densities on the growth and survival of the selais fish larvae cultured in the recirculation system.

The growth rate and the survival rate of selais fish larvae were inversely proportional to the density of fish larvae. The higher the stocking density the slower growth rate (weight and length), and survival rate. The optimal growth rate and survival rate found at lower stocking densities (10 larvae L^{-1}).

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