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Variation of Stocking Density and Water Flow Rate for the Growth and Survival of Siamese Catfish Fry (*Pangasius hypophthalmus*)

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ABSTRACT

The Siamese catfish (*Pangasius hypophthalmus*) can be cultivated with high stocking density and minimal water usage. The factor influencing fish growth is primarily water quality. The research aims to analyze the Variation of Stocking Density and Water Flow Rate for the Growth and Survival of Siamese catfish Fry (*Pangasius hypophthalmus*). The study was conducted in Sungai Malang Village, Amuntai Tengah District, North Hulu Sungai Regency, South Kalimantan. The experiment with two different factors can be applied to all experimental units: Factor A (Stocking Density) A1 = Stocking density 1,000 (fish/m3), A2 = Stocking density 3,000 fish/m3, Factor B (Water Flow Rate) B1 = Water flow rate 0 L/second (Control), B2 = Water flow rate 0.1 L/second, B3 = Water flow rate 0.2 L/second. Research Parameters: Absolute weight growth, Absolute length growth, Survival rate, and Condition factor. The influence of stocking density and water flow rate variations on the growth and survival of Siamese catfish fry (*Pangasius hypophthalmus*), focusing on stocking density (1,000 fish/m³ and 3,000 fish/m³) and water flow rate (control, 0.1 L/second, and 0.2 L/second). The research results show that the combination of stocking density of 3,000 fish/m³ and water flow rate of 0.2 L/second yields the best results in terms of absolute weight and length growth, as well as a higher survival rate. Stocking density variation significantly affects survival rates, while water flow rate does not show the same influence. Condition factors, including survival and growth, are also influenced by stocking density and water flow rate.

Keywords: *Siamese catfish, stocking density, water flow rate, factorial*

INTRODUCTION

According to Septimesy (2016), Siamese catfish (Pangasius hypophthalmu) can be cultivated with high stocking density and minimal water usage. The main factor influencing fish growth is primarily water quality. Research by Samsundari and Wirawan (2013) found that in a recirculating system, artificial feed becomes the main food for cultivated fish. Improving water quality, water flow, or water flow becomes a carrier of dissolved oxygen (DO) and removes ammonia (NH4+), making water conditions optimal again (Arddhiagung, 2010). One way to address this is by implementing a recirculating system (McLean et al., 1993).

According to Zonneveld et al. (1991), recirculation is an advanced stage in the cultivation of flowing water systems. According to Probowo (2000) and Kadarini et al. (2010), the recirculation system filters dirty water from the maintenance media using several materials as filters so that the water becomes reusable. The results of Darmawan et al.'s research (2016) with three stocking density treatments, "1 fish/L, 5 fish/L, and 10 fish/L using Siamese catfish seeds and Pasupati siamese catfish aged 28 days. Ghofur (2016) studied the growth rate and survival of African siamese catfish (C. gariepinus.B) larvae using the recirculation method at a water flow rate of 30 ml/s.

The results of Arddhiagung's research (2010) on the survival rate of Siamese catfish seeds with a recirculation system. Seed nurseries of Siamese catfish in concrete ponds with a water flow rate of 0.1 L/s and a stocking density of 120 fish/m2 obtained survival rates of 80% to 90% of Siamese catfish seeds with a total length increase of ±1.0 cm to ±1.8 cm over a 2-week maintenance period.

The study aimed to analyze the variation in stocking density and water flow rate for the growth and survival of Siamese catfish seeds (Pangasius hypophthalmu).

MATERIALS & METHODS

Time and Place of Research

The research was conducted in Sungai Malang Village, Amuntai Tengah District, North Hulu Sungai Regency, South Kalimantan. The siamese catfish seeds used in this study originated from Bogor, West Java, with a total of 18,000 individuals. The average total length ranged from 1.9 cm to 2.1 cm per individual, with an average weight ranging from 0.12 grams to 0.15 grams per individual. Feeding was administered according to the treatment, weighing 10% of the fish biomass per day, and feeding frequency was carried out 4 times a day at 08:00 AM, 12:00 PM, 04:00 PM, and 08:00 PM (Yulisman et al., 2011).

Research Design: The experiment involved two different factors, applicable to all experimental units:

Factor A (Stocking Density)

A1 = Stocking density 1,000 individuals/m³

A2 = Stocking density 3,000 individuals/m³

Factor B (Water Flow Rate)

B1 = Water flow rate 0 L/second (Control)

B2 = Water flow rate 0.1 L/second

B3 = Water flow rate 0.2 L/second

Research Parameters:

Absolute weight growth

Absolute length growth

Survival rate

Condition factor

Data Analysis:

Data analysis was performed using statistical analysis with the factorial ANOVA method using Microsoft Excel.

RESULT

Absolute Weight Growth

Absolute weight growth is obtained from the difference between the initial weight observations and the final weight observations during maintenance. The results of the absolute weight growth calculation are shown in Figure 1 below.

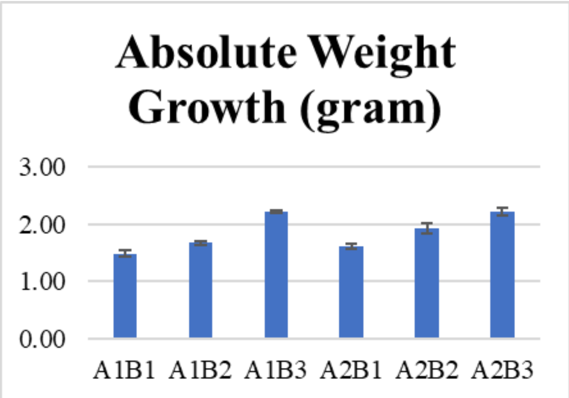


Figure 1. Results of Absolute Weight Growth Observation.

Figure 1 presents the analysis of the study with two factors, namely Factor A (stocking density) and Factor B (water flow rate), on the total absolute weight of siamese catfish fry. Two levels of Factor A (stocking density) were examined, namely 1,000 individuals/m³ and 3,000 individuals/m³, along with three levels of Factor B (water flow rate): control (0 L/second), 0.1 L/second, and 0.2 L/second. The results of the total absolute weight of siamese catfish fry show significant variations among treatments, with the highest total weight occurring in the combination of stocking density at 3,000 individuals/m³ and water flow rate at 0.2 L/second, reaching 6.62 grams. On average, each treatment indicates that variations in water flow rate and stocking density have a significant effect on the absolute weight growth of siamese catfish fry, where F-calculated > F-table or the data are homogeneous, and also L-calculated < L-table or the data are normally distributed. The ANOVA test results between treatments indicate that F-calculated < F-table at 0.5% and 1%, indicating differences among treatments.

Absolute Length Growth

Absolute length growth is obtained from the difference between the initial length observation and the final length observation during the maintenance period. The results of the absolute length growth calculation are shown in Figure 2 below.

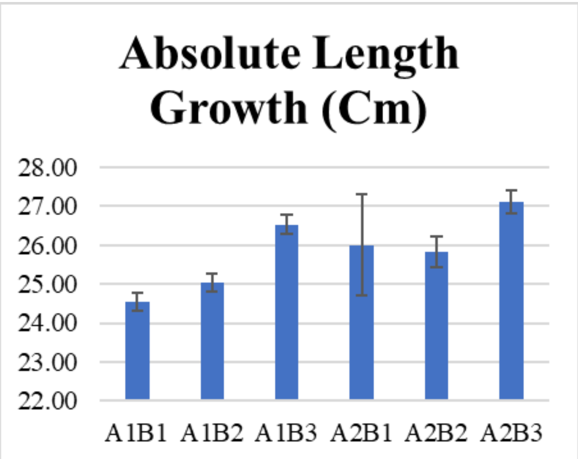
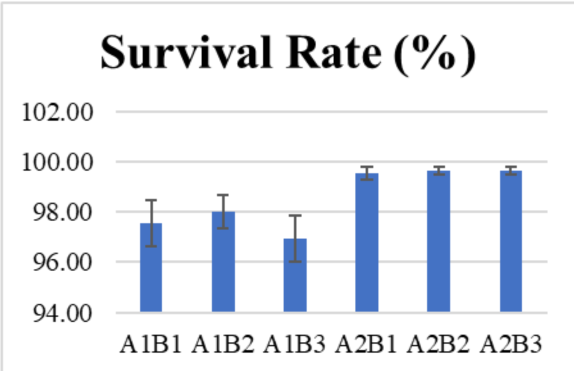


Figure 2. Results of Absolute Length Growth Observation.

Figure 2 illustrates the analysis showing the influence of factor A (stocking density) and factor B (water flow) on the absolute length of siamese catfish fry. Two levels of factor A (stocking density), namely 1,000 individuals/m³ and 3,000 individuals/m³, as well as three levels of factor B (water flow), namely control (0 L/second), 0.1 L/second, and 0.2 L/second. From the total absolute length of siamese catfish fry, it can be seen that the combination of stocking density of 3,000 individuals/m³ and water flow of 0.2 L/second resulted in the highest total length of 160.90 mm. Further statistical analysis is needed to determine the significance of differences between treatments. Stocking density and water flow are key factors influencing the growth and production of siamese catfish fry. It can be observed that, on average for each treatment, variations in water flow and stocking density have a very significant effect on the absolute length growth of siamese catfish fry, where F value > F table or data is homogenous, and also L value < L table or data is normally distributed. The results of the ANOVA test between treatments indicate that F value < F table at 0.5% and 1%, indicating differences between treatments.

Survival Rate (SR)

Survival rate is the final outcome of all fish that survived during the rearing period.



Gambar 3 Survival rate

Figure 3 shows the results of the study on the treatment factors of stocking density and water flow rate on the survival rate of Pangasius juvenile. There is a significant variation in survival rate among different treatments. Noticeable differences exist between stocking densities of 1,000 individuals/m³ and 3,000 individuals/m³, but it appears that water flow rates of 0.1

L/second and 0.2 L/second tend to provide slightly higher survival rates compared to the control without water flow. Calculations of the average survival rate of Pangasius juveniles during the observation period were performed. Homogeneity testing of the Survival Rate (%) data against differences in stocking density and water flow rate during the 10-day observation period yielded results indicating that the F-value is greater than the F-table value, indicating homogeneity of the data. Based on the normality test results of the daily growth rate data, the calculated L-value is less than the L-table value, indicating normal data distribution. Further analysis conducted was the analysis of variance for each treatment. The results of the analysis of variance for each treatment show that stocking density has a very significant effect (**) on the survival rate of Pangasius juveniles. However, water flow rate does not have a significant effect (*) on the survival rate of Pangasius juveniles.

Condition Factor

The analysis results of the condition factor regarding the differences in stocking density and water flow rate treatments can be observed in Figure 4.

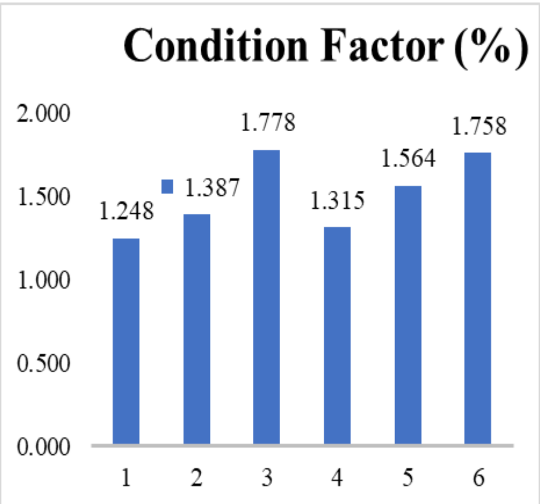


Figure 4. Graph of Condition Factor (%) Against the Differences in Stocking Density and Water Flow Rate During 10 Days of Observation

Figure 4 shows the observations on the condition factor of the siamese catfish fingerlings, indicating significant variations between the stocking density and water flow rate treatments. In this observation, it is evident that the treatment with a stocking density of 1,000 fish/m³ and no water flow (control) resulted in lower values for the condition factor of the siamese catfish fingerlings, with a total average of only 0.33. Conversely, the treatment with a stocking density of 3,000 fish/m³ and a water flow rate of 0.2 L/s showed higher values, with a total average reaching 1.67. This suggests that increasing stocking density and water flow rate tend to provide better conditions for siamese catfish fingerlings. The results indicate that the differences in stocking density and water flow rate have a highly significant effect (F-value > F-critical) on the condition factor of the observed siamese catfish fingerlings. The conditions here encompass survival rate, growth rate in length and weight, and feed efficiency. The ANOVA test among treatments showed that the F-value is greater than the critical F-value at 0.5% and 1%, indicating significant differences between treatments. The variations in stocking density and water flow rate do not affect the condition factor of Siamese catfish fingerlings.

DISCUSSION

Observations conducted over a 10-day period of fish fry maintenance/nursing, with variations in water flow rate and stocking density in a recirculating system, yielded data on absolute weight growth (in grams), absolute length growth (in centimeters), survival rate (SR), and condition factor.

Absolute Weight Growth

The total absolute weight of the patin fish fry showed significant variation among treatments, with the highest weight occurring in the combination of stocking density at 3,000 individuals per cubic meter and water flow rate at 0.2 liters per second, reaching 6.62 grams. Variations in stocking density and water flow rate were found to influence the weight growth of Siamese patin fish fry. Literature suggests that optimal stocking density can enhance fish growth and production by providing sufficient space for fish to grow without excessive competition for available resources. Water flow rate also plays a crucial role in fish growth, as proper water flow regulation can enhance the availability of oxygen and nutrients needed by the fish for optimal growth (Nasution & Zairin, 2014).

Absolute Length Growth

The total absolute length of the Siamese patin fish fry shows that the combination of stocking density at 3,000 individuals per cubic meter and water flow rate at 0.2 liters per second resulted in the highest total length of 160.90 mm. Variations in stocking density and water flow rate are observed to affect the absolute length growth of Siamese patin fish fry.

An excessive increase in stocking density has been observed to lead to a decrease in absolute length growth. This is in line with El-sayed's statement (2000) that fish culture at high densities usually results in slow growth. According to Coulibaly et al. (2007), individual growth and population density are closely related, and significantly larger fish growth is dramatically influenced by stocking density.

Nasution & Zairin (2014) state that proper regulation of water flow in fish farming can improve the availability of oxygen and essential nutrients for fish growth. An optimal water flow rate can create a conducive environment for the development of the absolute length of Siamese patin fish fry. Additionally, the impact of stocking density also contributes significantly.

Survival Rate (SR)

This result indicates that water flow regulation plays a significant role in maintaining the survival of siamese catfish fry, with the possibility of increased survival when using higher water flow rates. Nevertheless, further research is needed to gain a deeper understanding of the interaction between stocking density and water flow in influencing the survival of siamese catfish fry, in order to formulate more effective maintenance strategies in Siamese catfish farming. Stocking density has a very significant effect on the survival of siamese catfish fry. However, water flow does not have a significant effect on the survival of siamese catfish fry. Nasrullah (2019) conducted research on Siamese catfish fry in freshwater without water recirculation systems with a stocking density of 10 fry per aquarium, resulting in a survival rate of 76.67%, meaning that out of 10 Siamese catfish fry raised during the study, 7 to 8 survived per aquarium.

Fish mortality during the study is also suspected to be caused by limited swimming space in the rearing container, leading to competition for survival and food, potentially resulting in stress. Characteristics of dead fish include incomplete bodies, as they were eaten by other Siamese catfish. According to Handajani (2002), increased density affects the physiology and behavior of fish towards movement space, ultimately reducing the health and physiological condition of fish. This is supported by the aggressive nature of Siamese catfish, which tend to be fierce and attack weaker, smaller fish.

Decreases in water quality can also affect fish survival. According to Stickney (1979), increased stocking density in a limited container and at higher stocking densities, oxygen consumption and accumulation of metabolic waste in fish will also increase. According to Rostim (2001), the oxygen consumption rate of freshwater Siamese catfish is greater than that of common carp, at 373.96 mg/L. The minimum dissolved oxygen level that can be lethal to freshwater Siamese catfish is 1.24 mg/L. Freshwater Siamese catfish farming should be maintained above 1.41 mg/L. The lowest dissolved oxygen level during maintenance is 3.4 mg/L. Considering this study involves intensive farming, an oxygen level of 3.4 mg/L is inadequate for fish life, therefore, it is recommended that the dissolved oxygen level should be above 5 mg/L.

Condition Factor

The condition factor of fish, expressed based on length and weight data, depicts the state of the fish in terms of its physical capacity for survival and reproduction. Stocking density and water flow variations do not seem to affect the condition factor of Siamese catfish fry. The condition factor of fish, expressed based on length and weight data, depicts the state of the fish in terms of its physical capacity for survival and reproduction. The commercial use of condition factor values is significant in determining the quality and quantity of fish meat available for consumption (Wujdi and Wudianto., 2012). Ahmed et al. (2017) indicate that increasing stocking density can provide better access to feed for fish, while Cnaani et al. (2004) highlight the importance of optimal water flow in ensuring even distribution of feed throughout the pond. These results indicate that increasing stocking density and water flow tend to provide better conditions for siamese catfish fry, supporting more effective maintenance strategies in maximizing feed efficiency and siamese catfish production.

CONCLUSION

The influence of stocking density and water flow variations on the growth and survival of Siamese catfish fry (*Pangasius hypophthalmus*), focusing on stocking density (1,000 fish/m³ and 3,000 fish/m³) and water flow (control, 0.1 L/second, and 0.2 L/second). The research results indicate that the combination of a stocking density of 3,000 fish/m³ and water flow of 0.2 L/second yields the best results in terms of absolute weight and length growth, as well as higher survival rates. Stocking density variation significantly affects survival rates, while water flow does not show the same influence. Condition factors, including survival and growth, are also influenced by stocking density and water flow.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

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