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Growth performance of Wader Cakul juvenile (*Puntius binotatus*) with different stocking density

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ABSTRACT

One of the freshwater fishes that began to be developed is Wader fish, but there is still a lot of information that has not been supported on fish farming techniques. One of them is the optimal stocking density for cultivation. The purpose of this study was to study the effects of different stocking densities on the growth and survival rates of the Wader Cakul fish (*Puntius binotatus*). This research was conducted in May - July 2018. The method used in this study was to use a Completely Randomized Design with 4 training, namely P1 (2 fish/l), P2 (3 fish/l), P3 (4 fish/l) and P4 (5 fish/l). Each treatment was repeated 3 times. The main parameters were absolute growth rate (length and weight gain) (GR), specific growth rate (SGR), survival rate (SR), and feed conversion ratio (FCR). Data were analyzed using ANOVA (analysis of variance) and continued with the Least Significant Difference Test. The results showed that different stocking densities gave significant values (P <0.05) for GR, SGR, SR and FCR comparisons. The best treatment in this study was P1 with a growth value of 0.31 ± 0.01 gram, SGR 3.50 ± 0.03 %, Long Growth 1.97 ± 0.05 cm, SR 85.07 ± 2.17 % and FCR 1.47 ± 0.02. P1 (2 fish/l) is the best maintenance to increase the growth, survival rate, and feed efficiency of the Wader Cakul fish.

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1. Introduction

Wader Cakul fish (*P. binotatus*) can be found in the territory of Indonesia which is spread in the regions of Sumatra, Kalimantan, Java, Bali, and Lombok. This fish belongs to the family Cyprinidae, the order Cypriniformes or a relative to a carp (Myers *et al.*, 2013). According to Budiharjo (2002), wader fish have the potential to be cultivated because of the high selling prices. The maintenance period is relatively short, only about 6-8 weeks, does not require a large area can be maintained in a narrow pool, very adaptive to the local environment, also relatively resistant to disease disorders.

According to Sentosa and Djumanto (2010), efforts to cultivate wader fish have not been done much. This happens because the harvest is not in accordance with the costs incurred during the cultivation process. One method to increase the success of fish culture is to pay attention to the density of fish stocked. According to Kadarini *et al*., (2010), states that the regulation of high and low density in fish culture will determine the effectiveness of water requirement and space for production per unit. This stocking density problem is complex because it can affect on the growth and survival rate of fish. This study was conducted to utilize the best amount of stocking density for wader fish cultivation in order to support the growth and survival of fish, so as to produce an optimal amount of harvest.

2. Material and methods

2.1. Experimental design.

The research used was an experimental method, using a completely randomized design (CRD). In this study used 4 training with 3 replications. The total amount of stocking used in this study was P1 (2 fish/l), P2 (3 fish/l), P3 (4 fish/l), P4 (5 fish/l). The waders are kept in aquariums with 50 l of water and aeration system. Water exchanges are twice/week as much as 30 % of the water volume.

The *P. binotatus* juveniles that will be used is ± 1.5 cm from the UPT PBAT Umbulan, East Java. Feed with a protein content of 30 % is given at 5 % of body weight per day. Feeding is done twice a day at 09.00 and in the afternoon at 15.00. The duration of cultivation of wader cakul for 60 days.

2.2. Data collection.

The related variables are absolute growth rate (length and weight gain) (LGR and WGR), specific growth rate (SGR), survival rate (SR), and feed conversion ratio (FCR). Data was collected every 10 days by taking as many as 30 samples during the maintenance period. Water quality data measured every day include temperature, dissolved oxygen (DO), degree of acidity (pH) and Ammonia.

2.3. Data analysis

The main parameters (growth performance) observed in this research are LGR, WGR, SGR, SR, and FCR. Water quality cultivation was used as a supporting parameter. The data obtained from the observation of the research was analyzed using analysis of variance (ANAVA), followed by Smallest Differences test (BNT Test) at 5 % and 1 %.

3. Results and Discussion

3.1. Growth rate (length and weight gain).

Absolute growth measurement aims to determine the rate of weight addition of Wader Cakul (*P. binotatus*) with different stocking densities. Absolute growth rate data (weight and length) in this study is the result of research which was obtained for 60 days from 1.5 cm in size to the 4 cm. Data on the absolute growth rate of cakul *P. binotatus* can be seen in Figure 1. The data obtained in the form of the absolute growth rate of the *P. binotatus* the highest observation value was P1 0.31 g treatment, while the lowest growth in P4 treatment was 0.18 g. The lower the stocking density of the *P. binotatus* is cultivated, is higher and optimal of growth rate. According to Rahmat (2010), that in a dense condition, the high stocking of tilapia tends to show competitiveness in utilizing food, and space for movement, this impact affects the growth rate of cultivated tilapia.

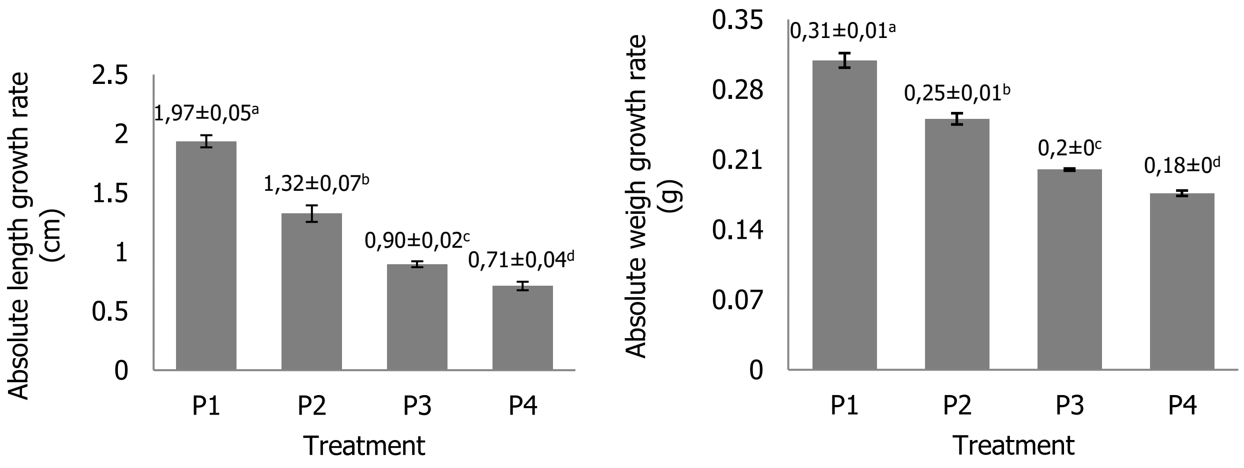

Figure 1. Growth performance of *P. binotatus*

The lower the density of cakul wader fish, the fish are able to optimize the space of movement and dissolved oxygen which is quite good, the impact of fish not experiencing stress and death, so that the *P. binotatus* can use the feed that gives well, good utilization of feed due to each fish can eat every given feed, the growth rate of P. binotatus is higher and optimal. In contrast to the high stocking density, the cakul wader fish is not able to optimize the wiggle room which impacts the fish will rub against each other so that the fish experiences stress. Low DO at high stocking densities will have an impact on the fish competing to get oxygen. Fish that we're unable to compete with will a decrease in body condition which results in fish being stressed and dead.

The feed given to high stocking densities during the study experienced a growth rate of fish that was not optimal because not all fish able to compete for feed, so length growth was slow. In this observation, it was found that the optimum stocking density of the cakul wader fish was 2 fish/L, which is the P1 treatment. According to Nurlaela *et al.*, (2010) in general, it can be said that the high density of the applied spread, the growth of catfish will be slower, because there will be competition both the wiggle room, dissolved oxygen and feed that affect the growth. According to Eka *et al.* (2016), that the higher the stocking density of Biawan fish, the growth rate of weight and length decreases, the decrease in absolute length growth and the rate of growth in daily weight, occur because of the increasingly narrower motion of the fish with increasing stocking density, so affect feed competition, oxygen, and fish physiological conditions.

3.2. Spesific growth rate (SGR).

Specific growth rate is the percentage of weight gain per day. Specific growth measurement aims to determine the addition of the weight of the cakul wader fish with different stocking densities. The results of this study are shown in Figure 2:

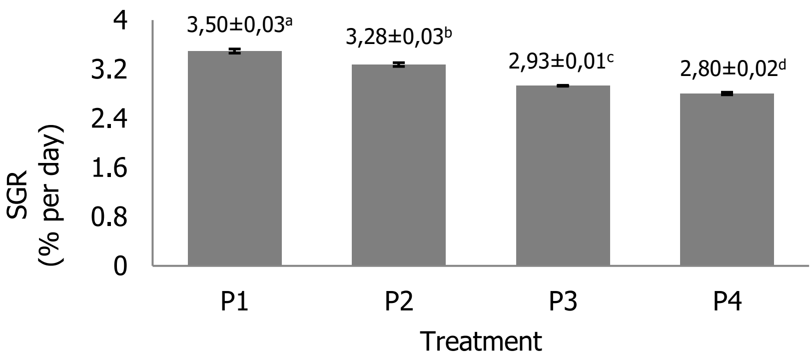

Figure 2. The specific growth rate of *P. binotatus*

Based on Figure 2, the data obtained in the form of the specific growth rate of *P. binotatus.* The highest observation value is P1 treatment at 3.50 %, P2 treatment at 3.28 %, then P3 treatment at 2.93 %, then the last and lowest treatment P4 of 2.80 %. In this specific growth rate data has decreased, this impact is suspected that the higher the density of fish stocking. The weight growth in fish will decrease, but it can be caused by the increasingly limited space for fish and competition in obtaining food, space for fish, and oxygen dissolved which decreases in line with the higher stocking density, is a factor in the decline in growth in high stocking densities. According to Rahmat (2010), that in dense conditions of high stocking of tilapia has a tendency to show competitiveness in utilizing food, and space for movement, this impact affects the growth rate of cultivation.

3.3. Survival rate (SR).

Survival Rate (SR) is a comparison value between the number of aquatic organisms at the beginning of stocking and the amount at harvest or at the end of cultivation expressed in percent. SR is used as a parameter of success in the cultivation process or cultivation activities. SR value is very closely related to the growth of fish weights to find out the cultivation techniques used are said to be successful or fail (Dewi *et al*., 2015). SR fish observation data in the study can be seen in Figure 3:

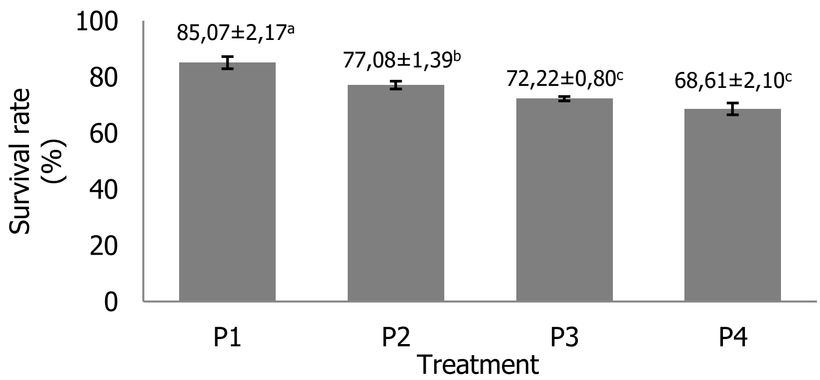

Figure 3. Spesific growth rate of *P. binotatus*

Based on the data in Figure 3, different stocking densities have a significant impact on the survival rate of *P. binotatus*. The survival rate of the *P. binotatus* in this study has decreased in the same direction as the higher stocking density. Fish mortality in high stocking is caused by the availability of dissolved oxygen which is very limited so that it makes the fish experience stress. Feeding competition is also a factor that can be used as a cause of death because not all fish can eat the feed provided.

3.4. Feed conversion ratio (FCR).

Feed conversion ratio (FCR) is the ratio between the weight of feed that has been given in with the total weight of fish produced at the end of the culture period. The FCR value shows how much food is consumed by fish into body biomass. Feed conversion value shows the efficient use of feed by fish. The lower conversion value of the resulting feed shows more efficient use of feed (Sulawesty *et al.*, 2014). FCR value data for each treatment can be seen in Figure 4.

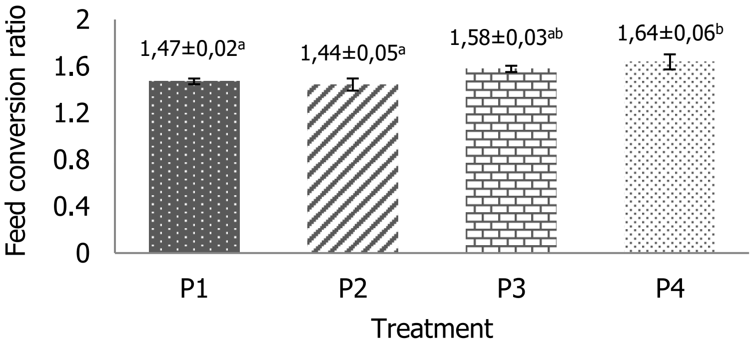

Figure 4. Spesific growth rate of *P. binotatus*

The results of FCR measurements show that different density treatments produce significantly different FCR. The lowest FCR values were found in treatments P1 and P2 while the highest values in treatments P3 and P4. According to Ihsanudin *et al.* (2014), the lower the value of the feed ratio, the better the quality of the feed provided, whereas if the high feed conversion value means that the quality of the feed given is not good. FCR value of 1.44 can be interpreted to produce biomass addition of 1 kg requiring 1.44 kg of feed. According to DKPD (2010), the FCR value is quite good if it ranges from 0.8–1.6.

3.5. Water quality.

Control of water quality parameters is done by the presence of a water exchange system of 30% of the volume of water in the aquarium 2 times a week. This application is carried out for 60 days of maintenance. The results of water quality measurements from each treatment include temperature, pH, DO and ammonia can be seen in Table 1.

Table 1. Water quality

Parameter	Unit	Average	Optimum (Ronald *et al.*, 2014)
Temperature	°C	27.77	25 – 30
pH		8.8	7 – 8
DO (Dissolved Oksigen)	mg/l	10.71	>5
Ammoniak	mg/l	0	≤ 0.02

Temperature variable values during the research process were 26.1–29.8 °C, pH values ranged from 7.02–9.66, DO ranged from 6.2 to 14.2 mg/l and ammonia was 0 mg/l. The results of water quality data during the research process can still be said to be optimal because the fluctuations of each parameter are not high, this shows that there is no significant effect on water quality because it is maintained.

4. Conclusions

The number of stocking densities that differ in *P. binotatus* significantly influences the absolute weight/length growth rate, specific growth rate, survival rate, and feed conversion ratio. The optimal amount of stocking density is P1 (2 fish/l).

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