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Effect of Diffuser Aerator to Increase Growth of Nilem (Osteochilus vittatus) Cultivation With Different Density

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ABSTRACT

Increasing the productivity of nilem cultivation can be done by high dense dispersion with the addition of input diffuser aerator technology. This research aims to determine the highest stocking density on the cultivation of nilem (Osteochilus vittatus) given diffuser aerator. The method used was an experimental method with complete randomized design (RAL) with 4 treatments and 4 replications, A treatment (50 fish/m^2), B (75 fish/m^2), C (100 fish/m^2), and D 125 fish/m^2). Used nilem measuring an average of 4-5 cm with an average weight of 1.57 gr derived from Fish Seed Hall in Sumedang with the tank measuring 85x85x40 cm. This research is carried out for 40 days. The research results showed the best treatment at 100 fish/m^2 stocking density with absolute long growth of 3.70 ± 0.19 cm, absolute weight growth of 6.84 ± 1.03 gram, daily growth rate of 4.15 ± 0.55%.

Keywords: diffuser aerator, nilem, growth rate

Introductions

Nilem (Osteochilus vittatus) is one of endemic freshwater fish of West Java with native habitat of living in swamp or river (Hardjamulia 1980). On a national scale Nilem is still less well known and less developed. National production of nilem cultivation of around 80% is still derived from West Java, it is seen from still imported nilem fish seed from West Java to meet the needs of enlargement outside of West Java. In connection with these conditions, it is necessary to develop cultivation technology to increase the production of nilem. Increased production will be useful to meet the community's protein needs.

Protein needs in nationwide can be fulfilled one of them by making improvements in the aquaculture fishery sector. Nilem is a potential fish to be developed. One way in increasing the production of fish cultivation nilem that is by conducting high stocking density on the culture medium. However, the consequences of the increase in stocking density leads to an increase in the need for dissolved oxygen concentration in the culture medium. In addition, the problems faced are high mortality because the level of competition in the media cultivation is higher, so in this case needed technology that can help solve mainly in the problem of dissolved oxygen concentration in the culture medium (Pillay and Kutty 2005).

Aerator diffuser is a type of aeration that uses air pressure dissolved into water with a finer quality of bubbles so that the dissolved oxygen concentration produced will be higher than the regular aerator (Atia 2015). Fine bubbles are usually more efficient than rough bubbles, so research needs to be done on the effect of Diffuser aerator on the dissolved oxygen concentration in high stocking dense conditions which will be associated with growth in the cultivation of nilem to obtain an efficient and effective cultivation method.

Previous research on growth and survival of nilem (Osteochilus vittatus) during 60 days of maintenance with different stocking density without the addition of any technological input has a significant effect on absolute growth rate, absolute longevity, daily growth rate. The best result in this research is in the treatment with dense stocking as much as 10 / m3 tail. The growth rate of absolute weight of fish nilem 4.68g. The absolute length is 3.07cm. Daily growth rate 1.25% and liveliness 93.33%. (Rizaqi 2015).

The feeding rate treatment of 7% of fish biomass weight resulted in good growth and survival rate for 2-3 cm nilem seeds, each of 0.551 grams and 97.8% with daily growth rate of 3.15% with a stocking stocking of 120 fish/m^2 (Rosmawati et al 2014). Based on this problem it is necessary to research about the effect of Diffuser aerator to the dissolved oxygen concentration in high stocking density conditions which aims to establish the highest stocking density in the cultivation of nilem fish (Osteochilus vittatus) given by Diffuser aerator (high oxygen) nilem.

Method

The research was conducted on 24 January - 04 March 2018 at Laboratory Faculty of Fisheries and Marine Sciences Universitas Padjadjaran. Laboratory testing activities in the form of analysis of water quality parameters such as ammonia, nitrate and phosphate concentration conducted in the Laboratory of Water Resources Management Department of Fisheries and Marine Science.

Determination of research treatment using experimental method with Randomized Complete Design (RAL) that is determination of research experiment on homogeneous condition with 4 treatment and 4 replication. The 4 treatments to be administered are based on the difference in the number of stocking stocks of the nilem as follows:

A : intensiveness nilem 50 fish/m^3

B : intensiveness nilem 75 fish/m^3

C : intensiveness nilem 100 fish/m^3

D : intensiveness nilem 125 fish/m^3

Fish that will be maintained before should be done for one week of acclimatization which aims to adjust to the surrounding environment. Further measured length and weight as length and initial weight using a ruler and scales. Then measured the length and weight on day-to-14. The 28th, and 40th, and then inserted into a tank size 85x85x40 cm in accordance with the treatment of stocking density. The feed given to the fish is FF-999 feed type which is given 5% of total weight as much as 2 times a day during research, feed is given at 8 am and 3 pm.

The survival of Nilem is obtained by following the formula Effendie (1979), which is as follows:

$$SR = Nt/No \times 100\%$$

Information:

SR = Animal survival (%)

Nt = Amount fish test at the end of the study

No = Amount fish test at the start of the study

Absolute weight growth is calculated using the formula Zonneveld et al. (1991) that is:

$$W = Wt - Wo$$

Information:

W = Absolute growth (gr)

Wt = Average weight at time t (gr)

Wo = The average weight at the beginning of the research (gr)

The daily growth rate (LPH) was calculated using the formula Zonneveld et al. (1991), that is:

$$SGR = \frac{lnWt - lnWo}{t} x100\%$$

Information:

SGR = Daily growth rate (%)

Wt = Average weight at time t (gr)

Wo = Average weight at the beginning of the research (gr)

T = Duration of research (days)

Water quality parameters measured include pH, temperature and dissolved oxygen (DO) twice daily at 8 am and 2 pm. Measurements of ammonia and nitrate concentrations were performed 5 times during research or 8 days during the study. To see the difference between treatments tested by comparing the mean with t test (Walpole 1992) followed by further testing duncan at 95%.

Result and Discussion

Based on the results of research the data includes the Absolute Weight Growth, Survival and Daily Growth Rate on Nile Fish (Osteochilus vittatus) which can be seen in figure 1:

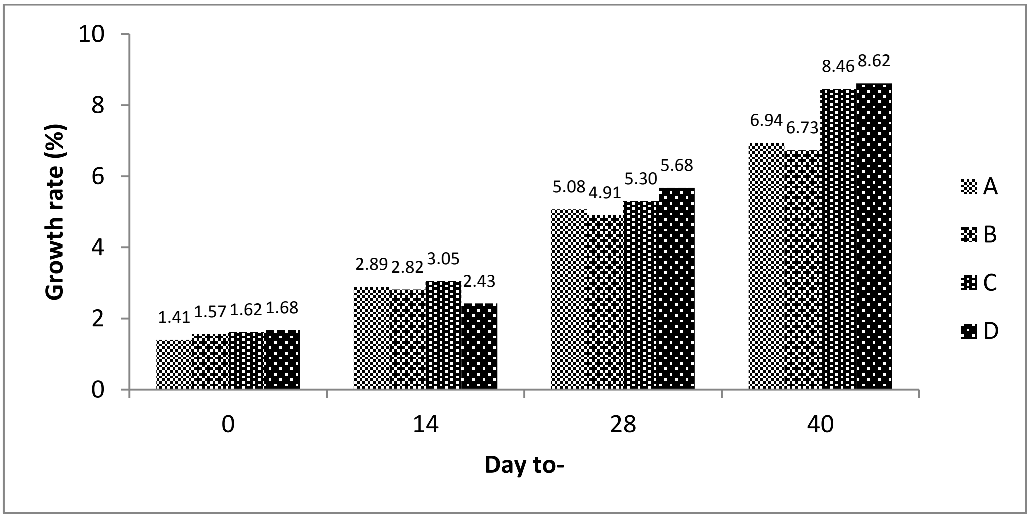

Figure 1. Growth of average weight of nilem during research

Based on Figure 1 it can be concluded that each treatment experienced significant growth and continued to increase at any time. The smallest growth was in treatment B with 75 fish/m^2 spreading from 1.57 to 6.7 grams for 40 days of maintenance. This is because there are some dead fish with a survival rate of 84%, causing a less aggressive appetite to feed given. According to Arif et al (2013), the decline in growth rate is due to the transfer of energy, in general the energy of the consumed feed use for maintenance energy and the rest is used for growth energy.

The greatest growth was found in treatment D with 125 fish/m^2 from 1.68 to 8.62 gram. This is due to the addition of technology diffuser aerator (high oxygen) can provide dissolved oxygen concentration in the media well and optimally so that the effect on the increased appetite that will impact on good growth. According to Rust (2002) changes in weight, associated with the consumed feed, health, energy levels of the body and intake of toxic substances in the fish body.

This is because with the increased density of stocking on a medium will give the instinct of a higher appetite because the level of automatic competition will increase when compared with the low density of the spread. In maintaining the life of the fish nilem should be given a good feed intake and water quality is maintained especially the concentration of dissolved oxygen that can give effect on the increase of appetite in fish. this role is run optimally by an aerator diffuser that has a good enough ability to provide dissolved oxygen concentration in the media. This is in line with the opinion of Meade (1989) which states that increased dissolved oxygen will increase the appetite of fish. the same opinion is expressed by Mallya (2007) and Hasan New (2013) which states that fish will decrease food intake in low oxygen conditions and this will have an impact on the growth decline and the opposite.

The growth of fish is autocatalytic, where growth in the early phases of his life starts at a slow pace and growth progresses rapidly. Growth will again slow down once the fish reaches its maximum point for growth. The point of change from the upward phase to the phase of growth slowing is called the inflection point. The time-size increase relationship is depicted in the sigmoid growth curve (Effendie 1997).

The highest survival is in treatment A of (93%) and the lowest in treatment D 76%, this is because with the addition of stocking density on a culture medium will result in increasingly narrower space and higher level of competition that will affect the level of continuity life. According to Dewi (2007), increasing density influences physiology process and fish behavior toward space which in the end can decrease fish health condition and by Effendie (1979) that survival is determined by the availability of feed and water quality.

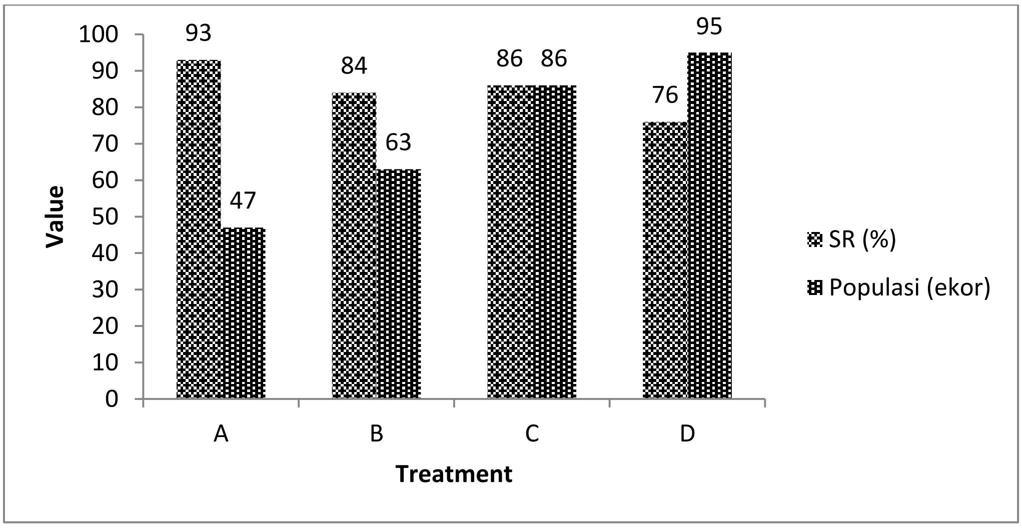

Figure 2. Survival rate average during research

Nilem live in clusters, so that in suitable solid stocking conditions will produce high growth as happened in treatment D which has 76% survival value with population of 95 fish can see in figure 2. The increase of stocking density will affect relative to the survival rate of the fish, meaning that increased stocking of fish stocks does not necessarily decrease survival value (Hogendorn and Koops 1983 in Saptoprabowo 2000). Survival is closely related to solid stocking. Increased solid stocking will decrease dissolved oxygen value due to high oxygen demand due to metabolism process, food management, movement activity and respiration process (Effendi 2003).

Daily Growth Rate

The highest growth rate occurred in the C treatment of 4.15 ± 0.55% followed by the treatment of D, A and B. The availability of oxygen is one determinant of the consumption of fish feed (appetite), because oxygen is one of the elements necessary to change food into energy. When the appetite is reduced, the intake of feed into the fish body is reduced so that 10 energy for maintenance and growth is not met. This if it lasts longer will cause death (Effendi 2003).

The growth of fish depends on several factors: fish species, genetic properties and ability to use food, resistance to disease and supported by environmental factors such as water quality, feed and space or stocking density (Hepher and Pruginin 1981 in Praptiwi 2011). Meanwhile, according to Arif et al (2013), the decline in growth rate due to the transfer of energy, in general energy from the feed in the consumption will in use for maintenance energy and the rest is used for growth energy.

Water Quality

All treatments had adjacent pH values ranging from 7.8 to 7.8, a good pH value for aquaculture is 6.5-9. If the pH value of water is not within that range for a relatively long time, the reproduction and growth of the fish will be reduced and may cause physiological symptoms (Boyd 1990). While the dissolved oxygen concentration in each treatment is still above the optimal minimum cultivation range of 6.5-6,7. The higher the dispersed density will be the higher the level of oxygen consumption required. The C and D treatment have lower concentrations than the A and B treatments of 6.5 mg/l. According to PP No.82 of 2001, the oxygen level for sensitive fish is 5 mg/l.

Measured temperature at each treatment is still in optimal condition that is around 25.3-25,7^o C. The higher temperatures while still at optimal conditions will increase respiration and faster metabolism so that in the treatment D the measured temperature is higher than other treatments that is 25.7^o C which impact on the growth of weight and length higher than the others. The good temperature for the life of nilem is 18–28^o C (Hardjamulia 1978).

Measured ammonia concentrations in each treatment ranged from 0.004-0.011 mg/l which is still below the maximum limit and can be considered quite low. The ammonia concentration is influenced by the degree of acidity and temperature. The high pH value and water temperature, resulting in NH3 toxicity can increase as well. The range of ammonia content that the fish can tolerate is less than 0.6 mg/L The measured nitrate concentration in each treatment ranged from 0.864 to 3.238 mg/L, this can be said to be optimal because it is still at the minimum permissible level of permissible concentration. The optimal nitrate in the recirculation system is no more than 100 mg/L (Forteath et al. 1993 in Hapsari 2001).

Conclusions

Treatment C with stocking density of 100 fish/m^2 was the best treatment with an absolute weighted growth of 6.84 ± 1.03 grams, daily growth rate of 4.15 ± 0.55%, 86% survival rate, population and 86 fish. The concentration of dissolved oxygen is 6,5 mg/L, temperature 25,7^o C, pH 7,85, ammonia 0,013 mg/L and nitrate 2,117 mg/L.

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