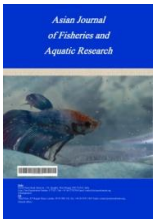

Asian Journal of Fisheries and Aquatic Research

8(3): 34-41, 2020; Article no.AJFAR.59483
ISSN: 2582-3760

Effectiveness of Different Bubble Size of Aeration to Survival and Growth Rate of Pangas Catfish Larvae, *Pangasius nasutus*

Irfan Noer[1*], Rafi Satriawan[1*], Iskandar[1], B. S. Ibnu Bangkit[1] and Rosidah[1]

[1]Department of Fisheries, Faculty of Marines and Fisheries, University of Padjadjaran, Jl. Raya Bandung–Sumedang Km 21, Jatinangor 40600, Indonesia.

Authors' contributions

This work was carried out in collaboration among all authors. Authors IN and RS designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors Iskandar and BSIB managed the analyses of the study. Author Rosidah managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJFAR/2020/v8i330142
Editor(s):
(1) Dr. Matheus Ramalho de Lima, Federal University of South of Bahia, Brazil.
Reviewers:
(1) Belem-Costa, Andrea, Federal University of Amazonas, Brazil.
(2) Kleber Campos Miranda Filho, Federal University of Minas Gerais, Brazil.
(3) Fernando Rogério de Carvalho, Universidade Federal de Mato Grosso do Sul, Brazil.
Complete Peer review History: http://www.sdiarticle4.com/review-history/59483

Original Research Article

Received 04 June 2020
Accepted 10 August 2020
Published 20 August 2020

ABSTRACT

This research was conducted at the fish fry center in Tasikmalaya City, Jl. Kadupugur No. 42 Kota Tasikmalaya. The research was done from November 2019 until February 2020. This research is carried out to determine the survival rate and growth of pangas catfish larvae up to the age of 22 days. Old with different bubble sizes of aeration stone the pangas catfish larvae used was 600 fingerlings that are spread evenly into 12 aquariums with four treatments each replicated three times using a completely randomized design (CRD). The parameters observed are survival rate, growth rate (weight and length), and water quality. The results showed that the aquarium with aerator ASB05 is the most effective treatment in influencing the productivity of pangas catfish larvae. The survival rate is 99.3%, the absolute length is 14.81mm and the absolute weight is 40.1 g. whereas the water quality of each treatment is still within the SNI quality standard (2000) with dissolved oxygen level is 5.40 mg/L.

Keywords: Aeration stone ASB03-ASB05; survival rate; growth; pangas catfish larvae.

**Corresponding author: Email: irfan.noer98@gmail.com;*

1. INTRODUCTION

Siamese catfish (*Pangasius nasutus*) is a freshwater fish species from the Pangasidae family and is one of the introduced fish species that has economic value to be cultivated. Aquaculture in the field of catfish hatchery in larval stages is still low so that its productivity needs to be increased. Increased productivity of catfish larvae is expected to increase seed availability, which in turn can increase the consumption of catfish consumption.

Consumption of catfish in Indonesia reaches 155,000 tons/year, while consumption of catfish consumption in Indonesia is still 145,000 tons/year. Ministry of Maritime Affairs and Fisheries targets the production of catfish in Indonesia to reach 319,300 tons/year [1]. This increase in consumption of catfish consumption needs to be supported by the availability of catfish seedlings [1].

Hatchery maintenance is one aspect that determines the success or failure of fisheries production because at this stage fish seeds will grow quickly along with optimal feeding. The critical stage or susceptibility of aquaculture fish is from the larval stage to the seed because the fish's body is still vulnerable to disease or the surrounding environment such as temperature, pH, and dissolved oxygen [2].

One of the critical conditions in catfish hatcheries is dissolved oxygen content (DO). Lack of dissolved oxygen can harm aquatic animals because it can interfere with a metabolism that causes death so that it can reduce productivity [3].

Aeration is used to increase dissolved oxygen (DO) to reduce gas saturation and heavy metal concentrations. Decreased levels of biological oxygen demand in ponds due to fish respiration and uptake by benthic or other organisms [4]. Oxygen is transferred from air to water through bubbles through the water column, aeration stones that have small holes that allow generating air from outside and make dissolved oxygen increase in catfish rearing media. The diffusion of air into a pool of water is determined by several factors, one of which is the size of the bubbles [5].

For this reason, it is necessary to make efforts to increase oxygen supply or aeration by using an aerator. The effect of oxygen supply on catfish larvae is very vulnerable in the process of seed growth, therefore dissolved oxygen in survival is needed to reduce the mortality of catfish larvae by giving aeration stones [6].

The purpose of this study was to determine an effective aeration stone size for the survival and growth of catfish larvae.

2. MATERIALS AND METHODS

2.1 Time and Place

In English: This research was carried out in the Tasikmalaya City Fish Seed Technical Implementation Unit (UPT BBI), Jl. Kadupugur No. 42 Kota Tasikmalaya. The research was conducted from November 2019-February 2020.

2.2 Tools and Materials

The materials used in this study are aquariums (60 cm x 30 cm x 40 cm), blowers, aeration stones, scoops, plastic bowls, scales, ruler/millimeter blocks, jars, water quality checkers, pH meters, ammonia test kits and materials used in this research is 600 catfish larvae observation of this change in length was carried out 3 times namely at the age of 7 days, 14 days, and 22 days, natural food (artemia and silkworms).

2.3 Research Methods

The method used in this study is a Completely Randomized Design (CRD), which consists of four treatments and three replications. Treatment A without aeration stone as a control, B using aeration stone ASB03, C using aeration stone ASB04, and D using aeration stone ASB05. Catfish larvae are randomly distributed into the aquarium. Each aquarium holds 50 larvae. The research was conducted during 22 days, while survival observations were carried out every day, for data collection and feeding adjustment. Weight growth measurements are calculated once every ten days.

2.4 Observation Parameters

The parameters observed were survival rate, absolute weight growth, absolute length growth, and water quality. The data obtained were analyzed using analysis of variance (ANOVA) if there were significant differences followed by the Duncan test with a 95% confidence level while the water quality data were analyzed descriptively.

2.4.1 The degree of survival

The survival rate of test animals can be determined by using formula according to [7]:

$$SR = \frac{Nt}{No} \quad X\ 100\%$$

Explanation:

SR : Degree of survival (%)
Nt : Number of living fish at the end of treatment (individual)
No : The number of fish at the beginning of treatment (individual)

2.4.2 Weight absolute growth

Calculation of absolute weight growth is done using the [8]:

$$G = Wt - W_0$$

Explanation:

G : Growth absolute weights
Wt : The average weight of the fish at the end of the study (g)
W_0 : Weight average at the beginning of the research (g)

2.4.3 Absolute length growth

Absolute length growth is calculated based on [9]:

$$L = L_t - L_0$$

Explanation:

L : Absolute length growth (mm)
L_0 : Fish length at the beginning of maintenance (mm)
L_t : Larval length at the end of rearing (mm)

3. RESULTS AND DISCUSSION

3.1 Survival Rate

The survival rate of catfish larvae in each aquarium counted the number of larvae that lived as much as 3 times, namely at the age of larvae 7 days, 14 days and 22 days with observations are presented in Table 1.

Overall there are significant differences between the average treatment on the survival rate of catfish larvae aged 0-7 days. To find out the difference between each treatment was done by Duncan's test with an error level of 5%. Duncan's test results can be seen in Fig. 1.

The results of observations of the survival rate for 22 days of maintenance showed the highest survival rate in treatment D (ASB05) of 99.33%, followed by treatment B (ASB03) of 97.33%, then treatment C (ASB04) of 97% and treatment A (control) of 89.67%.

Based on analysis of variance, treatment A or control without aeration stone was not significantly different from treatment B (ASB03), but significantly different from treatment C (ASB04) and treatment D (ASB05). This is in line with [10] that at a maximum stocking density of 500 fish / m2 with control over maintained water quality, the survival rate for maintenance periods up to 7 days is 85.97%.

3.2 Weight Absolute Growth

The growth rate is the absolute growth difference that is measured based on time sequence [11]. Based on observations, the absolute growth value is as in Table 2.

Table 1. Survival rate

The survival rate of catfish larvae on the 22 day					
Treatment	**Deuteronomy**			**Total %**	**Average**
	1	**2**	**3**		
A	97	86	86	269	89.67
B	97	95	100	292	97.33
C	93	100	98	291	97.00
D	100	100	98	298	99.33
Total	387	381	382	1150	383.33

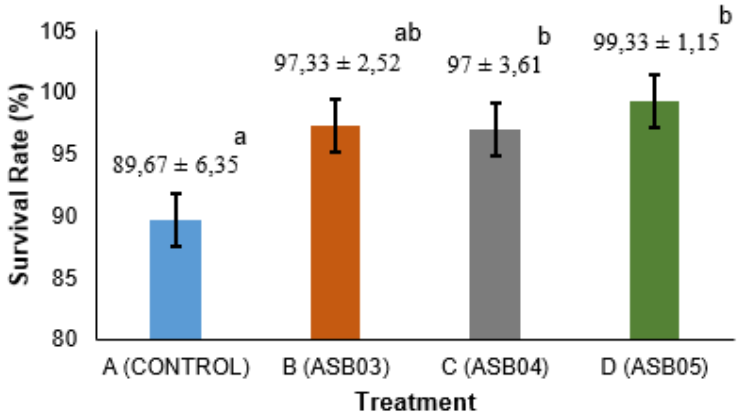

Fig. 1. Survival rate graphic

Table 2. Growth weight of catfish larvae (g)

Growth of absolute weight of catfish larvae on the 22 day					
Treatment	**Deuteronomy**			**Total %**	**Average**
	1	**2**	**3**		
A	26.56	26.13	25.56	78.25	26.08
B	31.17	31.53	31.82	94.52	31.51
C	35.66	35.29	35.75	106.7	35.57
D	40.3	39.99	40	120.29	40.10
Total	133.69	132.94	133.13	399.76	133.25

From the measurement of catfish larvae weights on the 22 day, homogeneity tests were carried out with a value (0.272)> 0.05, so homogeneity variance can be accepted so that it meets the normal distribution requirements for the ANOVA test. The resulting significance value is (0.035) <0.05. That is, it can be concluded that overall there are significant differences between the treatments on the growth of catfish larvae weight growth of 0-22 days. To find out the difference between each treatment was done by Duncan's test with an error level of 5%. The results of further tests can be seen in Fig. 2.

In the 7-day-old larvae, a significant difference in effect occurred in treatment D (ASB05), namely the use of aeration stones with ASB05 size that had the most significant impact on the growth of catfish larvae weights of 0-7 days. It can be analyzed that the number of oxygen bubbles can affect the movement of larvae. The more oxygen bubbles the more active the larvae move. The active movement of larvae stimulate the consumption of larvae to the higher feed. Dissolved oxygen levels in the maintenance media must be highly considered, because low oxygen concentrations in addition to the potential to cause death, growth, feed consumption, physiological conditions of fish and hurt activity and reproduction [12].

In measuring the growth of the weight of catfish larvae at 14 days of age, a homogeneity test was carried out with a value (0.122)> 0.05, so homogeneity variance can be accepted so that it meets the normal distribution. The resulting significance value is (0,000) <0.05. That is, it can be concluded that overall there is a significant difference between the average treatment on the growth of the weight of 14-day-old catfish larvae.

The results of growth measurements of 22-day-old catfish larvae showed data that were subsequently carried out homogeneity tests with the results of the sig value (0.484)> 0.05 then the homogeneity variance could be accepted so that it met the normal distribution. The resulting significance value is (0,000) <0.05. That is, it can be concluded that overall there is a significant difference between the average treatment in the growth of the weight of catfish larvae at 22 days.

Significant influence occurred in all treatments. The use of aeration stones of different sizes has a significant effect on the growth of catfish larvae weight up to the age of 22 days, where the use of

aeration stones ASB05 has the most significant difference. The less amount of oxygen bubbles from the aeration stones ASB04 and ASB03 has an impact on the slower movement of larvae at the age of 22 days. Due to the slow movement of larvae makes the level of consumption of feed becomes low.

3.3 Absolute Length Growth

Observation of this change in length was carried out 3 times namely at the age of 7 days, 14 days, and 22 days (end of study). The following observations are presented in Table 3.

From the measurement of the growth of catfish larvae length on the 7 day, a homogeneity test was performed with the result of sig value (0.722)> 0.05, so the homogeneity variance can be accepted so that it meets the normal distribution requirements for the ANOVA test. The resulting significance value is (0.030) <0.05. That is, it can be concluded that overall there is a significant difference (significant effect) between the average treatment on the growth of catfish larvae at 7 days. To find out the difference between each treatment was done by Duncan's further test with an error level of 5%. The results of further tests can be seen in Fig. 3.

A significant difference in effect occurred in treatment D (ASB05), namely the use of aeration stones with ASB05 size which had the most significant impact on the growth of catfish larvae ages 0-7 days. The growth of catfish larvae length is directly proportional to the growth in weights previously discussed. This can be compared in each treatment, both treatments without the use of aeration stones (control),the use of ASB03, the use of ASB04, and the use of ASB05 length growth is directly proportional to the growth of the weight.

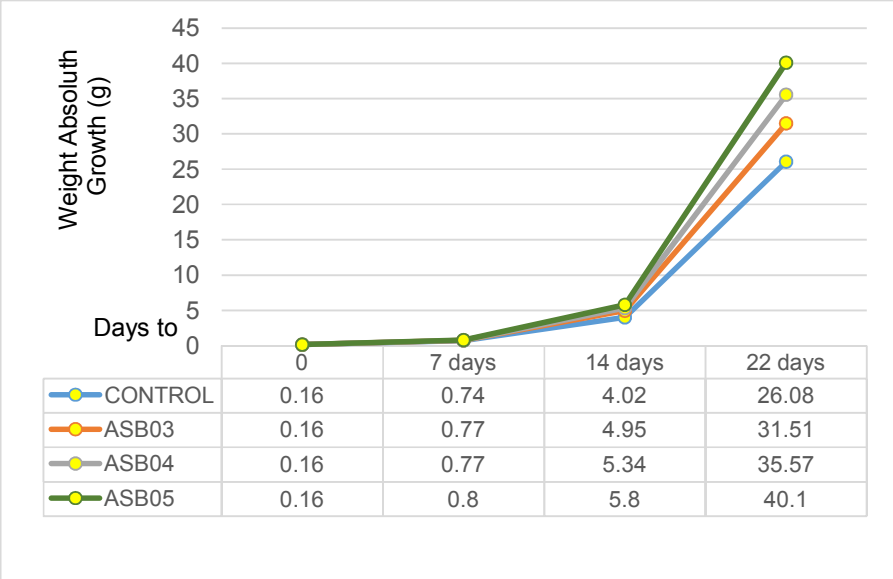

Fig. 2. Absolute weight growth of catfish larvae

Table 3. Growth of average length of catfish larvae (mm)

Growth of absolute length of catfish larvae on the 22 day					
Treatment	**Deuteronomy**			**Total %**	**Average**
	1	**2**	**3**		
A	10.69	10.51	10.28	31.48	10.49
B	12.54	12.68	12.8	38.02	12.67
C	14.35	14.2	14.38	42.93	14.31
D	16.21	16.09	16.09	48.39	16.13
Total	53.79	53.48	53.55	160.82	53.61

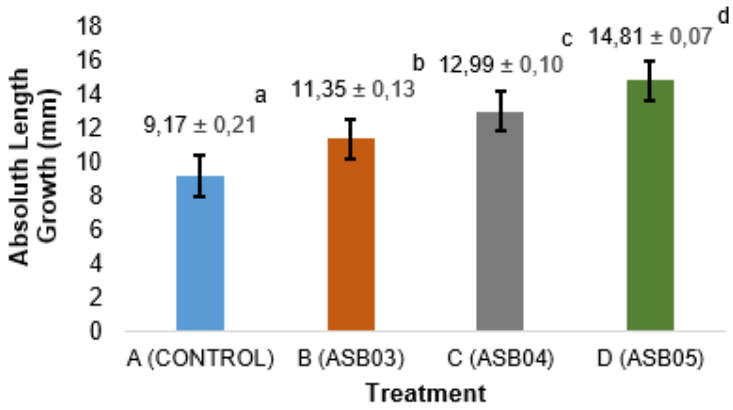

Fig. 3. Growth of absolute long catfish larvae

In measuring the growth of catfish larvae growth length of 14 days, a homogeneity test was carried out with a value (0.122)> 0.05, so the homogeneity variance can be accepted so that it meets the normal distribution. The resulting significance value is (0,000) <0.05. That is, it can be concluded that overall there is a significant difference between the average treatment on the growth of catfish larvae at 14 days.

Significant differences occurred in all treatments. The use of aeration stones of different sizes has a significant effect on the growth of catfish larvae length up to the age of 14 days, where the use of aeration stones ASB05 has the most significant difference. This is due to the active movement of larvae due to the most number of air bubbles produced from ASB05 aeration stones. [13] explained that an increase in stocking density would disrupt the physiological processes and behavior of fish to their space which in turn could reduce health and physiological conditions so that food utilization, growth, and survival had decreased. [14] added that stocking densities at a certain point in addition to being able to cause space competition and the struggle for dissolved oxygen in fish can also cause fish to experience stress, thereby inhibiting metabolism and resulting in decreased fish appetite.

The results of growth measurements of 22-day-old catfish larvae showed data that were then carried out homogeneity tests with the results of the sig value (0.470)> 0.05 then the homogeneity variance could be accepted so that it fulfilled the normal distribution. The resulting significance value is (0,000) <0.05. That is, it can be concluded that overall there is a significant difference between the average treatment on the growth of catfish larvae at 22 days.

Significant influence occurred in all treatments. The use of aeration stones of different sizes significantly influences the growth of catfish larvae length up to the age of 22 days, where the use of aeration stones ASB05 has the most significant difference. Because high DO can stimulate growth in fish because high oxygen supply causes a high metabolic rate [15].

3.4 Water Quality

The measured water quality includes temperature, oxygen, pH, and ammonia three times the measurement, namely at the beginning before the larvae are put into the aquarium, when the larvae age 11 days and at the end of the observation with the measurement results can be seen in Table 4.

The water quality parameters in each treatment are still very good (Table 4). The temperature during the study ranged from 28°C. The temperature is not active, this is because the research is in a controlled room. This is based on [16] the safe temperature limit for catfish seedling cultivation ranges from 27-30°C.

Dissolved oxygen during the study was influenced by the use of aeration stones. Based on [16] the safe limit of dissolved oxygen for catfish seed culture ranges from> 5 mg / L. This is supported by [17] which states that the dissolved oxygen content of water quality can be classified into four, namely the content of more or

Table 4. Average water quality measurement results

Parameter	Unit	Treatment A control	Treatment B ASB03	Treatment C ASB04	Treatment D ASB05
Temperature	°C	28	28	28	28
Oxygen	mg/l	4.7	5.25	5.40	5.47
pH	-	7.33	8.33	8.34	8.35
Ammonia	mg/l	0.554	0.547	0.544	0.532

equal to 8 mg / L is classified as very good, less than 6 mg / L is classified as good, less than 4 mg / L is critical and 2 mg / L is classified as very poor. However, the presence of organic waste can cause a decrease in the concentration of dissolved oxygen in water or oxygen depletion. This is thought to be caused by the activity of the bacterium *Nitrosomonas* which oxidizes ammonium to nitrite. Also, the activity of fish increases in line with the growth of fish so that oxygen will be needed. From the measurement results, it can be concluded that dissolved oxygen in all treatments is in the good category.

The pH during the study was classified as good in treatments A, B, C, and D of 7.2. According to the [16], the safe pH limit for catfish seed culture ranges from 6.5 to 8.5. This is supported by [18] stating that a good pH range for fish survival rates is 5.4-8.6.

Ammonia during the study can be controlled at 0.0554 mg / L up to 0.0532. This is consistent with the opinion of [19], which states the critical limit to the content of dissolved ammonia is 0.6 mg / L. Whereas [18] stated that NH3 levels of 0.2-2.0 mg / L in a short time would be toxic to fish.

4. CONCLUSIONS

We can concluded that the use of ASB05 aeration stones is the best treatment in influencing the productivity of catfish larvae with a survival value of 99.33%, an absolute length of 14.81mm and an absolute weight of 40.1 g. While the water quality of each treatment is still in SNI quality standard (2000) with DO levels of 5.40 mg / L which is the most influential during research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ministry of Maritime Affairs and Fisheries. Catfish management industry forum; 2012.
2. Muchlisin ZA, Arisa AA, Muhammad AA, Fadli N, Arisa II, Siti Azizah dan MN. Growth performance and feed utilization of keureling (tor tambra) fingerlings fed a formulated diet with different doses of vitamin e *(alpha-tocopherol)*. Archives of Polish Fisheries. 2016;24:47-52.
3. Tancung AB, Ghufran HM, Kordi K. Management of water quality in aquaculture. Jakarta: Rineka Cipta. Hal. 2007;2-3.
4. Meade JW. Aquaculture management. Van Nostrand Reinhold. New York; 1989.
5. Susanto H, Dan Amri K. Catfish cultivation. Self-help spreader. Jakarta. 90 hal; 2002.
6. Susanto H. Various fish ponds: Various types and how to make. Self-help spreader. Jakarta; 2013.
7. Effendi MI. Fisheries biology. Pustaka Nusantara Foundation, Yogyakarta. 1997;163.
8. Effendi I. Biological methods of fisheries. Dewi Sri Foundation, Bogor. 1979;112.
9. Effendie MI. Fisheries biology. Yogyakarta: Pustaka Nusantara Foundation; 2002.
10. Putri DS. Effect of salinity on growth of gift tilapia seeds. Essay. Faculty of Fisheries and Marine Sciences, Padjadjaran University. Bandung; 2009.
11. Mudjiman A. Fish food. (Ed) Revision. Agriwawasan Series. Self-Publisher Issuer. Jakarta; 2004.
12. Jobling M. Fish bioenergetics. Chapman and Hall. London; 1994.
13. Wedemeyer GA. Physiology of fish in intensive culture system. New York: Chapman and Hill; 1996.
14. Kadarini T, Sholichah dan L, Gladiyakti M. Effect of stocking density on survival and growth of silver dollar ornamental fish (*Metynnis hypsauchen*) seeds in the recirculation system. Jakarta. 2010;409-416.

15. Wheaton FW. Aquacultural engineering. Library of Congress, USA. 708 hlm; 1942.
16. SNI (Indonesian National Standard). Production of Siamese Patin (*Pangasius hypophthalmus*) seed distribution seeds; 2000.
17. Sedana IP, Syafriadiman, Hasibuan S, dan Pamungkas, Niken Ayu. Practicum guide for water quality management. Faculty of Fisheries and Marine Science. Riau University Pekanbaru. 2001;52.
18. Boyd CE. Water quality in pond for aquaculture. Birmingham Publishing Company, Alabama. 1990;482.
19. Sucipto A dan Prihartono. Enlargement of Red Tilapia Bangkok. Self-help spreader. Jakarta; 2005.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/59483