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THE EFFECT OF DIFFERENT LIGHT INTENSITIES ON THE ABSOLUTE GROWTH OF AFRICAN CATFISH (*Clarias gariepinus*)

Pengaruh Intensitas Cahaya yang Berbeda Terhadap Pertumbuhan Berat Mutlak Ikan Lele Dumbo (*Clarias gariepinus*)

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ABSTRACT

This study aimed to determine the effect of different light intensities on the absolute growth of African catfish (*Clarias gariepinus*). The experiment was conducted at the Purwosari Fish Hatchery, Magetan, East Java, for 30 days from May 11 to June 9, 2025, using a Completely Randomized Design (CRD) with three treatments (dark 0 lux, shaded 324–830 lux, and bright 6,630–17,070 lux) and nine replications. Data were analyzed using one-way ANOVA followed by the Least Significant Difference (LSD) test at a 5% significance level. The results showed that light intensity significantly affected the absolute growth of African catfish. The bright treatment produced the highest growth (198.98 ± 16.94 g) compared to shaded (155.00 ± 20.45 g) and dark treatments (136.67 ± 23.33 g). Water quality remained within the optimal range for catfish culture, although ammonia levels were higher under bright conditions. These findings indicate that although African catfish are nocturnal, light is still required in intensive aquaculture systems to optimize feeding activity and feed utilization efficiency.

Keywords: *Clarias gariepinus*, light intensity, growth, aquaculture

ABSTRAK

Penelitian ini bertujuan untuk mengetahui pengaruh intensitas cahaya yang berbeda terhadap pertumbuhan berat mutlak ikan lele dumbo (*Clarias gariepinus*). Penelitian dilaksanakan di Balai Benih Ikan Purwosari, Magetan, Jawa Timur selama 30 hari, dari 11 Mei 2025 hingga 9 Juni 2025, menggunakan metode eksperimental dengan Rancangan Acak Lengkap (RAL) yang terdiri dari tiga perlakuan (gelap 0 lux, teduh 324–830 lux, dan terang 6.630–17.070 lux) dengan sembilan ulangan. Data dianalisis menggunakan ANOVA satu arah dan dilanjutkan dengan Uji Beda Nyata Terkecil (BNT) taraf 5%. Hasil penelitian menunjukkan bahwa intensitas cahaya berpengaruh signifikan terhadap pertumbuhan berat mutlak ikan lele dumbo. Perlakuan terang menghasilkan pertumbuhan terbaik (198,98 ± 16,94 g) dibandingkan dengan perlakuan teduh (155,00 ± 20,45 g) dan gelap (136,67 ± 23,33 g). Kualitas air selama penelitian masih berada pada kisaran optimal untuk budidaya ikan lele, meskipun kadar amonia lebih tinggi pada perlakuan terang. Temuan ini menunjukkan bahwa meskipun ikan lele bersifat

nokturnal, keberadaan cahaya tetap diperlukan dalam sistem budidaya intensif untuk mengoptimalkan aktivitas makan dan efisiensi pemanfaatan pakan.

Kata Kunci: *Clarias gariepinus*, intensitas cahaya, pertumbuhan, budidaya ikan

INTRODUCTION

African catfish (*Clarias gariepinus*) is a freshwater fishery commodity with significant economic value in Indonesia due to its increasing consumption demand. Its high protein content, affordable price, and ease of cultivation make this fish popular among farmers and the wider community. Data from the Ministry of Maritime Affairs and Fisheries (2013) shows that 57.2% of the national animal protein requirement comes from fish, and East Java is among the regions with the highest fish consumption levels, reaching 51.45 kg/capita in 2023. However, catfish cultivation productivity still faces challenges related to growth efficiency and feed conversion, which are influenced by environmental factors, one of which is light intensity. Light is an important factor that influences fish physiological activities, including feeding behavior, metabolism, and growth. The intensity and duration of light exposure affect fish circadian rhythms and growth hormone secretion. Several previous studies have revealed the effect of light on the growth of freshwater fish. According to Maishela et al. (2013), fish raised with adequate lighting showed better weight gain compared to fish raised in total darkness. Meanwhile, research by Darmawan et al. (2020) states that light intensity that is too low can inhibit feeding activity, while light that is too high can cause physiological stress in fish.

Although catfish are known as a nocturnal species, recent research shows that these fish can adapt to bright conditions if feeding patterns are maintained regularly. In intensive culture systems, light regulation is a crucial aspect for optimizing growth, increasing feed conversion efficiency, and maintaining stable water quality. However, the direct effect of light intensity on the absolute weight growth of African catfish has not been specifically studied, especially in culture conditions using limited containers with varying light intensity controls. Based on this background, this study was conducted to determine the extent to which different light intensities affect the absolute weight growth of African catfish (*Clarias gariepinus*). This study also aims to provide a scientific basis for optimal lighting management in catfish cultivation to increase productivity and feed efficiency. This research used an experimental approach at the Purwosari Fish Seed Center in Magetan, with three different light intensity treatments: dark (0 lux), shade (324–830 lux), and bright (6,630–17,070 lux).

In general, this research is based on the hypothesis that light intensity significantly influences the absolute weight growth of African catfish. This hypothesis is supported by fish physiology theory, which explains that lighting influences growth hormone secretion and metabolic activity. The results are expected to strengthen previous findings and contribute to the improvement of sustainable aquaculture practices by considering both biological and environmental aspects. Thus, this research is relevant not only for the development of catfish aquaculture technology but also for supporting food security and increasing the income of freshwater fish farmers in Indonesia.

RESEARCH METHODS

This research was conducted at the Purwosari Fish Seed Center, Magetan Regency, East Java, for 30 days, from May 11 to June 9, 2025. The test animals used were African catfish (*Clarias gariepinus*) seeds with an average size of 8 cm and a weight of about 4 grams per fish, totaling 270 fish. The rearing media was a 15-liter water gallon containing 10 liters of water for each treatment. The tools used included a DO meter, pH meter, thermometer, lux meter, scales, and an NH_3 ammonia test kit, while the materials used were fresh water and pellet feed with more than 30% protein. The research used an experimental method with a Completely

Randomized Design (CRD) consisting of three different light intensity treatments, namely dark (0 lux), shade (324–830 lux), and bright (6,630–17,070 lux), each with 9 replications. The fish were kept under different conditions according to the treatments, fed three times daily, and their absolute weight growth and water quality parameters (temperature, pH, DO, and ammonia) were periodically measured. The data obtained were analyzed using a one-way Analysis of Variance (ANOVA), followed by a Least Significant Difference Test (LSD) at the 5% level to determine differences between treatments on the growth of the African catfish.

RESULT

Absolute Weight Growth of Dumbo Catfish

The absolute weight growth of African catfish (*Clarias gariepinus*) over 30 days showed significant differences between light intensity treatments. The light treatment (6,630–17,070 lux) produced the highest growth of 198.98 ± 16.94 g, followed by shade (324–830 lux) at 155.00 ± 20.45 g, and darkness (0 lux) at 136.67 ± 23.33 g.

Table 1. Data on absolute weight growth of catfish fry

Treatment	Absolute Weight Growth Range of Catfish (g)	Average Growth Absolute Weight (g)	Standard Deviation
Dark	107-186	136,67	23,33
Shade	119-184	155,00	20,45
Light	170-219	198,98	16,94

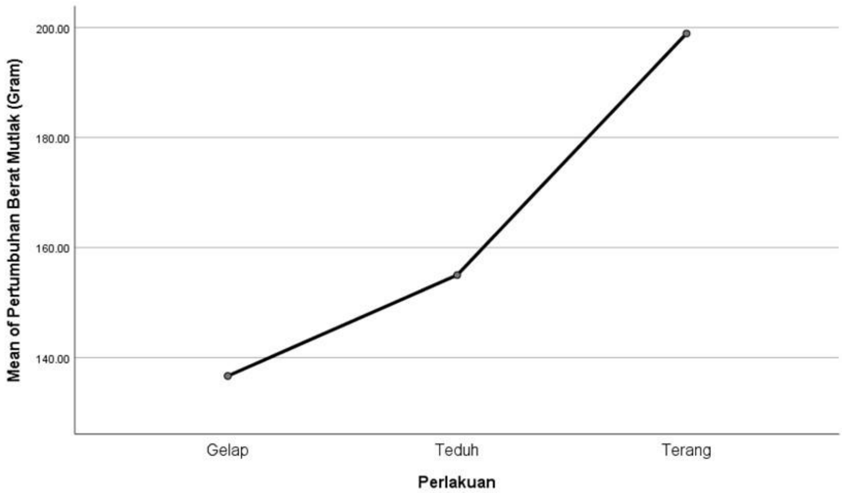

Figure 1. Absolute weight growth graph of catfish

The results of the one-way ANOVA test showed a significant difference between treatments with an F-value of 22.094 and a Sig. of 0.000 (<0.05), indicating that light intensity significantly affected the absolute weight growth of African catfish. Further testing at 5% BNJ showed that the light treatment was significantly different from the dark and shade treatments.

Table 2. ANOVA Test of Absolute Weight Growth of Catfish Fry

ANOVA

Absolute Weight Growth (Gram)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	18401.852	2	9200.926	22.094	.000
Within Groups	9994.889	24	416.454		
Total	28396.741	26			

Table 3. BNJ Test at 5% Level on Absolute Weight Growth

Absolute Weight Growth (Grams) Tukey HSD[a]

		Subset for alpha = 0.05	
Perlakuan	N	1	2
Gelap	9	136.6667	
Teduh	9	155.0000	
Terang	9		198.8889
Sig.		.159	1.000

Means for groups in homogeneous subsets are displayed. a.
Uses Harmonic Mean Sample Size = 9.000.

Optimal growth in light treatment is thought to be due to light stimulating feeding activity and increasing the efficiency of feed conversion into biomass. According to Darmawan et al. (2020), intensive lighting can accelerate the growth rate of freshwater fish by increasing feeding rhythms and metabolism.

Water Quality

During the study, water quality parameters (temperature, pH, dissolved oxygen, and ammonia) were within the optimal range for catfish cultivation.

Temperature

The average temperature ranged from 25.5–29.8°C, with the highest values in the light treatment due to increased light intensity. The ANOVA test showed no significant differences between treatments (Sig. > 0.05), indicating that the temperature remained stable.

Table 4. ANOVA Test for Water Temperature

ANOVA

Water Temperature /

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	96.658	2	48.329	51627.541	.000

	Sum of Squares	df	Mean Square	F	Sig.
Within Groups	.022	24	.001		
Total	96.681	26			

pH

The pH value was in the range of 6.7–7.5, still within the ideal limits for catfish growth (6.5–8.0). No significant differences were found between treatments based on the ANOVA results (Sig. > 0.05).

Table 5. ANOVA test of pH of catfish seed water

ANOVA

pH

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.326	2	.663	1299.485	.000
Within Groups	.012	24	.001		
Total	1.338	26			

Dissolved Oxygen (DO)

DO values ranged from 5.4–6.8 mg/L, with the highest values occurring in the light treatment due to more active photosynthesis. This value is still within the optimal range to support fish metabolism.

Table 6. Average DO of water

Treatment	Water DO Range (mg/l)	Average DO of Water (mg/l)	Std. Deviation
Dark	4.4 – 6.9	5.5	0.04
Shady	4.4 – 6.3	5.1	0.02
Bright	4.5 – 7.4	6.0	0.03

Ammonia Level (NH_3)

Ammonia levels were relatively higher in the light treatment, but remained within the safe range (<0.05 ppm). This indicates the need for routine water management to prevent ammonia accumulation from disrupting growth.

Table 7. Average values of ammonia levels NH_3

Treatment	**Mean**	**Std. Deviation**
Dark	2.19	0.88
Shady	2.19	0.88
Bright	2.50	1.12

DISCUSSION

Effect of Light Intensity on Absolute Weight Growth

Light intensity plays a crucial role in influencing the behavior, physiological activity, and metabolic efficiency of catfish (*Clarias gariepinus*). The results showed that treatment with bright light intensity (6,630–17,070 lux) resulted in the highest absolute weight gain of 198.98 ± 16.94 g, compared to shaded (155.00 ± 20.45 g) and dark (136.67 ± 23.33 g) treatments. These results confirm that bright lighting significantly increases the growth rate of African catfish. The differences in results between treatments are related to the effect of light on the fish's biological system, particularly in terms of activity rhythm, feeding efficiency, and physiological processes in the culture environment. Light functions as an environmental stimulus that regulates the fish's circadian rhythm, a daily activity pattern that influences feeding times and energy metabolism. Under bright conditions, fish are more active in foraging and responding to the food provided, resulting in increased feed consumption and faster growth. Optimal lighting can increase the efficiency of feed conversion into body biomass, as stated by Darmawan et al. (2020) stated that adequate light accelerates the feeding activity and growth of freshwater fish. This study's findings also align with the findings of Maishela et al. (2013) that *Clarias gariepinus* still exhibits optimal growth in bright conditions if feeding is carried out regularly. In intensive culture systems, catfish are able to adapt to daytime feeding patterns, so despite being nocturnal, their feeding activity can be adjusted with regular maintenance management.

Higher light intensity also increases the photosynthetic activity of phytoplankton and algae in the rearing medium. This process produces higher levels of dissolved oxygen (DO), which is essential for fish respiration and metabolism. According to Effendi (2003), the optimal DO level for catfish growth is above 5 mg/L, and research results show that light treatments tend to have higher oxygen levels than dark treatments. This explains the relationship between lighting, increased dissolved oxygen, and fish growth efficiency. In addition to increasing oxygen levels, light also helps fish recognize food more quickly through visual stimulation. Although catfish have barbels that are highly sensitive to vibrations and odors, lighting makes it easier for them to find food, thereby reducing uneaten food waste and increasing feed conversion efficiency (FCR). With good feeding efficiency, more energy from the feed is used for tissue growth.

Overall, bright lighting creates the most supportive environmental conditions for African catfish growth. Light not only functions as an illumination factor but also plays a role in regulating biological rhythms, improving metabolism, and increasing feed efficiency. Although increasing light intensity can slightly raise water temperature, research results show that this temperature range is still within the optimal range for catfish. Therefore, it can be concluded that bright lighting is the ideal condition in African catfish aquaculture systems because it can increase biological activity, improve water quality, and optimize absolute weight growth.

Relationship between Water Quality and Growth

Water quality is an environmental factor that significantly influences the survival and growth of catfish (*Clarias gariepinus*). Based on the research results, all water quality parameters were within the ideal range according to Effendi (2003), namely temperature between 25–30°C, pH 6.5–8, dissolved oxygen (DO) more than 5 mg/L, and ammonia (NH_3) levels below 0.05 ppm. This condition indicates that during the research, the rearing medium had adequate physical-chemical qualities to support fish growth. Light intensity indirectly affects these parameters, especially temperature, dissolved oxygen, and ammonia levels, all of which are correlated with the biological activity of fish and other organisms in the water. In the bright treatment, increased light intensity resulted in slightly higher water temperatures compared to the shaded and dark treatments. Warm temperatures play an important role in accelerating the metabolism and digestive processes of fish, resulting in better feed utilization efficiency. In addition, adequate lighting increases phytoplankton photosynthesis, which produces greater amounts of dissolved oxygen. High oxygen levels facilitate respiration and promote fish growth. However, the higher biological activity in the light treatment also leads to increased ammonia levels due to metabolism and feed residue. Nevertheless, the measured ammonia levels remained within safe limits and thus did not cause toxic effects to the fish.

The results of this study demonstrate a balance between the influence of light on water quality and its impact on African catfish growth. Bright lighting creates optimal environmental conditions because temperature, oxygen, and pH remain within the fish's physiological tolerance limits. Therefore, it can be concluded that appropriate light intensity regulation not only influences fish feeding behavior and metabolic activity but also maintains ideal water quality, which overall supports maximum absolute weight growth in African catfish.

CONCLUSION

Based on the results of the research and discussion that has been carried out, the conclusions of this research are as follows:

1. Light intensity has a significant effect on the absolute weight growth of dumbo catfish, where treatment with bright light intensity (6,630-17,070 lux) gives the best growth results compared to shade (324-830 lux) and dark (0 lux) treatments.
2. The light treatment with 6,630-17,070 lux produced the highest absolute weight growth with an average value of 198.98 grams, followed by the shade treatment with an average of 155 grams, and the lowest was the dark treatment with an average value of 136.67 grams.
3. Water quality parameters consisting of temperature, pH, DO (Dissolved Oxygen), and ammonia NH_3 during maintenance are in the optimal range for catfish growth, but ammonia levels tend to be higher in treatments with bright light intensity, so good water maintenance management is required.

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