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INFLUENCE OF BIOMASS *Lemna* sp. ON THE PHYSICAL PARAMETERS OF PEAT WATER IN THE REARING MEDIUM OF ASIAN REDTAIL CATFISH (*Hemibagrus nemurus*)

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ABSTRACT

Peatland waters hold great potential for aquaculture development; however, their unfavorable characteristics, such as low pH, brownish water color, and high levels of Total Dissolved Solids (TDS) and Total Suspended Solids (TSS), pose major challenges. One approach to improving peat water quality is the use of aquatic plants as phytoremediation agents, such as *Lemna* sp. This study aims to determine the effect of *Lemna* sp biomass on the physical parameters of peat water and to identify the optimal biomass for the rearing of Asian redtail catfish (*Hemibagrus nemurus*). The study was conducted from March to July 2025 at the Integrated Marine Science Laboratory of the Faculty of Fisheries and Marine Sciences at the Universitas Riau. The research method used was an experiment with a one-factor completely randomized design (CRD), consisting of five *Lemna* sp biomass treatments (0, 25, 37.5, 50, and 62.5 g/m²) and three replicates. The parameters observed included TDS, TSS, turbidity, temperature, pH, water color, absolute weight gain, and survival rate of Asian redtail catfish. The results showed that the addition of *Lemna* sp biomass significantly improved ($P<0.05$) the physical parameters of peat water. Increasing the *Lemna* sp biomass reduced TDS and TSS values and improved water clarity compared to the control without *Lemna* sp. These improvements in water quality positively affected the absolute weight gain and survival rate of Asian redtail catfish during the rearing period. A *Lemna* sp. biomass of 62.5 g/m² yielded the best results, with the most optimal physical quality of peat water and the highest growth and survival rates of Asian redtail catfish.

Keywords: *Lemna* sp, Peat water, Physics parameters, Phytoremediation

1. INTRODUCTION

Peat waters are one of the terrestrial aquatic ecosystems widely found in Riau Province and have the potential to be used as a medium for freshwater fish cultivation. However, the use of peat waters for aquaculture activities still faces various obstacles related to their water quality, which is less supportive of fish life[1]. Peat waters generally have a low pH and a brownish to blackish color due to their high dissolved organic matter content[2]. The high organic matter content in peat waters increases Total Dissolved Solids (TDS) and Total Suspended Solids (TSS) values. High TSS values can increase water turbidity, thereby inhibiting light penetration[3]. Meanwhile, high TDS levels can disrupt osmotic balance and respiration in fish, further contributing to declines in growth and survival[4]. Acidic peat waters can also cause physiological stress on fish when used as a maintenance medium without prior treatment[5].

Various efforts have been made to improve the water quality of peat waters, both through physical, chemical, and biological approaches. The biological

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approach using aquatic plants as phytoremediation agents is considered more environmentally friendly and sustainable[6]. Phytoremediation is the process of utilizing plants' ability to absorb, accumulate, and reduce the concentrations of solutes and suspended particles in water, thereby improving water quality naturally[7]. This method is relatively easy to apply and has the potential to be used in fisheries cultivation systems in peat waters[8].

One aquatic plant with potential for use as a phytoremediation agent is *Lemna* sp. This floating plant has a fast growth rate and good adaptability to various aquatic conditions[9]. *Lemna* sp. can absorb solutes, thereby lowering TDS and TSS values and improving water clarity[10]. The use of *Lemna* sp in fish rearing media is expected to improve the physical quality of peat water and create a more suitable aquatic environment for survival[11].

Asian redtail catfish (*Hemibagrus nemurus*) is one of the freshwater fish with high economic value and is in great demand by the people in Riau Province. This fish has a fairly good ability to adapt to fluctuations in water quality, including in waters with relatively low pH[12]. However, the growth and survival of Asian redtail catfish remain greatly influenced by the quality of the maintenance media, especially water physics parameters such as TDS, TSS, and turbidity[13].

Although the use of *Lemna* sp. as a phytoremediation agent has been widely reported, studies on the influence of differences in *Lemna* sp biomass on peat water physics parameters in Riau Province and their impact on the growth and survival of Asian redtail catfish are still limited[14]. Therefore, this study aims to determine the influence of *Lemna* sp biomass on peat water-physical parameters and to identify the optimal biomass for Asian redtail catfish rearing media.

2. RESEARCH METHOD

Time and Place

This research was carried out from March to July 2025. This research was conducted at the Integrated Laboratory of Marine Sciences, Faculty of Fisheries and Marine, Universitas Riau, Pekanbaru.

Experimental Design

This study used an experimental method with a one-factor Complete Random Design (CRD), consisting of five treatment levels and three replicates, yielding 15 experimental units. Treatment in the form of *Lemna* sp. biomass variation was determined based on Nisa's[15] research, which showed that phytoremediation using *Lemna* sp. significantly affected the growth and survival of Asian redtail catfish and increased *Lemna* sp. biomass, with the best treatment being 50 g. The biomass levels of *Lemna* sp. used were 0, 25, 37.5, 50, and 62.5 g/m².

Procedure

Container Preparation

The container used in this study is a round plastic bucket measuring 60 cm in diameter and 45 cm high with a maximum capacity of 100 L of water ± 15 units. Before use, the container is washed with PK powder at a dose of 1 g/ 10 L of water. Furthermore, the container is filled with peat water to a height of 80 L. After that, aeration is installed to supply oxygen to the maintenance container.

Lemna sp.

The *Lemna* sp. used was obtained from Jl. Soekarno Hatta, West Labuh Baru Village, Payung Sekaki District, Pekanbaru. Before use, *Lemna* sp. is acclimated for 3 days in a 100 L bucket. Next, Lemna sp. is drained and weighed according to the treatment biomass, then put into a research container. Given that the biomass of *Lemna* sp. can multiply within 2 days[11], reweighing is performed every 3 days to maintain the biomass at the treatment dose, with

adjustments made in adding or reducing biomass as needed.

Maintenance and Feeding of Asian Redtail Catfish (*H. nemurus*)

The 5–7 cm Asian redtail catfish seeds used came from the same parent and were obtained from the Paku River. Fish were stocked at a density of 700 fish/m³ [16]. Each rearing container had a volume of 80 L (0.08 m³), resulting in a stocking density of 56 fish per container. Prior to the study, fish were acclimatized for 7 days in peat-water media to reduce stress and improve adaptation[6]. Maintenance lasted for 28 days, with commercial pellets (PF-800; 0.7–1 mm) at 5% of biomass weight, fed three times a day at 07.00, 12.00, and 17.00 WIB. Survival rates were observed at the end of the study, while absolute weight growth was measured on days 7, 14, 21, and 28 by sampling 30% of the fish population in each container.

Measured Parameters

Measurement of Changes in Biomass *of Lemna* sp.

Lemna sp. biomass is weighed at the dose before being placed in the research container. Given that *Lemna* sp. can multiply rapidly over 2–4 days[17], weighing is performed every 3 days during maintenance. Biomass adjustment is performed by subtraction or addition to maintain the biomass amount consistent with the initial dose at each treatment.

Relative Growth Rate Measurement of *Lemna* sp.

The relative growth rate of *Lemna* sp. is measured along with changes in biomass. Data were obtained through biomass weighing and further calculated using the RGR formula according to Mitchell[18]:

$$RGR = \frac{\ln W2 - \ln W1}{T2 - T1}$$

Description:

RGR : Relative growth rate (g/day)
W1 : Initial fresh weight (g)
W2 : Fresh weight on the day of... (g)
T1 : Initial observation time
T2 : Observation time

Total Dissolved Solids (TDS)

TDS sampling was conducted at 08.00 WIB, and measurements were taken at the Integrated Laboratory of Marine Sciences, Faculty of Fisheries and Marine, Universitas Riau, using the electrometry method with a TDS meter (HM Digital, range 0–9999 ppm).

Total Suspended Solid

TSS sampling was carried out at 08.00 WIB. The TSS analysis was carried out at the Marine Chemistry Laboratory, Faculty of Fisheries and Marine, Universitas Riau, following the procedure proposed by BSN[19]. Measurements were carried out using the filtration method with Whatman paper, drying at 105ºC, and weighing with an analytical scale to calculate the TSS value.

$$TSS\ (g) = \frac{A-B}{V} \times 1000$$

Description:

A : Filter paper weight + residue (mg)
B : Filter paper weight (mg)
V : Test sample volume (L)

Brightness

Brightness level was measured in the morning (08.00 WIB) at the research site using a Secchi disc, according to the SNI[20] method. The disc was lowered to visible and invisible limits, then the measurement distance was recorded for brightness calculation.

$$P = \left(\frac{x+y}{2}\right)$$

P : Brightness
x : Distance disc buckets still visible (cm)
y : Distance disc buckets invisible (cm)

Water Color

Water colour was visually assessed every 7 days. Color changes were documented and presented as color gradations and histograms. Each sample was assigned a score ranging from 1 to 6, with

higher scores representing better peat water color quality[8].

Temperature

Temperature measurements were carried out in accordance with SNI[20] by measuring air and water temperatures at the research site. The air temperature is measured using a thermometer placed in an area protected from direct sunlight on a stable scale. The water temperature is measured by dipping the thermometer to the scale limit for 2–5 minutes and reading without lifting the thermometer. Measurements are taken once a week in the morning (±08.00 WIB) and afternoon (±17.00 WIB) to represent the minimum and maximum temperatures.

Degree of Acidity

pH measurements are performed using a pH Meter ATC (range 0,0–14,0 pH) and are conducted weekly. Data collection was carried out in the morning (±08.00 WIB) and afternoon (±17.00 WIB) because at those times the water pH generally reached its minimum and maximum values.

Absolute Weight Growth

Absolute weight growth was calculated using a formula from Zonneveld et al.[21].

$$W = Wt - Wo$$

Description:

W : Absolute Weight Growth (g)
Wo : Average weight of fish at the beginning of the study (g)
Wt : Average weight of fish at the end of the study (g)

Survival Rate (SR)

The calculation of SR using the formula of Effendie[22] is:

$$SR = \frac{\Sigma Nt}{\Sigma No} \times 100\%$$

Description:

SR : Survival Rate (%)
Nt : Number of fish at the end of the rearing
No : Number of fish at the beginning of stocking

Data Analysis

Data on average growth in absolute weight and graduation rate are presented in a table. The parameters of TSS, TDS, brightness, *Lemna* sp. biomass, and LPS are presented in tables and graphs, while water colour is analysed descriptively. Data were analyzed using variance analysis (ANOVA). A significant difference ($P < 0.05$) indicated the influence of *Lemna* sp. on the physical quality of peat water, whereas the results were insignificant ($P > 0.05$) and indicated no effect. The Student Newman Keuls follow-up test was used to determine the differences between treatments[23].

3. RESULT AND DISCUSSION

Biomass *Lemna* sp.

Based on the research conducted, the data on weighing *Lemna* sp. biomass are shown in Figure 1.

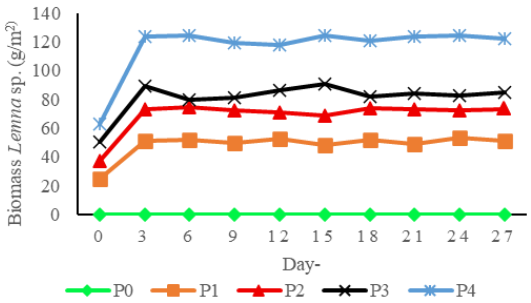

Figure 1. Biomass *Lemna* sp.

Based on Figure 1, biomass increased only in the *Lemna* sp. treatment (P1–P4), reaching about twice the initial weight. Sampling every three days aims to monitor growth and maintain the uniformity of the initial biomass, so that the observed increase in biomass reflects the plant's natural growth. Treatment with the highest initial biomass (P4) yielded the highest final biomass. In contrast, the lowest initial biomass (P1) yielded the lowest final biomass, suggesting that biomass increase was directly proportional to initial biomass. This is thought to be related to the greater number of *Lemna* sp. individuals in the

initial biomass, leading to a higher nutrient-absorption capacity and increased photosynthetic activity. These findings are in line with Shi et al.[24], who reported that increasing *Lemna* sp density to some extent can enhance biomass accumulation. In addition, *Lemna* sp has high photosynthetic efficiency, rapid growth, and plays an effective role as a bioremediation agent by absorbing organic and inorganic compounds in water[25]. Overall, *Lemna* sp. grew optimally in peat water, resulting in increased biomass and improved water quality, whereas the control treatment (P0) showed no significant change.

Relative Growth Rate of *Lemna* sp.

Based on the research conducted, the relative growth rate of *Lemna* sp obtained during the study is shown in Figure 2.

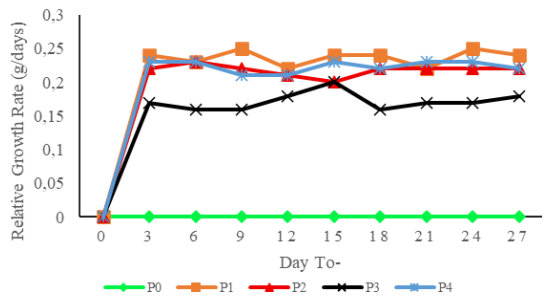

Figure 2. Relative growth rate *Lemna* sp

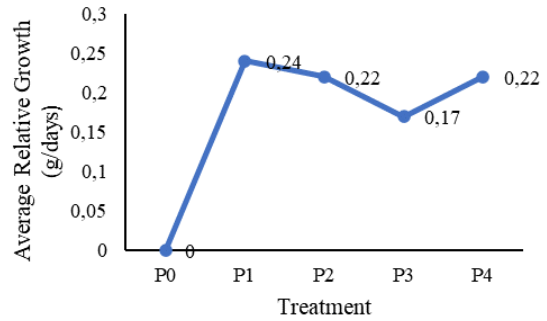

Figure 3. Average Relative Growth Rate of *Lemna* sp.

Based on Figure 2, the relative growth rate *of Lemna* sp. for 27 days showed an increase on day 3 in the P1, P2, P3, and P4 treatments. P1, P2, and P4 treatments further maintained a relatively stable growth rate in the range of 0.20–0.25 g/day, with P1 tending to be higher. P3 treatment was in the lower range, which was 0.15–0.20 g/day. P0 treatment showed no growth, as it was a control without *Lemna* sp (Figure 3).

The relative growth rate of *Lemna* sp. during the study ranged from 0.16 to 0.25 g/day, with consistent growth across treatments every three days. The highest average LPR was observed in the P1 treatment (0.24 g/day), followed by P2 and P4 (0.22 g/day), and the lowest in P3 (0.17 g/day). The growth of *Lemna* sp. is thought to be influenced by the availability of nutrients derived from metabolic residues and fish feed.

The high RGR at P1 indicated that the media conditions in the treatment were optimal for *Lemna* sp growth. The decrease in LPR in P3 is thought to be related to less supportive media conditions, possibly due to variations in other environmental factors such as light intensity or nutrient availability[26].

In the P4 treatment, RGR increased again, demonstrating the physiological adaptability of *Lemna* sp. at higher densities through resource utilization efficiency[24,27]. The similarity of RGR values between P2 and P4 indicates that both treatments remain within the optimal density range, where competition between plants has not significantly reduced productivity, consistent with the concept of a non-linear density-growth relationship in *Lemna* sp.[27]

Peat Water Physics Parameter of Asian Redtail Fish Maintenance Media

Total Dissolved Solids (TDS) is a dissolved solid substance in water consisting of ions, compounds, and colloids. Based on research on the influence of biomass of *Lemna* sp in peat water in the maintenance of Asian redtail catfish, the TDS value of peat water is presented in Table 1.

Based on Table 1, the total dissolved solids in the peat-water medium for Asian redtail fish farming with *Lemna* sp. biomass treatment ranged from 58.33 to 231.67 mg/L. The highest TDS value was found in the control treatment (P0), while the lowest was found in the P4 treatment (62.5 g/m²). The addition of *Lemna* sp. reduced TDS

concentration in all P1–P4 treatments, with the greatest reduction observed in P4, from 153.33 to 58.33 mg/L. Conversely, in P0, TDS increased to 231.67 mg/L, although all treatments remained within safe limits for fish farming (<1,000 mg/L) according to Government Regulation No. 82 of 2001.

Table 1. Total Dissolved Solid (TDS) value mg/L

Treatment	Day to					Average	Standards PP No.82/ 2001
	0	7	14	21	28		
P0	153	169	197	224,33	231,67	195±3,53^{c}	<1.000 mg/L
P1	140	130	127	121,33	115	126,66±0,70^{b}	
P2	125,67	120,33	114,33	107	98	113,06±4,27^{b}	
P3	148,67	100,33	90,50	76	69,67	97,03±6,55^{a}	
P4	153,33	105,33	81,33	72	58,33	94,06±14,33^{a}	

Note: Different superscript letters on different lines show a noticeable difference (P < 0.05).

The effectiveness of TDS reduction is related to the ability of *Lemna* sp. to absorb dissolved organic and inorganic compounds through the roots, which are then distributed throughout plant tissues[28,29]. Lower TDS levels had a positive impact on Asian redtail fish growth, as indicated by higher absolute fish weight in the P1–P4 treatments compared to P0. The increase in TDS at P0 is thought to result from the accumulation of feed residues and fish metabolic products that are not absorbed by plants, leading to a buildup of solutes[8].

The results of this study showed that the effectiveness of *Lemna* sp. is higher than that of other aquatic plants, such as *Eichhornia crassipes* and *Hydrilla verticillata*, which are reported to be only able to lower TDS by up to 110–130 mg/L[30,31]. The Advantages of *Lemna* sp. include the morphology of roots hanging directly in the water and the leaf surface area, which accelerate solute absorption and photosynthesis[28]. This finding aligns with the research of Nurrasyida et al.[32], which found that *Lemna* sp effectively reduces TDS and organic residues in fish farming media.

Total Suspended Solids in the Peat Water Media

Total Suspended Solid (TSS) is the total of suspended organic and inorganic solids in water that are insoluble and can be retained by the filter medium. TSS components include sludge, sediment, dead organic matter, microorganisms, and other solid particles. The effect of *Lemna* sp. biomass on TSS values in Asian redtail catfish rearing peat water was observed for 28 days with five treatments, namely P0 (without *Lemna* sp.), P1 (25 g/m²), P2 (37.5 g/m²), P3 (50 g/m²), and P4 (62.5 g/m²), the results of which are presented in Figure 4.

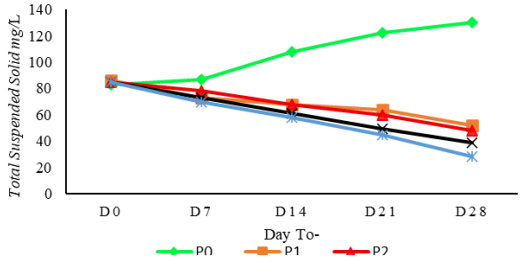

Figure 4. Peatwater TSS

Based on the results of observation for 28 days, all treatments with the addition of *Lemna* sp. showed a decrease in the total value of suspended solids (TSS), while treatments without *Lemna* sp. (P0) experienced an increase in TSS. The highest decrease occurred in the P4 treatment (62.5 g/m²) from 85 to 28 mg/L, followed by P3, P2, and P1. The TSS value in the treatment *of Lemna* sp. remains relatively good. It has little effect on fishery activities, in accordance with the water quality standards set by Poppo et al.[33]. TSS degradation is thought to occur through bioremediation mechanisms mediated by aquatic plants, including the absorption of suspended particles, the decomposition of organic matter, and phytodegradation by

microorganisms on plant roots. The effectiveness of TSS reduction increases with *Lemna* sp. biomass, in line with the opinion of Unisah & Tauny[34], who state that the increase in aquatic plant mass is directly proportional to the ability to reduce TSS.

In contrast, the increase in TSS in P0 from 83 mg/L to 130 mg/L is thought to be due to the accumulation of feed residues and the metabolic results of fish that plants do not absorb. According to Suherman et al.[35], high TSS values can increase water turbidity, inhibit light penetration, and disrupt the osmoregulatory systems of aquatic organisms, thereby reducing habitat quality and fish survival**.**

Brightness

The brightness of the waters indicates the ability of light to penetrate the water column and plays an important role in supporting photosynthesis in natural waters[36]. The results of the study on the effect of *Lemna* sp. biomass on peat water for Asian redtail catfish farming show the brightness value presented in Table 2.

Table 2. Brightness

Treatment	Day to					Average	Measurement Standards
	0	7	14	21	28		
P0	9,82	8,53	6,58	5,45	5,23	7,12±0,07[a]	PP No.82/2001
P1	7,62	9,33	11,27	14,51	16,07	11,72±0,11[b]	45 cm
P2	8,67	10,44	14,16	16,60	18,37	13,63±0,15[c]	
P3	9,50	13,76	16,41	19,23	20,52	15.88±0.14[d]	
P4	9,42	14,20	17,53	19,90	21,83	16.57±0.04[e]	

Note: Different superscript letters on different lines show a real difference ($P < 0.05$).

Based on Table 2, the brightness value of peat water in Asian redtail catfish rearing media with the application of *Lemna* sp. ranges from 5.23 to 21.83 cm. The highest brightness was found in the P4 treatment (62.5 g/m²), with an average of 16.57 cm, while the lowest was in the control (P0), at 7.12 cm. The results of the variance analysis (ANOVA) showed that administering *Lemna* sp. at different biomass levels significantly increased the brightness of peat water ($P<0.05$), with P0 significantly different from all *Lemna* sp. treatments. The increase in brightness occurs through the absorption mechanism of contaminants and suspended solids by plant roots[37]. The P4 treatment showed the best results with an increase in brightness from 9.42 to 21.83 cm, while P0 experienced a decrease in brightness due to the accumulation of fish feed residues and metabolites.

Increased brightness plays an important role in supporting photosynthesis and maintaining dissolved oxygen levels, as fine particles such as plankton, detritus, and mud can reduce water brightness and oxygen levels[38]. This condition affects fish growth and survival, with the P0 showing the lowest absolute weight and the lowest survival rate. The results of this study are better than those of Drastinawati et al.[39], who reported that the increase in peat water brightness reached only 8–14 cm. The advantage of *Lemna* sp. is its small, floating morphology, which allows it to effectively absorb suspended particles without excessively covering the water surface[40].

Temperature

The water temperature of aquaculture ponds plays an important role in determining the physiological condition of aquatic organisms, as it affects water viscosity, mineral distribution, and dissolved oxygen concentration. Temperature changes that do not meet fish's needs can inhibit energy mobilization and, in a short time, cause death[41]. In addition, temperature fluctuations can induce stress in fish, characterized by changes in blood glucose levels that lower appetite[42]. Based on research on the influence of *Lemna* sp. on peat water for Asian redtail catfish rearing, the temperature

of the deep peat water media was determined (Table 3).

Based on Table 3, the temperature of peat water at the entire treatment, both without *Lemna* sp. (P0) or with the addition of *Lemna* sp. (P1–P4), was in the range of 25–28.8°C and showed no significant difference between treatments. The temperature range is still within the optimal range for Asian redtail fish farming (24–29°C). It supports fish growth during the rearing period, as indicated by the increase in absolute fish weight. The water temperature remained relatively stable throughout the study, with no noticeable fluctuations between morning and evening.

Table 3. Water temperature

Treatment	Treatment										References
	P0		P1		P2		P3		P4		
	M	A	M	A	M	A	M	A	M	A	
P0	26,1	28	26,3	28,3	26,4	28,7	26	26,8	26,7	27	24-29°C
P1	26,4	28,2	26,6	28,5	26,4	28	26,1	27,2	26,3	27	(Optimal)
P2	26,2	28,3	26,4	28,8	26,1	26,8	25	26,7	26,6	27,5	
P3	26,4	28,7	26,5	28,6	26,1	28,4	25,1	27	26,7	27,9	
P4	26,1	28,5	26,2	28,2	26	28,2	26,8	27,8	26,5	27,9	

Note: M: morning; A: afternoon

The presence of *Lemna* sp in this study acts as a natural shade that can stabilize the water temperature through a reduction in the intensity of direct sunlight, so it is different from the system that uses *Azolla pinnata* reported by Putri et al.[43], which has higher temperature fluctuations due to uneven canopy closure. Thus, the use of *Lemna* sp. can create more stable thermal conditions and support the metabolism and growth of Asian redtail fish in peat waters.

Degree of Acidity (pH) of peat water media

pH is an important parameter that determines water acidity and directly affects the stability of aquatic ecosystems, particularly by regulating nutrient availability and the solubility of chemical compounds. Too low or too high pH conditions can affect the biological activities of aquatic organisms, including respiration, growth, and fish resilience. In this study, the pH of peat water used as a rearing medium for Asian redtail catfish was monitored weekly, with the addition of *Lemna* sp. biomass, to determine in changes during the maintenance period. The results are presented in Figure 5.

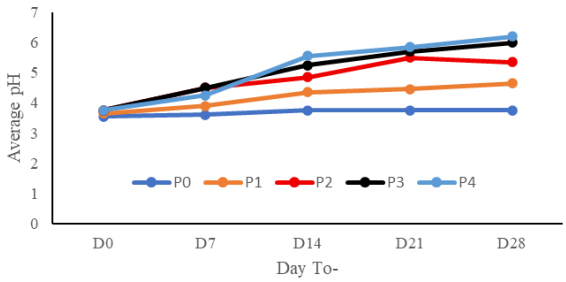

Figure 5. pH Average

Based on Figure 5, the treatment without *Lemna* sp. (P0) showed the lowest pH, averaging 3.75. In contrast, the addition of *Lemna* sp. biomass significantly increased the pH of peat water. The P4 (62.5 g/m²) was the most effective, increasing pH to an average of 6.2, close to the optimal range for bream growth[44]. The increase in pH is suspected to occur through the absorption of decomposed organic matter by *Lemna* sp. and through the use of CO_2 during photosynthesis, thereby reducing the formation of H^+ ions that cause acidity.

These results show that *Lemna* sp. is more effective in neutralizing the pH of peat water than the use of large aquatic plants such as *E. crassipes*, which only increases the pH to 5.5[1], or the chemical method using dolomite lime, whose increase is temporary[45]. The effectiveness and stability of pH produced by *Lemna* sp. are supported

by its high photosynthetic capacity, which helps naturally reduce water acidity[40].

Peat Water Color in Fish Farming Media

The color of peat water is visually observed. Based on the research carried out, the results of the colour change in peat water media are shown in Figure 6.

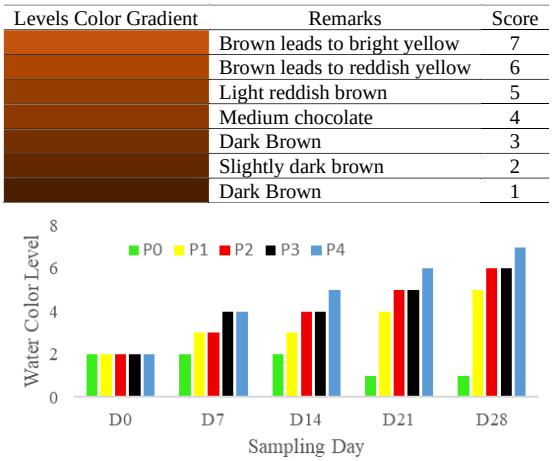

Figure 6. Histogram and color gradient of peat water

Based on Figure 6, there is a change in the color of peat water during the Asian redtail catfish rearing period. Treatment without *Lemna* sp. (P0) indicates a change in color from brown to dark brown, with a decrease in color score from level 2 to 1. In contrast, treatment with *Lemna* sp. (P1–P4) resulted in a lighter water colour and increased colour scores to levels 5–7 on day 28. The darker discoloration in P0 is thought to result from the accumulation of feed residues and metabolic products, which increase water turbidity. In contrast, the presence of *Lemna* sp. increases the clarity of the maintenance medium. This is in line with Dwiningtias et al.[8], who state that aquatic plants do not significantly alter water colour but do affect the clarity of the maintenance medium.

Growth and Survival Rate of the Asian Redtail Catfish (*H. nemurus*)

The results of the study on the influence of *Lemna* sp biomass on peat water physics parameters in the Asian redtail catfish rearing medium showed the absolute weight value of fish during the study period, as presented in Table 4.

Table 4. Average absolute weight

Treatment	Average Absolute Weight (g)		W (g)
	Beginning	End	
P0	1,94	2,55	0,61±0,07^{a}
P1	1,88	2,87	0,99±0,20^{b}
P2	1,85	3,06	1,20±0,16^{bc}
P3	1,87	3,25	1,38±0,15^{cd}
P4	1,94	3,58	1.64±0.09^{d}

Note: Different superscript letters on different lines show a real difference ($P < 0.05$).

Based on Table 4, the absolute weight of Asian redtail catfish during the study ranged from 0.61–1.64 g, with the highest value at the P4 treatment (*Lemna* sp. biomass 62.5 g/m²) and the lowest at the P0 (without *Lemna* sp.). The analysis showed that applying *Lemna* sp. biomass to peat-water media significantly increased absolute weight gain in Asian redtail catfish, with *Lemna* sp. treatments resulting in higher growth than controls. An absolute weight increase goes hand in hand with improvements in water quality, such as increased pH, decreased TSS and TDS, increased brightness, and stability in dissolved temperature and oxygen. According to Zimmo et al.[46], *Lemna* sp can absorb excess nutrients and improve water quality, thereby creating a more conducive environment for fish growth.

The results of the ANOVA test (Table 4) showed that the biomass of *Lemna* sp. had a significant effect on the absolute weight of the Asian redtail catfish, with the results of the follow-up test of Student-Newman-Keuls showing that the control (P0) was significantly different from the rest of the treatments of *Lemna* sp (P1–P4). Although

not all treatments show noticeable differences, P4 treatments still produce the highest absolute weight, both biologically and applicatively.

The increase in *Lemna* sp. biomass is positively correlated with the growth rate of fish, indicating improved water quality and greater efficiency of fish metabolism. This is in line with Azhari & Tomasoa[47], who stated that water quality greatly affects the growth and survival of cultivated fish, as well as Fajriyani & Bayu[48], who emphasize the importance of water quality stability in peat media.

Compared to the previous study, the absolute weight of Asian redtail catfish in this study was higher than the results of Syafriadiman & Hasibuan[40], which only reached 0.92 g/head without aquatic plants. This shows that *Lemna* sp is more effective at improving water quality and supporting fish growth. Because the dosage and feed type are made uniform across treatments, the absolute weight growth difference is mainly influenced by the water quality conditions of the maintenance medium. Thus, P4 treatment (62.5 g/m²) can be declared the most effective treatment in supporting the growth of Asian redtail catfish in peat water.

Survival Rate of Asian Redtail Catfish

The average survival of Asian redtail catfish obtained during the study is shown in Table 5.

Table 5. Average survival rate

Repetition	Survival Rate (%)				
	P0	P1	P2	P3	P4
1	57,14	71,43	78,57	80,36	85,71
2	71,43	80,36	76,79	83,93	82,14
3	62,50	78,57	85,71	87,50	96,43
Average	63,69±19,67[a]	76,78±4,72[b]	80,35±4,72[b]	83,93±3,57[b]	88,09±7,43[b]

Based on Table 5, the application of *Lemna* sp. to peat water media affects the survival of Asian redtail catfish. The survival rate ranged from 63.69–88.09%, with the highest value in the P4 treatment (62.5 g/m²) and the lowest in the P0 (without *Lemna* sp.). During the study, fish in all treatments showed normal physiological conditions, but those in the *Lemna* sp. treatment appeared more active and responsive to feed than those in the P0 treatment. This is thought to be related to more stable water quality in the *Lemna* sp.-treated medium, whereas in P0, water quality decreases due to the accumulation of feed residues and fish metabolism. This condition aligns with Widodo et al.[49], which states that poor water quality can reduce appetite and trigger fish diseases. However, the water quality at P0 is still within the tolerance range for Asian redtail catfish, according to Cahyanurani et al.[50], so the fish can still survive.

In addition, the P4 treatment results were higher than those reported by Syafriadiman & Hasibuan[40], who used *E. crassipes* and reported a survival rate of 82.5%. The advantage of *Lemna* sp. is thought to be its small leaf size and even distribution, which make it more effective at maintaining water quality without inhibiting oxygen diffusion. In general, the addition of *Lemna* sp., especially in the P4 treatment, has proven most effective in increasing and stabilising the survival of Asian redtail catfish in peat waters.

4. CONCLUSION

Research shows that *Lemna* sp. biomass affects the physical parameters of peat water in the Asian redtail catfish rearing media. Feeding *Lemna* sp. biomass at different doses resulted in noticeable changes in TDS, TSS, brightness, pH, and water color. The biomass treatment at 62.5 g/m² (P4) showed the best results, namely TDS of 58.33 mg/L, TSS of 28 mg/L, brightness of 21.83 cm, and pH of 6.2, with lighter water color. The treatment also resulted in the highest absolute weight (1.64

g) for Asian redtail catfish and a survival rate of 88.09%. Based on these results, *Lemna* sp. biomass significantly improved the physicochemical parameters of peat water, with a dose of 62.5 g/m² being the optimal treatment in Asian redtail catfish rearing media.

Based on the results of this study, it can serve as a source of information for cultivators, especially Asian redtail catfish, who use peat water by utilizing *Lemna* sp. plants with a biomass of 62.5 g/m2 to improve the physical quality of the peat water.

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