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The Effect of Water Hyacinth Biomass (*Eichornia crassipes*) on the Concentration of Chlorophyll-a on Local Catfish (*Clarias batrachus*) Rearing

Pengaruh Biomassa Eceng Gondok (Eichornia crassipes) Terhadap Konsentrasi Klorofil-a pada Pemeliharaan Ikan Lele Lokal (Clarias batrachus)

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Abstract

Eichornia crassipes have root fibers that can repair water quality, improve the concentration of chlorophyll-a, increase growth, and maintain the survival of local catfish. The purpose of this study was to obtain the best biomass of water hyacinth for the increasing concentration of chlorophyll-a on local catfish rearing in August – September 2020. This study used a one-factor completely randomized design (CRD) with 4 treatments and 3 replication. The treatments in this study had different water hyacinth biomass, P_0 (Control), P_1 (112 g m^{-2}), P_2 (162 g m^{-2}), and P_3 (212 g m^{-2}). The local catfish seeds that are used are sized approximately 5-7 cm, weigh 2.62-3.02 g, maintained for 30 days in a rearing container with a peat water volume of 98 L and a density of 2 fish L^{-1}. The result showed that the best treatment was biomass 212 g m^2 water hyacinth containing concentration chlorophyll-a 0.73 µg L^{-1} with the value of correlation concentration chlorophyll-a (r)=0.97 and R^2=0.95, it was able to improve concentration chlorophyll-a on local catfish rearing such as increasing pH 5.7-6.0, nitrate 2.45 mg L^{-1}, phosphate 2.09 mg L^{-1}, temperature 27-28^{0}C and dissolved oxygen 5.4-5.5 mg L^{-1}. Absolute weight growth (9.04g) with the value of correlation (r) = 0.99 and R^2 = 0.99, and survival rate of local catfish (94.67%). The highest growth of the biomass water hyacinth per 3 days is 2.82%.

Keywords: Peat Water, Fry, Chlorophyll-a, Biomass

Abstrak

Eceng gondok memiliki akar serabut yang mampu memperbaiki kualitas air, sehingga dapat meningkatkan konsentrasi klorofil-a, meningkatkan pertumbuhan dan mempertahankan kelangsungan hidup ikan lele lokal. Penelitian bertujuan untuk mendapatkan biomassa terbaik terhadap konsentrasi klorofil-a pada pemeliharaan ikan lele lokal pada bulan Agustus s/d September 2020. Penelitian ini menggunakan Rancangan Acak Lengkap (RAL) satu faktor dengan 4 perlakuan dan 3 kali ulangan. Perlakuan dalam penelitian ini adalah pemberian biomassa eceng gondok yang berbeda, yaitu P_0 (kontrol), P_1 (112 g m^{-2}), P_2 (162 g m^{-2}), dan P_3 (212 g m^{-2}). Benih ikan yang dipakai berukuran 5-7 cm, bobot 2,62-3,02 g, dipelihara selama 30 hari dalam wadah penelitian dengan volume air gambut 98 L dan kepadatan 2 ekor L^{-1}. Hasil penelitian menunjukkan bahwa perlakuan terbaik adalah pemberian biomassa 212 g m^{-2} eceng gondok dengan konsentrasi klorofil-a 0,73 µg L^{-1} dengan nilai korelasi konsentrasi klorofil-a (r) = 0,97 dan R^2 = 0,95, mampu meningkatkan konsentrasi klorofil-a terhadap pemeliharaan ikan lele lokal seperti meningkatkan pH 5,7-6,0, nitrat 2,45 mg L^{-1}, fosfat 2,09 mg L^{-1}, suhu 27-28^{0}C dan oksigen terlarut 5,4-5,5 mg L^{-1}. Pertumbuhan bobot mutlak (9,04g) dengan nilai korelasi (r) = 0,99 dan R^2 = 0,99, dan tingkat keberlangsungan hidup ikan lele lokal (94,67%). Pertumbuhan biomassa eceng gondok tertinggi per 3 hari adalah 2,82%.

Kata Kunci: Air Gambut, Benih, Klorofil-a, Biomassa

1. Introduction

Peat water is surface water that is abundant in swampy areas and lowlands and has the following characteristics: high color intensity, low pH, high organic content, turbidity and low content of suspended particles and low cation content (Suswati *et al*., 2011). Peat waters have the potential to develop fishery commodities for aquaculture ponds (Syafriadiman & Harahap, 2017). One way to improve water quality is the use of water hyacinth (*Eichornia crassipes*).

Water hyacinth in peat water treatment can increase the pH value (Zainuddin, 2013). Water hyacinth has the ability to improve water quality (Syafriadiman *et al*., 2005). Water hyacinths can increase pH, DO, nitrate, and phosphate (Ratnani *et al*., 2011). Water hyacinths can increase oxygen in the waters through the process of photosynthesis and are distributed to the waters to meet the oxygen needs of microorganisms (Hartanti *et al*., 2014). Water hyacinths can balance nitrate and phosphate nutrients in the water (Asih, 2019). The fertility of water can be measured by nutrients (Leitao, 2012). Nitrate and phosphate nutrients are used for the needs of phytoplankton for their growth life thereby increasing chlorophyll-a (Rumanti *et al*., 2014). Chlorophyll-a is one of the parameters that greatly determines primary productivity in waters. The presence of chlorophyll-a is supported by nitrate and phosphate as nutrients found in the waters. Roshisati (2002) states that nitrate and phosphate nutrients are important factors used for the growth process of chlorophyll-a.

Catfish are one of the fish that can live in peat water ecosystems with peat water quality. Hasan & Rudhy (2013) stated that the local catfish has an additional respiratory organ, namely an arborescent cell. Catfish, one of the fish, can live well in pH and DO waters (2-3 mg L^{-1}). This fish is also able to live at a low pH of 3-4 and high ammonia levels (0.5-1 mg L^{-1}) (Huwoyon & Gustiano, 2013). Based on the above, the authors are interested in obtaining the best biomass from water hyacinth (*Eichornia crassipes*) against chlorophyll-a concentrations in raising local catfish (*C. batrachus*).

2. Material and Method

2.1. Time and Place

This research was carried out in August - September 2020 in the courtyard of the Faculty of Fisheries and Marine. Analysis of chlorophyll-a samples was carried out at the Environmental Quality Laboratory for Aquaculture and the Chemistry Laboratory.

2.2. Tools and Materials

The tools and materials used in this study were 12 plastic buckets with a diameter of 50 cm and a height of 60 cm, jerry cans, analytical scales, and digital scales (Krisbow range 0.1-600 g, resolution 0.1 g, accuracy 1%), millimeter paper, DO meter (Lutron DO 5510), pH meter (ATC accuracy ± 0.01 pH), tank, thermometer (accuracy 1^{0}C), aluminum foil, stationery, bottle, camera, spectrophotometer (Spectronic 20D+), vacuum pump (Thomas DAA-V174-ED), cuvettes, *E.crassipes*, *C.batrachus*, peat water, millipore paper (0.45 millimicrons), label paper, acetone, commercial pellets (PF-800), $KMNO_4$.

2.3. Method

The method used in this study was an experimental method using a 1-factor completely randomized design (CRD) with 4 treatment levels and 3 replications. Ratnani *et al*. (2011) namely the best research results of water hyacinth (*E.crassipes*) with a biomass of 162 g m^{-2}. Biomass can improve water quality in the form of pH, DO, nitrate, and phosphate. Therefore, the research treatment used is as follows:

P0 : Without giving water hyacinth (E. *crassipes*) biomass (control)
P1 : Provision of 112 g m^{-2} biomass of water hyacinth (E. *crassipes*)
P2 : Provision of 162 g m^{-2} biomass of water hyacinth (E. *crassipes*)
P3 : Provision of 212 g m^{-2} biomass of water hyacinth (E. *crassipes*)

2.4. Procedure

2.4.1. Research Container Preparation

The container used is a tubular plastic bucket with a diameter of 50 cm and a height of 60 cm. The container is washed using clean water and 10% $KMnO_4$. Then the containers were arranged and randomized as many as 12 units by lottery and labeled the treatment

2.4.2. Preparation for Maintenance of Local Catfish (Clarias batrachus)

Local catfish were prepared with a size of 5-7 cm, a weight of 2.52-3.02 g with a stocking density of 2 fish/L. Based on research by Yunus *et al*. (2014), the best stocking density is 5 fish/10 L. In this study, 98 L of water were used and 49 fish were needed. During the study, the fish were fed 3 times a day with commercial feed with a protein content of 39-41% ad libitum, until the fish were full, at 07.00; 12.00, and 16.00 WIB. Survival Rate and absolute weight growth were measured on the 7th day, 14th day, 21st day, 28th day.

2.4.3. Preparation of Water Hyacinth (Eichornia crassipes)

Water hyacinth has specifications of 6-10 leaves, 9-15 stems, 10-15 cm leaf length, 8-10 cm leaf width, and 20-30 cm plant height (Ratnani *et al*., 2011). Furthermore, the water hyacinth used is weighed and adjusted to the biomass used. The water hyacinth was re-weighed every 3 days with the aim that the water hyacinth biomass remained in accordance with the initial dose of the study. If there is an increase in biomass, then it will be reduced, and vice versa. Reduction is done by reducing the leaves and stems of water hyacinth.

2.4.4. Parameter Measurement During Research

Parameters measured during the study were temperature (measured in the morning and evening on day 0 to day 30 with a thermometer with an accuracy of 1^0C), pH (measured in the morning and evening on day 0 to day 30 with a pH meter (ATC accuracy ± 0.01 pH), DO (measured on day 2 to day 28 with a DO meter (Lutron DO 5510), nitrate and phosphate (measured on day 2 to day 28 filtered with a vacuum pump and millipore paper using the Naphtyl method for nitrate and Stannus Chloride for phosphate), SR (measured at the beginning-mid-end of the study), absolute weight gain (measured at the beginning and end of the study with a digital scale (Krisbow range 0.1 -600 g, resolution 0.1 g, accuracy 1%), water hyacinth biomass (measured once every 3 days with an analytical balance).

2.4.5. Measurement of Biomass Changes in Water Hyacinth

The water hyacinth was weighed so that the water hyacinth biomass remained in accordance with the initial dose of the study. Measurements and sampling were carried out every three days. If there is an increase in biomass, then it will be reduced, and vice versa. According to Brown (1997), the specific growth rate of water hyacinth for a certain time is calculated using the formula:

$$\%Wt/day = \frac{Wt - W0}{Wt.t} \times 100\%$$

2.4.6. Sampling and Measurement of Chlorophyll-a

Chlorophyll-a sampling was carried out three times, namely at the beginning, middle, and end of the study. This aims to determine the measurement of how many peaks of abundance and decrease in chlorophyll-a concentration occur. The time for sampling and measurement was carried out at 10.00-14.00 WIB, the chlorophyll-a sample was taken using a 500 ml sample bottle to prevent acidification that could break down the chlorophyll, then the sample bottle was covered using black plastic/aluminum foil (Sinaga, 2019). The procedure for determining chlorophyll-a is as follows. As much as 500 ml of sample water is filtered using milipore paper (if there are invertebrate animals, aquatic plants or wood chips removed before filtering). Then the milipore paper containing chlorophyll-a was folded four times, then wrapped using a plastic clip coated with aluminum foil and stored in the freezer overnight. Then fold the milipore paper into the test tube, add 5 ml of 90% acetone then grind until crushed using a small spatula that is done manually. Then 3.5 mL of 90% acetone was added, and then the sample water was centrifuged at 2,000 rpm for 15 minutes to separate the precipitate from the supernatant solution (clear liquid). Then the supernatant solution was put into the cuvette, the value of the chlorophyll-a concentration was calculated at a wavelength of 655 nm and 750 nm (Julianti, 2017). The concentration of chlorophyll-a is calculated using the Boyd formula (1979) as follows:

$$\text{Chlorophyll-a } (\mu g/L) = 11{,}9\ (A_{665} - A_{750}) \times \frac{V}{L} \times \frac{1.000}{S}$$

2.4.7. Sampling and Weighing of Local Catfish (C.batrachus)

Sampling and weighing of local catfish was carried out twice, namely at the beginning and end of the study in the afternoon. Sampling is carried out in the afternoon so that the fish are not easily stressed due to changes in temperature (Syulfia, 2015). This aims to determine the weight gain of local catfish during the study. Weight growth is calculated by the formula (Zonneveld *et al*., 1991):

$$W = W_t - W_0$$

2.4.8. Survival Rate of Local Catfish

Survival Rate can be found by the following formula (Effendie, 1979):

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

2.5. Data Analysis

The data obtained is tabulated in the form of tables and graphs. Then to see the contribution of water hyacinth that improves water quality on fish growth was analyzed using linear regression. Furthermore, to find out whether the water hyacinth biomass had an effect on the concentration of chlorophyll-a, an ANOVA test (Analysis of Variance) was carried out (Sudjana, 1991). The basis for decision making in this study is to follow the steps suggested by (Syafriadiman *et al.*, 2005), if p <0.05 then the hypothesis is accepted. The results of the measurement of water quality parameters were analyzed descriptively

3. Result and Discussion

3.1. Chlorophyll-a Concentration

The results of measuring the concentration of chlorophyll-a in each treatment given water hyacinth had different values for local catfish. For more details, the value of chlorophyll-a concentration during the study can be seen in Table 1.

Table 1. Results of Measurement of Chlorophyll-a Concentration During the Study

The results of measuring the concentration of chlorophyll-a (µg L^{-1})			
Treatment	Day 10	Day 20	Day 30
P_0	0.19±0.04^a	0.33±0.04^a	0.26±0.04^a
P_1	0.33±0.06^b	0.54±0.02^b	0.44±0.05^b
P_2	0.42±0.05^{bc}	0.63±0.02^b	0.51±0.03^b
P_3	0.49±0.03^c	0.73±0.07^c	0.60±0.03^c

Note: On the same colom numbers with the same letter are not significantly different (p<0.05); P_0: Treatment without giving water hyacinth; P_1: Treatment of water hyacinth biomass 112 g m^{-2}; P_2: Treatment of water hyacinth biomass 162 g m^{-2}; P_3: Treatment of water hyacinth biomass 212 g m^{-2}

Based on Table 1, P0 to P3 on the 10th to 20th day experienced an increase, while P0 to P3 on the 10th to 20th day decreased. Based on Table 1, shows that the highest concentration of chlorophyll-a on the 10th day was in treatment P3 and the lowest was in P0. Based on the results of the analysis of variance test (ANOVA), it showed that water hyacinth biomass had a significant effect on chlorophyll-a concentration (P<0.05), then continued with the results of the Newman Keuls Study test which showed that treatment with 212 g m^{-2} biomass was significantly different with the treatment of biomass 0 g m^{-2}, 112 g m^{-2} and the effect was not significantly different from the treatment of 162 g m^{-2}. On the 20th day, the highest value was found in treatment P3 and the lowest was found in P0, then continued with the results of the Student Newman Keuls which showed that the treatment with 212 g m^{-2} biomass was significantly different from the 0 g m^{-2} biomass treatment, 112 g m^{-2}, and 162 g m^{-2} treatment, but the 162 g m^{-2} treatment had no significant effect on the 112 g m^{-2} treatment. The results of measuring the concentration of chlorophyll-a increased from the 10th to the 20th day. At P3 with water hyacinth, biomass of 212 g m^{-2} was the treatment with the best chlorophyll-a yield.

Treatment with water hyacinths can improve water quality so that the water quality is good, and the nutrients in the waters are good. Water hyacinths can decompose organic matter left over from feed and fish waste or metabolism in waters. Nitrates and phosphates in the waters come from leftover feed and metabolism (Guritno, 2003). Treatment by giving water hyacinths can decompose organic matter and produce nutrients in the waters. This is supported by Purwasari *et al*. (2011) that water hyacinth has rhizosphere microbes in its roots that can decompose organic matter into nutrients in the water. The decomposition of organic matter produces nitrate and phosphate in the water. Nitrate and phosphate are important compounds in primary productivity, namely as elements used by phytoplankton and needed in the process of photosynthesis (Balali *et al.*, 2013). This is also supported by Rumanti *et al.* (2014) stating that nitrate and phosphate nutrients are important factors for photosynthesis thereby increasing chlorophyll-a. The results showed that the treatment with the best chlorophyll-a concentration was at P3 with water hyacinth biomass of 212 g m^{-2}. On the 30th day, the highest value was found in treatment P3 and the lowest was found in P0. Based on the results of the analysis of variance test (ANOVA), it showed that water hyacinth biomass had a significant effect on chlorophyll-a concentration (p <0.05), then continued with the results of the Newman Keuls Study test which showed that treatment with 212 g m^{-2} biomass was significantly different with 0 g m^{-2}, 112 g m^{-2} biomass treatment and 162 g m^{-2} treatment, but 162 g m^{-2} treatment had no significant effect on 112 g m^{-2} treatment. The results of measuring the concentration of chlorophyll-a decreased from the 20th to the 30th day.

Decrease because nutrients have been used by phytoplankton for growth and photosynthesis. This is in accordance with the opinion of Sukmawardi (2011) that the decrease in nutrient content is caused by the use of nitrogen in the form of nitrate and phosphate by phytoplankton for nutritional needs. In the study, the results of measuring the concentration of chlorophyll-a showed that the concentration of chlorophyll-a was 0.73 µg L^{-1} and classified as oligotrophic. This is supported by Adani *et al.* (2013) that chlorophyll-a is grouped into 5 categories, namely the concentration of 0-2 µg L^{-1} chlorophyll-a is classified as oligotrophic, 2-3 µg L-1 is classified as meso-oligotrophic, 5-20 µg L^{-1} is classified as mesotrophic, 20-50 µg L-1 is classified as eutrophic and >50 µg L^{-1} is classified as hyper-eutrophic. The oligotrophic chlorophyll-a concentration is thought to be due to the presence of a few types of phytoplankton in the waters. Yusnita (2019) that the types of phytoplankton that are often found in fresh waters, especially in peat waters, are classified as Chlorophyceae, Cyanophyceae, and Bacillariophyceae reinforces this. For more details, the following is a linear regression chart for measuring chlorophyll-a concentrations with water hyacinth biomass, which can be seen in Figure 1

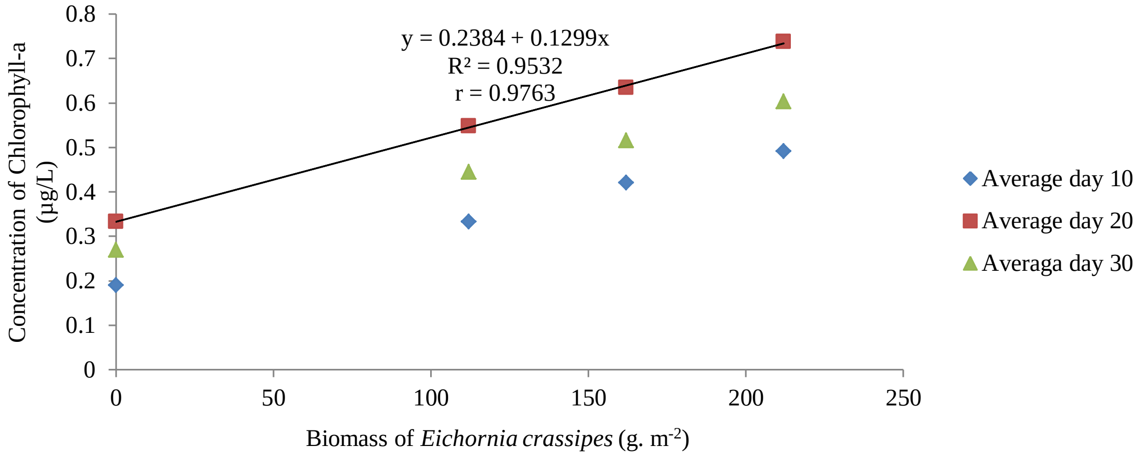

Figure 1. Graph of linear regression relationship of chlorophyll-a concentration with water hyacinth biomass during the study

Figure 1, explains that the linear regression equation for chlorophyll-a concentration is y = 0.2384 + 0.1299x, R2 = 0.95 indicating that the concentration of chlorophyll-a is affected by water hyacinth by 95%. According to Sugiyono (2007), the correlation value (r) is getting closer to 1 or -1, meaning the relationship between the two variables is getting stronger. Based on the linear regression above, the correlation value (r) = 0.97 means that there is a very strong positive relationship between the concentration of chlorophyll-a and water hyacinth. Treatment with water hyacinths can improve water quality so that the water quality is good, and the nutrients in the waters are good. Water hyacinths can decompose organic matter left over from feed and fish waste or metabolism in waters. The rest of the feed and metabolism is the origin of nitrate and phosphate in the waters (Guritno, 2003). The decomposition of organic matter produces nitrate and phosphate in the water. Nitrate and phosphate are important compounds in primary productivity, namely as elements used by phytoplankton and needed in the process of photosynthesis (Balali *et al.*, 2013). This is also supported by Rumanti *et al.* (2014) stating that nitrate and phosphate nutrients are important factors for photosynthesis thereby increasing chlorophyll-a.

3.2. Results of Measurement of Water Quality Parameters

3.2.1. Temperature

Temperature has a considerable impact or influence on various metabolic activities of organisms that inhabit a body of water. Based on the research results, the temperature measurement results are obtained in Table 2.

Table 2. Temperature (℃)

Treatment	Day							
	0		10		20		30	
	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
P_0	25-26	27-28	26	27-28	25-26	27	25-26	27
P_1	25	26	26	27	25	27	26	27
P_2	25	26	26	27	25	27	25-26	27
P_3	25	26	26	27	25	27	26	27

The temperature without water hyacinth (P0) with a temperature range of 25-280C was not much different from the treatment with water hyacinth (P1, P2, P3) with a temperature range of 25-270C, so the water hyacinth administration had no effect on temperature. Emmanuel *et al.* (2018) that giving water hyacinth has no effect on pond temperature. Differences in temperature are caused by weather conditions such as heat, rain, and duration of sunshine (Sukmawardi, 2011).

The highest temperature is 28°C and the lowest temperature is 25°C. This is in accordance with what was stated by Kordi & Tancung (2005) that the temperature is classified as optimal for aquaculture activities because the temperature range is still in the normal range, namely 23-32°C. The temperature in the research is optimal for the range of temperatures obtained including both for the growth and development of chlorophyll, this is supported by Boyd (2015) that a good temperature range to support the presence of chlorophyll-a ranges from 25-320C. The temperature range obtained during the research is good for supporting the life of aquatic organisms.

3.2.2 pH

The degree of acidity or pH is an important parameter in monitoring water stability. Based on the research results, the pH measurement results are obtained in Table 3.

Table 3. pH

Treatment	Day							
	0		10		20		30	
	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
P_0	3.6-3.7	3.7-3.8	3.7-3.8	3.8-3.9	3.8-3.9	3.8-3.9	3.7-3.8	3.8-3.9
P_1	3.7	3.8	3.8-4.0	3.9-4.2	4.0-4.5	4.2-4.6	4.3-4.6	4.3-4.9
P_2	3.8-3.9	3.9-4.0	4.0-4.2	4.3-4.5	4.8-4.9	4.9-5.0	4.9-5.3	5.0-5.4
P_3	3.8-3.9	3.9-4.0	4.0-4.1	4.5-4.6	5.1-5.4	5.3-5.5	5.6-5.9	5.7-6.0

Table 3 is known that the results of pH measurements in this study experienced an increase, the initial pH ranged from 3.6-3.9 and the final pH ranged from 3.8-6.0. The pH in treatments P_0, P_1, P_2, and P_3 increased during the study, from day 0 to day 30. From the results of the study, it was seen that the pH of the treatment given water hyacinth increased.

The increase in pH occurs due to the process of respiration from fish and also organic decomposition ($CO_2+H_2O \rightarrow H_2CO_3 \rightarrow 2H^+ + CO_3^=$), namely food waste and fish metabolism which produces carbon dioxide compounds (CO_2) which are utilized by water hyacinth through chlorophyll and stomata for photosynthesis. This is in accordance with the opinion of Ratnani *et al.* (2011) that water hyacinth is able to increase the pH of peat pond water. Damayanti (2015) that the degree of acidity in water is influenced by several factors including photosynthetic activity.

3.2.3. Nitrate

Nitrate is one of the important elements in the needs of plant life and aquatic algae. Based on the research results, the results of nitrate measurements were obtained in Table 4.

Table 4. Nitrate

Treatment	Day 2	Day 14	Day 28
P_0	$0.33{\pm}0.01^a$	$0.85{\pm}0.01^a$	$0.54{\pm}0.03^a$
P_1	$1.63{\pm}0.01^b$	$2.02{\pm}0.01^b$	$1.83{\pm}0.03^b$
P_2	$1.76{\pm}0.02^c$	$2.25{\pm}0.01^c$	$1.93{\pm}0.01^c$
P_3	$1.87{\pm}0.01^d$	$2.45{\pm}0.01^d$	$2.06{\pm}0.04^d$

Note: On the same colom numbers with the same letter are not significantly different ($p<0.05$)

Table 4, P_0 to P_3 on the 2nd to 14th day experienced an increase, while P_0 to P_3 on the 14th to 28th day decreased. Based on Table 4, the highest average nitrate value was found in the P_3 treatment of 2.45 mg L^{-1}, the range of nitrate during the study was classified as good for water. This is confirmed by Effendi (2003), that good nitrate levels for water are 2–5 mg L^{-1}. Nitrates in water have an influence on the growth process of chlorophyll-a in waters. Nitrate and phosphate are needed for photosynthetic activity by phytoplankton so that they can increase the concentration of chlorophyll-a in the waters. This is supported by (Kordi, 2010) stating that phytoplankton photosynthesis requires nitrate and phosphate nutrients. Niti (2008) said that chlorophyll-a can grow well at a nitrate content of 0.01-4.5 mg L^{-1}.

The availability of nitrate in water comes from metabolism and feed residue. Guritno (2003) supports this that nitrate comes from the decomposition or decomposition of organic matter left over from feed and the rest of the metabolism of cultivated fish. The rhizosphere microbes found in the water hyacinth roots break down the rest of the feed and the rest of the metabolism. This is supported by Purwasari *et al.* (2011) that water hyacinth has rhizosphere microbes in its roots that can decompose organic matter into nutrients in the water. Nitrates from the decomposition of organic matter in the waters are used by phytoplankton for their growth thereby increasing chlorophyll-a. Measurements at the end of the study on the 28th day of all treatments decreased because nitrogen in the form of nitrate had been utilized by chlorophyll-a as a nutrient for life. This is in accordance with the opinion of Sukmawardi (2011), that the decrease in nitrate content is caused by the use of nitrogen in the form of nitrate by phytoplankton as a nutritional need to increase chlorophyll-a.

3.2.4. Phosphate

Phosphate is one of the important elements in life in the waters. Based on the research results, the results of phosphate measurements are obtained in Table 5.

Table 5. Phosphate

Treatment	Phosphate (mg L^{-1}) Day 2	Day 14	Day 28
P_0	0.67±0.08[a]	1.36±0.01[a]	0.85±0.01[a]
P_1	0.83±0.01[b]	1.50±0.01[b]	0.97±0.01[b]
P_2	1.12±0.03[c]	1.83±0.01[c]	1.43±0.02[c]
P_3	1.34±0.01[d]	2.09±0.02[d]	1.90±0.07[d]

Note: On the same colom numbers with the same letter are not significantly different ($p<0.05$)

Table 5, P_0 to P_3 on the 2[nd] to 14[th] day experienced an increase, while P_0 to P_3 on the 14[th] to 28[th] day decreased. Based on Table 5, the highest average value of phosphate was found in the P_3 treatment of 2.09 mg L^{-1}, the phosphate range is classified as optimal for chlorophyll-a. This is in accordance with the opinion of Rumanti *et al*. (2014), that the optimal phosphate content for chlorophyll-a concentrations is in the range of 0.27-5.51 mg L^{-1}, while the orthophosphate content is less than 0.02 mg L^{-1} will be the limiting factor.

Phosphate in waters can come from metabolic waste. This is supported by Sanaky (2003), that phosphate compounds in waters come from natural sources such as weathering of plants, soil erosion, and animal waste. The rhizosphere microbes that are present in the water hyacinth roots break down the rest of the waste or metabolism. This is supported by Purwasari *et al.* (2011), that water hyacinth has rhizosphere microbes in its roots that can decompose organic matter into nutrients in the water. Phosphate from the decomposition of organic matter in water is used by chlorophyll-a for growth.

Measurements at the end of the study on day 28 all treatments decreased due to the use of phosphate by chlorophyll-a as a nutrient for growth. This is in accordance with the opinion of Effendi (2003), that orthophosphate is the most abundant form of inorganic phosphate in the phosphate cycle and is used directly by chlorophyll-a for nutritional needs.

3.2.5. Dissolved Oxygen

Dissolved oxygen or DO is one of the important parameters in the life of aquatic organisms. Based on the research results, the DO measurement results are obtained in Table 6.

Table 6. Dissolved Oxygen

Treatment	DO (*Dissolved Oxygen*) (mg L^{-1}) Day 2	Day 14	Day 28
P_0	3.6-3.8	4.1-4.2	3.8-3.9
P_1	4.1-4.2	4.4-4.5	4.2-4.3
P_2	4.2-4.5	4.8-4.9	4.6-4.7
P_3	4.6-4.8	5.4-5.5	5.1-5.2

The average range of dissolved oxygen during the study was good. This is in accordance with the opinion of Tarkus *et al*. (2014) that a good oxygen level for the life of aquatic organisms is between 2-10 mg L^{-1}. The minimum dissolved oxygen level for aquaculture activities is 3 mg L^{-1}. DO increases due to the diffusion process of oxygen from the free air. This is reinforced by Saputra (2012), which the source of dissolved oxygen in waters comes from the atmosphere and photosynthetic activity. The decrease in DO occurred in this study, it is suspected that there is a process of utilizing oxygen for the respiration of microorganisms. This is reinforced by Dinata (2017), which photosynthesis stops but respiration continues.

3.2.6. Absolute Weight Growth

Based on the research that has been done, the measurement results on the absolute weight growth of local catfish (C. *batrachus*) obtained in each treatment can be seen in Table 7.

Table 7. Absolute Weight Growth of Local Catfish (C. *batrachus*)

Treatment	Weight Growth (g/fish) early	Weight Growth (g/fish) end	Absolute Weight (g/fish)
P_0	2.71	9.94	7.23±0.04[a]
P_1	2.75	11.00	8.25±0.13[b]
P_2	2.77	11.59	8.81±0.15[c]
P_3	3.00	12.04	9.04±0.06[d]

Based on Table 7, knowing that the results of observations of each treatment given water hyacinth had a significant effect on the absolute weight growth of local catfish. This can be seen in the results of the weight of catfish in the untreated container (P0) the growth is smaller than in the treated container (P1, P2, and P3). Based on the research results table, it can be seen that the highest weight growth was in the P3 treatment with fish weight growth of (3.00-12.04 g) water hyacinth biomass of 212 g/m^2. While the lowest weight growth was in the P0 treatment, namely without giving water hyacinth (2.71 g-9.94 g). The difference in weight growth in catfish is not much different. This is because giving water hyacinth improves water quality so it is good for fish growth. This is reinforced by Yunus *et al.* (2014) that water quality greatly influences various chemical reactions in water bodies, one of which is the effect on fish metabolism that will affect growth. Fish growth is also influenced by the feed given to fish. This is supported by Ismet (2020) states that providing nutritional intake from artificial feed such as pellets also has an effect on the growth and survival of fish.

The low fish growth is thought to be due to the fish's ability to utilize food. This is in accordance with Hidayat *et al.* (2013), who stated that growth is influenced by several factors, namely internal factors, and external factors, while internal factors include heredity, disease resistance, and ability to utilize food, while external factors include physical, chemical and aquatic biological properties. Food factors and water temperature are factors that can affect fish growth.

Water hyacinth directly or indirectly affects the growth of fish. Water hyacinth can directly improve water quality so that water quality becomes good, such as by increasing DO, nitrate, and phosphate. Improved water quality can indirectly affect fish metabolism, fish metabolism is good, but fish appetite is also high, which affects fish growth to be high. For more details, the following presents a regression graph of the average DO, nitrate, and phosphate on the growth of absolute fish weight, which can be seen in Figure 2

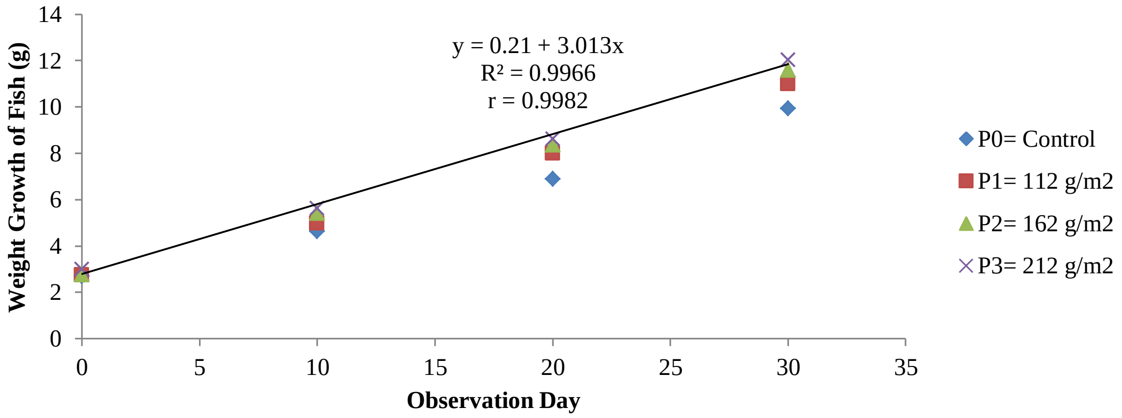

Figure 2. Graph of the linear regression relationship of fish weight growth with water hyacinth biomass during the study

Based on Figure 2, explains that the linear regression equation for fish weight and water hyacinth biomass is y = 0.21 + 3.013x, R^2 = 0.99 indicating that the increase in fish weight is affected by water hyacinth biomass by 99%. According to Sugiyono (2007), the correlation value (r) is getting closer to 1 or -1, meaning the relationship between the two variables is getting stronger. Based on the linear regression above, the correlation value (r) = 0.99 means that there is a very strong positive relationship between fish weight and water hyacinth biomass. This is because giving water hyacinth improves water quality so it is good for fish growth. This is reinforced by Yunus *et al*. (2014) that water quality greatly influences various chemical reactions in water bodies, one of which is the effect on fish metabolism, thereby affecting growth. Fish metabolism is good, so fish appetite is also high which affects fish growth to be tall.

3.2.7. Local Catfish Survival Rate

Based on the research that has been done, the measurement results on the survival of local catfish (C.*batrachus*) obtained in each treatment can be seen in Table 8.

Table 8. Survival of Local Catfish (C. *batrachus*)

Repitition	Survival Rate (%)			
	P_0	P_1	P_2	P_3
1	72	86	88	94
2	80	92	92	94
3	74	88	94	96
Amount	226	266	274	284
Average	75.33±4.16^a	88.67±3.05^b	91.33±3.05^b	94.67±1.15^b

Note: On the same row numbers with the same letter are not significantly different (p<0.05).

Based on Table 8, knowing that each treatment with water hyacinth had the same effect on the survival rate of local catfish. However, the effect exerted between containers that were not treated with those that were treated was very different. This can be seen in the number of catfish in the container without water hyacinth biomass (P0) being smaller than the container with water hyacinth biomass (P1, P2, P3).

Differences in the effect of the treatment given also occur from each treated container. These differences include the highest survival rate for catfish found in containers given water hyacinth biomass of 212 gm^{-2}. Based on this, it can be said that P3 is the best treatment because it is able to maintain the highest survival rate of catfish compared to other treatments, namely 94.67%. Meanwhile, without giving water hyacinth (P0) it can only maintain a survival rate of 75.33%. This states that water hyacinth is able to improve water quality so that it affects the survival of fish. Fish survival was low at P0 because water hyacinth biomass was not given at P0 so that the water quality at P0 was not good. Water hyacinth can improve water quality. This is supported by Hasim (2014) that water hyacinth can set aside metabolic waste, and feed to make water quality good, resulting in absolute length growth, higher survival and absolute daily weight growth rate. Low fish survival is also thought to be due to the presence of high ammonia which can also cause fish to die due to poor water quality (Dauhan *et al.*, 2014).

Based on the results of the Analysis of Variance (ANAVA) test, it was shown that the administration of water hyacinth with different biomass had a significant effect on the sustainability of local catfish ($P<0.05$). The results of the Student-Newman-Keuls test showed that the P1, P2 and P3 treatments were significantly different from P0 (without water hyacinth)

3.2.8. Growth of Water Hyacinth Biomass during Research

Water hyacinth requires nutrients and absorbs them for growth which comes from the water, and can improve water quality, so it seems to be a good solution for fish pond water management (Hasim, 2014). Based on the research that has been done, the data on the growth of water hyacinth biomass obtained during the following research can be seen in Table 9.

Table 9. Growth of water hyacinth biomass during the study

Treatment	Water hyacinth Biomass Growth (g)										
	0	3	6	9	12	15	18	21	24	27	30
P_1	112.00	120.27	123.87	127.59	131.42	135.36	139.42	143.60	147.91	152.35	156.92
P_2	162.00	172.61	177.79	183.13	188.62	194.28	200.11	206.11	212.29	218.66	225.22
P_3	212.00	218.97	225.54	232.30	239.27	246.45	253.84	261.46	269.30	277.38	285.70

Based on Table 9, shows that the water hyacinth in each treatment of the research container experienced growth every 3 days from day 0 to day 30 during the study. Every 3 days the water hyacinth experienced biomass growth of P1 2.82%, P2 2.79%, and P3 2.55%. Water hyacinth has experienced biomass growth; this is due to the presence of nutrients from food waste and metabolic waste as natural nutrients for its growth. The growth of water hyacinth biomass was higher at P1; this was allegedly due to less water hyacinth biomass and higher nutrients than other treatments. This is reinforced by Ugya *et al.* (2015) that water hyacinth requires nutrients and absorbs them for growth from within water bodies.

4. Conclusion

The results obtained in this study were the administration of water hyacinth P3 (giving the biomass of 212 g m^{-2} of water hyacinth (*E.crassipes*) as the treatment that gave the best effect with a chlorophyll-a concentration of 0.73 µg L-1 with a correlation value of chlorophyll-a concentration (r) = 0.97 and R2 = 0.95. Furthermore, for water quality, temperature 27-28^{0}C, pH 5.7-6.0, nitrate 2.45 mg L^{-1}, phosphate 2.09 mg L^{-1}, and DO 5.4-5.5 mg L-1. Survival of local catfish reared for 30 days with absolute weight growth (9.04 g) with a correlation value (r) = 0.99 and R2 = 0.99, and maintaining the survival of local catfish (94.67%). The highest growth of water hyacinth (*E.crassipes*) per 3 days was (2.82%).

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