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Limnological analysis and survey of planctonic chlorophyce in the supply weir and in an effluent from the fish farming center Carlos Eduardo Matiazze in Presidente Médici, RO, Brazil

The phytoplankton consists of a diverse set of algae that are important for the water quality of aquatic ecosystems. Studies have revealed that various organisms are directly dependent on microalgae, as well as being primary producers, they are irreplaceable sources of food. Therefore, the aimed of the study was to evaluate the limnological conditions and carry out a survey of planktonic microalgae in the Chlorophyta division of the Chlorophyceae class of the supply weir and an effluent from the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici, RO, Brazil. For that, the physical-chemical parameters temperature, oxygen dissolved in water (ODA), pH, transparency, alkalinity, hardness, electrical conductivity in water (CEA), carbon dioxide and total ammonia concentration (CAT) were analyzed. The results were compared with the norms established by CONAMA Resolution 357, of 2005 fresh waters, especially class 2. And also, the survey of chlorophytes was carried out, and the analyzes of the samples were carried out by means of slide preparations for immediate reading through the observation under the binocular optical microscope. The microalgae species of the Chlorophyta division of the Chlorophyceae class were identified in a taxonomic category of order, family, genus and species. The weir water showed acceptable values, according to CONAMA, for the parameters analyzed here for most of the year. The effluent also expressed acceptable values according to the legislation, with the exception of dissolved oxygen with a value of 1.7 mg/L. Concerning the survey of chlorophytes, it was observed that the weir is rich and diversified, which can be an indicator of pollutants and contamination since the weir is exposed to a large amount of effluents.

Keywords: Bioindicator; Chlorophyceae; Phytoplankton; Water quality.

Análise limnológica e levantamento de clorofíceas planctônicas na represa de abastecimento e em um efluente do centro de piscicultura Carlos Eduardo Matiazze em Presidente Médici, RO, Brasil

O fitoplâncton consiste de um conjunto diversificado de algas que são importantes para a qualidade da água dos ecossistemas aquáticos. Estudos têm revelado que a vários organismos são dependentes diretamente das microalgas, pois além de serem produtoras primárias são fontes insubstituíveis de alimento. Por isso, o objetivo do estudo foi avaliar as condições limnológicas e realizar um levantamento das microalgas planctônicas da divisão Chlorophyta da classe Chlorophyceae da represa de abastecimento e de um efluente do Centro de Piscicultura Carlos Eduardo Matiazze, Presidente Médici, RO, Brasil. Para isso foram analisados os parâmetros físico-químicos temperatura, oxigênio dissolvido em água (ODA), pH, transparência, alcalinidade, dureza, condutividade elétrica em água (CEA), gás carbônico e concentração amoniacal total (CAT). Os resultados foram confrontados com as normas estabelecidas pela Resolução CONAMA 357, de 2005 águas doces em especial a classe 2. E também, foi realizado o levantamento das clorofíceas, sendo as análises das amostras realizadas por meio de preparações de lâminas para leitura imediata através da observação no microscópio óptico binocular. As espécies de microalgas da divisão Chlorophyta da classe Chlorophyceae foram identificadas em categoria taxonômica de ordem, família, gênero e espécie. A água da represa apresentou valores aceitáveis, segundo o CONAMA, para os parâmetros aqui analisados na maior parte do ano. O efluente também expressou valores aceitáveis de acordo com a legislação, com exceção do oxigênio dissolvido com o valor de 1,7 mg/L. Concernente ao levantamento de clorofíceas observou-se que a represa é rica e diversificada o que pode ser um indicador de poluentes e contaminação uma vez que a represa se encontra exposta a uma grande quantidade de efluentes.

Palavras-chave: Bioindicador; Chlorophyceae; Fitoplâncton; Qualidade da água.

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INTRODUCTION

The art of creating and multiplying aquatic animals and plants, called aquaculture, is a growing activity in Brazil (VALENTI et al., 2021). This culture, however, has its production index directly linked to water quality, since fish depend on it to perform all its vital functions, that is: breathing, feeding, reproducing and excreting (SIMÕES et al., 2008). The incidence of diseases and parasites in aquatic organisms gradually increases due to the qualitative decline of the water, so, to guarantee success, it is essential that the water used in the tanks is of good quality (FIGUEIREDO et al., 2014).

Since Fish Farming is an activity that implies the control of different aspects of the life of aquatic organisms and cultivation facilities, the monitoring of some variables of the water used is mandatory so that the activity does not compromise. Therefore, limnological parameters such as temperature, transparency, pH, dissolved oxygen and others must remain balanced to enable the maintenance of the supply of aquaculture activity (BROOKS et al., 2019). The phytoplankton consists of a diverse set of algae that are of great importance for the water quality of aquatic ecosystems (COSTA et al., 2015), as they produce oxygen through photosynthetic activity constituting the base of the food chain and source of food for other communities aquatic organisms, and serve as support for the constitution of biological indicators (SILVA et al., 2018). Currently, phytoplankton has aroused the interest of many researchers of aquatic ecosystems because these organisms respond promptly to changes that occur in the environment, thus functioning as ecological indicators and helping to understand the interactions between physical processes at an extreme and the biological responses in the environment (MOURA et al., 2007; SILVA et al., 2018).

Studies have revealed that the life of the aquatic fauna, especially the ichthyofauna, is directly dependent on microalgae, because in addition to being primary producers, they are irreplaceable sources of food mainly in the early stages of life (COSTA, 2013). Currently, researchers have successfully used microalgae species, especially from the Chlorophyta division, as a food source in the cultivation of fish in Fish Farming ponds (CAMPECHE et al., 2009; YUSUF, 2020). The Chlorophyta division is the largest and most varied among the algal phyla, characterized by the green coloration attributed to the predominant pigments chlorophyll "a" and "b", although they contain other pigments such as: α, β and γ carotenoids and several xanthophylls (SHEATH et al., 2015; SANTOS et al., 2019). They are microalgae that most resemble higher plants, based on photosynthetic pigments, storage of starch and structural organization of chloroplasts. They have free or colonial life, with temporary or absent scourges (ALENCAR et al., 2019). The main representatives of phytoplankton are chlorophylls, which have greater growth in high light intensity and low availability of nutrients (ESTEVES, 1998; MATSUZAKI et al., 2015). The vast majority of Chlorophyceae species, approximately 90%, are freshwater, with a cosmopolitan distribution (ALHO et al., 2020). It is the plankton predominantly from limnetic environments and is found in almost all environments (REVIERS, 2006).

The supply weir of the Carlos Eduardo Matiazze Fish Farming Center is used as a source of tanks supply at the Fish Farming Research Center of the Fisheries Engineering course at the Universidade Federal de Rondônia (UNIR) (LOPES et al., 2019). In the vicinity of the weir, there are residents who discard their solid waste, thus generating an excessive supply of nutrients in the aquatic environment, contributing to the eutrophication of this ecosystem (RODRIGUES et al., 2020). Planktonic microalgae, despite having great ecological importance for aquatic ecosystems and, more recently, economic interests with regard to the possibility of energy production, specifically biodiesel, in general, have been little studied in the Amazon. Based on this assumption, the aimed of the study was to evaluate the limnological conditions and carry out a survey of planktonic microalgae in the Chlorophyta division of the Chlorophyceae class of the supply weir and an effluent from Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

METHODOLOGY

Study location

The supply weir of the Carlos Eduardo Matiazze Fish Farming Center was built in 1994 from Presidente Médici/RO, for the purpose of landscape harmony, leisure and fishing. It is located between the coordinates (Figure 1). The water body belongs to the Universidade Federal de Rondônia (UNIR). Currently, the weir is intended only for the supply of fish Farming tanks where mainly tambaqui (*Colossoma macropomum*) is grown and is surrounded by residents of District Lino Alves Teixeira. It is worth mentioning that, for many years, it has been suffering anthropic aggressions, such as discharges of domestic and industrial effluents, deforestation of the margins, which has contributed to the alteration of its physical-chemical characteristics, in fact compromising the communities of aquatic organisms that depend on it for their survival (SANTOS et al., 2019). The vegetation that borders this ecosystem is of the low type like grasses and ciperaceas, and sparse shrubs.

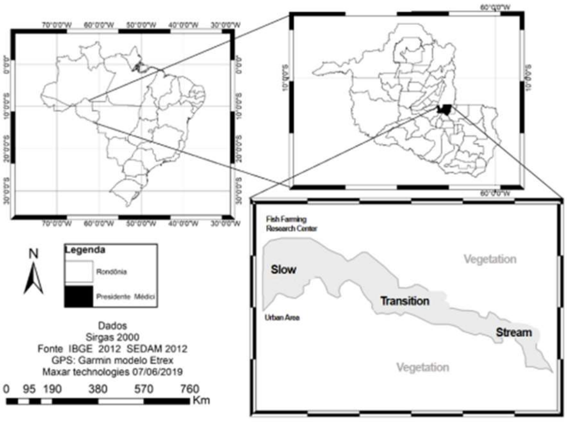

Figure 1: Geographic location of the supply weir of the Carlos Eduardo Matiazze Fish Farming Center, Universidade Federal de Rondônia (UNIR), Presidente Médici, RO, Brazil.

In the state of Rondônia, the predominant climate is humid and hot tropical, all year round. According to the classification of Köppen (1931), the state of Rondônia has a Tropical Rainy Climate, with a well-defined dry period during the winter season. The months of November to April (rainy period), the monthly precipitation is superior to 200 mm/month, while the months of June to August are extremely dry reaching a precipitation less than 20 mm/month (FISCH et al., 1997). The annual average air temperature is between 24 and 26° C (SEDAM, 2014). The annual average of the pluvial precipitation varies between 1,400 and 2,500mm/year, and more than 90% of this occurs in the rainy season (the rainy period occurs from October to March and, the dry period from April to September). According to the Secretariat for Environmental Development (SEDAM, 2014), the climate of the micro region of Presidente Médici/RO is characterized by presenting a spatial and seasonal homogeneity of the average air temperature, the same not occurring in relation to rainfall, which presents a temporal variability, and on a smaller spatial scale, caused by the different atmospheric phenomena that act in the annual precipitation cycle.

Analysis of limnological parameters

Sample collections of the study took place on the fifth day of each month from August 2013 to June 2014. The collection sites in the weir were demarcated using GPS (GarminGPS map 76CS x). The first sampling point (1) was in the area close to the formation of the weir, that is, close to the entrance of the waters that supply it; the second point (2) was in the transition area, on whose margins there are residences; and the third point (3) was close to the outlet of the water from the weir to the fish breeding ponds. The last collection site was in the base effluent (4) (SILVA, 2014). To perform the collections, the recommendations of Parron et al. (2011). The physicochemical parameters evaluated were temperature, oxygen dissolved in water (ODA), pH, transparency, alkalinity, hardness, electrical conductivity in water (CEA), carbon dioxide and total ammoniacal concentration (CAT). The results were compared with the norms established by CONAMA Resolution 357, of 2005 fresh water, especially class 2, which refers to aquaculture and fishing activity. The parameters of dissolved oxygen, electrical conductivity, pH and temperature were determined with the aid of a multiparametric probe, previously calibrated, brand YSI Professional Plus. The measurements were carried out monthly, as for the other parameters. The collections were carried out on the sub-surface, and the data analyzed belong to the first layer (epilimnium). However, ammonia measurements were made monthly in situ using the labcom Test kit. The reaction that occurs is based on the Nessler method, and a visual comparison is made using a colorimetric chart. Nessler's reagent consists of an alkaline solution of mercury iodide and potassium (K_2 (HgI_4), which in the presence of ammonia, forms an orange to red-brown precipitate. The transparency of the water was determined *in situ*, monthly, using of Secchi's record. The alkalinity, hardness and carbon dioxide analyzes were performed monthly in the laboratory. Methodologies proposed by FUNASA (BRASIL, 2006) were used. A Van Dorn bottle made with a PVC tube was used. The bottle was dipped with the mouth down, 15 to 30 cm below the surface of the water. After collection, the water was placed in a one-liter, serrated-threaded glass jar, and then stored under refrigeration, for analysis within a maximum of 24 hours. It is worth mentioning that the limnological analyzes were carried out in triplicate. For the analysis of total alkalinity, 50 mL of each sample was taken and placed in Erlenmeyer. Then, three drops of bromocresol green/methyl red indicator solution were added. Soon after, the titration with sulfuric acid (H_2SO_4) 0.02N continued until the blue-green color changed to pink. According to Esteves (1998), the total volume of H_2SO_4 spent (V) in mL was obtained, using Equation 1.

$$\text{Total Alkalinity (mg/L of } CaCO_3) = V \times 20 \quad (1)$$

The total hardness is calculated with the sum of the concentrations of calcium and magnesium ions in the water, expressed as calcium carbonate. For this analysis, 25mL of the sample were collected, with a dilution of up to 50mL with distilled water in a volumetric flask. Soon after, this content was transferred to a 100mL Becker, with 1 to 2mL of the buffer solution being added to raise the pH to 10 ± 0.1. Then, it was transferred to a 250mL Erlemeyer flask with approximately 0.05g of Eriochromeblack T indicator. After performing the previous process, it was titrated with 0.01M EDTA, stirring continuously until the reddish purple color disappeared and the appearance blue color (end of titration). A white was prepared with distilled water. The volume of EDTA spent on titration of the sample was subtracted from the volume of EDTA spent on sample titration. According to Esteves (1998) there was a difference in the volume that was applied in Equation 2.

$$\text{Total water hardness (mg/L of } CaCO_3) = \text{mL of EDTA} \times 1000 \times Fc/\text{mL of the sample} \quad (2)$$

Where: Fc = EDTA correction factor.

The evaluation of the concentration of carbon dioxide in the water was also carried out using a titrometric process. Were 100mL of sample was taken (without shaking) in an Erlenmeyer flask, 10 drops of 0.05 mL of phenolphthalein were added. According to Esteves (1998), if staining occurs, it was considered to have no CO_2, but if color did occur, proceed with titration using 0.02N sodium hydroxide solution (NaOH) until the appearance of a light pink color, persistent for least 30 seconds. After that, Equation 3 is applied.

$$V \times 10 \times Fc = \text{mg/L of } CO_2 \text{ free} \quad (3)$$

Where: Fc = NaOH correction factor.

Chlorophyce survey

Samples were collected at the weir margins in the rainy season in the months of January and March 2011, in the periods between 8:00 am and 9:00 am. The weir was divided into three collection points: the lentic, the transition and the fluvial (Figure 1), in order to improve the sampling. Collecting flasks were used, which were superficially immersed in order to absorb part of the substrate and then transported to the Environmental Sciences Laboratory of the Federal University of Rondônia (UNIR) for further identification and analysis of the data. The analyzes of the samples were carried out by means of slide preparations for immediate reading through observation under the binocular optical microscope. For each collection point, 15 slides were analyzed. The microalgae species of the Chlorophyta division of the Chlorophyceae class were identified in a taxonomic category of order, family, genus and species, with the help of the specialized bibliography (BICUDO et al., 2006; FRANCESCHINI et al., 2010) and the dichotomous key.

Statistical analysis

To organize, describe and summarize the data, a descriptive statistic was applied, presenting minimum, maximum, average values, standard deviation and coefficients of variation of the sample collection points. The software used to carry out the statistical analysis was the Genes Program made available by the Universidade Federal de Viçosa (UFV), version 13.3 (CRUZ, 2013), to emphasize that the statistical program R was linked to facilitate the interpretation of results.

RESULTS AND DISCUSSION

Limnological conditions

The water temperatures in the studied points showed average values that varied from 28.4 to 30° C. In the rainy season, this parameter was lower, except in December, where the temperature was from 30.5 to 31.6° C. These results fall within the temperature value recommended by CONAMA Resolution 357/2005 (below 40° C). The highest temperature recorded in September 2013 was 39.7° C (Table 1; Figure 2).

Table 1: Water temperature data (°C) verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil

Water temperature (°C)		Sample collection points		
	Weir – Point 1	Weir – Point 2	Weir – Point 3	Effluent
Minimum	27.0	28.3	27.9	26.0
Maximum	39.7	31.6	32.4	30.5
Average	30.0	29.3	29.5	28.4
DP (±)[1]	3.4	1.0	1.3	1.1
CV (%)[2]	11.3	3.4	4.4	3.8

[1]Standard deviation; [2]Coefficient of variation.

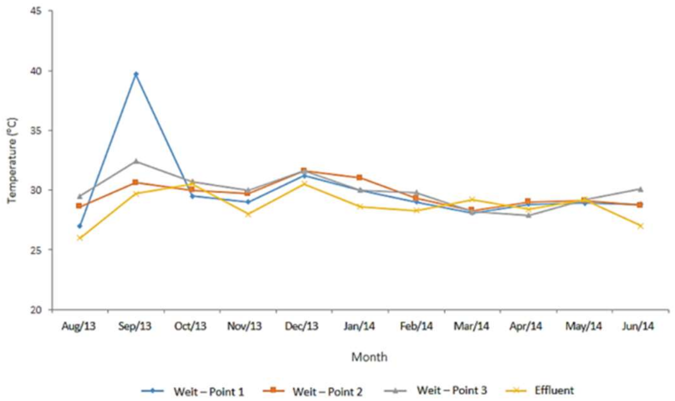

Figure 2: Graph of the water temperature values (°C) verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

The concentrations of oxygen dissolved in water (ODA) varied from 1.7 to 10.0 mg/L. The ODA presented in all points studied between 5.0 and 5.7 mg/L, and the standard value of water quality recommended by CONAMA nº 357/2005 for class 2 freshwater bodies should not be less than 5.0 mg/L of ODA. In the effluent, the values ranged from 1.7 to 9 mg/L. In June, the effluent had the lowest value of 1.7 mg/L, as can be seen in Table 2 and Figure 3. On the occasion of the collection that resulted in this value, there were parts of tree trunks in the effluent, as partial deforestation had been carried out around it.

Table 1: Values of Dissolved Oxygen (ODA) (mg/L) verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

ODA (mg/L)				
			Sample collection points	
	Weir – Point 1	Weir – Point 2	Weir – Point 3	Effluent
Minimum	3.7	3.6	2.7	1.7
Maximum	8.5	9.1	10.0	9.0
Average	6.0	5.6	5.4	5.0
DP (±)[1]	1.6	1.2	2.1	1.6
CV (%)[2]	29.6	21.4	38.8	32.0

[1]Standard deviation; [2]Coefficient of variation.

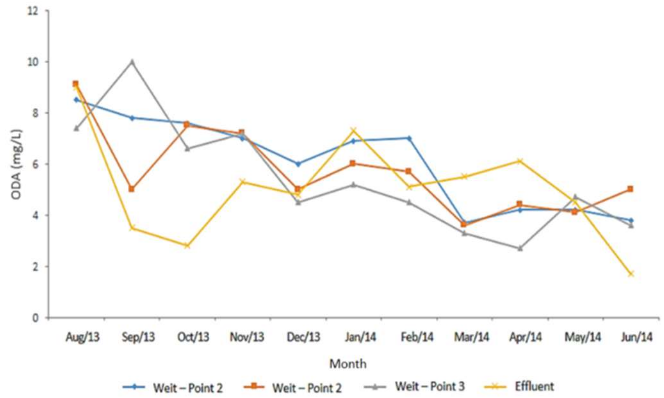

Figure 3: Graph of ODA values verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

In the water samples collected at the weir and effluent points, the pH values did not differ from neutrality, maintaining an overall average of 7.49, which represents a positive aspect of this parameter in relation to the water quality in the studied location. As shown in Table 3 and Figure 4, the pH values ranged between 5.4 and 8.5. Therefore, the lower and upper limits of the studied points indicate, respectively, the slightly acidic and slightly alkaline character of its analyzed waters.

Table 2: PH values verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

		pH Sample collection points		
	Weir – Point 1	Weir – Point 2	Weir – Point 3	Effluent
Minimum	5.8	7.3	5.4	7.1
Maximum	8.0	7.9	8.0	8.5
Average	7.4	7.5	7.4	7.6
DP (±)[1]	0.56	0.13	0.75	0.40
CV (%)[2]	7.5	1.7	10.1	5.2

[1]Standard deviation; [2]Coefficient of variation.

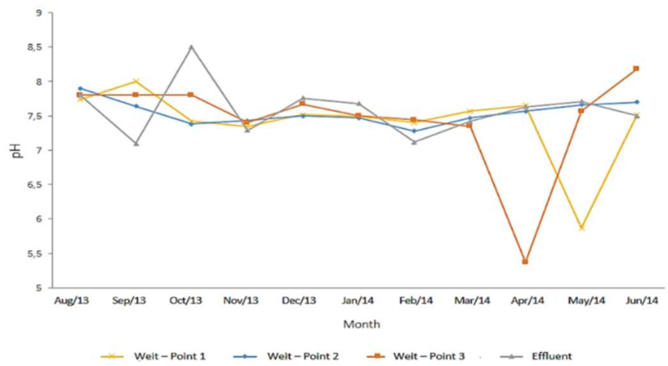

Figure 4: Graph of pH values verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

The electrical conductivity in water (CEA) of water is one of the most important variables in water quality studies, since it can provide information on the state of the aquatic ecosystem. The relationship with pH was observed in point 1 in the month of September, which increased when compared to August, in the same way as the pH in the same period. The same occurs in the month of November at point 2, in the month of May in the effluent, and in the month of June at points 2 and 3 of the weir (Table 4; Figure 5). The reverse was also observed, so that these two parameters simultaneously decreased their values: in the month of October, at points 1 and 2 of the weir, the values of both pH and electrical conductivity decreased together. In November, the same occurs in relation to the effluent. In January, the same situation occurs at all collection points (Table 4; Figure 5).

Table 3: Values of Electrical Conductivity (CEA) (µS/cm) verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

CEA (µS/cm)				
	Sample collection points			
	Weir – Point 1	Weir – Point 2	Weir – Point 3	Effluent
Minimum	40,8	40,5	42,7	41,6
Maximum	58,4	55,4	57,0	70,4
Average	48,7	48,1	49,3	55,3
DP (±)[1]	4,9	4,4	5,0	8,1
CV (%)[2]	10,0	9,1	10,1	14,6

[1]Standard deviation; [2]Coefficient of variation.

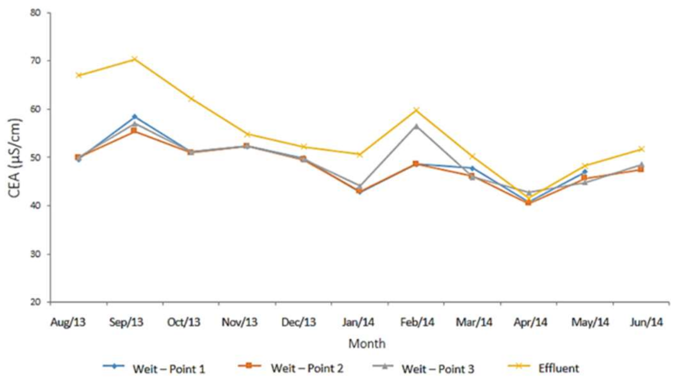

Figure 5: Graph of CEA values verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

The values at all points are well below the standard water quality value proposed by CONAMA resolution 357/2005 (2.0 mg/L, for pH between 7.5 and 8.0) for class 2 freshwater bodies. The highest ammonia index was in the effluent, in October, with the highest value obtained: 0.092 mg/L, due to the increase in pH (Table 5; Figure 6). For a long time of exposure, concentrations of 0.7 and 2.4 mg/L of non-ionized ammonia can be lethal to freshwater fish.

Table 4: Total Ammoniacal Concentration Values (CAT) (mg/L) verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

CAT (mg/L)				
	Sample collection points			
	Veir – Point 1	Weir – Point 2	Weir – Point 3	Effluent
Minimum	0.004	0.003	0.004	0.003
Maximum	0.021	0.014	0.021	0.092
Average	0.007	0.006	0.008	0.018

DP (±)[1]	0.005	0.002	0.005	0.026
CV (%)[2]	79.0	28.0	65.0	142.0

[1]Standard deviation; [2]Coefficient of variation.

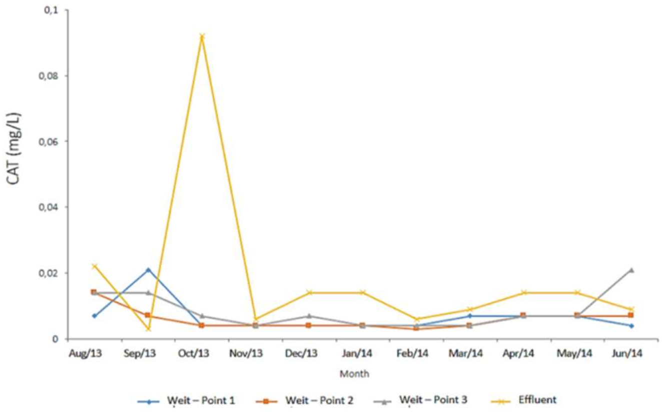

Figure 6: Graph of the CAT values verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil

Water transparency can be used as an indicator of planktonic density and the possibility of critical ODA levels occurring during the night. The average values of total transparency vary from 45.2 to 80.3 cm, for the effluent and weir respectively (Table 6; Figure 7). It was observed that the highest values were in the period of January, March and May, months in which there was a high incidence of rain in the North region. The highest values were at point 2 with 112 cm in June and 103 cm in January, and point 3 in May presented with 103 cm, with low phytoplankton densities. Waters with transparency greater than 60 cm allow the penetration of a large amount of light in depth, favoring the growth of submerged aquatic plants.

Table 5: Transparency values (cm) verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

Transparency (cm)				
		Sample collection ponts		
	Weir – Point 1	Weir – Point 2	Weir – Point 3	Effluent
Minimum	50.0	49.0	48.0	28.0
Maximum	99.0	112.0	103.0	63.0
Average	77.7	82.4	80.3	45.0
DP (±)[1]	16.1	20.1	18.8	11.1
CV (%)[2]	20.7	24.4	32.4	24.5

[1]Standard deviation; [2]Coefficient of variation.

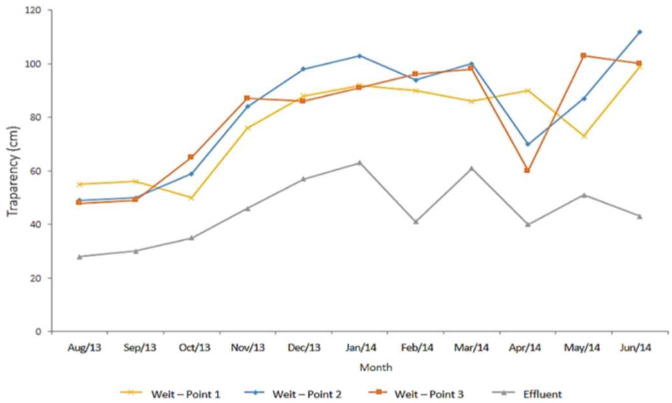

Figure 7: Graph of the transparency values (cm) verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

This parameter refers to the total concentration of titratable bases in the water. Although ammonia, phosphates, silicates and hydroxyl (OH^{1-}) behave as bases contributing to total alkalinity, bicarbonate (HCO^{3-}) and carbonate (CO^{3-}) ions are the most abundant and responsible for practically all alkalinity in the waters of aquaculture systems. The alkalinity values were an average of 22.5 to 24.3 mg/L of $CaCO_3$. And, they varied between 17.4 to 33.1 mg/L of $CaCO_3$ (Table 9; Figure 8). According to Sipaúba-Tavares (1995), values above 20.0 mg/L are desirable for Fish Farming. In Santa Helena Fish Farming, the alkalinity ranged from 50 to 195 mg/L of $CaCO_3$ (COSTA, 2014). The point 2 of the weir was the one with the highest value found, 33.1 mg/L of $CaCO_3$, in October 2013, when the region's rainfall regime began. In that month, in fact, all points of the weir, in addition to the effluent, showed values above 20 mg/L. Alkalinity is related to the ability to neutralize acids, and this capacity is depleted as the volume of rainwater increases and dilutes the carbonates present in the water, recomposing its more acidic character (BEZERRA, 2012).

In April, all values were reduced, which may be associated with the dilution of the bases by the capture of water with different limnological properties, an increase in the rainfall regime in the region and the process of decomposition of organic matter. The lower the alkalinity of the water, the greater the pH variation in the medium. Waters that represent alkalinity lower than 20 mg/L of $CaCO_3$ have low buffering power for acidity, while concentrations between 20 to 300mg/L of $CaCO_3$ are in the ideal range, indicating a good amount of mineral salts for organic Fish Farming, helping in the formation of plankton. The use of limestone is recommended whenever the alkalinity level is below 20 mg/L of $CaCO_3$ (MACÊDO, 2007). There was little variation in the alkalinity values during the research.

Table 6: Alkalinity values (mg/L of $CaCO_3$) verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

	Alkalinity (mg/L of $CaCO_3$) Sample collection points			
	Weir – Point 1	Weir – Point 2	Weir – Point 3	Effluent
Minimum	17.6	17.8	17.4	18.2
Maximum	31.5	33.1	28.5	32.5
Average	23.3	23.3	22.5	24.3
DP (±)[1]	4.2	4.3	3.0	4.7
CV (%)[2]	18.0	18.4	13.2	19.2

[1]Standard deviation; [2]Coefficient of variation.

Figure 8: Graph of the values of alkalinity verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil.

The total hardness represents the concentration of metal ions, mainly the calcium (Ca^{2+}) and magnesium (Mg^{2+}) ions present in the water. The total hardness of the water is expressed in $CaCO_3$ equivalents (mg $CaCO_3$/L). The results regarding the total water hardness values in the four points studied are shown in Table 8 and Figure 9. The total hardness varied between minimum and maximum from 9.5 to 54.0 mg of $CaCO_3$/L, both at the point two from the weir. It can be seen through the data in figures 6 and 9 that the hardness had little influence on the CEA, so that these two parameters increased and decreased concomitantly in the months of September to December 2013 and from April to June 2014 in point 1. In point 2, this occurred in the months of October to November 2013 and also in the month of March and June 2014. In point 3 the same occurred in the months of October to December 2013 and then in the months of March, April and June 2014 Finally, in the effluent occurred in October and December 2013 and in 2014 in March and June.

Table 7: Hardness values (mg of $CaCO_3$/L) verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil

	Hardness (mg of $CaCO_3$/L) Sample collection points			
	Weir – Point 1	Weir – Point 2	Weir – Point 3	Effluent
Minimum	12.6	9.5	11.2	12.0
Maximum	48.0	54.0	50.0	41.2
Average	21.2	20.4	18.7	19.8
DP (±)[1]	10.2	10.1	11.6	8.5
CV (%)[2]	48.1	49.5	61.7	43.0

[1]Standard deviation; [2]Coefficient of variation.

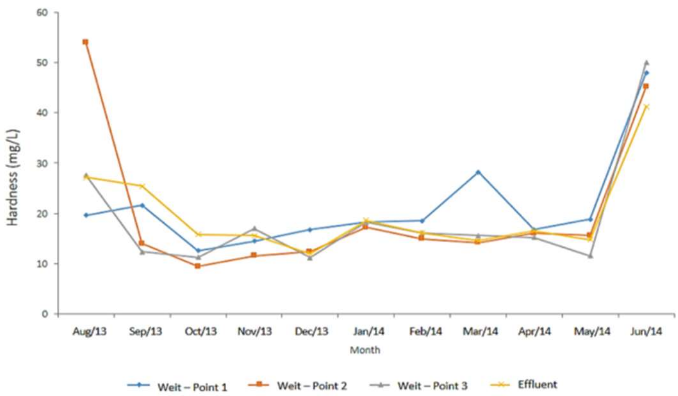

Figure 9: Graph of the total hardness values verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil

The respiration of algae, macrophytes, fish, zooplankton, as well as the microbiological processes of decomposition of organic matter are important sources of CO_2 in aquaculture systems. The carbon dioxide (CO_2) values at the points showed an average between 8.2 to 13.6 mg/L (Table 9; Figure 10). It is observed with the results of CO_2 in the sample points, that there was a variation between 4.6 to 28.0 mg/L. The highest value of carbon dioxide (CO_2) was represented in point 1 of the weir with a significant difference with 28.0 mg/L, in the month of May. At the time of collection, there was an enormous amount of algae around the site. In the rainy season, carbon dioxide (CO_2) showed higher rates in this location than in other places in the months of December to May. According to Macêdo (2007) as the pH decreases, the concentration of CO_2, which is toxic to fish, increases and that of CO_2 in the medium decreases.

Table 8: Values of Carbon Gas - CO_2 (mg/L) verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici, RO, Brazil

	Carbon Gas - CO_2 (mg/L) Sample collection points			
	Weir – Point 1	Weir – Point 2	Weir – Point 3	Effluent
Minimum	4.6	7.1	4.2	5.5
Maximum	28.0	26.8	12.0	13.0
Average	13.6	11.5	8.2	9.1
DP (±)[1]	7.8	5.4	2.7	2.2
CV (%)[2]	57.0	47.0	33.0	24.2

[1]Standard deviation; [2]Coefficient of variation.

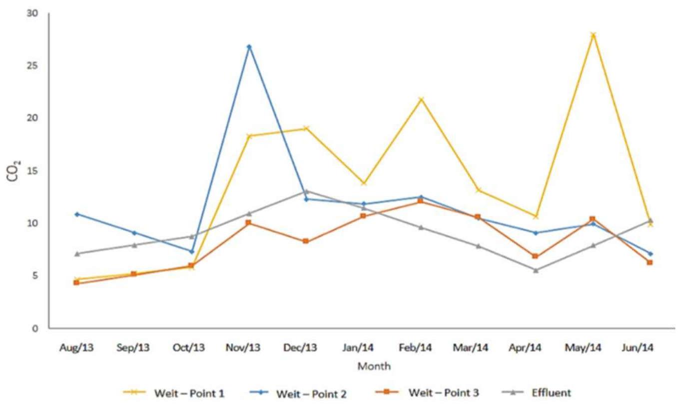

Figure 10: Graph Carbon Gas values verified in the supply and effluent weir of the Carlos Eduardo Matiazze Fish Farming Center, Presidente Médici/RO, Brazil

Chlorophyceae Identification

The results showed 52 taxon of chlorophytes distributed in seven orders, 17 families and 43 genus. The most representative families were Oocystaceae with 17 species, Scenedesmaceae with seven species, and Ulotrichaceae with five species. For the other families, one, two and three species were registered according to Table 10.

Table 10: Orders, families and species of Chlorophyceae identified in the supply weir Carlos Eduardo Matiazze, Presidente Médici - RO, Brazil

Order	Family	Species
Sphaeropleales	Ankistrodesmaceae	*Diplochloris hortobagyi* B. Fott *Staurastrum rotula* Nordstedt
Chlamidomonadales	Chlamydomonadaceae	*Chlamydomonas nivalis* (F. A. Bouer) Wille
Chlorococales	Chlorococcaceae	*Tetraëdron lobulatum* (Nägeli) Hansgirg *Tetraedrum* sp. *Treuboxia* sp.
Chlorococales	Coccomyxaceae	*Dispora globosa* C.E.M.Bicudo & R.M.T.Bicudo *Possonia sestonica* Hindák
Chlorococales	Dictyosphaeriaceae	*Westella botryoides* (West) De Wildeman
Tetrasporales	Gloeocystaceae	*Gloeocystis* sp.
Chlorococales	Hydrodictyaceae	*Pediastrum tetras* (Ehrenberg) Ralfs *P. duplex* Meyen *Hydrodictyon reticulatum* (Linnaeus) Bory
Chlorococales	Micractiniaceae	*Golenkinia radiada* Chodat *Echinosphaeridium nordstedtii* Lemmermann *Micractinium pusillum* Fresenius
Microsporales	Microsporaceae	*Microspora* sp.
Chlorococales	Oocystaceae	*Ankistrodesmus bernadii* Komárek *A. gracilis* (Reisch) Korsikov *Chlorella regularis* (Artari) Oltmanns *C. vulgaris* Beyerinck *Closteriopsis acicularis var. acicularis* (Chodat) J.H.Belcher & Swale *Diacanthos belenophorus* Korshikov *Echinosphaerella* sp.

		Kirchneriella lunares (Kirchner) Möbius *Lagerheimia tetraedriensis* Y.V.Roll *Nephrocytium* sp. *N. shilleri* (Kammerer) Comas *Quadrigula closterioides* (Bohlin) Printz *Raphidocelis contorta* (Schmidle) Marvan, Komárek & Comas *Selenastrum* sp. *S. gracile* Reinsch *Treubaria triapendiculata* C. Bernard
Volvocales	Palmellaceae	*Sphaerocystis schrooeteri* Chodat
Chlorococales	Radiococcaceae	*Catenococcus tortuosus* Hindák *Eutretamorus* sp.
Chlorococales	Scenedesmaceae	*Coeslatrum microporum* Nägeli *Dicloster acuatus* C.C.Jao, Y.S.Wei & H.C.Hu *Didymocystis* sp. *Etetramorus* sp. *Scenedesmus ecornis* (Ehrenb.) Chodat *S. linearis* Komárek *Scenedesmus* sp.
Tetrasporales	Tetrasporaceae	*Tetraspora* sp.
Chlorococales	Treubariaceae	*Treubaria triappendiculata* C. Bernard
Oedogoniales	Ulotrichaceae	*Binuclearia* sp. *B. tectoru* (Kützing) Berger ex Wichmann *Gloeotila pelágica* (Nyegaard) Skuja *Ulothrix zonata* (F.Weber & Mohr) Kützing *Ulothrix* sp.
Volvocales	Volvocaceae	*Eudorina elegans* Chodat *Volvox aureus* Ehrenberg

The average temperature of all points in the weir was 29.6° C, registering a maximum value of 39.7° C and a minimum of 27.0° C, which provide a range of thermal variation of 12.7° C. This value it indicates an annual variation of high temperature, being superior to the oscillations, 6.0 to 9.0° C observed in lakes of the Amazon region (APRILE, 2011; APRILE et al., 2013). Kubitza (1999) and Bayer et al. (2017), showed that the ideal temperature range for the cultivation of tropical fish is between 28º C and 32º C. The mean temperature values of the points were similar to those of Paiva (2014) who found values from 27.8º C to 29.9ºC in a Fish Farming system in the municipality of Ji-Paraná/RO. In the research by Brito (2006), in the Catalan lake in the central Amazon, the temperature fluctuated between 28.3º C and 32.3º C. In the work carried out by Costa (2014), in Santa Helena fish Farming in the municipality of Alvorada D'Oeste/RO, the temperature ranged from 26.6 to 30.1º C. In October and November there was a slight decrease in temperature for all points in relation to the other months. However, in December, the second highest temperature of the year was obtained for the studied points. The lowest temperatures obtained, in general, were in the effluent, probably due to the vegetation cover in its vicinity. This fact is corroborated by Butzek (2013) and Aprile et al. (2013) found in streams in the municipality of Ji-Paraná/RO, places that do not have vegetation cover, the temperature values are higher when compared to those that did.

According to Boyd (1982), in tropical regions, water temperatures are within a range of 25 to 30 ºC, corresponding to the averages found in the present study. In the study by Costa (2014), the levels of ODA ranged from 0.95 to 7.5mg/L. For Janzen et al. (2008), Alonso (2020) and Pontuschka et al. (2021), when the ODA is below limits acceptable by law, it can affect the health of the water body and prevent the use of water for different purposes. Similar values occurred in the study by Paiva (2014), Farias et al. (2013) and Alonso (2020), found in fish Farming system effluents, ODA values between 0.5 to 7.55 mg/L. The months of September, October and December 2013 and in the months of May and June 2014 there were low values of ODA in the effluent. Perhaps, a greater amount of organic matter from the rest of the feed and fish excreta has been released, which also requires greater oxygen consumption (FARIAS et al., 2013).

Henry-Silva et al. (2010) and Bayer et al. (2017) state that the feed supply, associated with the growth of aquatic organisms, increases the concentrations of nutrients and reduces ODA values in the effluents. Similar studies on the Juçu River in Braço Norte/ES, show that vegetation and soil rich in organic matter can cause lower ODA values in water bodies, being associated with the decomposition process of organic matter, generating humic and fulvic acids (SILVA et al., 2014). The oxygenation conditions of a body of water are closely related to its circulation pattern and thermal stratification. Oxygen gas is influenced by temperature and the higher the temperature of a liquid, the less likely it is to retain the gases (ALONSO, 2020). There was a decrease in the value of ODA at point 1 of the weir (Figure 3) in September 2013, when the temperature reached 39.7° C (Figure 2). The same situation occurred in the month of December 2013 at this point and in the others. In February 2014, the opposite occurred, when the temperature decreased and the ODA increased at point 1, and at other points the temperature was high. Therefore, ODA values were reduced.

Augusto-Silva et al. (2019) showed in lacustrine environments that oxygen solubility is affected in a linear manner by temperature, increasing considerably when it decreases. In March 2014 there was an abundance of rain in the region. A drop in ODA rates was observed in all points of the reservoir, there was probably a dilution of the nutrients necessary for phytoplankton activity (ESTEVES, 1998). In summary, the concentration of ODA results from the metabolic activity of different aquatic organisms, more specifically from the balance between photosynthetic processes and the respiratory activity of different organisms (SILVA, et al., 2019). A study on the Catalan lake in central Amazonia presented the same situation, in the rainy season there were drops in the concentration of ODA (BRITO, 2006).

In April, point 3 of the weir showed a low value of 2.7 mg/L of ODA, being lower than what is recommended. This low value may be due to the fact that in its vicinity there is a large supply of emerging aquatic macrophyte communities, which produce large amounts of biomass, generating a large addition of organic matter to the aquatic ecosystem. Low oxygen concentrations can indicate pollution or degradation of organic matter (ESTEVES, 1998). In addition, when ODA values are less than 2.0 mg/L, depending on the exposure time, it is lethal to most fish species (BASTOS et al., 2003). However, the measurement in point 3 of the weir was made early in the morning. Throughout the day, the same algae can produce oxygen, increasing its water content.

The point 3 is located near the water entrance to the Fish Farming base, however, the water that goes to the ponds is more than 2 meters below the collection point. According to Esteves (1998), from two meters deep, there is a strong deficit in ODA and a sharp increase in carbon dioxide. Similar pH values were found by Butzek (2013), when evaluating the water quality in the Pintado stream of Ji-Paraná/RO, they ranged between 6 and 8. In the Catalão lake of Central Amazonia it showed values ranging from 5.81 to 7.55 (BRITO, 2006). In October 2013, the highest observed pH value was obtained, 8.5, in the effluent. Normally, the pH range above 8.0 has as main responsible, the presence of bicarbonate and carbonate (ESTEVES, 1998; BAYER et al., 2017).

According to Silva et al. (2006) and Pontuschka et al. (2021), the pH reflects the type of soil that the waters travel along the water body. In the month of June, the pH reached 8.0 at point 2 of the weir, a location located in front of homes that, perhaps, throw household waste in the direction of the studied site. There are continuously animals around these residences. And around the weir there is also agriculture and livestock, and when there is rain, these can carry large amounts of garbage, and organic matter from other houses in the neighborhood. Thus, as found by Alonso (2020) and Pontuschka et al. (2021), in the same location of this study, there may be an excess of organic load that influences the increase in the algae population, which, due to the process of photosynthesis, the pH may increase reaching 9 or more. During the process of photosynthesis, there is consumption of carbon dioxide, and therefore a decrease in the carbonic acid in water and a consequent increase in pH (VON SPERLING, 2005; SILVA et al., 2019). These algae run through the reservoir due to external factors, such as the wind. In this collection period, there were several algae in the studied location (APRILE et al., 2013).

The point 3 in the month of April and point 1 in the month of May showed the lowest pH values, showing a tendency to acidity probably due to the carbon dioxide that was produced during the night by aquatic microorganisms. The pH values below the recommended by the legislation, at this point, can also be related to the decomposition process of organic matter (ESTEVES, 1998; ALONSO, 2020; PONTUSCHKA et al., 2021). At point 3 in April 2014 and at point 1 in May 2014, the pH value was expressed as acid, outside the standard of CONAMA resolution 357/2005, so that the appropriate pH range must be between 6.0 and 9.0. In general, high pH values are related to the photosynthetic potential of the aquatic environment, while low values are linked to the microbiological degradation stage (SCHWOERBEL, 1977).

The electrical conductivity of water (CEA) can vary according to temperature and pH (ESTEVES, 1998). According to Tundisi and Matsumura (2008), CEA is an indicator of salinity resulting from the concentration of salts, acids and bases in natural waters, being the measure of the water molecule's capacity to conduct electric current through the electrolytic content of water. CEA is related to the presence of ions dissolved in an aquatic system. The greater the amount of dissolved ions, the greater the CEA. According to Table 4, the average CEA values ranged from 48.13 to 55.34 µS/cm. In September, the highest conductivity index was obtained in all the studied points, reaching a value of 70.4µS/cm in the effluent, showing a higher concentration of ions in that month. The values obtained in the current study were, on average, similar to those observed in some lowland lakes in the Central Amazon with 40-60 µS/cm (FURCH, 1984), but higher than those found in the floodplains of the upper Paraná River, with values of 16-51 µS/cm (THOMAZ et al, 1992). In studies carried out on the Catalan lake in Central Amazonia, Brito (2006) detected mean values of conductivity from 30.4 to 61.5 µS/cm. And in the research by Costa (2014) in Piscicultura Santa Helena de Alvorada D'Oeste/RO, conductivity ranged from 6.4 to 155.4 µS/cm.

In the months of November to January there were drops in the CEA values, probably due to the heavy rains, as the CEA can be reduced when there is dilution of the ions. This same behavior occurred in the Dois de Abril stream in Ji-Paraná/RO, during the rains, which caused the dilution of ions (BEZERRA, 2012). According to Esteves (1998), the rain regime can even influence the ionic composition of water bodies. In this sense, Zillmer et al. (2007) observed in their research in the stream Salgadinho from Nova

Xavantina/MT, that the values of CEA varied according to the hydrological cycle, and in the dry period the values were high, while in the period of greater precipitation the values of CEA were minors. The same occurred in the studies by Paiva (2014) in the weir and in the effluents of a fish Farming system in Ji-Paraná/RO and Lopes et al. (2019) at a Fish Farming Research Center from Presidente Médici/RO.

It is worth mentioning that, the ions most directly responsible for the CEA values are the so-called macronutrients such as: calcium, magnesium, potassium, carbonate, sulfate and chloride. The nutrients of nitrate, nitrite and orthophosphate have little influence, and the ammonium ion can only influence high concentrations (ZILLMER et al., 2007). According to Esteves (1998), this variable can provide important information about the metabolism of the ecosystem, helping to detect polluting sources in aquatic systems. The Resolution 357/2005 does not define a standard for CEA, thus, it was used as a reference for comparing the results obtained in this study, the values established by CETESB. In general, CEA values greater than 100 Ms/cm indicate impacted environments (CETESB, 2009). This shows the good quality of the water in both the reservoir and the effluent under study with regard to this parameter, showing that these environments are more conserved, when compared to other areas, where the anthropic influence is greater.

The ammonia (NH_3), also called non-ionized ammonia, is after ODA, the second most important factor in aquaculture systems, being very toxic to fish (BOYD, 1990). Ammonia is the main form of nitrogen excretion by fish, resulting from protein catabolism (NIELSEN, 2002; CAMPBELL, 1973). The average values for ammonia were between 0.0064 to 0.01845 ppm. According to Macêdo (2007), the higher the pH and the water temperature, the higher the NH_3 concentration will be. This foundation could be verified in point 1 in September, when there was an increase in ammonia and temperature and pH simultaneously, with the same situation occurring in October in the effluent, in December in point 3 and effluent, in the month of March and in the month of April in the effluent. Because, the toxicity of ammonia increases as the pH becomes alkaline (ALHO et al., 2020). Because, when the concentration of ammonia increases in the aquatic environment, the excretion of this compound, in most animals, decreases, causing an increase in the level of ammonia in the blood and tissues; affecting the physiology of fish and consequently reducing performance (BAYER et al., 2017). Thus, the values found at all points throughout the year show the adequacy of the waters analyzed for this parameter in view of the CONAMA legislation 357/2005.

According to Macêdo (2007), water transparency values above 60 cm mean that the water is very clear, productivity can become inadequate and cause problems with the generation of aquatic weeds, with the exception of effluent, this value was well exceeded in all points during most of the year, as can be seen in Figure 7. The average values of points 1, 2 and 3 also denounce this fact. And, it is closely related to total alkalinity, which in turn is directly linked to the water's ability to maintain the acid-base balance (buffer power of the water) (APRILE et al., 2013). The natural origin of alkalinity comes from the dissolution of rocks and the reaction of CO_2 with water (CO_2 from the atmosphere or from the decomposition of organic matter), while the anthropogenic origin is usually found in domestic and industrial waste (APRILE et al., 2013). The alkalinity has no health significance for drinking water, but if it is in high concentrations it may taste bitter in water. The most frequent use of this parameter is in the characterization of raw and treated supply water, raw waste water and control of the operation of water treatment plants (VON SPERLING, 2005).

In a study conducted by Brito (2006), in the Catalan lake in Western Amazonia, alkalinity showed values from 6.1 to 97.6 mg/L. This author observed that during the dry season there were major differences, and the smallest differences occurred during the flood period. The same occurred in the Samambaia stream, in Goiânia/GO, by Borges (2009) who also found lower values of alkalinity in the rainy season. Bezerra (2012) and Lopes et al. (2019) showed the same similarity, in the April 2 stream in Ji-Paraná/RO and in a Research Center from Presidente Médici/RO, respectively. Higher levels for this parameter can be attributed to numerous sources, including the disposal of treated and/or untreated wastewater for aquatic bodies (ALONSO, 2020). In addition, higher values of alkalinity may also be associated with the decomposition of nutrients and organic substrates, under anaerobic conditions (LOPES et al., 2019).

The presence of free Ca^{2+} and Mg^{2+} ions in water (major components of total hardness) is of fundamental importance to the functioning of the buffer system. These ions help to immobilize the ions (KUBITZA, 1998). These magnesium and calcium ions play an important role in aquatic ecosystems, as they are part of important physiological processes in their communities and their presence in the aquatic environment is mainly due to the origin of the water, having an influence on the CEA values (QUEIROZ et al., 2015; CONDE et al., 2021). The presence of free Ca^{2+} and Mg^{2+} ions in water (major components of total hardness) is of fundamental importance to the functioning of the buffer system. These ions help to immobilize the ions (KUBITZA, 1998). These ions have an important role in aquatic ecosystems, because they are part of important physiological processes in their communities and their presence in the aquatic environment is mainly due to the origin of the water, influencing the CEA values (QUEIROZ et al., 2015; CONDE et al., 2021).

However, excess Ca/Mg can cause the appearance of burns on the fish's dorsal integument. It is worth remembering that water with greater hardness has lower concentrations of ODA, as they are poorer in organic elements, disfavoring photosynthesis and, consequently, the presence of ODA (ALONSO, 2020). There are no specifications on hardness in the CONAMA legislation. However, according to Tavares (1994), waters with up to 50 mg of $CaCO_3$ per liter (total hardness) are considered "very soft"; 50 to 100 mg, "moles"; from 100 to 150 mg, "slightly hard"; from 150 to 250 mg, "medium hard"; from 250 to 350 mg, "hard" and from 350 mg upwards, "very hard". All samples were less than 50 mg of $CaCO_3$ per liter, considered as "very soft", except in August 2013, in point 2 with the value 54 mg of $CaCO_3$/L, being classified as "soft".

Carbon dioxide (CO_2) is highly soluble in water and can cause acidification. This could be seen in the month of September in the effluent, when the pH value decreased and carbon dioxide (CO_2) increased, and in November the same occurred in point 3 of the weir and in the effluent, and in the month of May it also occurred in the effluent and in point 2 of the weir, so that when the pH decreased, carbon dioxide (CO_2) increased. Brito (2006) found values of 3.1 mg/L and 40.5 mg/L in Lake Catalão in Central Amazon. The different forms of inorganic carbon (free CO_2, bicarbonate and carbonate), varied according to the pH of the water. According to Macêdo (2007), carbon dioxide (CO_2) is highly soluble in water, and can be found in the aquatic environment, in three forms: free CO_2 and HCO^{3-} (bicarbonate ion), when the pH values are between 4, 5 to 8.3, and in the form of $CO^{3-}{}_2$ (carbonate ion), for pH values above 8.3. In the reservoir, the pH values of the present study ranged between 5.9 and 8.0. Thus, according to the same author, carbon dioxide was present in all the points of the reservoir in the first two forms. And in the effluent, as the pH of 8.5 in October, the form $CO^{3-}{}_2$ (carbonate ion) must have occurred.

According to Esteves (1998), carbon dioxide (CO2) is about 35 times more soluble in water than oxygen, when one increases the other decreases. This statement can be confirmed in November 2013, when there was a variation in points 1 and 2 of the supply weir, CO_2 increased and ODA decreased, the same occurring in December 2013 in the effluent, in February 2014 in points 1 and 2 of the reservoir and effluent, and in May 2014 this situation occurred in all sample points. Finally, in the effluent, in June, carbon dioxide increased and oxygen decreased. The higher the CO_2 content, the lower the O_2 content, influencing the presence of autotrophic beings (producers) and the formation of H_2CO^{3-} carbonic acid.

Concerning the results of the identification of chlorophytes, similar results were observed in reservoirs in the Northeast region (QUEIROZ et al., 2015; CARDOSO et al., 2017; CONDE et al., 2021). In the Oocystaceae family, a greater number of species was observed in relation to the other families, this difference may be associated with the richness of nutrients favoring the proliferation of certain species (FRANCESCHINI et al., 2010). In a study by Costa et al. (2010) at Lago Água Preta, Belém/PA, also in the rainy season, the authors recorded the occurrence of 30 species distributed in 12 families of Chlorophyceae, the most representative being Scenedesmaceae with eight species, and Ankistrodesmaceae with six species. For the Oocystaceae family, only two species were registered, which does not compare with the data obtained in the supply pond Carlos Eduardo Matiazze, from Presidente Médici/RO, possibly due to the fact that Lago Água Preta is not in the eutrophication process (SANTANA et al., 2020).

According to Rodrigues et al. (2010) and Alho et al. (2020), the high richness of Chlorophyceae species confirms the floristic predominance of this class in tropical and generally eutrophic bodies of water (SANTANA et al., 2020; CONDE et al., 2021). Esteves (1998) and Alencar et al. (2019) point out that as nutrient concentrations increase, algae productivity accelerates, changing the ecology of the aquatic system. According to Iwata and Câmara (2007) and Alencar et al. (2019), both natural and artificial environmental conditions influence the composition of microalgae, which can modify the quantity and frequency through various factors such as climate, water temperature, seasons and anthropic actions.

CONCLUSIONS

The weir water showed acceptable values, according to CONAMA, for the parameters analyzed here most of the year. The effluent was also with acceptable values according to the legislation, with the exception of dissolved oxygen with the value of 1.7 mg/L, as it is the place where the discharge of Fish Farming occurs. This value may have been influenced by many factors, among them, the large supply of organic matter from the surplus of feed and fish excreta, and the management of Fish Farming, so that there is a great demand for oxygen. The effluent must be monitored and managed so that any form of environmental impact can be avoided or reduced. It is recommended to use a settling pond at the Fish Farming Center, a method that aims to retain the water from the spawned ponds, since solid waste is deposited on the bottom and after a few days, the water is released, minimizing the environmental impact. In this context, for a better assessment of the water quality of both the supply weir and the effluent, it is important to analyze total solids and phosphorus, as the knowledge of the values of these two parameters contributes significantly to verify the amount of discharge that would be the agriculture, livestock and the urban environment surrounding the weir, as well as the discharge of the activity of Fish Farming. These analyzes are used as a classification standard for natural waters according to CONAMA Resolution 357/05, in addition to the parameters that were analyzed in the research.

Concerning the survey of chlorophytes, it was observed that the Carlos Eduardo Matiazze weir is rich and diversified, which can be an indicator of pollutants and contamination since the reservoir is exposed to a large amount of effluents enriching it with nutrients. In periods of rain it receives a great discharge of nutrients leached by the floods, making it favorable for the proliferation of some species. What would be interesting is the realization of new surveys in periods of drought to confirm these observations.

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