Temporal variation of periphyton biomass in semilotic environments of the upper Paraná River floodplain

Variação temporal da biomassa perifítica em ambientes semilóticos da planície de inundação do alto Rio Paraná

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Abstract: Temporal variation in periphytic biomass was evaluated in four semilotic environments of the upper Paraná River floodplain during one year (from Februry 2001 to Februry 2002). The sampled substrate consisted of petioles of the aquatic macrophyte *Eichhornia azurea* Kunth. Periphyton biomass was determined using chlorophyll-*a* and ash-free dry weight (AFDW). Biological indices were also applied to classify the periphyton. Regardless of location, higher chlorophyll-*a* content values were observed in the first five months of 2001, in which the Paraná River reaches its highest level ($p < 0.05$; $r = 0.48$). The chlorophyll-*a* contents in the four environments were also related to the concentration of nutrients, especially nitrogen. AFDW and ash dry weight and (ADW) showed a positive correlation with the hydrological level of the Upper Paraná River floodplain in only one of the environments. The periphytic community can be characterized during the entire period as autotrophic and no variation trend was observed for inorganic-organic contents.

Keywords: periphytic algae, floodplain, chlorophyll-*a*, biomass, Paraná River.

Resumo: As variações temporais biomassa perifítica foram avaliadas em quatro ambientes semilóticos da planície de inundação do alto rio Paraná, durante um ciclo anual. O substrato amostrado foi pecíolo da macrófita aquática *Eichhornia azurea* Kunth. A biomassa do perifíton foi determinada através da clorofila-*a* e do peso seco livre de cinzas (AFDW). Foram aplicados índices biológicos para classificação do perifíton. Observou-se em linhas gerais, independente do local, valores mais elevados dos teores de clorofila-*a* nos cinco primeiros meses do ano de 2001, meses de maior nível do rio Paraná ($p < 0{,}05$; $r = 0{,}48$). Os teores de clorofila-*a* nos quatro ambientes estiveram também relacionados com a concentração de nutrientes, principalmente nitrogênio. O AFDW e o peso seco das cinzas (ADW) apresentaram correlação positiva com o nível hidrológico da planície de inundação do alto rio Paraná apenas em um dos ambientes. A comunidade perifítica foi caracterizada durante todo o período como do tipo autotrófica e não foi observada uma tendência de variação quanto ao seu conteúdo inorgânico-orgânico.

Palavras-chave: algas perifíticas, planície de inundação, clorofila-*a*, biomassa, Rio Paraná.

1. Introduction

River-floodplain systems are characterized by a marked seasonality in water level, which reflect on their energy and matter pulses and are considered the most important forcing function on the operation of these ecosystems (Neiff, 1990; Junk, 1996). Floodplains are important in the regulation of the water balance and biogeochemical cycles at a continental scale. They belong to the most productive ecosystems in the globe and represent important centers of biological diversification (Junk, 1996).

An understanding about the horizontal compartmentalization of the water body is required in floodplains, in addition to its "transversal" compartmentalization in relation to the river's course. Due to their high importance, water level oscillations end up expanding the flooded areas or, on the contrary, they may dry up marginal lagoons maintained by surface or ground water that enters them. These horizontal fluxes between the environments regulate the productivity of plant groups and associated processes (Carignan and Neiff, 1992; Neiff et al., 2001) among which the periphytic community.

The periphyton shows remarkable spatial and temporal heterogeneity, with variations in its composition, density, biomass, and productivity (Stevenson, 1997). Understanding the community distribution patterns is essential, since its components form the base of the food chain in many lotic systems (Lamberti, 1996), acting as nutrient reducers and transformers (Wetzel, 1996), and promoting the formation of habitats for a variety of organisms. Because periphyton is attached to a substrate, such as on aquatic macrophytes, this community may provide a good assessment of the environment, based on their composition and biomass (Stevenson, 1997).

In addition, depending on nutrient availability, the epiphytic productivity of macrophyte surface can be higher than the productivity of the macrophyte itself (Moeller et al., 1988). Consequently, these primary producers of the littoral zone (aquatic plants and epiphytes) contribute a large part of the inflow of dissolved and particulate organic detritus into the lake system (Wetzel and Likens, 2000).

Chlorophyll-*a* can be considered an effective measure to evaluate the photosynthetic biomass of the periphytic community and, when related to physical and chemical factors, it can be used as an indicator of the trophic conditions of the environment (Atayde and Bozelli, 1999). According to Moschini-Carlos and Henry (1997), many indices based on organic matter, dry weight, and chlorophyll can be used to classify the periphyton on artificial and natural substrates, or as to whether it is autotrophic or heterotrophic, organic or inorganic.

This study intended to evaluate the spatial and temporal variations in periphytic biomass in four semilotic environments of the upper Paraná River floodplain in 2001. We also evaluated the influence of abiotic variables on the periphytic biomass and applied some biological indices, in an attempt to contribute toward an understanding about the floodplain ecosystem.

2. Material and Methods

2.1. Study area

The study area comprised four environments considered as semilotic, located in the vicinity of the city of Porto Rico (Paraná-Brazil), on the border of the State of Mato Grosso do Sul, in the upper Paraná River floodplain (Figure 1), characterized as follows:

Bilé Bayou (22° 45' 13" S and 53° 17' 9" W), Located in Mutum Island, with a length of about 582.6 m and variable width. Its banks are lined with arboreal riparian vegetation. The littoral region comprises a large quantity of aquatic macrophytes.

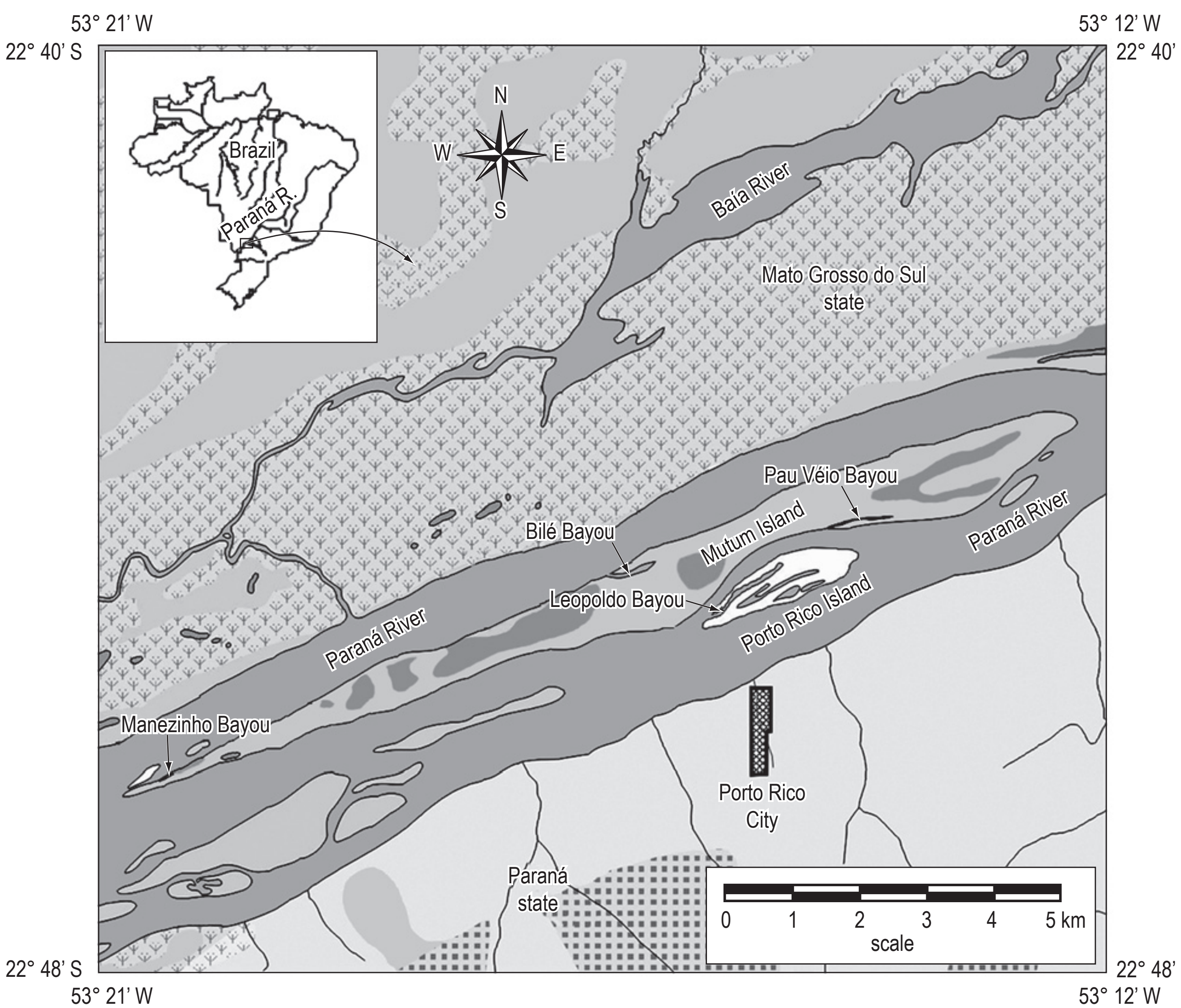

Figure 1. Map showing the location of four semilotic environments sampled (Bilé Bayou, Pau-Véio Bayou, Leopoldo Bayou, Manezinho Bayou) in the upper Paraná River floodplain in 2001 and January/February 2002.

Manezinho Bayou (22° 46' 44" S and 53° 20' 56" W), Located in Mutum Island, it is separated from the Paraná River by a river branch. A natural dike forms the left bank where dense riparian vegetation can be observed. It is 100 m in length, with a mean depth of 2.1 m. The littoral region presents only a few species of aquatic macrophytes, mainly *Eichhornia azurea* Kunth.

Pau Veio Bayou (22° 44' 50" S and 53° 15' 11" W), Also located in Mutum Island, it communicates with the Paraná River on its right bank. With a length of about 1.2 km and a mean depth of 1.8 m, its left bank shows a vegetation gradient from the aquatic to the terrestrial system, consisting of aquatic macrophytes and riparian vegetation.

Leopoldo Bayou (22° 45' 24" S and 53°16' 7" W), Located in Porto Rico Island, with approximately 966 m in length and a mean depth of 3.1 m. Its right and left banks contain riparian vegetation. The littoral region comprises a large quantity of aquatic macrophytes, mainly *E. azurea* Kunth.

2.2 Data collection

The river level and rainfall index values for the Paraná River were provided by ANA (Agência Nacional das Águas) and obtained at the Porto São José climate station (PR), located 17 km from the collection sites. The precipitation and river level data were obtained daily (Figure 2). However, the ten-day average prior to the sampling date was taken into consideration for the analyses.

The data were colleted monthly in the four bayous during the period from February 2001 to February 2002. The following limnological variables were determined in the field: water temperature (°C), using a FAC brand digital thermistor, pH and electric conductivity ($\mu S.cm^{-1}$), using portable, field digital potentiometers. All measurements were made at the water surface. Turbidity values were observed in the laboratory using digital potentiometers, while total alkalinity ($mEq.L^{-1}$) was determined according to the "Gran" method, using 0.01 N sulfuric acid; results were obtained via the ALCAGRAN software program (Carmouze, 1994).

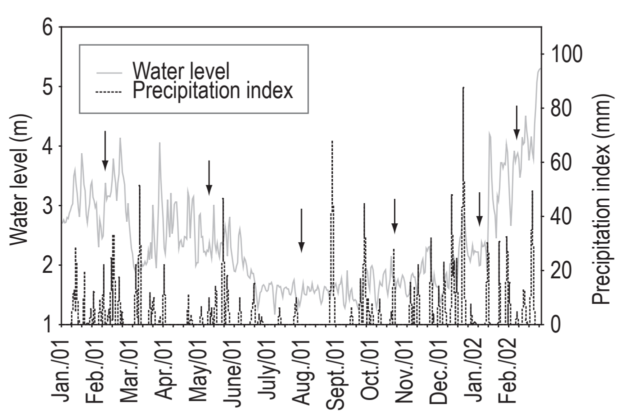

Figure 2. Water level variation and precipitation index in the year 2001 and from January to February 2002 in the upper Paraná River floodplain (data made available by ANA – Agência Nacional das Águas).

In each sampling were collected two petioles from the aquatic macrophyte *Eichhornia azurea* Kunth. The periphyton was removed from the substrate with a razor blade and squirts of distilled water, and immediately filtered through GF/F filters (pore diameter 0.6-0.7 µm), under low pressure. The periphyton photosynthetic biomass was determined by chlorophyll-*a* corrected for pheophytin, by the acidification method according to Golterman et al. (1978). The determination of ash-free dry weight and ash dry weight for the periphyton community followed Schwarzbold (1990).

Samples for abiotic analyses were collected quarterly in sub-surface water and packed in ice. Part of the collected water was filtered in the laboratory to obtain dissolved nutrients and the other part was immediately frozen (–20 °C) for total nitrogen and phosphorus determinations. Total nitrogen (TN) was determined according to APHA (1995); Nitrate, according to Mackereth et al. (1978); and ammonia, according to Koroleff's method (1978). Total phosphorus (TP), total dissolved phosphorus (TDP), and orthophosphate (PO4) were obtained according to Golterman et al. (1978).

2.3. Data analysis

2.3.1. Periphyton classification

Based on chlorophyll-*a*, dry weight, and ash-free dry weight data, we adopted indices proposed by Lakatos (1989) and APHA (1995) for periphyton classification (Table 1). Chlorophyll-*a* contents (%) and ash percentages (total dry weight %) were calculated.

The Autotrophic Index (AI) is the quotient between ash-free dry weight and chlorophyll-*a* values. This index determines the trophic nature of the periphytic community. Values higher than 200 indicate heterotrophic associations (H); values below this point indicate an autotrophic nature (A) (Lakatos, 1989).

2.3.2. Statistical analyses

The limnological variables (mean values ± standard deviation) observed in 2001 and from January to February 2002 in the littoral region of the four environments studied and

Table 1. Periphyton classification according to variations in biomass.

Type	Ash Content	%
I	Inorganic periphyton	>75
II	Inorganic-organic periphyton	50-75
III	Organic-inorganic periphyton	25-50
IV	Organic periphyton	<25
Type	**Chlorophyll-*a* Content**	**%**
I	Autotrophic periphyton	>0.60
II	Auto-heterotrophic periphyton	0.25-0.60
III	Hetero-autotrophic periphyton	0.10-0.25
IV	Heterotrophic periphyton	<0.10

periphytic biomass (chlorophyll-*a* and ash-free dry weight) (Table 2). The chlorophyll-*a* and some physical and chemical attributes in the four environments were evaluated jointly and in each environment separately via Pearson correlations.

3. Results

3.1. River level and rainfall in the upper Paraná River floodplain.

During the study period, the Paraná River water level oscillated between 3.5 and 2.0 m, with a few records above 4 m in the months from January to April 2001 and from January to February 2002. The river reached the highest water levels during this period. The lowest water levels occurred from July to December 2001, with values below 2 m (Figure 2). The year 2001 was characterized as a drought year, with precipitation values below the mean, especially from January through May. Practically no rain occurred in the region in the months of July and August.

3.2. Variations in periphytic biomass

Regardless location, higher chlorophyll-*a* content values were observed in the first five months of 2001 (February to June) (Figure 3). The fluctuation trend of chlorophyll-*a* concentration followed the Paraná River water cycle for the year 2001 (Figures 2 and 3).

The highest chlorophyll-*a* content values were recorded in February/01 for the Leopoldo and Bile Bayous and the June for the all environments. Conversely, the lowest chlorophyll-*a* concentration values were found in July for the Bile Bayou, August for the all environments, and September for the Leopoldo Bayou, October for Pau Veio and Leopoldo Bayous, and in December for the Bile Bayou (Figure 3).

The ash-free dry weight (AFDW) and ash dry weight (ADW) values for the periphytic community are shown in Figure 4. No trend pattern was noted for dry weight that would allow months with higher water level to be differentiated from those with lower water level. During the analysis period (February/2001 to February/2002), the highest dry weight values were recorded for the Pau Veio Bayou, while the lowest values were recorded for the Manezinho Bayou.

The highest AFDW values were observed in June and July for the Pau Veio Bayou, in March for the Leopoldo Bayou, in October for the Bile Bayou, and in February/02 for the Manezinho Bayou. The smallest values were verified in September, October, July, and August, respectively, for the Pau Veio, Leopoldo, Bile, and Manezinho Bayous (Figure 4). The latter months here in cited correspond to the period with the lowest water level in the Paraná River.

The highest ADW values, however, occurred in July for the Pau Veio Bayou, in April for the Bile Bayou, in March for the Leopoldo Bayou, and in February/02 for the Manezinho Bayou (Figure 4). In the last two environments, the highest ADW values coincided with the highest AFDW values. Finally, the smallest periphyton ash values were recorded in February/02 for the Pau Veio and Leopoldo Bayous, in July for the Bile Bayou, and in August for the Manezinho Bayou. Therefore, in the last two environments, the smallest ADW values also coincided with the smallest AFDW values.

3.3. Abiotic limnological variations and correlations with periphytic biomass

The abiotic limnological data are presented in Table 2 and Figure 2.

In the four environments, the water level of the upper Paraná River floodplain was the only factor associated with photosynthetic biomass. There was a positive correlation with chlorophyll-*a* in the periphytic community ($p < 0.05$, $r = 0.50$); at higher water levels, the chlorophyll contents were also high in all environments.

Table 2. Limnological variables (mean values ± standard deviation) observed in 2001and from January to February 2002 in the littoral region of the four environments studied (BB = Bilé Bayou; MB = Manezinho Bayou; LB= Leopoldo Bayou; PVB= Pau Véio Bayou).

Variables	High water level				Low water level			
	BB	MB	LB	PVB	BB	MB	LB	PVB
pH	6.18 ± 0.49	6.39 ± 0.24	6.36 ± 0.38	6.46 ± 0.21	6.72 ± 0.67	6.54 ± 0.39	6.23 ± 0.54	6.24 ± 0.43
Water temp. (0C)	28.5 ± 3.54	27.64 ± 2.60	27.82 ± 1.82	28.7 ± 4.71	23.9 ± 3.22	25.7 ± 2.68	26.21 ± 2.13	26.17 ± 3.18
Turbidity	11.99 ± 7.04	6.48 ± 2.39	8.57 ± 6.44	8.17 ± 2.81	14.64 ± 11	6.88 ± 2.64	4.15 ± 1.7	9.76 ± 4.49
Alkalinity (mEq.L^{-1})	282.5 ± 20.2	291.7 ± 13.45	280.6 ± 53.6	306.5 ± 43.7	223.9 ± 238.9	238.0 ± 236.8	281.8 ± 341.9	274.37 ± 381.6
Depth (m)	1.11 ± 0.35	1.98 ± 0.58	3.56 ± 0.49	1.12 ± 0.53	0.86 ± 0.35	1.77 ± 0.3	2.52 ± 1.01	0.97 ± 0.43
Conductivity (µS.cm^{-1})	54.62 ± 9.7	57.14 ± 7.78	58.02 ± 7.29	53.3 ± 5.39	54.21 ± 6.32	53.2 ± 3.1	50.42 ± 8.91	56.6 ± 9.97
NO3 (µg.L^{-1})	74.55 ± 31.64	163.15 ± 80.12	98.54 ± 48.85	119.63 ± 66.98	42.90 ± 31.2	60.27 ± 46.7	44.3 ± 41.8	69.7 ± 56.0
NH4 (µg.L^{-1})	60.59 ± 34.74	46.36 ± 2.24	22.31 ± 9.69	9.14 ± 1.34	42.8 ± 54.5	20.4 ± 16.08	8.54 ± 0.37	17.3 ± 11.5
TN (µg.L^{-1})	483.5 ± 143.1	441.1 ± 149.5	378.4 ± 137.9	478.9 ± 127.2	254.1 ± 46.78	318.34 ± 67.51	179.09 ± 37.6	363.6 ± 43.09
TP (µg.L^{-1})	41.6 ± 17.1	25.33 ± 15.15	21.7 ± 7.71	21.31 ± 13.6	40.05 ± 16.11	27.41 ± 10.53	14.24 ± 2.8	3.16 ± 1.75
TDP (µg.L^{-1})	10.8 ± 5.44	9.3 ± 1.21	7.76 ± 2.07	7.79 ± 2.08	15.39 ± 11.01	14.31 ± 5.8	7.12 ± 2.09	10.14 ± 4.9
PO4 (µg.L^{-1})	5.55 ± 2.2	6.91 ± 1.42	4.72 ± 2.06	9.32 ± 0.19	ND	ND	3.16 ± 1.75	3.88 ± 2.00

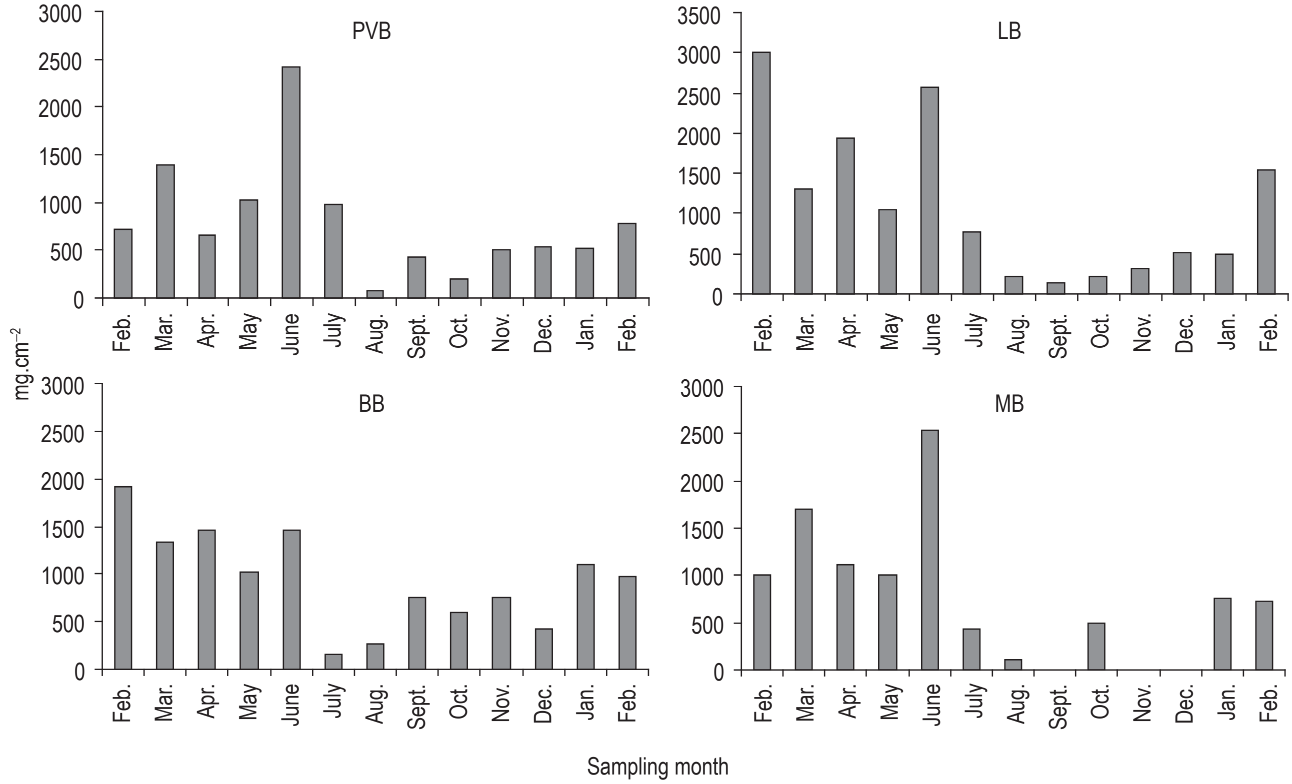

Figure 3. Temporal variation (February/2001 through February/2002) in chlorophyll-*a* contents at four environments (Pau Veio Bayou (PVB), Leopoldo Bayou (LB), Bile Bayou (BB) and Manezinho Bayou (MB)) in the upper Paraná River floodplain.

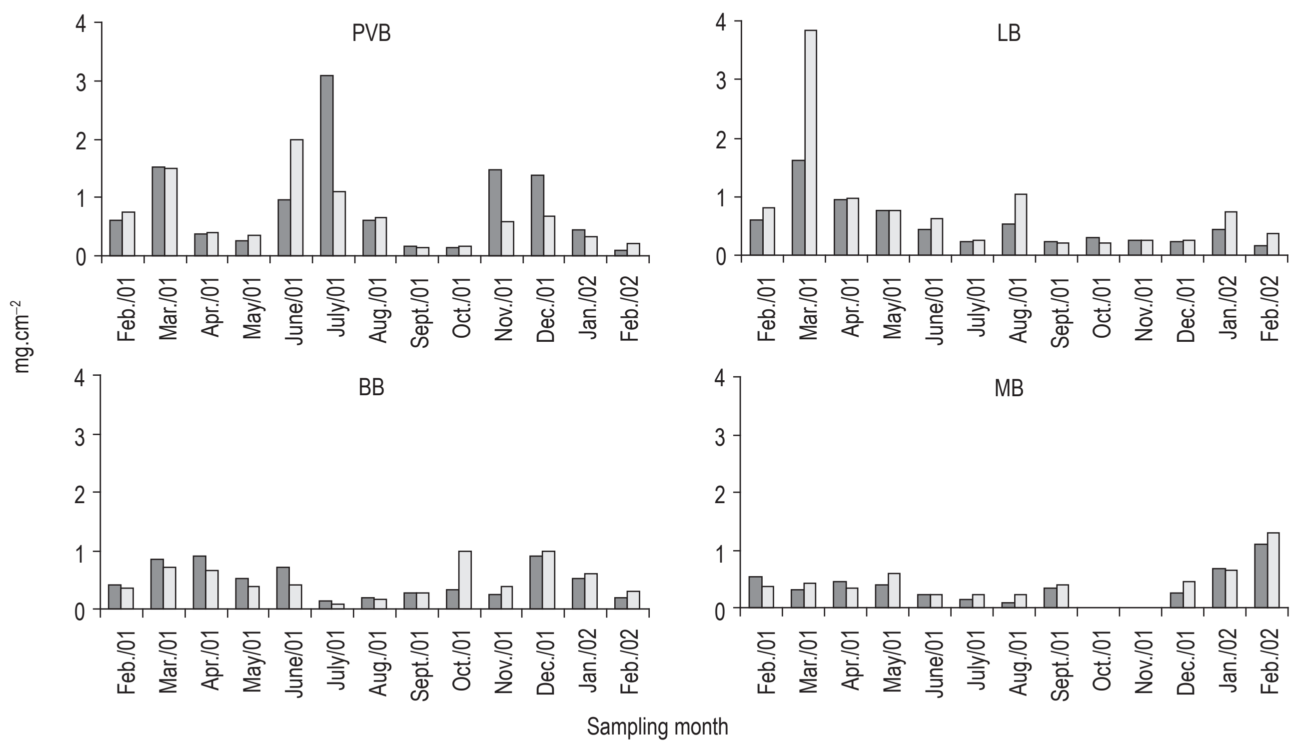

Figure 4. Temporal variation (February/2001 through February/2002) in ash-free dry weight - AFDW (white) and ash dry weight - ADW (black) at four environments (Pau Veio Bayou (PVB), Leopoldo Bayou (LB), Bile Bayou (BB) and Manezinho Bayou (MB)) in the upper Paraná River floodplain.

The chlorophyll-*a* contents in the four environments were related to the concentration of nutrients. Total nitrogen, nitrate, and ammonium showed a positive correlation with chlorophyll in the Leopoldo Bayou ($p < 0.05$, $r = 0.94$; $p < 0.05$, $r = 0.86$; $p < 0.05$, $r = 0.84$, respective), but only total nitrogen was positively correlated in the Bile Bayou ($p < 0.05$, $r = 0.83$).

AFDW and ADW showed a positive correlation with water level in the upper Paraná River floodplain only at the Manezinho Bayou ($p < 0.05$, $r=0.87$ for AFDW and $p < 0.05$, $r = 0.96$ for ADW). Also, only at the Manezinho Bayou there was a negative correlation between turbidity and AFDW ($p < 0.05$, $r = -0.89$) and ADW ($p < 0.05$, $r = -0.88$), indicating that when turbidity was low, periphytic biomass was high.

3.4. Periphyton classification

In general, there was an alternation between the inorganic-organic (II) and organic-inorganic (III) periphyton types in each environment and during the study period of analysis (Table 3). Only at the Bile Bayou a clear separation was verified for the inorganic-organic periphyton type between the months of February/2001 and September and for the organic-inorganic type between the months of October/2001 and February/2002.

Based on chlorophyll-*a* the community was basically classified as autotrophic type. In the same way, when the autotrophic index (AI) was applied, the autotrophic status was found in practically all environments and throughout the study period. The Leopoldo Bayou, in March and August, indicated the presence of heterotrophic associations in the community. The Bile Bayou indicated this tendency in December and o Pau Veio Bayou presented heterotrophic status in August (Table 3).

4. Discussion

Flood pulses constitute one of the most important regulating factors of physical, chemical, and biological processes in floodplains, so the analysis of the water regime of rivers associated with these ecosystems occupy a central position in the interpretation of their ecological processes (Junk, 1996; Neiff, 1996; Agostinho et al., 1995; Thomaz et al., 1997; Rodrigues and Bicudo, 2004).

In the upper Paraná River floodplain, Thomaz et al. (1997) characterized the pulse as irregular when compared with other rivers in South America. The occurrence of several flood pulses does not allow a precise delimitation of its flooding and drought stages, and two periods are typical, the high water (between November and May) and low water period (between June and October). However, the variations imposed by the dam located upstream (Porto Primavera and Rosana reservoirs), associated with the low rainfall observed throughout 2001, did not allow this marked regularity between the high water and low water.

Table 3. Classification of periphyton type on natural substrate (*Eichhornia azurea* Kunth) based on ash content. Chlorophyll-*a* concentration. and Autotrophic Index (AI) in 2001 and January/February 2002 for the environments studied (PVB = Pau Veio Bayou; LB = Leopoldo Bayou; BB = Bile Bayou; MB = Manezinho Bayou).

Year/Month Sites	Date	% ASH	Type	Chlorophyll %	Type	AI	Type
PVB	Feb./01	44.23	III	0.53	II	106.20	A
	Mar./01	50.49	II	0.46	II	106.86	A
	Apr./01	47.97	III	0.84	I	61.77	A
	May/01	42.06	III	1.67	I	34.68	A
	June/01	32.42	III	0.82	I	82.02	A
	July/01	73.63	II	0.23	II	13.05	A
	Aug./01	48.52	III	0.06	IV	828.36	H
	Sept./01	53.62	II	1.51	I	30.73	A
	Oct./01	47.52	III	0.65	I	80.41	A
	Nov./01	71.46	II	0.25	II	116.23	A
	Dec./01	67.40	II	0.26	II	126.07	A
	Jan./02	58.92	II	0.68	I	60.15	A
	Feb./02	27.90	III	2.61	I	27.64	A
LB	Feb./01	42.97	III	2.13	I	26.75	A
	Mar./01	29.71	III	0.24	III	293.65	H
	Apr./01	49.20	III	1.01	I	50.31	A
	May/01	50.50	II	0.69	I	71.54	A
	June/01	40.63	III	2.43	I	24.47	A
	July/01	47.11	III	1.65	I	32.11	A
	Aug./01	33.94	III	0.14	III	455.89	H
	Sept./01	51.43	II	0.32	II	152.93	A
	Oct./01	58.44	II	0.43	II	96.94	A
	Nov./01	50.73	II	0.62	II	80.11	A
	Dec./01	47.51	III	1.04	I	50.36	A
	Jan./02	37.78	III	0.43	II	145.06	A
	Feb./02	31.53	III	2.92	I	23.45	A
BB	Feb./01	54.04	II	2.57	I	17.92	A
	Mar./01	54.85	II	0.86	I	52.67	A
	Apr./01	57.49	II	0.93	I	45.78	A
	May/01	58.04	II	1.13	I	37.21	A
	June/01	63.08	II	1.30	I	28.50	A
	July/01	61.56	II	0.71	I	54.19	A
	Aug./01	54.28	II	0.79	I	58.22	A
	Sept./01	50.55	II	1.40	I	35.35	A
	Oct./01	25.52	III	0.45	II	165.05	A
	Nov./01	38.94	III	1.17	I	52.06	A
	Dec./01	47.51	III	0.22	III	230.25	H
	Jan./02	46.93	III	0.98	I	53.89	A
	Feb./02	37.55	III	2.02	I	30.84	A
MB	Feb./01	58.66	II	1.11	I	37.33	A
	Mar./01	42.09	III	2.30	I	25.20	A
	Apr./01	55.76	II	1.41	I	31.32	A
	May/01	40.92	III	1.01	I	58.77	A
	June/01	50.62	II	5.45	I	9.06	A
	July/01	37.23	III	1.17	I	53.87	A
	Aug./01	30.00	III	0.36	II	194.45	A
	Sept./01	46.49	III	ND	ND	ND	ND
	Dec./01	36.47	III	ND	ND	ND	ND
	Jan/02	50.85	II	0.57	II	85.76	A
	Feb./02	45.86	III	0.30	II	180.96	A

ND = not detected by the method.

Nevertheless, a separation between both periods was observed through the year 2001. A period with higher levels occurred from January to June 2001. During that period, the pulse frequency showed more intense peaks. From July to December 2001 levels were lower, characterized by low-intensity pulses. In January and February 2002 the Paraná River reached again higher levels.

According to Agostinho et al. (2005), more than 600 dams have been built in Brazil, mainly to generate electricity. Consequently, the biodiversity of floodplains located downstream of these environments artificially created by man, as in the case of this study, is affected by the control of the flooding regime through the reduction of floodplain areas, retention of nutrients, and changes in habitats caused by erosion.

The chlorophyll-*a* contents of periphyton community showed a temporal fluctuation trend in the environments over the study periods. The increase in periphyton photosynthetic biomass was higher in the period of higher levels for all sites analyzed.

These data confirm the explanation of Thomaz et al. (2004) for the aquatic macrophyte community. Those authors stated that for environments directly connected to the Paraná River, the rise in water level results in an increase of water transparency, increase levels of nitrogen forms, and increase numbers of submerged aquatic macrophytes. Probably the increase in macrophytes, in addition to other factors mentioned by the authors, contributed toward an increase in propagules of metaphytic and/or periphytic algae and, consequently, to an increase in periphytic biomass. Felisberto and Rodrigues (2005) found a correlation between macrophytes and periphytic desmids in the Rosana Reservoir. Algarte et al. (2006) also observed a bigger periphytic algae riches in March associated to the increase in the substratum availability (aquatic macrophytes) and nutrients.

As the level of the Paraná River rises, the environments that have a wide connection with the main channel, like the four Bayous studied, receive a greater inflow of nutrients, especially nitrogen. Total nitrogen, nitrate, and ammonium showed a positive correlation with chlorophyll in the Leopoldo Bayou, whereas total nitrogen was positively correlated in the Bile Bayou. The other two environments were not correlated with this nutrient. Liboriussen and Jeppesen (2006) also found a strong correlation between increased periphytic biomass and increased nitrogen.

Besides nutrient availability (Nitrogen), higher temperatures during higher water level periods probably enhanced the community metabolic activity, leading to a more accelerated biomass accumulation. According to Denicola (1996), although temperature is not usually limiting for the biomass and primary production of periphytic algae, it sets a production threshold when other variables are optimal.

The Upper Paraná River floodplain, based on ash percentage, chlorophyll-*a* content and autotrophic index, can be considered predominantly as having an autotrophic periphytic community during the high water period and a heterotrophic community during the low water period (PELD, 2000; Silva et al., 2001). The data we gathered do not corroborate such statement. When only one type of environment was taken into consideration, i.e., Bayous, the tendency over the year was toward an autotrophic periphyton condition. Autotrophic index values were within the range considered usual for periphytic communities in systems without pollution and distortions by the marked presence of detritus (APHA, 1995).

The upper Paraná River floodplain area studied constitutes the last dam-free portion within the Brazilian territory. However, presents a set of modifications provided by the formation of reservoirs (Porto Primavera UHE, Rosana UHE) and the ever growing incorporation of areas remaining from the productive system (such as *Pfaffia* extraction and rice cultivation).

These results point indicate the role of the hydrological regime on periphytic biomass in environments with a wide connection with the main channel of the Paraná River. Considering that periphytic biomass may represent an important form of energy transfer to other trophic levels, the necessity for quantifying disturbance events on communities and the magnitude of the anthropic impact caused by the artificial regulation of the Paraná River flow must be reinforced for an actual understanding about the functional dynamics of this ecosystem.

Acknowledgements

The authors are greatfull to the "Núcleo de Pesquisas em Limnologia, Ictiologia e Aquicultura" – NUPELIA for the support, and to Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq for the financial support, the doctors scholarship for JAL and productivity fellowships for LR. This study is part of the PELD program - Pesquisas Ecológicas de Longa Duração, site 6, conducted by Nupélia, that it is inserted in the International Long Term Ecological Research (ILTER).

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Received: 19 February 2007
Accepted: 05 March 2008