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Changes in species composition of Cladocera and food availability in a floodplain lake, Lago Jacaretinga, Central Amazon*

by

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Abstract

The composition, seasonal sucession of Cladocera and food availability as chlorophyll-a or as sestonic carbon (particles less than 20 µm) were studied weekly from February to April at Lago Jacaretinga (Brazil). The Cladocera community, shifted from a complete dominance by *Diaphanosoma sarsi, Ceriodaphnia cornuta*, and *Daphnia gessneri* corresponding with the time of low water level to dominance and density by, *Moina reticulata* with the time of high water level period. The values of edible chlorophyll-a, particulate organic carbon (POC), and the carbon levels of the edible non-algal fraction showed a gradual increase with the entry of the water from the Solimões River to the lake. The edible algal carbon did not vary markedly. It is evident that the non-algal contribution to the sestonic carbon content was greater than algal carbon by about ten times, indicating that non-algal particulate carbon accounts for the large amount of total POC. Nevertheless, there is not a condition of food limitation in the lake because the algal carbon always attained above 0.1 mg C/l.

Keywords: **Amazon, Cladocera, composition, flood, food availability.**

Resumo

A composição, sucessão sazonal de Cladocera e disponibilidade de alimento, como clorofila-a ou como carbono sestonico (particulas menores que 20 µm) foram estudadas semanalmente de fevereiro a abril de 1986 no Lago Jacaretinga (Brazil). A comunidade de Cladocera mudou de uma completa dominância de *Diaphanosoma sarsi, Ceriodaphnia cornuta* e *Daphnia gessneri* correspondendo com o período de águas baixas (seca), para *Moina reticulata*, na cheia. Os valores de clorofila-a comestivel, carbono organico particulado (POC) e a fração de carbono algal não comestível mostrou um aumento gradual com a entrada da água do Rio Solimões no lago. O carbono algal comestivel não variou marcadamente. No entanto, a

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contribuição não algal ao carbono sestonico ficou evidente, sendo cerca de 10 X maior do que o carbono algal, indicando que o carbono particulado não contribue em grande parte para o POC total. Apesar disso, no Lago Jacaretinga não há condição de limitação por alimento, pois o carbono algal sempre alcançou limites acima de (0.1 mg C/l), durante o período investigado.

Introduction

Amazonian floodplain lakes can be characterized by the nature and the extent of their connection with the main river (ROBERTSON & HARDY 1984). Lago Jacaretinga's main feature is its periodic connection with the Rio Solimões and although during the past decade it has been subjected to various limnological studies there are still many questions with regard to understanding this complex system particularly with respect to plankton productivity.

BRANDORFF & ANDRADE (1978) during a short period of study from February to April 1975 described a change in species composition, density and egg production of zooplankton coinciding with the beginning of the flood, followed by an decline and disappearence of the zooplankton fauna.

The possible reasons for the decline of the plankton which were raised at the time were: dilution and predation. On this study we propose to try and refine the pattern of changing zooplankton composition and the possible reasons for the same by intensive sampling of both limnological parameters and zooplankton.

Study site and methods

Lake Jacaretinga (3°14' S and 59°45' W), located approximately 25 km East of Manaus in the Central Amazon of Brazil, is a small floodplain lake with an area of 0.10 km^2 and is connected periodically for about six months with the Rio Solimões (as the Rio Amazon is called above its junction with the Rio Negro (Figure 1)). As the level of the Amazon rises from February-September, water from the Paraná do Careiro flows over the embankment and through the varzea forest into the lake via a very narrow canal about 150 meters long to the west of the lake. Other references concerning lago Jacaretinga include JUNK (1973), HARDY (1980), RAI & HILL (1980), ZARET et al. (1981), RIBEIRO (unpubl.), DEVOL et al. (1984) and TUNDISI et al. (1984).

Vertical profiles of temperature and dissolved oxygen concentration were taken with an oxygen sensor, the Termoeletrico Model WIW OX1 91. Transparency and depth of water were both measured with a 20 cm white Secchi disk and a line marked at 5 cm interval. Water samples were collected using a 1 litre transparent Ruttner volume sampler at 1.0, 2.0 and 3.0 m depths and bulked to provide an integrated column sample. The bulked sample was fractioned by filtration through 55 µm netting and 20 µm netting to provide samples of different sizes of algae.

The chlorophyll-a was determined using a spectrophotometer Spectronic 100, digital Bausch & Lomb. The calculation was made according to GOLTERMAN (1971). The same bulked Ruttner samples provided water for estimation of the sestonic particulate organic carbon in the water column. These too were filtered through the same series of nettings as for chlorophyll-a but in the field and finally onto 45 mm GF/F pads, previously pre-combusted at 500 °C to remove background carbon. The determinations of particulate organic carbon were made by the wet dichromate oxidation method according to MACKERETH et al. (1978).

In order to convert the measured less than 20 µm chlorophyll-a fractions to algal carbon, a conversion factor of 40:1 was used. The edible algal carbon concentration can be obtained by multiplying the less than

20 μm chlorophyll-a fraction by 40. The edible non-algal component of the particulate organic carbon could then be obtained by subtraction from the measured values of sestonic carbon.

The field studies on the cladoceran populations were carried out weekly from February to April 1986. The quantitative samples of zooplankton were collected using a 12-litre Patalas-Schindler volume sampler which had a net with a mesh pore size of 55 μm from between four and six depths and then bulked and concentrated, immediately killed and preserved by addition of concentrated formaldehyde to allow a final concentration of 6 %. The sample was sub-sampled with a 5 ml Stemple-pipette and was counted in a counting chamber under an Olympus microscope.

Results

Figure 2 shows that the depth of the lake fluctuates from 1.8 m at the end of February to 4.0 m by the end of April, as a result of the entry of the river water from the end of March onwards. Thus, the water depth doubled in two months. The same figure shows that the water transparency of the lake declined with the influx of water from the white water river. The Secchi disk depth decreased from 1.40 m at the beginning to 0.7 m towards the end largely due to the increased presence of large quantities of inorganic particles in suspension.

The water temperature of the lake was measured at two depths and the mean temperature of these varied very little with time, between 27.5 °C and 30.8 °C. Although the thermal pattern was rather unvarying throughout the study period, with an overall average of 28 °C, there were large differences in the concentration of dissolved oxygen, both between the surface and bottom samples and with time between the low and high water phases. Figure 2 shows that the highest oxygen concentration was 3.0 mg/l in the surface water when the depth of the lake was only 1.80 m. As water depth increased, the oxygen content of the water declined to 1.0 mg/l and there appeared, a zone of anoxia at the bottom from mid-March onwards. Even at these high temperatures, the level of dissolved oxygen is very low in the lake; at 28 °C, 3.0 mg/l represents saturation and 1.0 mg/l, only 11 %.

The turbidity of the water of Lake Jacaretinga has not been studied in any sistematic manner but a water sample collected on May 9th 1986, after the river flood, was used to count and size its suspended particles by a TAII Coulter Counter, using a 140 μm tube. This was used to determine the concentration and total volume of the particles recorded in the channel counting the smallest particles (less than 25 μm^3 volum and less than 3.6 μm equivalent spherical diameter) as well as the total numbers of particles. These values were determined for the river, the channel and within the lake. As a result, the less than 3.6 μm particles formed slightly more than 50 % of the total particles and both the smallest and the total particles declined in abundance as the water passed from the river to the lake via channel, and the concentration of the particles in the lake was about one sixth that in the river both numerically and by volume. The details are described elsewhere (HARDY, 1989).

In order to obtain some idea of the level of food available to the cladoceran populations in Lake Jacaretinga, the chlorophyll-a and sestonic carbon were measured at weekly intervals as the concentrations of the fractions which passes through a 20 μm mesh. Figure 2d illustrates how the concentrations of fractions of chlorophyll-a and particulate organic carbon (POC) changed with time.

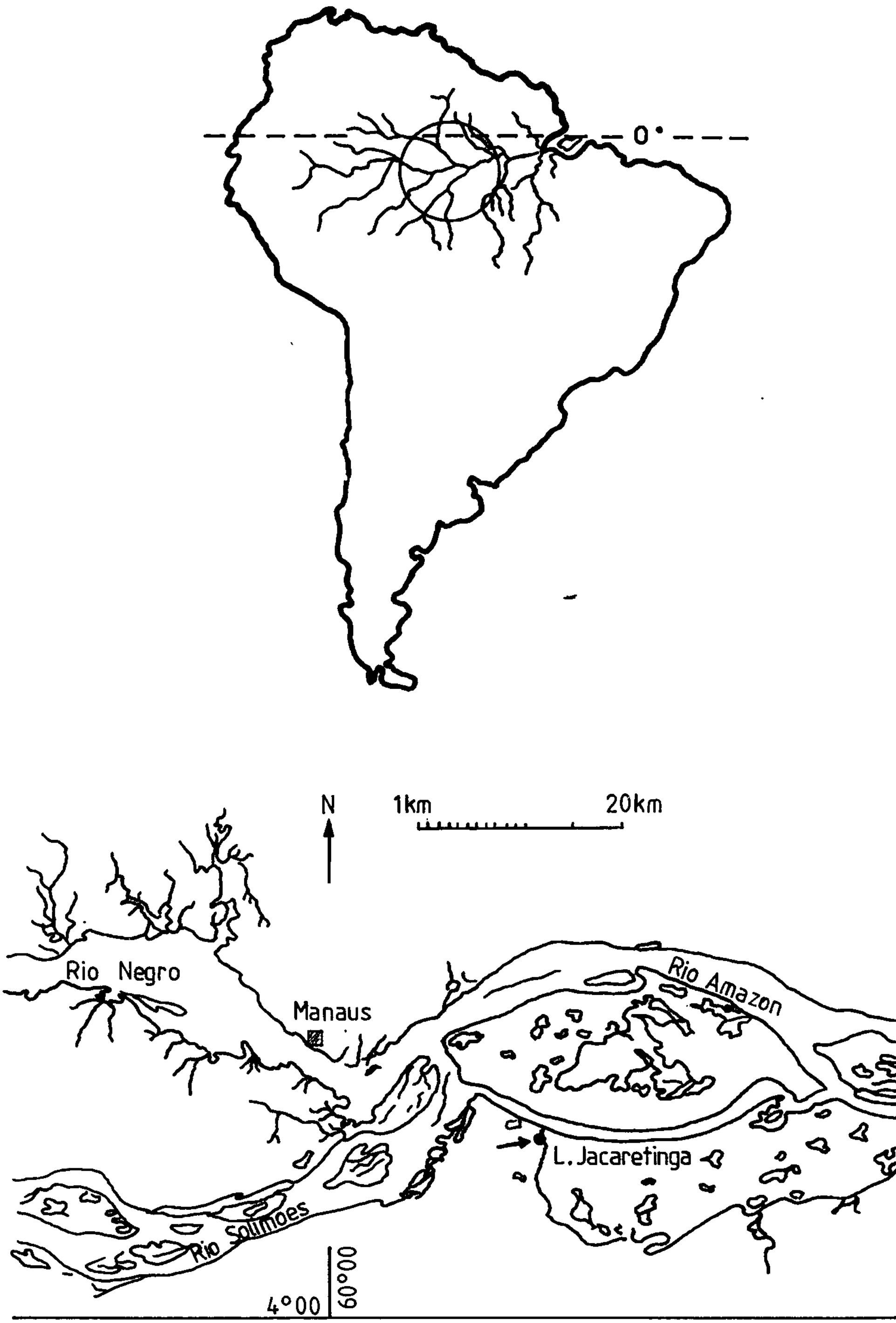

Fig. 1:
Map of South America showing the River Amazon basin and geographical position of the study area (above). Central Amazon region showing the lake studied (below).

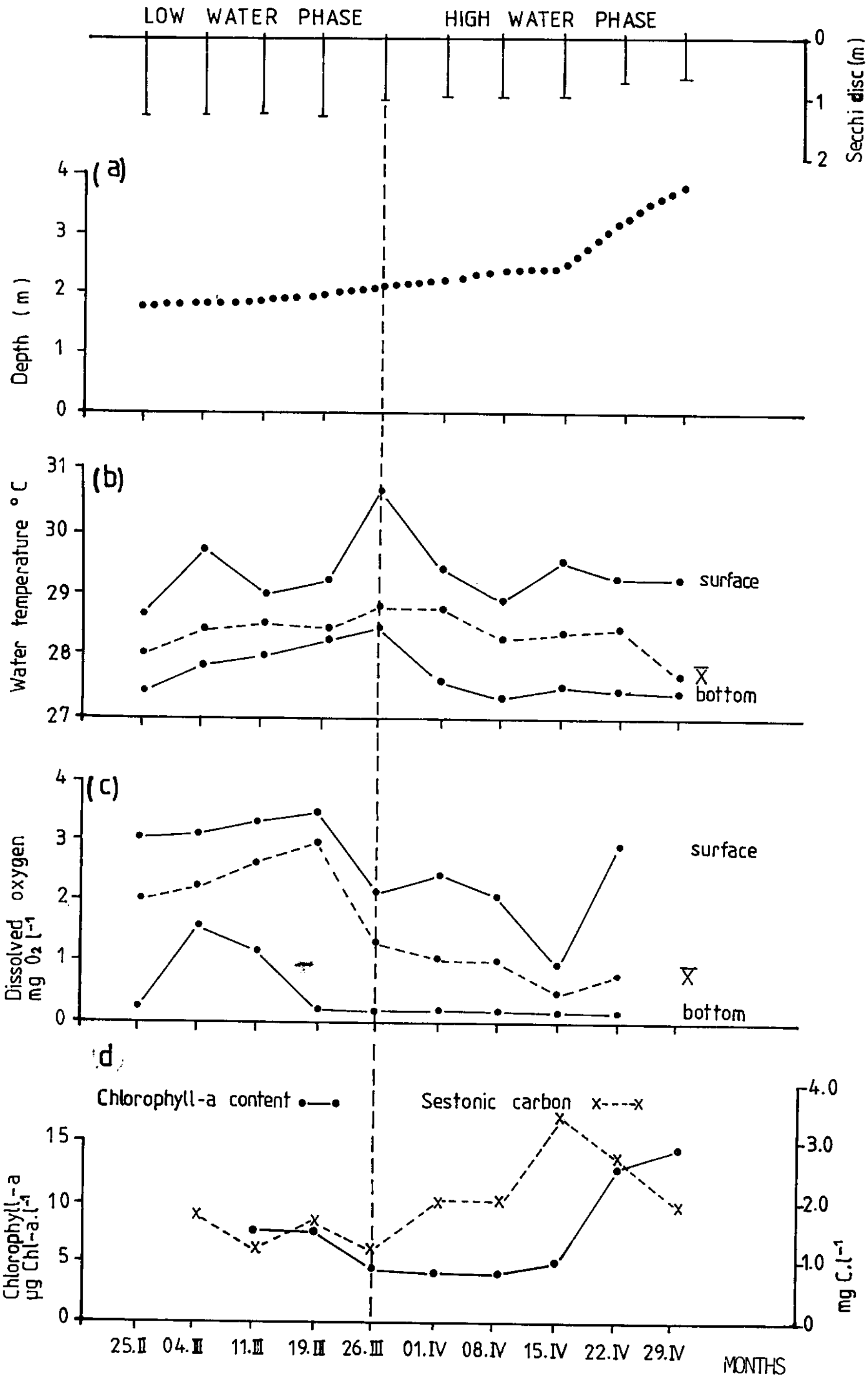

Fig. 2:
Physico-chemical and biological characteristics at station I, Lake Jacaretinga (February-April 1986). The vertical broken line indicates when flood began in the lake.

The chlorophyll-a concentration became very low and minimal immediately on the onset of the high water phase but reached a maximal value of 14 µg/l by the middle of April. A similar changeover from low values in the water phase to higher values in the high water phase was also recorded for the particulate sestonic carbon. The highest value of 3.4 mg C/l was reached in mid-April, a week earlier than the chlorophyll-a. This pattern suggests that the reduced water transparency of this period is associated with organic as well as mineral particles transported by the river into the lake.

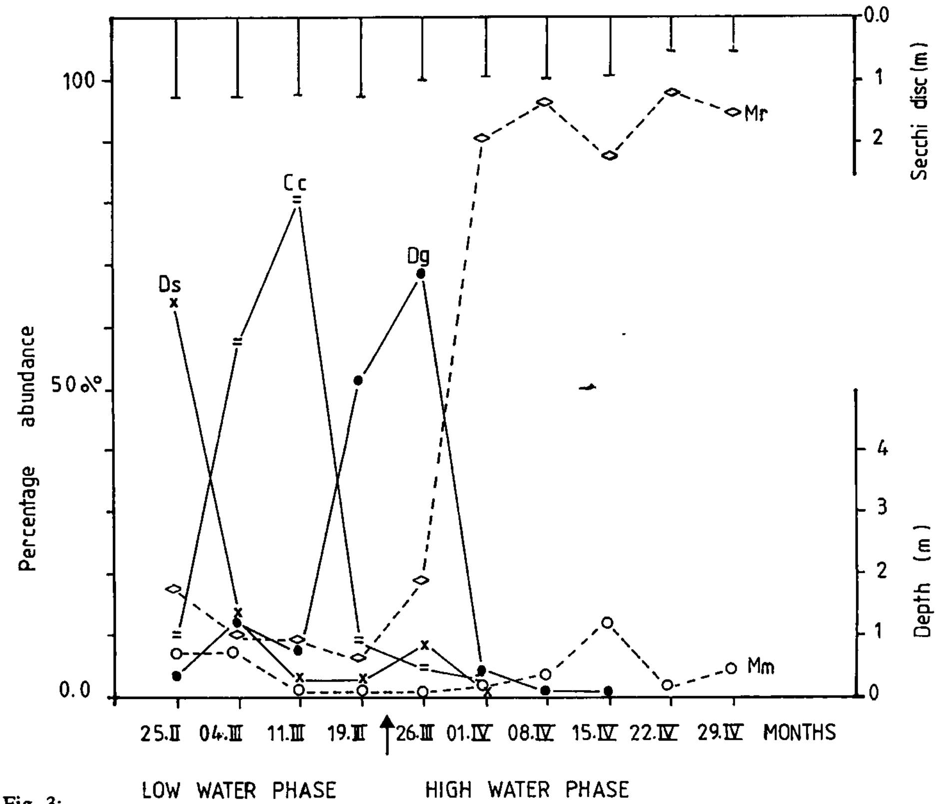

Fig. 3:

Cladocera density as % of total counted zooplankton; means of five stations. Transparency (Secchi disc) in Lake Jacaretinga. Ds – *Diaphanosoma sarsi*, Cc – *Ceriodaphnia cornuta*, Dg – *Daphnia gessneri*, Mr – *Moina reticulata*, Mm – *Moina minuta*.

Seven species of Cladocera were recorded from the limnetic zone of Lake Jacaretinga: *Diaphanosoma sarsi, Ceriodaphnia cornuta, Daphnia gessneri, Moina reticulata, Moina minuta. Bosminopsis deitersi* and *Bosmina* sp. were both recorded but were always rare (less than 1 %) and were not considered further in these studies. The mean density and percentage abundance of each of the five species of cladocerans on ten sampling dates are presented in table 1 and illustrated in figure 3. These show a strong pattern of succession of species. As can be seen in figure 3, *Diaphanosoma sarsi* was dominant in the early samples, followed by *Ceriodaphnia cornuta* and *Daphnia gessneri*, each species declining as the next one took over. *Moina reticulata* contributed only 10 % of the individuals during this low water phase but, in sharp contrast, became the dominant species immediately after the flood and during the whole of the high water phase. *Moina minuta*, on the other hand, rarely contributed more than 5 % of the animals and appeared to be of minor importance although it was present throughout.

Tab. 1: The Cladocera species of Lake Jacaretinga, their density (number per litre) during February-April 1986. Means of five stations and three replicates. Number between brachets are percentages. N = 15; x = mean value; SD = standart deviation.

Dates		*D. sarsi* x ± SD	*C. cornuta* x ± SD	*D. gessneri* x ± SD	*M. reticulata* x ± SD	*M. minuta* x ± SD
Feb 25th		15.1 ± 13.5 (64.5)	2.3 ± 2.3 (9.8)	0.7 ± 0.8 (2.98)	3.3 ± 2.4 (14.3)	1.98 ± 1.2 (8.45)
Mar 4th		3.0 ± 2.7 (13.4)	13.2 ± 16.9 (54.2)	3.1 ± 5.0 (12.5)	2.8 ± 2.0 (11.1)	2.34 ± 2.8 (9.48)
Mar 11th		0.7 ± 0.6 (1.98)	78.9 ± 22.9 (78.9)	3.0 ± 2.3 (8.4)	3.4 ± 1.7 (9.3)	0.49 ± 0.3 (1.33)
Mar 19th		0.9 ± 0.7 (6.8)	1.3 ± 0.1 (9.5)	9.6 ± 5.5 (74.3)	1.0 ± 0.9 (8.3)	0.13 ± 0.2 (1.0)
Mar 26th		4.2 ± 4.6 (12.2)	2.2 ± 1.0 (6.4)	19.7 ± 15.3 (57.3)	8.2 ± 5.1 (23.8)	0.1 ± 0.1 (0.3)
Apr 1st	F	0	0.5 ± 0.4 (3.4)	0.7 ± 0.4 (5.8)	11.5 ± 8.6 (88.2)	0.32 ± 0.2 (2.45)
Apr 8th	L	0	0	0	23.5 ± 19.2 (94.4)	1.38 ± 1.73 (5.54)
Apr 15th	O	0	0	0	79.0 ± 64.7 (88.5)	10.26 ± 9.0 (11.5)
Apr 22nd	O	0	0	0	67.2 ± 24.0 (97.8)	1.48 ± 0.6 (2.1)
Apr 29th	D	0	0	0	6.63 ± 3.1 (95.3)	0.32 ± 0.2 (4.6)

When the species are considered in the order of their appearence in the succession, table 1 shows that *Diaphanosoma sarsi* was the first to achieve a maximal mean density of 15 Ind./l on February 25th and then rapidly declined to less than 1 Ind./l before the end of the low water phase. Although there was a second small peak abundance of about 4 Ind./l immediately after the flood, this did not last long and the species disappeared during the high water phase. *Ceriodaphnia cornuta* built up its population densities during February and March to peak at 29 Ind./l on March 11th, two weeks after *Diaphanosoma sarsi.* Its densities declined to 2 Ind./l or less with the onset of the flooding of the river from March 19th - 26th and disappeared during the whole of the high water phase. Individuals of *Daphnia gessneri* were present on most sampling dates but in variable densities (0 - 30 Ind./l). Table 1 shows two peak abundances, 31.5 Ind./l on March 4th before the flood dates and 19.7 Ind./l on March 26th which coincided with the influx of the white water. During its second peak, *Daphnia gessneri* contributed the highest percentage (50 %) of the cladoceran fauna but immediately afterwards declined to less than 1 Ind./l, which formed only 4 % of the cladocerans. The population of *Moina reticulata* was present throughout the period of study but with widely fluctuating densities, from 1 - 79 Ind./l. Densities were low during the water phase, 1 - 3 Ind./l and less than 10 % of all the animals. However, the influx of white water was followed by a period of increasing densities of this species until it attained a density of 79 Ind./l on April 15th 1986. From April 1st onwards and during the whole high water phase, this species contributed 88 % or more of the cladocerans. *Moina minuta* was present throughout the period of study in much lower densities. Its peak abundance of 10.38 Ind./l also occurred on April 15th during the flood but did not long and densities soon declined to less than 1 Ind./l.

The number of eggs or embryos per gravid female could be calculated reliably only for *Moina reticulata* and *Daphnia gessneri* and these values for fecundity are given in table 2. The fecundity of *Moina reticulata* varied between 2 - 5 eggs per gravid female throughout the period of study and appears to differ very little.

Tab. 2: The number of eggs per female of *Moina reticulata* and *Daphnia gessneri* during February - April 1986. N = number of females with eggs; x = mean value; SD = standard deviation; 95 % CL.

		Eggs per female					
Dates		***Daphnia gessneri***			***Moina reticulata***		
		N	**x ± SD**	**± 95 % CL**	**N**	**x ± SD**	**± 95 % CL**
Feb 25th		no egg-bearing female			15	3.4 ± 1.20	± 0.68
Mar 4th		55	5.2 ± 1.80	± 0.49	41	2.3 ± 0.77	± 0.24
Mar 11th		22	4.1 ± 0.90	± 0.42	36	2.7 ± 1.00	± 0.34
Apr 1st	F	10	5.2 ± 0.95	± 0.67	36	4.8 ± 1.30	± 0.45
Apr 8th	L	no egg-bearing female			56	3.6 ± 1.10	± 0.31
Apr 15th	O	no egg-bearing female			32	3.4 ± 0.90	± 0.34
Apr 22nd	O	no egg-bearing female			15	3.4 ± 1.20	± 0.68
Apr 29th	D	no egg-bearing female			18	3.2 ± 0.80	± 0.24

The availability of edible particles, as chlorophyll-a or as sestonic carbon, to the cladoceran populations in L. Jacaretinga was obtained over the same period of two months of weekly sampling. For this purpose, the particles passing through a mesh size of less than 20 μm was chosen to represent the particle sizes that the species of Cladocera in the lake could ingest in relation to their body sizes. This decision was based upon the relationship established by BURNS 1968 for temperate daphnid species which is supported by JAYATUNGA's 1986 results for tropical species which appear to be similar to temperate species in their filter structure and filter area despite their smaller body size.

Table 3 presents the results for each stage in the calculation and the time course for edible chlorophyll-a, edible sestonic carbon and the two expressed in carbon weight per litre are illustrated in Figure 4a, b, c. Figure 4a shows that the highest values, up to 17 μg/l, occurred later in April and were associated with higher water levels.

Tab. 3: Chlorophyll-a, algal carbon, total sestonic carbon (POC) and non-algal carbon content of Lake Jacaretinga during March - April 1986. The results are expressed in mg/l ± SD. A conversion factor of 40 : 1 chlorophyll-a was used.

Date		Chlorophyll-a 20 μm (mg/l) measured	Algal carbon mg/l (column 1x40)	Sestonic carbon mg C/l (20μm) (measured)	Non-algal carbon mg C/l (20 μm)
Mar 4th		0.0080 ± 0.008	0.320	1.118 ± 0.004	0.798
Mar 11th		0.0072 ± 0.003	0.288	0.813 ± 0.002	0.533
Mar 19th		0.0062 ± 0.001	0.248	1.046 ± 0.001	0.798
Mar 26th		0.0036 ± 0.017	0.144	1.250 ± 0.004	1.106
Apr 1st	F	0.0061 ± 0.023	0.244	1.582 ± 0.004	1.338
Apr 8th	L	0.0040 ± 0.022	0.160	2.005 ± 0.004	1.845
Apr 15th	O	0.0109 ± 0.034	0.436	1.209 ± 0.004	0.873
Apr 22nd	O	0.0147 ± 0.010	0.588	*	*
Apr 29th	D	0.0171 ± 0.019	0.684	1.856 ± 0.002	1.172

*undetermined

The time course of POC in figure 4b shows a gradual increase with the entry water river (indicated by an arrow). Lowest levels were obtained in April (2.7 mg C/l). As given in figure 4c, edible algal carbon did not vary markedly. Values ranged from 0.15 to 0.7 mg C/l with the average of 0.35 mg C/l. The maximum values were observed by the end of April when this fraction exceeded 0.5 mg C/l. On the other hand, the carbon levels of the edible non-algal fraction in relation to sestonic carbon, given in figure 4c and table 3 is much higher and more variable ranging from 0.5 to 1.83 mg C/l throughout the period of study, with a clear increase during the entering of water from the river. Is is evident that the non-algal contribution to the sestonic carbon content was greater than algal carbon by about 10 times. The results might be interpreted as showing that non-algal particulate carbon accounts for the large amount of total particulate organic carbon (POC) in Lake Jacaretinga. Nevertheless, there is not a condition of food limitation in the lake because the algal carbon always attained above 0.1 mg C/l.

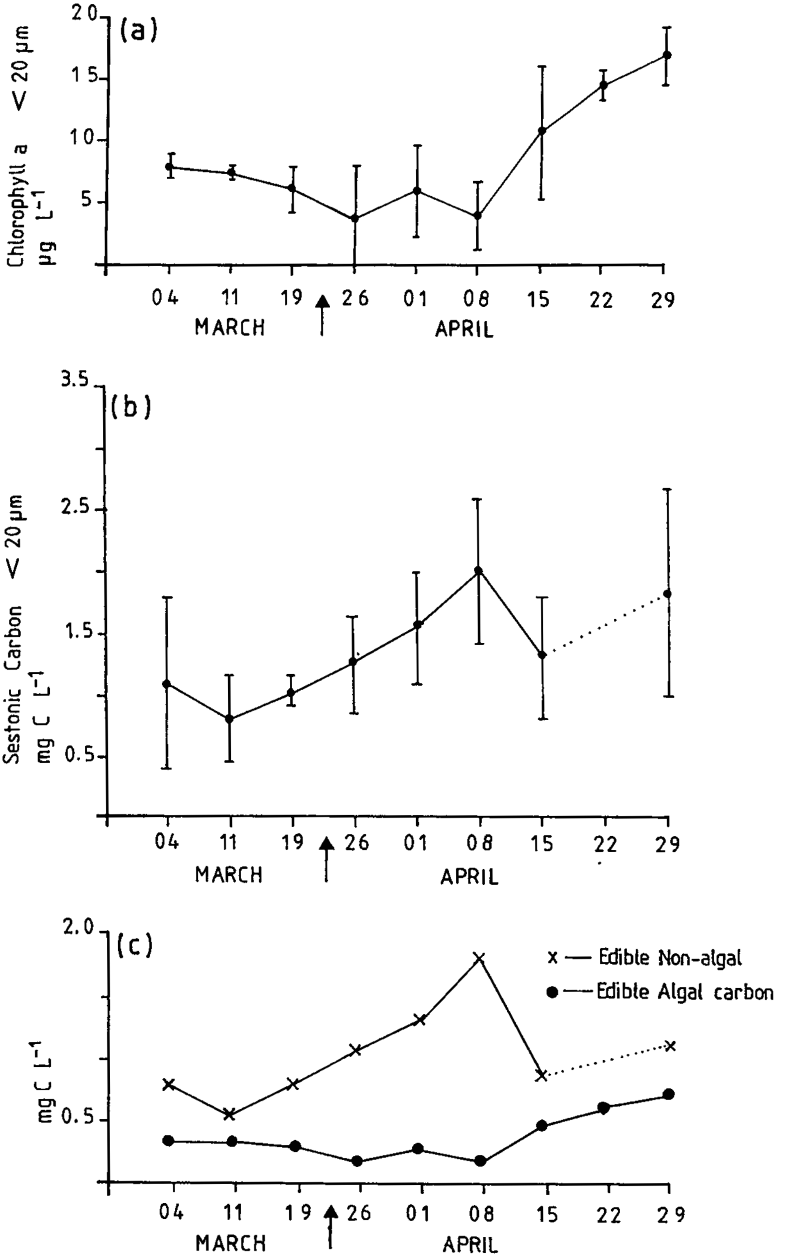

Fig. 4:
Edible chlorophyll-a (a), edible sestonic carbon (POC) (b) and carbon-chlorophyll-a (c) relationship in Lake Jacaretinga during March - April 1986.

Discussion

The results of this study have shown (Figure 3) that, during the period from February 25th to April 29th 1986, the cladoceran community in Lake Jacaretinga, a shallow tropical lake, shifted from a complete dominance by *Diaphanosoma sarsi, Ceriodaphnia cornuta*, and *Daphnia gessneri* to dominance and density by *Moina reticulata* a smaller-bodied cladoceran (0.40 - 0.80 mm). This shift was associated with the annual floading of the River Amazon, when water carrying a large ammount of fine suspended particles entered into the lake. Attempts to explain seasonal succession in a natural zooplankton community often suggest that one species has certain genetic, morphological, physiological or ecological features which temporarily enable it to utilize its habitat to greater advantage.

Many authors have investigated the possibility that water renewal (dilution, currents, transparency), temperature, dissolved oxygen, predation (vertebrate and invertebrate) and food (quality and quantity) are the major factors. There is no doubt that a variety of factors contribute to the seasonality of the cladocerans and play an important role in life cycle characteristics. However, which factors are exactly more important and how they operate are rarely demonstrated. DE MOTT (1983) found that food composition influenced the relative advantage of each *Daphnia* species more than temperature, pH or dissolved oxygen. BROOKS & DODSON (1965) have implicated the influence of predation and EDMONDSON & LITT (1982) discussed the combined effects of predation and nutrition.

The effect of dilution and flushing out of the plankton could be easily accepted in Lake Jacaretinga on account of the intensity and duration of the flood. During heavy floods, Lake Jacaretinga is connected by a narrow "furo" to another lake, Lake Redondo, although such connection was not observed during the present studies. The magnitude of throughflow, especially during 1986 (measured by water depth, Figure 2a) seems inadequate to reduce zooplankton by dilution significantly. In spite of strong currents generated by the inflow as was seen in the mouth of canal, it does not occur in the lake, since natural barriers such as inundated forest and aquatic macrophytes diminish the current effect.

Temperature has long been know to influence rates of activity of different animals. The general positive effect of temperature on secondary production is a result of the reproductive biology of zooplankton. In evaluating this possibility, it should be remembered that the water temperature in Lake Jacaretinga varies very little with time, between 27.5 °C and 30 °C with an overall average of 28 °C. It would be naive, however, to postulate that temperature is the direct cause of changes in composition at least in tropical aquatic environments.

Dependence of the distribution of aquatic invertebrate upon oxygen concentration is though to be critical and is described by several authors in Amazonia lakes and reservoirs. JUNK (1973) shows that the numbers and total biomass of periphyton coloninzing the floating macrophyte vegetation diminishes strongly under hypoxic conditions. BRANDORFF (1977) observed *Daphnia gessneri* inhabiting only the oxygenated layers of Lake Castanho. FISHER et al. (1983), found, in Lake Calado, the zooplankton confined to the epilimnion in the top 4 meters of the water column where the O_2 saturation was less than 30 %. The hypolimnion was anoxic and contained H_2S, a very commun feature in such kinds of lake, including Lake Jacaretinga. The authors invoked the lack of oxygen and the presence of reducing substances as possible environmental clues that enable the zooplankers to avoid the hypolimnion. A two-year study on the composition and abundance of the zooplankton was conducted in an Amazonia várzea, Lake Camaleao, by HARDY et al. (1984). This provided some evidence that the poor oxygen conditions may be harmful enough to cause changes in the structure population of aquatic organisms.

The rarity and the absence of *Daphnia gessneri, Diaphanosoma sarsi* and *Ceriodaphnia cornuta* after the flood and in contrast to the dominant presence of *Moina reticulata*, as demonstrated in this field investigation in Lake Jacaretinga, did correspond with changes in dissolved oxygen, low transparency associated with the quantitaty of suspended food and silt particles. Unfortunately no experimental investigation has been done relating to oxygen tolerance in these species. Based on available evidence, it appears that the confinement of cladoceran, especially *Daphnia gessneri*, within the shallow, oxygenated upper layers is not an unusual, particularly in the Amazonia lakes. How far changing oxygen concentrations lead to shift or death of cladoceran species cannot yet be shown.

THRELKELD (1986) has studied the dynamic population of four cladocerans in a turbid reservoir. His field collections revealed that *Ceriodaphnia* and *Daphnia* populations declined immediately after the arrival of turbid water, and remaining females carried fewer eggs. Conversely, populations of *Moina micrura* and *Diaphanosoma leuchtenbergianum* increased during the flood, and life table experiments showed that these species were able to grow well in silt-laden water. According to the author, the strong life table responses of *Moina* and *Diaphanosoma* to environments high in suspendend sediments suggest a potent reason for their increased densities during the flood period. HART (1986) investigated on population dynamic and production of crustacean on Lake le Roux, and his findings showed that the abundance of zooplankton was positively related to water transparency; daphnids were virtually absent in years when high levels of inorganic turbidity prevailed. The present results partially supported the findings of THRELKELD and HART and suggest that there a highly specific responses of individual populations to turbid inflow. The principal effect of high turbidity might be upon food availability and interference with mechanical acquisition of food particles, and may be a compound influence, although turbid water fauna like *Moina reticulata* may have evolved appropriate morphological or behavioral compensations. Measurements of food availability in Lake Jacaretinga as presented in Fig. 4c shows that there is no condition of food limitation during the period of study. However, mineral particles can be ingested by cladocerans and occupy the gut space with no nutritive food. In Lake Jacaretinga the algal carbon was always more than 0.1 mg C/l, higher than the threshold food level found in the experimental work carried out by HARDY (1989). She found 0.05 - 0.03 mg C/l using unialgal *Scenedesmus acutus* as food.

LAMPERT (1978) provided some evidence that it is not possible to apply the experimentally defined threshold levels directly to the field conditions since food quality also matters in the determination of food thresholds. The food quality of the natural seston may not have been as good as that provided in the experiments. Thus, it is important to evaluate the quantity of edible food available in the field for each species. DUNCAN (1985) put forward an indirect method for evaluating this by means of length-carbon regressions. The availability of food resources is reflected in the presence of egg-bearing females number of eggs in the brood pouch. The results presented in Table 2 show that the number of eggs per female was kept constant for *Moina reticulata* and no egg bearing female was found for *Daphnia gessneri*. Differencial ingestion and assimilation of suspended silts may partially mediate species composition among those cladoceran. Unfortunatly there is no comparable studies to test the possibility that *Moina reticulata* and the other cladoceran assemblege in Lake Jacaretinga differ in their abilities to capture, ingest, or assimilate natural food items. However, long-term life cycle experiments using natural silt particles and *Scenedesmus acutus* as food source, provide evidence against high concentration of silt particle (50 NTU) particularly for *Daphnia gessneri* (HARDY 1989). *Moina reticulata* may exploit more efficiently non-conventional food resources such as silt-adsorbed dissolved organic matter in Lake Jacaretinga turbid waters.

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