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Caloric Variability of *Corbicula fluminea* (Mollusca, Bivalvia) in Rosana Reservoir, Brazil

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ABSTRACT

The purpose of the present study was to investigate temporal and longitudinal variation of caloric density of Corbicula fluminea *in Rosana Reservoir. Significant differences concerning the caloric density of* C. fluminea *were observed throughout the year at the three reservoir sites. The caloric density variation during the year was probably related to reproductive activity, which demanded higher allocation of energy in certain period. The food source used by this species might be an important factor in the caloric value temporal and spatial variation of* C. fluminea *in Rosana Reservoir.*

Key words: *C. fluminea*, caloric content, temporal and longitudinal variation, reservoir

INTRODUCTION

In tropical regions, studies about caloric density have been carried out mainly on ichthyofauna (Ngan et al., 1993; Dória and Andrian, 1997; Benedito-Cecílio et al., 2004) and aquatic insects (Higuti et al., 2003). Investigations of the bioenergetics of mollusks have been performed in other countries, mostly, on marine species (Stanczykowska and Lawacz, 1976; Clarke et al., 1985; Dauvin and Joncourt, 1989; Williams and McMahon, 1989; Beukema, 1997; McMahon, 2000).

Corbicula fluminea (Müller, 1774) is a native species from Southeast Asia and has r-strategist characteristics, in other words, to present high fecundity, short life span and high rate of growth and dispersion (McMahon, 1982; Ortmann and Grieshaber, 2003). Such factors have made it a successful colonizer of most freshwater habitats, adapting to a large variability of environmental conditions (McMahon, 2000). They are widely distributed in riverine systems (Cataldo and Boltovskoy, 1999; Rajagopal et al., 2000) and reservoirs (Layzer et al., 1993; McMahon, 2000). In Brazil, they were first observed in 1970 by Veitenheimer-Mendes (1981), and subsequently by others (Callil and Mansur, 2002; Takeda et al., 2004; Bagatini, 2004).

C. fluminea has caused a series of environmental and economical impacts (Aldridge and Müller, 2001). This mollusk species strongly influences aquatic ecosystem, since it obtains its energy directly from primary producers (Vaughan and Hakenkamp, 2001), transferring it to other links of the trophic chain, including some species of fishes, aquatic birds and mammals (McMahon, 2000). Dry matter caloric content measurements have been used mainly to verify energetic relationships in environments (Verduin, 1961; Grant, 1996).

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Thus, the present study aim to investigate temporal and longitudinal variation of caloric density of *C. fluminea* in Rosana Reservoir.

STUDY AREA

The Rosana Reservoir Hydroelectric Power Plant dam is located in the Paranapanema River between Rosana (State of São Paulo) and Diamante do Norte (State of Paraná). The reservoir has an area of 220km^2 and is about 25 meters depth. Three sampling sites were established through the longitudinal axis of the reservoir, lotic site (22^{o}39'05''S and 052^{o}10'52''W), intermediate site (22^{o}36'57''S and 052^{o}29'20''W) and lentic site (22^{o}35'24''S and 052^{o}49'51''W) (Fig. 1).

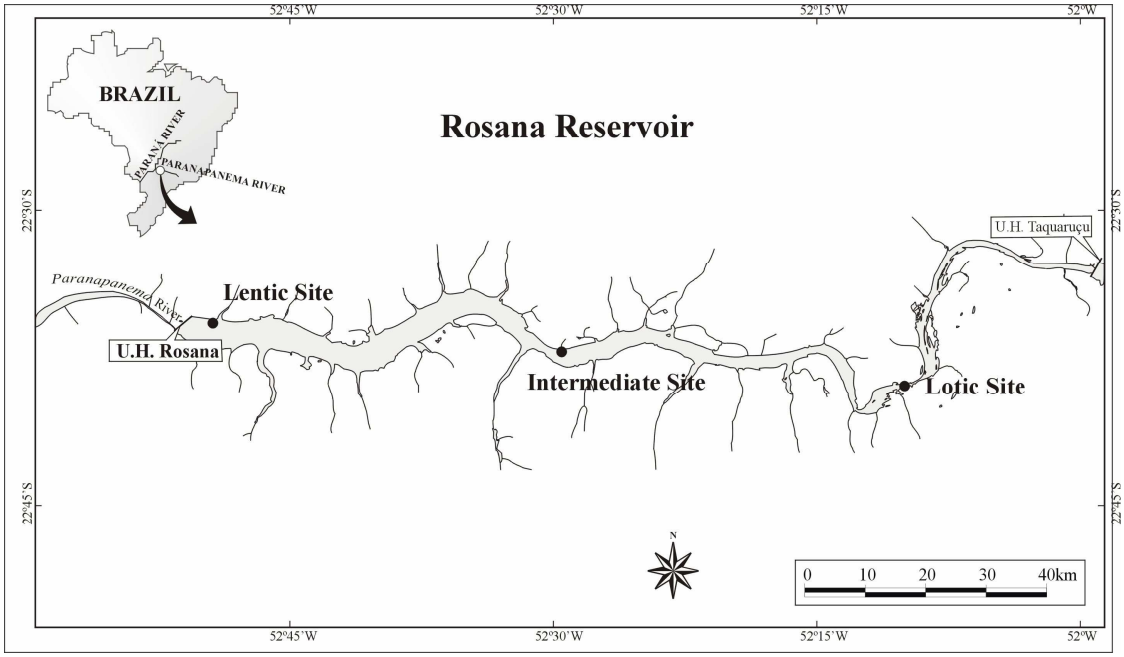

Figure 1 - Rosana Reservoir sites at Paranapanema River

MATERIALS AND METHODS

Data collection

The collection of *C. fluminea* was carried out quarterly from March to December 2002, on the shore of the lotic, intermediate and lentic Rosana Reservoir sites. At least three samples of *C. fluminea* were collected using a modified Petersen grab (0.018m^2) and preserved in liquid nitrogen (-196^{o}C).

Caloric content determination

Considering the *C. fluminea* (n = 193) specimens, the calorimetric analyses were carried out based on a minimum of three samples, in order to identify their caloric variability (Flat and Diana, 1985; Economids et al., 1981). In the laboratory, the valves were size measured and the bodies of two or three individuals with similar length were grouped together to form a sample with a dry weight above 0.025g (minimum weight for combustion). The samples were dried in oven at 60^{o}C for 24 h. The calorie per gram of the organisms was determined from the dry biomass, using a Parr 1261 calorimeter. A two-way ANOVA was performed using the caloric values of *C. fluminea* at different sites and months.

RESULTS

Decrease in the mean caloric content of *C. fluminea* was observed during the year, with very close values in September and December (Fig. 2a). The mean highest caloric density was recorded at the intermediate site (5000 cal/g), followed by the lotic (4920 cal/g) and lentic (4800 cal/g) ones (Fig. 2b). Differences in the caloric content of *C.*

fluminea at the three sites ($p < 0.05$; $F = 8.87$) and over the months ($p < 0.05$; $F = 7.84$) were significant. However, the interaction between sites and months was also significant ($p < 0.05$; $F = 7.13$) suggesting that both sites and months might influence the caloric content of *C. fluminea*.

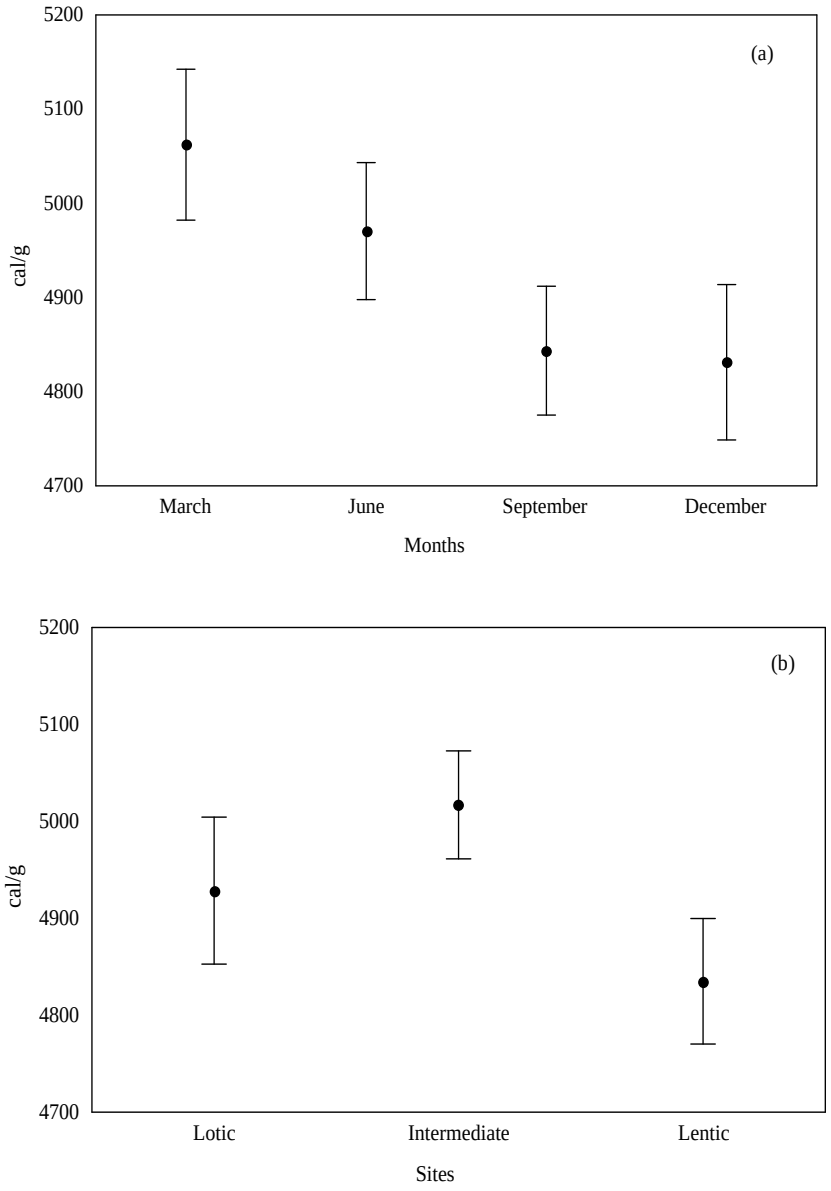

Figure 2 - Caloric content per gram of dry weight of *C. fluminea* in the Rosana Reservoir (a) Months; (b) Sites.

DISCUSSION

The variation in the energy of *C. fluminea* during the year might be related to its reproductive period. Kraemer and Galloway (1986) reported that the reproductive process generally occurred during the coldest months, since with the increase in water temperature, the sequence of reproductive development was interrupted. Also, the occurrence of only one annual reproductive period was recorded in South America (Bacia do Plata) (Cataldo and Boltovskoy, 1999). In Rosana Reservoir, the caloric density, in general, was higher in March and June. According to Bagatini (2004), these months precede the assumed reproductive period of *C. fluminea* (July and

August). This might be related to large acquisition of energy for the reproductive period, and consequent decrease in caloric density over the next months (September and December).

According to Willians and McMahon (1989), the biomass rises and, consequently, so does the energetic value of *C. fluminea*, coinciding with the period of higher energetic demand for reproduction. Experiments carried out by McMahon and Willians (1986) with *C. fluminea* also evidenced seasonal changes concerning the condition of the tissues of this bivalve. The results obtained in Rosana Reservoir were in agreement with the above, since high caloric density was observed in the beginning of the year, followed by a decrease in caloric value (from September onwards), which probably occurred after the liberation of larvae into the water.

C. fluminea is a filterer species and its biomass is expected to consist basically of carbon from phytoplankton or even from bacterioplankton (Vaughan and Hakenkamp, 2001). Thus, the energetic value of *C. fluminea* could be influenced by available food source. Low phytoplankton biomass was recorded in Rosana Reservoir (Train et al., 2005); however, the energy of *C. fluminea* probably was kept by algae, besides the high biomass of the bacterioplankton (Pagioro et al., 2005), which was also a source of energy for organisms specialized in feeding on finely particulate detritus (Smith et al., 1982). This availability of food demonstrated that the energetic content might change temporally and spatially. In spite of low phytoplankton biomass in Rosana Reservoir (Train et al., 2005), the higher caloric values of *C. fluminea* were in agreement with the temporal and spatial phytoplankton variation, suggesting algae as main energetic source of this species.

Similar results were also reported for *Mytilus chilensis* (Bivalvia), in which the energetic content change with available food, growth and reproduction (Duarte et al., 1980).

Some studies have also demonstrated that species of fish benthophagous feed on *C. fluminea* (Montalto et al., 1999; Gaspar da Luz et al., 2002). Thus, the exotic species, *C. fluminea*, can take part in the trophic chain, especially because of high biomass in freshwater environments. The present study, although restricted to Rosana Reservoir, revealed that the invasive species *C. fluminea* could have an important role in the transfer of energy.

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RESUMO

O objetivo deste estudo foi investigar a variação temporal e longitudinal da densidade calórica de *C. fluminea* no reservatório de Rosana. Diferenças significativas na densidade calórica de *C. fluminea* foram observadas ao longo do ano e nas três estações do reservatório. A variação na densidade calórica de *C. fluminea*, durante o ano, provavelmente foi relacionada à atividade reprodutiva, que exige uma maior alocação de energia em determinado período. O recurso alimentar utilizado por esta espécie pode ser um importante fator na variação temporal e espacial do valor calórico de *C. fluminea* no reservatório de Rosana.

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