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First report: Amazon River Prawn reared in biofloc-technology

Primeiro relato: Camarão Amazônico criado com tecnologia de bioflocos

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ABSTRACT

The objective of this work was to evaluate the use of biofloc technology to reared Amazon River prawn (*Macrobrachium amazonicum*). One hundred Amazon River prawn juveniles were divided into two experimental units (250 L), 50 animals per each. Prawns were fed two times per day, with 3% of the prawn biomass. Dissolved oxygen and temperature were performed twice a day. Total suspended solids, pH, alkalinity, ammonia nitrogen, nitrite and nitrate were monitored twice a week. Prawns shown 77.67%, survival, 2.98 feed conversion, weekly weight gain of 0.29 g day^{-1}, and yield of 822.0 g m^{-3} after six weeks of rearing. Dissolved oxygen, temperature and pH were suitable for specie, however, for some weeks, ammonia nitrogen and nitrite were higher than the limits recommended for prawn. In conclusion it is possible to use BFT to maintain and rearing Amazon River Prawn (*M. amazonicum*), however to improve the performance it is necessary to define nutritional requirements, as well improve the management techniques for this specie in BFT.

KEYWORDS: BFT, *Macrobrachium amazonicum*, aquaculture.

RESUMO

O objetivo deste trabalho foi avaliar o uso da tecnologia de bioflocos para criar camarão do rio Amazonas (*Macrobrachium amazonicum*). Cem camarões amazônicos foram divididos em duas unidades experimentais (250 L), com 50 animais por cada. Os camarões foram alimentados duas vezes por dia, com 3% da biomassa dos camarões. Oxigênio dissolvido e temperatura foram mensurados duas vezes ao dia. Sólidos suspensos totais, pH, alcalinidade, nitrogênio amoniacal, nitrito e nitrato foram monitorados duas vezes por semana. Os camarões apresentaram 77,67%, de sobrevivência, 2,98 de conversão alimentar médio, ganho em peso semanal de 0,29 g dia^{-1}, e produtividade de 822,0 g m^{-3}, após seis semanas de criação. O oxigênio dissolvido, a temperatura e o pH foram adequados à espécie, enquanto, por algumas semanas, nitrogênio amoniacal e nitrito foram superiores aos limites recomendados para o camarão. Em conclusão, é possível utilizar o BFT para manter e criar o camarão amazônico (*M. amazonicum*), no entanto, para melhorar o desempenho é necessário definir requisitos nutricionais, bem como melhorar as técnicas de manejo para esta espécie em BFT.

PALAVRAS-CHAVE: BFT, *Macrobrachium amazonicum,* aquicultura.

The biofloc-technology (BFT) culture is highlighted, due to the interest in closed systems with minimum or no water exchange, with greater biosafety, and environmental and marketing advantages over conventional systems (extensive and semi-intensive). In addition, it can be used at any stage of the culture (larvae, fingerlings and juveniles) as well as for keep a breeding stock (EMERENCIANO et al. 2013), however, few studies were carried out to evaluate the use of this technology for Brazilian native species, mainly prawns.

Farming of native prawns is a worldwide trend; China and India have been produced *Macrobrachium nipponense* and *M. malcolmsonii*, respectively, as alternative for *M. rosenbergii* culture (FAO 2016). In Brazil, Amazon River prawn (*M. amazonicum*) is important for ecology and economy in several regions, being registered from Amapá to the state of Paraná (MORAES-RIODADES & VALENTI 2002, MORAES-VALENTI et al. 2010) and it is a good option for native freshwater prawn culture. Therefore, this species may adapt well for different culture systems (intensive or extensive), due its less-aggressive behavior and its ability to grow in many aquatic environments (MACIEL & VALENTI 2009).

The objective of this work was to evaluate the use of biofloc technology to reared Amazon River prawn (*Macrobrachium amazonicum*).

This study was carried out in the Laboratório de Aquicultura (LAQ), Instituto Federal Catarinense (IFC).

One hundred Amazon River prawn juveniles (*Macrobrachium amazonicum*), average weight 3.88 ± 0.36 g, were divided into two experimental units, 50 animals per each.

Seven days before the stocking with prawn in experimental units (rectangular tanks, 0.72 m² x 0.35 m) with 250 L, water fertilization was carried out with a carbon source (sugar) and powdered diet to keep the carbon:nitrogen (C:N) ratio 10:1, (AVNIMELECH 1999, EBELING et al. 2006) resulting in an initial solids concentration of 100.0 mg L^{-1}. Seven days after prawn stocking, fertilization was maintained at 10:1 (C:N) to neutralize 40% of the feed nitrogen and to keep the ammonia below 1.0 mg L^{-1}. Calcium hydroxide was added when alkalinity fell below 30 mg L^{-1} $CaCO_3$, and when necessary, the dose was 10% of the daily ration.

Prawns were fed two times per day (9:00 and 15:00), with commercial diet (Guabi Poti Mirim QS 1.6 mm, 38.0% crude protein, 7.5% ethereal extract, 5.0% crude fiber, 13.0% ash, 3.0% calcium), with 3% of the prawn biomass. Biometric measurements were carried out weekly to check prawn growth and adjust the amount of feed offered.

Dissolved oxygen and temperature (YSI55; YSI Incorporated, Yellow Springs, OH, USA) were measured twice a day. Total suspended solids (TSS) (APHA 2005 − 2540 D), pH and alkalinity (APHA 2005 − 2320 B) and settleable solids (Imhoff cone) were monitored twice a week. Fiberglass microfilters (0.6 μm, GF-6 Macherey-Nagel, Düren, Germany) were used for TSS analysis. Ammonia (total ammonia nitrogen − TAN), nitrite-N and nitrate-N were also monitored twice a week according to APHA (2005). Survival, final weight, week weight gain, specific growth rate, food conversion ratio and yield were all determined after six weeks with the formulas described by (JATOBÁ et al. 2014).

Dissolved oxygen, temperature and pH were suitable for species (MACIEL &VALENTI 2009), however, for some weeks, ammonia nitrogen and nitrite were higher than the limits recommended for prawn (DUTRA et al. 2017), other water variables have not their lethal levels determined. Total suspended solids (TSS) may cause gill obstruction, but no one prawn was observed with these characteristics during the experiment, suggesting that TSS levels were adequate (Table 1).

Table 1. Water quality variables in tanks of Amazon River prawn (*Macrobrachium amazonicum*) juveniles reared in BFT.

Variables	Mean ± S.D.
Dissolved Oxygen (mg L^{-1}) morning	6.1 ± 2.2
Dissolved Oxygen (mg L^{-1}) afternoon	6.0 ± 1.9
Temperature (°C) morning	26.9 ± 2.1
Temperature (°C) afternoon	27.3 ± 2.2
Settleable solids (cm)	19.6 ± 20.6
pH	7.1 ± 0.2
Alkalinity (mg $CaCO_3$ L^{-1})	72.3 ± 13.6
Hardness (mg L^{-1})	88.7 ± 36.1
Ammonia Nitrogen (mg de NH_3 L^{-1})	2.4 ± 2.6
Nitrite (mg NO_2^- L^{-1})	4.3 ± 3.7
Nitrate (mg NO_3^- L^{-1})	6.4 ± 5.8
Total suspended solids (mg L^{-1})	150.9 ± 85.8

Level of nitrogenous compounds (ammonia, nitrite, and nitrate) shown oscillation during rearing period (Figure 1).

Which normally occurs during the process of floc formation while the nitrification process had not been established (AVNIMELECH 1999, EBELING et al. 2006). Hardness is an important water quality variable for freshwater prawn because some physiological processes, such as ecdysis, depend on the availability of Ca and Mg ions (BROWN et al. 1991), its level has increased over time due to calcium hydroxide in puts (Figure 2).

The growth performance of Amazon River prawn in BFT was better than that observed in prawns reared at different stocking densities (10, 20, 40 and 80 prawns m^{-2}) with survival rates were between 65.6 and 72.2% (MORAES-VALENTI & VALENTI 2007). The yield of the higher density (2,051 kg ha^{-1}; 80 shrimps m^{-2}) was four times lower than that observed in this study (Table 2).

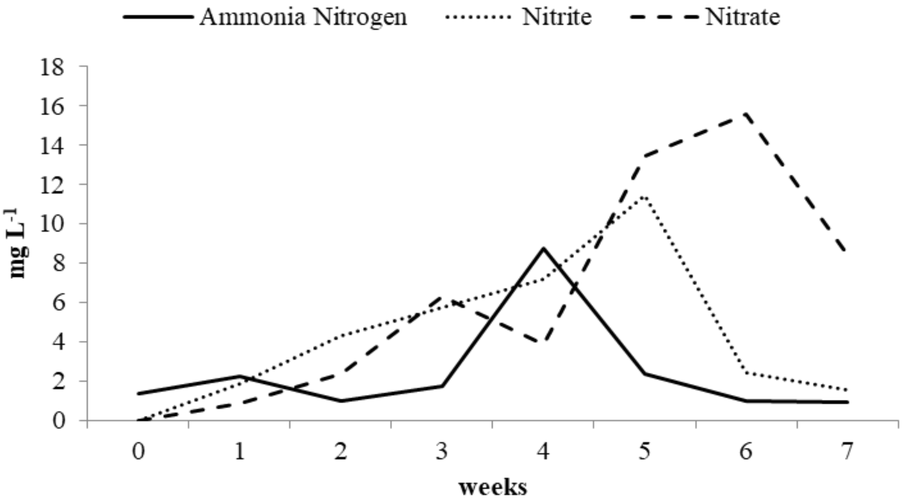

Figure 1. Variation (mean + S.P.) of nitrogen compounds of the water during Amazon River prawn (*Macrobrachium amazonicum*) juveniles reared in BFT.

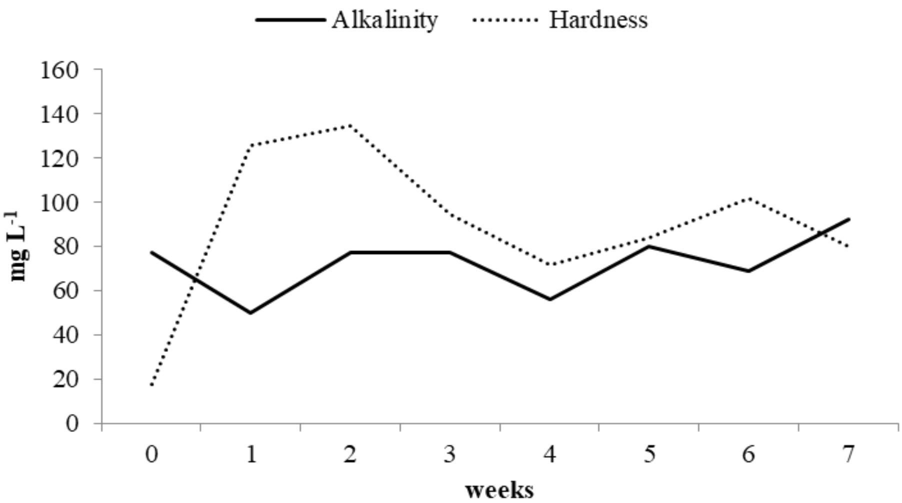

Figure 2. Variation (mean + S.P.) alkalinity and hardness of the water during Amazon River prawn (*Macrobrachium amazonicum*) juveniles reared in BFT.

Table 2. Growth performance of Amazon River prawn (*Macrobrachium amazonicum*) juveniles reared in BFT.

Variables	Mean ± S.D.
Mean of final weight (g)	5.36 ± 0.71
Mean of final length (cm)	7.89 ± 1.04
Survival (%)	77.67 ± 5.85
Food conversion ratio	2.98 ± 0.14
Specific growth rate (% dia^{-1})	0.61 ± 0.04
Week weight gain (g week^{-1})	0.29 ± 0.04
Yield (g m^{-3})	822.00 ± 17.75

However, these values are still lower than obtained by *Litopenaeus vannamei* reared in BFT that exceed 30 ton ha^{-1} (JATOBÁ et al. 2014).

The absence of records of the other zootechnical variables makes it difficult to compare the results, however considering other species of shrimp and prawn grown in BFT (EBELING et al. 2006, JATOBÁ et al. 2014). The specific growth rate was higher than that observed by MORAES-VALENTI & VALENTI (2007) that decrease from 0.6 to 0.4 % day^{-1} in the lowest and highest stocking density, respectively. The data obtained can improve, since little is known about its nutritional, physiological and environmental requirements within this culture system, being necessary the resumption of research with this species.

In conclusion it is possible to use BFT to maintain and rearing Amazon River Prawn (*Macrobrachium amazonicum*), however, to improve the performance it is necessary to define nutritional requirements, as well improve the management techniques for this specie in BFT.

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