# Combination of diet and water salinity in larviculture of piabanha-do-Pardo (*Brycon vonoi*, Lima 2017)[1]

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## ABSTRACT

Two experiments were carried out to study piabanha-do-Pardo (*Brycon vonoi*) larvae development. In the first, six different diets were evaluated, being *Artemia* sp., plankton, feeds, feeds + *Artemia* sp., feeds + plankton, and *Prochilodus hartii* (curimba) larvae. In the second, four different water salinity levels (0, 2, 4, and 6‰) were tested. Both assays were entirely randomized design experiments, lasting for 10 days. At the end of these trials, fish biomass, survival, total length, weight, and specific growth rate were measured. Additionally, water quality, temperature, oxygen, pH, and electric conductivity measurements were made every three days. The curimba larvae diet presented higher survival rate (47.2%) and biomass weight (2.5 g) than the other diets, which were similar among each other. Piabanha-do-Pardo larvae weight, length, and specific growth rate varied with the offered diets. All water salinity treatments showed better results than those observed for fresh water. When cultivated in 2‰ salinization, larvae had 52.5% survival rates and 0.49 g biomass weight, while in the fresh water these results were 6.6% and 0.23 g, respectively. To conclude, we may identify curimba larvae as an adequate diet, and a 2‰ water salinity as recommended if *Artemia* sp. larvae are fed to piabanha-do-Pardo larvae.

**Keywords:** *Artemia* sp.; cannibalism; characiforms; native species; diet management; *Prochilodus hartii*.

## RESUMO

### Combinações de alimentos e salinidade da água na larvicultura de piabanha-do-Pardo (*Brycon vonoi*, Lima 2017)

Foram conduzidos dois experimentos com larvas de piabanha-do-Pardo *Brycon vonoi*. No primeiro ensaio, avaliaram-se seis dietas: *Artemia* sp., plâncton, ração, ração + *Artemia* sp., ração + plâncton, larvas de *Prochilodus hartii* (curimba). No segundo, quatro salinidades de água (0, 2, 4 e 6‰), ambos os experimentos em delineamento inteiramente casualizado, com duração de 10 dias. A biomassa, sobrevivência, comprimento total, peso e taxa de crescimento específico foram mensurados ao final dos experimentos; já os parâmetros de qualidade de água, temperatura, oxigênio, pH e condutividade elétrica foram aferidos a cada três dias. O alimento larva de curimba resultou em maior sobrevivência (47,2%) e biomassa (2,5 g) do que os demais tipos, que foram similares entre si. O peso, o comprimento e a taxa de crescimento específico não diferiram entre si para as larvas alimentadas com os diversos tipos de alimento. Todos os tratamentos com salinização apresentaram melhores resultados em relação a água doce sem salinização. No entanto, quando cultivadas sob 2‰ de salinização, as larvas apresentaram 52,5% de sobrevivência e 0,49 g de biomassa, e em água doce sem salinização foram observados apenas 6,6% e 0,23 g, respectivamente. Conclui-se que a utilização de larvas de curimba como dieta é o mais adequado e recomenda-se salinizar a água com 2‰, caso seja fornecida artêmia como alimento.

**Palavras-chave**: *Artemia* sp.; canibalismo; characiformes; espécie nativa; manejo alimentar; *Prochilodus hartii*.

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## INTRODUCTON

Piabanha-do-Pardo (*Brycon vonoi*, Lima 2017) is pointed out as a potential species for fish farming given its flavorful meat, excellent response to induced procreation, good acceptance to artificial diet, and great adaptation to captive breeding (Alves *et al*., 2008). Additionally, technology development in native Brazilian fish production has been a perceived need since the larval stage is a bottleneck for national large-scale fish farming. This is the case of the following fish species: piracanjuba (*Brycon orbignyanus*) (Pedreira, 2003), matrinxã (*Brycon cephalus*) (Pedreira *et al*., 2006), matrinxã-do-São-Francisco (*Brycon orthotaenia*) (Pedreira *et al*., 2008b) and piabanha-do-Pardo (*B. vonoi*), which become cannibals a few hours after hatching.

Live food is used in some larvae diet as a key to production success, such as in the case of piabanha-do-Pardo (fish farming) and other species of the *Brycon* sp. genus, which also present elevated cannibal conduct. Kubitza (2003) emphasized the importance of natural feeds in larviculture because their higher nutritional value, by which fish can balance their diets choosing items normally found in natural habitats. However, when cultivation is performed in captivity, foods must be selected in order to fulfill these requirements.

The majority of fish species larvae are not used to accept artificial diets. When accepting, these fish species usually present unsatisfactory growth rates since they have an undeveloped digestive system (Dabrowski, 1984). Providing food with high biological value, as most planktonic organisms, is important to guarantee success during the initial phase (Furuya *et al.,* 1999). This aspect is quite important as allows intensive breeding density to be higher, as seen in ornamental cyprinid larvae, *Epalzeorhynchus frenatus* (Jha, 2010).

Forage fish larvae such as some species of curimba (Prochilodus sp.), which easily reproduce, have also been used as food in larviculture of many fresh water species, being thus considered an excellent food source for initial (growth) phases (Schütz & Nuñer, 2007). Conversely, high costs and difficulty to find adequate products to perform induced fish reproduction has forced farmers to seek for alternative live feedstuff. Within these alternatives, a microcrustacean, *Artemia* sp., has stood out due to its easy reproduction and excellent nutritional value (Conceição *et al*., 2010). Yet, this microcrustacean is originally a marine species and its survival rate is greatly reduced when maintained in fresh water. A manner for fresh water fish larvae to take better advantage of the nauplii (crustacean larval form) is to perform larviculture in slightly salinized water (Beux & Zaniboni-Filho, 2007), which also helps to avoid pathogens and reduces fish stress (Baldisserotto, 2002).

Given the above background, this study has the objective of evaluating types and combinations of food and water salinities in piabanha-do-Pardo larviculture.

## MATERIAL AND METHODS

Two fish farming experiments were performed in the Machado Mineiro hydroelectric plant dam, which is managed by the Energy Company of Minas Gerais State (CEMIG). This plant is located in the town of Águas Vermelhas (- 15º44’ S and - 41º27’ W), in the Rio Pardo river basin, north of Minas Gerais state (Brasil). Larvae from breeders, captured in the Rio Pardo Basin, were induced to spawn to supply both experiments with the required amount of food. Females received two applications of carp pituitary extract (0.5 and 5.0 mg/kg), with an interval of 12 h between applications. Males received only one dose (1.5 mg/kg) at the same time as the first female dose (Zaniboni-Filho & Barbosa, 1996). After fertilization, eggs and larvae were monitored for identification of the moment when larvae developed horizontal swimming movements. At this time, larvae presented reduced contents of the vitelline sac. Fifteen animals were placed in 10% formalin for future biometry.

To fulfill the goals proposed, two assays were performed. The first occurred between December 3 and 13 of 2008. Larvae weighing on average 2.4 ± 0.02 mg and being 7.82 ± 0.46 mm long were used. The animals were individually counted and randomly transferred to 18 four-liter aquariums, at storage densities of 15 larvae/L, or 60 individuals/ aquarium. All aquariums were supplied with constant aeration and natural photoperiod.

The experimental design was an entirely randomized block composed of six treatments and three repetitions each. Piabanha-do-Pardo larvae were fed the following diets: *Artemia* sp. nauplii, plankton, feed, feed + *Artemia* sp., feed + plankton, and curimba larvae (*Prochilodus hartii*). Plankton was collected daily from an external tank using a 65-µm mesh collector net.

Aliquots of 12.5 g cysts were used to obtain *Artemia* sp. nauplii, which were submitted to hydration, hypochlorite wash, and later, put to hatch in five-liter incubators, being supplied with constant aeration and 30‰ water salinity. After 24 h, screen concentration and nauplii were washed; then, they were counted for density estimation, and finally supplied to piabanha-do-Pardo larvae. The commercial powder fish feed used contained 55% minimum crude protein, 4% minimum lipids, 6% maximum crude fiber, 10% maximum humidity, 10% maximum mineral matter, 5% maximum calcium, and 1.5% minimum phosphorus.

The food was supplied freely three times per day at 8 a.m., 12 p.m., and 4 p.m., being always careful for excess.

For the second assay, performed between the 13th and 23rd of December 2008, the average larvae used were 7.77 ± 0.48 mm long and weighed 2.2 ± 0.03 mg. The animals were individually counted and randomly transferred to 12 four-liter aquariums containing water, at storage densities of 15 larvae/L and 60 individuals/aquarium. All aquariums were supplied with constant aeration and natural photoperiod.

This experiment was also carried out under an entirely randomized design with four different levels of salinity (0, 2, 4, and 6‰) and three repetitions each. *Artemia* sp. nauplii were supplied freely three times per day at 8 a.m., 12 p.m., and 4 p.m., always aware of food surpluses. Again, the same procedures of the first assay were adopted to obtain *Artemia* sp. nauplii.

In both experiments, siphoning of aquarium water was performed daily to remove excess food and feces. About 30% of the water volume of each aquarium unit was replaced daily. Physical and chemical water parameters, such as temperature (ºC), dissolved oxygen (mg/L), pH, and electric conductivity (µS/cm), were monitored every three days before cleaning.

At the end of the experiments, the larvae were weighed and counted to determine the biomass weight and survival rate, respectively. They were later desensitized and put into 10% formalin for weighing on an analytic scale (0.1 mg precision), and total and standard length measurements (mm). The later was only measured on samples from the salinity experiment, using a pachymeter (0.02 mm precision) on 15 animals from each experimental aquarium unit. Using the average results of initial weight ($Pt_i$) and final weight ($Pt_f$) of each repetition, specific growth rates were calculated using the expression: $TCE = 100 (\ln Pt_f - \ln Pt_i)/Dt$; Dt representing the time duration in days between sampling.

The data regarding water quality, survival, weight, biomass, total length, and specific growth rate of the feeding experiment were submitted to variance analysis (ANOVA). The average measurements were compared by the Tukey's test at 5% probability. The trend effect of different salinities on biological parameters and water quality was verified by submitting the obtained data to a variance analysis at 5% probability level and to a subsequent linear regression for conductivity and polynomial regression of the second degree for the other parameters, using the SAS software version 9.0 (Statistical Analysis System, 2002).

## RESULTS AND DISCUSSION

Piabanha-do-Pardo larvae began exogenous feeding only after the yolk reserve was totally absorbed, between 24 and 48 hours after hatching. On one hand, this result is in agreement with those found for sturgeon larviculture (*Acinpenser baeri*) (Gisbert & Williot 1997) but differs from the findings of Atencio-Garcia *et al.* (2003), who observed exogenous feeding in yamú (*Brycon siebenthalae*) still with abundant yolk reserves.

The best biomass and survival rates (Table 1) were obtained when piabanha fish were fed curimba larvae. This data is in consonance with those found in the first feeding of yamú (Atencio-Garcia *et al*., 2003) and dourado (*Salminus brasiliensis*) (Schütz & Nuñer, 2007). These studies verified an improvement of animal development and decreasing of cannibalism by using forage larvae. Optimum results were also attained when matrinxã-do-São-Francisco larvae were fed curimatá-pioa (*Prochilodus costatus*) larvae (Pedreira *et al*., 2008b) when compared to matrinxã fed plankton (Pedreira *et al*., 2006) or piracanjuba larvae fed plankton or feeds (Pedreira, 2003).

Larvae from other species have been used as food to improve growth (length and weight) and survival rates in *Brycon* sp larviculture because they lessen cannibalism. Tambaqui (*Colossoma macropomum*), pacu (*Piaractus mesopotamicus*), curimba (*Prochilodus margrave*) (Ceccarelli & Senhorini, 1996), and curimatá-pioa (Pedreira *et al*., 2008b) are all examples of larvae species used in *Brycon* sp. feeding. Larvae of curimba (*P. hartii*) are also used to feed piabanha-do-Pardo (Coraspe-Amaral *et al*., 2012) larvae (Coraspe-Amaral *et al*., 2012).

This can be explained because of an enhanced cost/benefit proportion when large preys are captured. It happens with piabanha larvae due to their large buccal cavity and excellent visual perception. Therefore, larger preys improve fish development. However, Saccol-Pereira & Nuñer (2003) tested different diets (*Artemia* sp., commercial feeds, and curimbatá larvae) on piracanjuba larviculture and found no influence of these preys on animal growth rates.

All the larvae fed exclusively feeds died after the fifth day of experiments. This result was similar to those obtained by Feiden *et al.* (2005) for Surubim-do-Iguaçu (*Steindachneridion* sp.) larvae. In quinguio (*Carassius auratus*) larviculture, Soares *et. al.* (2000) also verified 100% mortality for animals fed exclusively artificial diets. The same authors reported a few fish species whose larvae accept or satisfactorily develop eating inert or artificial food. Such fact occurs because these animals have underdeveloped digestive and enzymatic systems at this stage of life. Moreover, inert food is barely perceived, arousing less interest from larvae compared to live baits (Tesser & Portella, 2006). However, *Brycon* sp. larvae fed plankton and feeds captured feedstuff during their first days of life (Pedreira & Sipauba-Tavares 2002; Pedreira *et al*. 2008b; Silva *et al*. 2009).

For a large portion of characiform larvae, the same order as *Brycon* sp., live foods are a necessity during their first days of life. They are unable to digest artificial feeds, therefore present low growth, and survival rates when fed this type of nutrition. Some examples species are matrinxã (*B. cephalus*) (Ceccarelli & Senhorini, 1996), tambaqui (*C. macropomum*) (Pedreira *et al*., 2015) and some Silurifirmes, like surubim-do-Iguaçu (*S. melanodermatum*) (Feiden *et al*., 2006) and pacamã (*Lophiosilurus alexandri*) (Pedreira *et al*., 2008a). Nevertheless, when feeds were offered in association to plankton, piracanjuba larvae were capable of absorbing theses feeds and, consequently, presented better yield than did those fed exclusively plankton (Pedreira & Sipaúba-Tavares, 2002), which contrasts the results observed for piabanha-do-Pardo.

Piabanha-do-Pardo larvae only seized feeds from the third day of life onwards. Thus, it should be offered from the fifth day on to avoid food waste and water quality degradation. In some *Brycon* sp. larviculture, the feed was offered only after the third (Pedreira & Sipaúba-Tavares, 2002; Coraspe-Amaral *et al*., 2012) and fifth days of life (Pedreira *et al*., 2008b; Silva *et al*., 2009).

Both artificial feeds and plankton modified water quality by increasing its acidity in comparison to the *Artemia* sp. feeding (Table 2). These results are in agreement with those found by Pedreira *et al*. (2008), who supplied pacamã larviculture with feeds and observed a pH decrease, deteriorating water quality. These authors also verified higher survival rates and biomass variability within aquariums supplied feeds, even without general yield changes. In the same group, some aquariums showed high survival rates, others low, while aquariums in the group fed only live foods maintained higher and more homogeneous results for survival and biomass gains. Therefore, live foods are proper for cultivation. The monitoring of water quality is essential since increasing mortality rates or larval development impairment may occur when it abruptly changes (Auld & Schubel, 1978).

Water from treatments containing plankton had lower pH values than those from treatments using *Artemia* sp. Feiden *et al*. (2006) also observed this pattern. Differently, other larviculture tests showed slight pH variations (Soares *et al*., 2000), suggesting variability as a function of plankton composition and plant conditions. The pH was measured in all treatments varying from a minimum of 6.8 ± 0.01 to a maximum of 7.4 ± 0.02, averaging 7.1 ± 0.17. These results were all within common pH levels for piabanha-do-Pardo pisciculture (Coraspe-Amaral *et al*., 2012), as well as in fish farming practices for other species of this genus (Pedreira, 2003; Reynalte-Tataje *et al*., 2004; Pedreira *et al*., 2006; Pedreira *et al*., 2008b).

Higher electric conductivity measured in *Artemia* sp. treatments was due to the salt water carried over from the hatching period. Similar conditions were observed by Soares *et al.* (2000) and Feiden *et al.* (2006), who registered conductivity variation depending on whether *Artemia* sp. was washed or not. Despite these distinctions in conductivity, all results were within the common piabanha-do-Pardo fish farming practices

**Table 1:** Average results (± standard deviation) of weight, total length (TL), survival (S), biomass, and specific growth rate (SGR) for piabanha-do-Pardo (*Brycon vonoi*)

| Diets | Weight (mg) | TL (mm) | S (‰) | Biomass (g) | SGR |
|---|---|---|---|---|---|
| *Artemia* sp. nauplii | 87.8±1.89 | 20.9±1.18 | 8.3±7.63[b] | 0.1±0.06[b] | 36.0±0.21 |
| Plankton | 87.8±2.51 | 19.4±0.88 | 4.4±1.92[b] | 0.1±0.03[b] | 35.9±0.29 |
| Commerial Feed* | - | - | - | - | - |
| Commerial Feed + *Artemia* sp. | 88.2±1.45 | 21.0±1.21 | 1.6±0.01[b] | 0.1±0.02[b] | 36.0±0.15 |
| Commerial Feed + Plâncton | 85.7±12.56 | 20.0±1.11 | 2.2±0.95[b] | 0.1±0.05[b] | 35.6±1.48 |
| Curimba larvae | 89.1±6.37 | 21.6±1.02 | 47.2±7.51[a] | 2.5±0.58[a] | 36.1±0.71 |

Averages in the same column followed by different letters are differed by Tukey's Rage Test (P < 5%). *Mortality of all samples.

**Table 2:** Average results (± standard deviation) of physical and chemical water parameters obtained during the experiment with piabanha-do-Pardo larvae (*Brycon vonoi*) submitted to different diets

| Diets | Conductivity (µS/cm) | pH | T (ºC) | $O_2$ (mg/L) |
|---|---|---|---|---|
| *Artemia* sp. nauplii | 458.3±25.73[a] | 7.2±0.07[b] | 23.6±2.1 | 7.2±0.2 |
| Plankton | 39.8±0.43[c] | 7.0±0.07[c] | 23.5±2.1 | 7.4±0.2 |
| Commerial Feed* | 35.6±1.18[c] | 6.8±0.01[d] | 23.4±2.1 | 7.3±0.3 |
| Commerial Feed + *Artemia* sp. | 205.5±5.82[b] | 7.0±0.00[c] | 23.5±2.1 | 7.2±0.3 |
| Commerial Feed + Plâncton | 44.1±0.64[c] | 6.9±0.01[d] | 23.4±2.1 | 7.2±0.2 |
| Curimba larvae | 39.7±0.64[c] | 7.4±0.02[a] | 23.4±2.1 | 7.2±0.2 |

Averages in the same column, followed by different letters, are differed by Tukey's Rage Test

(Coraspe-Amaral *et al*., 2012) as well as in farming practices of other *Brycon* sp. (Pedreira, 2003; Pedreira *et al*., 2006; Pedreira *et al*., 2008b).

Since all results for water quality corroborate those recorded by other authors in other fish farming models, as described above, pH, electrical conductivity, and dissolved oxygen were all within *Artemia* sp. comfort zone.

There was no statistical difference in final average weight, total average length, and specific growth rate among the samples taken from different treatments. The individuals fed *Artemia* sp. nauplii, plankton, or either of them, in association to feeds, became predators of their counterparts and, consequently, reached good growth results. Yet these treatments presented low survival rates, following the same pattern of results obtained by Coraspe-Amaral *et al*. (2012) for this same species.

Similarly, the addition of feeds to zooplankton and *Artemia* sp. had no effect on weight or length of piracanjuba larvae (Pedreira & Sipaúba-Tavares, 2002), which also presented low survival rates due to cannibalism. However, the authors did record higher survival rates and biomass when zooplankton was combined with feeds.

Pedreira *et al.* (2008a) concluded there is no improve in larval development by adding feeds into the diet, indicating low or lack of capacity to absorb the feeds offered. Nonetheless, some authors verified improved breeding conditions in larviculture of different fish species by adding feeds to plankton or to *Artemia* sp., e.g. quinguio (*C. auratus*) (Soares *et al.*, 2000), surubim-do-Iguaçu (*Steindachneridion* sp.) (Feiden *et al.*, 2006), and mandi-pintado (*Pimelodus britskii*) (Diemer *et al.*, 2010).

The use of *Artemia* sp. nauplii and plankton as primary food resources for piabanha-do-Pardo larvae were inefficient, which possibly favored cannibalism and low survival rates in both treatments. This can be explained by the composition variability of the zooplankton

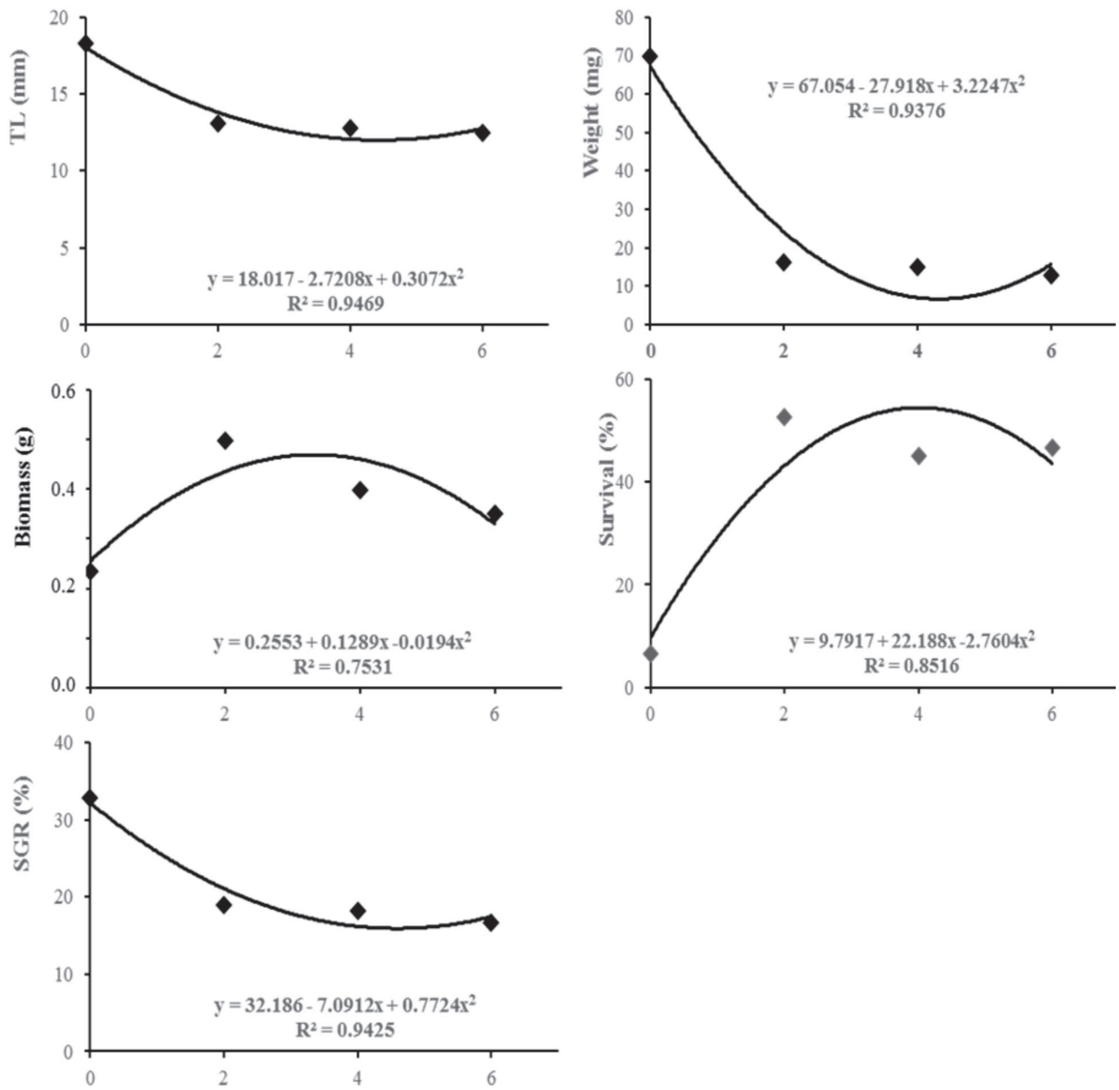


**Figure 1:** Second-degree polynomial regression equations of piabanha-do-Pardo (*Brycon vonoi*) larvae development in different water salinities (0, 2, 4 and 6‰).

communities, which could contain predatory organisms, competitors, and heterogeneity in microorganism size (Cestarolli *et al*., 1997). Although the *Artemia* sp. nauplii presented similar results, they should be further studied, because they present homogeneous size, essential amino acid richness, fatty acids, vitamins, and minerals, serve an important pigmentary role (Faria *et al*., 2006) and are easy to produce at a laboratory level.

Native fish larvae with cannibalistic tendencies prefer eating forage fish larvae, such as curimba (*Prochilodus* sp.). Therefore, this feeding technique has been used in *Brycon* sp. larviculture (Coraspe-Amaral *et al*., 2012; Pedreira *et al*., 2008b). However, further studies testing other live feeding options is necessary to discover new ways to lower production costs, better functionality and produce more positive and constant results (Schütz *et al*., 2008), other than those observed here.

In the second assay, animal survival rate and biomass were positively influenced by all levels of salinity. At 2‰ salinity, slightly better cultivation results were reached if compared to the level of 0‰ salinity (Figure 1). This might have been due to an improved distribution of *Artemia* sp. nauplii in the water column and their longer survival time, which promoted more time for the piabanha-do-Pardo larvae to feed. These *Brycon* larvae were initially attracted to moving prey because of their reduced visual capacity, mainly within the first days of life.

This data is in agreement with the findings of Luz & Santos (2008), who evaluated pacamã larvae tolerance to different water salinities, during initial development phases. These authors recommended using 4‰ salinity. However, they also affirmed the use of a 6‰ salinity for larvae after 8-12 days of hatching. Therefore, the response of the larvae to different levels of salinity may vary according to species (Luz & Santos, 2008) and age. Likewise, jundiá *Rhamdia quelen* larvae presented decreased survival rates (98[a], 93[a], 79[a], 30[b], 7[c], 0, 0 and 0%) as salinity was increased (0, 2, 4, 6, 8, 10, 15 and 20‰, for 96 hours) throughout the experiment after 3 days of hatching and in its initial exogenous feeding stage (Fabregat *et al*., 2015). As in this research, Fabregat *et al.* (2015) also recommend 2‰ water salinity in intensive larviculture of jundiá, a native Brazilian species. Altinok & Grizzle (2001) evaluated the effect of water salinity on the development of six different species of young fish and found water salinization is detrimental to *channel catfish* (*Ictalurus punctatus*) and quinguio (*C. auratus)*. On the other hand, growth and weight gain had no effect from salinity when testing Nile tilápia (*Oreochromis niloticus*) (Moreira *et al*., 2011), i.e. larvae cultivated in salt water presented the same results as those cultivated in fresh water.

An improved osmotic balance between the larvae and the medium may also have favored water salinity treatments. Since fresh water fish are hyperosmotic in relationship to

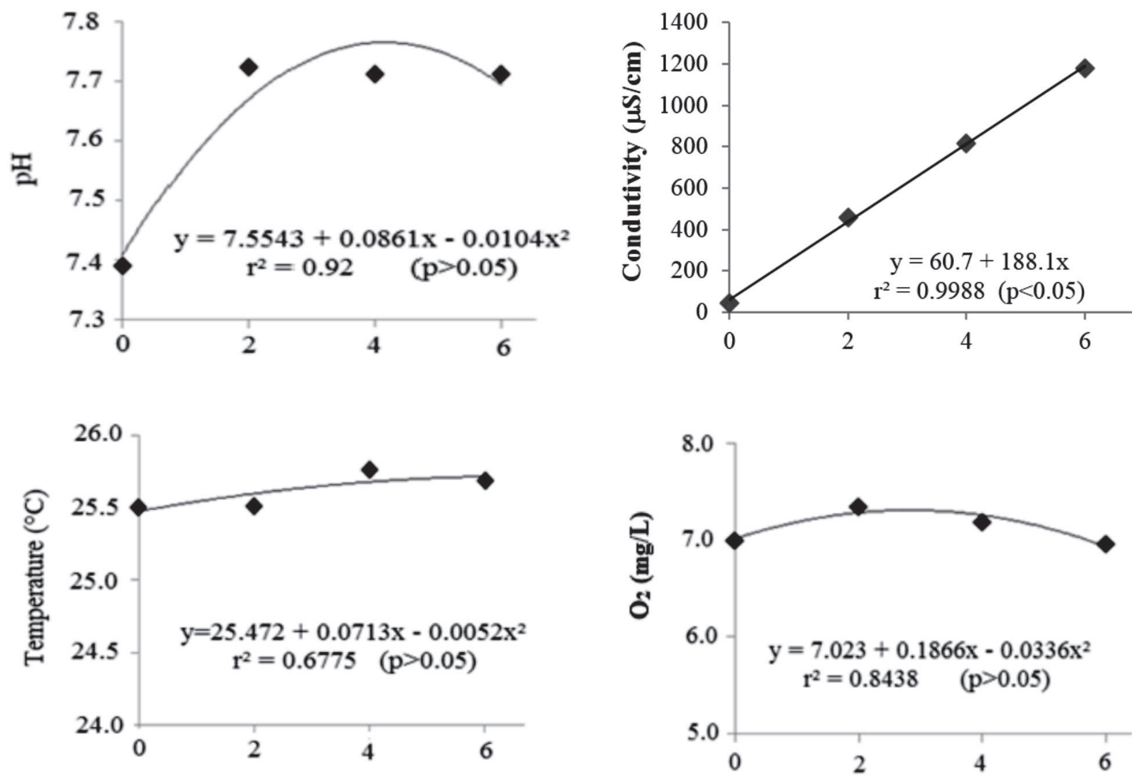


**Figure 2:** Regression equations between physical and chemical water parameters in piabanha-do-Pardo (*Brycon vonoi*) larviculture in different salinities (2, 4, and 6‰).

their medium, they tend to lose ions easily, but in salty mediums, this rarely happens. Simultaneously, salt avoids pathogen proliferation, which reduces animal stress and mortality probability (Baldisserotto, 2002). Other papers have also confirmed the benefits of using salt water in fish farming (Beux & Zaniboni-Filho, 2007; Kubitza, 2007). However, usage levels should vary according to the species and age. Although 4 and 6‰ salinity had increased larvae survival and biomass rates when compared to fresh water (0‰) larvae, these results were inferior to those obtained from larvae in 2‰ salinized water. This indicates certain stress by larvae when salinity was too high, which was also the case of pacamã larvae (Luz & Santos, 2008). Altinok & Grizzle (2001) had already described salinity effects on fish energy cost and response.

Average weight, length, and specific growth rate in salt water were superior to the results obtained from animals cultivated in fresh water (0‰). Nonetheless, when these data are analyzed in association with survival and biomass rates, the individuals preyed on their counterparts. Thus, cannibalism promoted a better development of these samples, because *Artemia* sp. nauplii had a shorter survival time when compared to other treatments, and, consequently, became less attractive to piabanha-do-Pardo larvae. These results are in agreement with those obtained by Beux & Zaniboni-Filho (2007), who tested pintado larvae (*Pseudoplatystoma corruscans*).

Temperature, pH, and dissolved oxygen concentration were similar in all treatments and presented average values of 25.5 ± 1.04 ºC, 7.4 ± 0.17, and 7.11 ± 0.2 mg/L, respectively. All of these results were within the limits observed in larviculture of piabanha-do-Pardo *Brycon* sp. (Coraspe-Amaral *et al*., 2012; Costa *et al*., 2013) and of other *Brycon* (Pedreira, 2003; Pedreira *et al*., 2006; Pedreira *et al*., 2008b). Yet the electric conductivity of water (Figure 2) increased as water salinity was raised, due to increased ions release caused by salt, as observed by Camargo *et al.* (2006). However, this alteration did no influence the development of the animals.

## CONCLUSIONS

Within the types of foods evaluated, curimba larvae improve piabanha-do-Pardo larviculture performance.

When piabanha-do-Pardo larvae are fed *Artemia* sp. nauplii, a 2‰ water salinity is recommended for prey survival and biomass rates increase.

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