

NOTAS E COMUNICAÇÕES

PRELIMINARY OBSERVATIONS ON THE EFFECT OF SUDDEN CHANGES OF TEMPERATURE ON SURVIVAL OF YOUNG MATRINXÃ (*Brycon cephalus*) UNDER LABORATORY CONDITIONS

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ABSTRACT - Matrinxã is a very promising amazonian fish for fish culture in Brazil. This study is aimed at determining the approximate tolerated temperature range in this species. Groups of ten young matrinxã specimens (15.1±0.8 cm average length and 58.3±10.3 g average weight) were subjected to 9 different temperatures for 24 hours without previous acclimation. Fish were transferred from an initial temperature of 27 °C to those ranging from 12 to 39 °C at 3 °C intervals. Both 12 °C and 39 °C temperatures were lethal for this species with 100% mortality rate. Following 2 minutes of exposure to 39 °C fish changed behavior, showing an increase in opercular movements and erratic swimming; mortality reached 100% after 18 minutes. At 12 °C, fish lost equilibrium immediately after exposure and started swimming erratically; after only 4 minutes fish became lethargic and remained immobile on the bottom of the tank. Total mortality was only evident following 24 hours. At 15 °C matrinxã lost equilibrium after 5 to 6 minutes of exposure but mortality was only 20% after 24 hours. Fish tolerated well temperatures ranging from 18 to 36 °C with 100% survival after 24 hours. This preliminary study suggests that temperatures between 18 and 36 °C are the approximate range normally tolerated by this species, although survival at other temperatures may be increased by gradually acclimating fish to the more severe increases or decreases in temperature. In addition, it indicates that matrinxã may be cultivated over a wide geographical area.

Key-words: matrinxã, *Brycon cephalus*, temperature, thermal tolerance.

Observações Preliminares sobre o Efeito de Mudanças Bruscas de Temperatura na Sobrevivência de Juvenis de Matrinxã (*Brycon cephalus*) em Condições de Laboratório.

RESUMO - O matrinxã é um peixe amazônico muito promissor para a piscicultura brasileira. Este trabalho visou determinar a amplitude aproximada de temperatura tolerada por esta espécie. Grupos de 10 matrinxãs jovens (15,1±0,8 cm de comprimento médio e 58,3±10,3 g de peso médio) foram submetidos durante 24 horas a 9 diferentes temperaturas sem aclimação prévia. Os peixes foram transferidos de 27 °C a temperaturas que variaram de 12 a 39 °C a 3 °C de intervalo. Temperaturas de 12 °C e 39 °C foram letais para o matrinxã com 100% de mortalidade. Após 2 minutos a 39 °C os peixes mudaram de comportamento aumentando os movimentos operculares e nadando erratically; a mortalidade foi de 100% após 18 minutos. Aos 12 °C os peixes perderam o equilíbrio imediatamente após introduzidos e começaram a nadar erratically; após 4 minutos tornaram-se letárgicos e imóveis no fundo do tanque. Mortalidade total foi evidenciada somente após transcorridas as 24 horas. Aos 15 °C os peixes mostraram perda de equilíbrio após 5 a 6 minutos de exposição mas a taxa de mortalidade foi de apenas 20% após 24 horas. Os peixes toleraram bem temperaturas entre 18 e 36 °C com 100% de sobrevivência após 24 horas. Este estudo preliminar indica que temperaturas entre 18 a 36 °C são normalmente toleráveis pelos matrinxãs jovens, muito embora a sobrevivência a outras temperaturas possa ser aumentada por meio de aclimação gradual dos peixes a aumentos e decréscimos mais severos na temperatura. Adicionalmente, o estudo indica que o matrinxã pode ser cultivado em extensa área geográfica.

Palavras-chave: matrinxã, *Brycon cephalus*, tolerância térmica.

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The genus *Brycon* is widely distributed throughout the neo-tropical region, from Honduras down to Rio de la Plata, Argentina, comprising about 60 nominal species, from which 40 are considered to be valid species (Howes, 1982). The taxonomy of this group is still poorly known but *matrinxã*, *Brycon cephalus* GUNTHER, 1869, the species addressed by this study, is endemic and abundant in the Brazilian Central Amazon. This species is relatively important as a fishery catch in the Amazonas State, Brazil, where it is much appreciated by the local people. Between 1994 and 1997 it represented about 13.5% of the whole fish production in Manaus (Federação dos Pescadores dos Estados do Amazonas e Roraima, 1998). *Matrinxã* is considered to be a very promising species for aquaculture in Brazil. Bard (1976) pointed *Brycon* as a good candidate for fish culture and Gery (1977) compared the genus to trouts, calling it "South American trout". It is an omnivorous fish, it grows very fast feeding on artificial diets, and is resistant to handling and poor water quality, as in hypoxic conditions when the fish develops a dermal extension of the inferior lip to catch oxygen from the upper layer of the water surface, a phenomenon known as "aiú". This fish, like other characoids, does not spawn spontaneously in captivity but the techniques for inducing reproduction are widely disseminated through the use of reproductive hormones. In Manaus, Brazil, the National Institute for Amazon Research, INPA, has routinely induced reproduction in *matrinxã* managed in different conditions (earthen ponds, recirculating tanks and "igarapés" - small streams) and conducted preliminary studies on the neuro-endocrine regulation of reproduction by measuring the levels of steroid hormones (testosterone and estradiol) and calcium in the blood plasma of broodstocks during the reproductive period (Fim *et al.*, 1999). The most usual method for egg incubation and larviculture is that described by Woynarovich & Horváth (1989), common for various species. Cannibalistic behavior among early larvae is a particular problem that affects productivity during larviculture of *matrinxã*. Tests with different feeding conditions, photoperiod, shelter, water turbidity and turbulence have been conducted by INPA's researchers in

laboratory, in order to identify the main factors that affect cannibalism (Fregadolli, 2000). Nevertheless, it is a problem that still needs to be solved. *Matrinxã* has been introduced for aquacultural purposes in other regions of Brazil where sudden changes of temperature and amplitudes broader than 15 °C may be found (Lopes *et al.*, 1995). Due to the lack of information on the response of this fish to critical temperatures, this preliminary study aims to determine the approximate temperature range tolerated by this species under laboratory conditions without acclimation for 24 hours.

Groups of ten young *matrinxã* specimens caught from the wild (15.1±0.8 cm average length and 58.3±10.3 g average weight) were transferred from the initial temperature of 27 °C to 9 different temperatures ranging from 12 to 39 °C, at 3 °C intervals, without previous acclimation, and kept in these conditions for 24 hours. Isothermal 120 L capacity tanks containing 80 L of well aerated water at the desired temperature were used for each ten fish group. Every tank was covered with a net to prevent fish from escaping. Test temperatures were controlled during the test period in ±1°C by adding warm water or ice into each experimental unit. After being introduced into the new environment, the fish behavioral responses were closely observed for the first hour and recorded during 24 hours, after which survival rates were also recorded.

Survival rates at each temperature are shown in Figure 1. 12 °C - Very strong thermal shock. Immediately after being placed at this temperature fish showed a short swimming response and total loss of equilibrium, swimming laterally and upside down. After four minutes fish stayed lethargic on the bottom of the tank with feeble movements. After one hour, fish remained on the bottom without apparent movements. Mortality was only evident after 24 hours and survival was 0%. 15 °C - Short swimming response. Soon after being introduced into this temperature condition fish started to swim quickly and, sometimes, laterally. Signs of loss of equilibrium started five to six minutes after exposure with fish swimming agitated, laterally and upside down, near to the surface and hitting the walls of the tank. After 16 minutes fish started

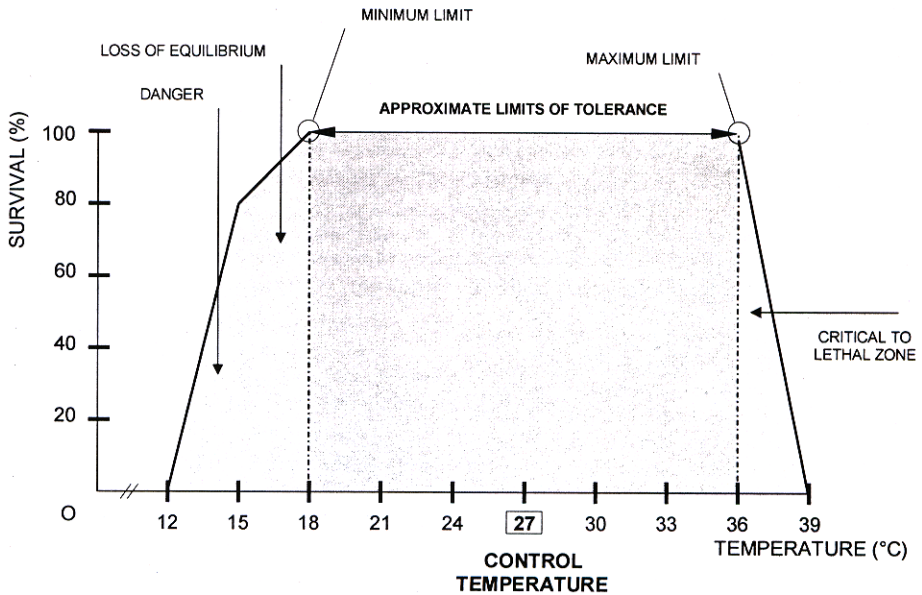


Figure 1 - Survival rates of young matrinxã at different temperatures following 24 hours without acclimation.

recovering movements and following about 23 minutes half of them could swim almost normally. After one hour fish started again showing signs of lost equilibrium and lethargy. Survival was 80% following 24 hours. 18 °C - Normal swimming response. Fish were constantly swimming in the middle of the water or close to the bottom with no signs of agitation. Opercular movements were apparently slow. Following one hour some fish showed opaque eyes and reddish mouth but were in good condition and swimming normally. Survival was 100% following 24 hours. 21 °C - Normal swimming response. Initially fish were swimming calmly. Following 10 minutes fish started showing signs of agitation jumping against the net cover and breathing near the water surface. Following one hour exposure fish were behaving normally again. Survival was 100% following 24 hours and fish were apparently in excellent condition. 24 °C - Normal swimming response. After being introduced into this temperature condition fish remained quiet with few swimming movements. Following about 10 minutes fish started swimming more vigorously and started breathing near the water surface or close to the

eration stone. Following 40 minutes some fish tried to escape jumping against the net cover, while others stayed close to the water surface to catch oxygen. After one hour survival was 100% and fish were apparently in excellent condition after 24 hours. 27 °C - Control Temperature. 30 °C - Normal swimming response. During the first hour fish behaved normally, swimming calmly in the middle of the water. Survival was 100% and fish were apparently in excellent condition after 24 hours. 33 °C - Normal swimming response. Soon after being introduced into this temperature condition, fish were swimming quickly near to the bottom of the tank. Following one hour fish were behaving normally with no sign of agitation. Following the test period water was opaque, frothy and with a typical smell of bacterial development. Survival was 100% after 24 hours with fish in excellent condition. 36 °C - Initial swimming response was normal. After being introduced into the water fish behaved normally, swimming close to the bottom of the tank with no sign of agitation. Following one hour fish were still behaving normally but, sometimes, trying to escape jumping against the net cover. Bacterial

development in the water was very pronounced. Water was opaque, frothy and with a typical smell after the test period. Survival was 100% after 24 hours with fish in good condition. 39 °C - Critical swimming response. Immediately after being introduced into this temperature condition, fish were very agitated, swimming intermittently and trying to escape. After two minutes fish showed signs of hypoxia, breathing close to the water surface and swimming vertically, laterally or upside down. After four minutes fish lost equilibrium and were extremely agitated hitting the walls of the tank. After 15 minutes nine fish were dead and one was moribund, dying three minutes later. Survival was 0% after only 18 minutes.

The temperature of 12 °C seemed to have a lethal effect on young matrinxã after a relatively short period of exposure, but total mortality was only evident following 24 hours. After two hours at this temperature it was also observed that fish could recover their movements gradually if transferred to temperatures of 18 °C or above. When subjected to 27 °C fish were totally recovered following four hours. Danger seemed to be imminent at 15°C, since mortality was 20% within 24 hours. Also, due to the general condition of survivors, there was no indication that fish could endure this temperature much longer. Temperatures above 36 °C may be critical for young matrinxã and 39 °C was lethal after a very short period of exposure. Given the 100% survival and good condition of fish after 24 hours, this study suggests that temperatures not far from 18 and 36 °C seem to be the approximate lower and upper limits of thermal tolerance of this species. Presumably fish could easily withstand these two temperatures indefinitely, even without acclimation. It indicates that young matrinxã can tolerate well temperatures varying between 18 and 36 °C, although survival at other temperatures may be increased by gradually acclimating fish to the more severe increases or decreases in temperature. Because of the wide distribution of the genus, it also indicates that matrinxã may be cultivated over a wide geographical area. Accurate studies on thermoregulatory behavior have to be directed to better understand the influence of temperature on this species in fish farming conditions.

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