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## Preferred pH of silver catfish *Rhamdia quelen* acclimated to different pH levels

### pH preferencial em jundiás *Rhamdia quelen* aclimatados em diferentes níveis de pH

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#### - NOTE -

#### ABSTRACT

The aim of this study was to investigate the preferred pH in silver catfish *Rhamdia quelen* acclimated to different pH. Fish were acclimated for one week at pH 4.2±0.1, 5.2±0.1, 6.3±0.1, 7.2±0.1, 8.0±0.1, and 9.0±0.1 and after this period, transferred to a polyethylene tube with a pH gradient from 3.5 to 10.0. The position of the fish in the pH gradient was observed 1, 6 and 12 hours after transference. Results indicated that acclimation to different pH did not change pH preference of silver catfish (pH 7.0-7.6), occurring only a transitory variation around 6 hours after transference. This pH preference coincides with the best pH indicated in the literature for growth of this species.

**Key words:** pH preference, water quality, behavior.

#### RESUMO

O objetivo deste estudo foi verificar o pH preferencial de jundiás *Rhamdia quelen* aclimatados em diferentes pH. Os jundiás foram aclimatados por uma semana em pH 4,2±0,1; 5,2±0,1; 6,3±0,1; 7,2±0,1; 8,0±0,1 e 9,0±0,1 e, após esse período, transferidos para um tubo de polietileno com pH variando entre 3,5 e 10. A posição dos exemplares no gradiente de pH foi observada 1, 6 e 12 horas após a transferência. Os resultados indicam que a aclimação em diferentes pH não altera o pH preferencial dos peixes (pH 7.0-7.6), ocorrendo apenas uma variação transitória em torno de 6 horas após a transferência. Este pH preferencial coincide com o pH indicado na literatura como o melhor para o crescimento desta espécie.

**Palavras-chave:** pH preferencial, qualidade da água, comportamento.

Abiotic factors such as light, temperature, oxygen, and water quality parameters as pH can change physiological, biochemical and behavioral responses of fishes. The effect of environmental variables on movement of aquatic organisms can be examined using preference and avoidance behaviors (KROON & HOUSEFIELD, 2003). Water pH is usually regulated by the carbonate – bicarbonate system, generally remaining between 6.0 and 8.0. Oscillations in pH levels can occur in fish culture tanks or in the environment due to the soil composition, acid rain, phytoplankton, presence of humic substances, and other factors (BALDISSEROTTO, 2011). Acidic pH can damage gills, resulting in ionic imbalance while alkaline pH impairs ammonia excretion (BALDISSEROTTO, 2011), increasing its plasma levels, which can lead to death (SCOTT et al., 2005).

The silver catfish *Rhamdia quelen* has neotropical distribution and therefore can be exposed to a wide pH range (BALDISSEROTTO, 2009). This species tolerates pH between 4.0 and 9.0 (ZAIONS & BALDISSEROTTO, 2000) and juveniles presented better growth at pH 7.0-7.5 than at pH 5.5 and 9.0

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(BALDISSEROTTO, 2011). Most studies related to extreme pH refer to the lethality. Although there are many studies investigating the behavior of fish in relation to environmental factors and water quality, studies relating effects of water pH and behavior are scarce (JONES et al., 1985; IKUTA et al., 2003; SCOTT et al., 2005) and nonexistent in Brazilian native species. Therefore, the objective of this study was to evaluate silver catfish preferred pH.

Juveniles (10±4g) were obtained from a local fish farm and acclimated to laboratory conditions (23±01°C) for 20 days. Photoperiod was 12h light-12h darkness, and the luminosity of the laboratory was 0.6 lux (measured with a LI-COR photometer model LI-185B). Fish were then divided in groups and kept for seven days in continuously aerated 40L aquaria with different pH: 4.2±0.1, 5.2±0.1, 6.3±0.1, 7.2±0.1, 8.0±0.1, and 9.0±0.1. Juveniles were fed once a day, at 8:00 a.m. Uneaten food, as well as other residues and feces were siphoned 30 min after furnishing the food, and consequently at least 20% of the water was replaced with water previously adjusted to the appropriate pH using NaOH or H<sub>2</sub>SO<sub>4</sub> 0.5M. After this period, each group was transferred to a 6m long polyethylene tube containing 50L of water, which had been added at one end 1N sulfuric acid to generate pH around 3.5 and, in the other end 1N sodium hydroxide was added to obtain pH around 10. The reagents added at the extremities diffused through the water along the tube, creating the pH gradient, which was maintained with addition more of the same reagents at the extremities every two hours if necessary.

Each group (three replicates per treatment, N=10 each) was placed in the tube region closest to its acclimation pH. Fish location at the pH gradient was visually observed 1, 6 and 12 hours after the transfer, in order to identify their preferred pH. The pH was always measured at the location at the moment of the observation. After 12 hours observation the water of the tube was exchanged and a new replicate was placed in tube.

Aerators were placed at the two ends of the tube, and oxygen monitored with oxygen meter YSI (Y5512) every 4 hours. The Ethics and Care Committee for Laboratory Animals of Federal University of Santa Maria (UFSM) agreed with the study protocol (2007-24).

The data obtained were analyzed with the Kruskal-Wallis test followed by Dunn test using the GraphPad InStat Software and reported as mean±S.E.M. The minimum significance level was set at 95% (P<0.05).

Results indicate that silver catfish tended to settle in a neutral pH irrespective of acclimation pH. The exception was the group acclimated at pH 8.0 that 6 hours after the transference preferred a more alkaline pH compared to groups acclimated to pH 5.2 and 7.2. This different preference was transitory, and in the other times observed there was no significant difference between groups (Table 1).

Sockeye salmon (*Oncorhynchus nerka*), brown trout (*Salmo trutta*) and Japanese trout (*Salvelinus leucomaenis*) showed inhibition of digging and swimming behavior against the flow in water slightly acidic (5.8-6.4) compared to neutral pH (6.8-7.1) (IKUTA et al., 2003). Juvenile brook trout (*Salvelinus fontinalis*) were given the choice of untreated (pH 7.4) or decarbonated acidic waters at varying pH levels (4.0, 5.0, 5.5, and 6.0) for 96 hours. Significant avoidance did not occur at neutral pH levels. Brook trout avoided pH 4.0, 5.0 and 5.5. The authors also observed that lower pH affected social interactions in this species (PEDDER & MALY, 1986). Consequently, these species showed preference to a pH range near neutrality, as observed in the present experiment with silver catfish.

However, in other experiment brown trout juveniles demonstrated attraction to low pH (4.0, 4.5 and 5.0) compared to neutral pH (ÅTLAND, 1998). In addition, stickleback (*Gasterosteus aculeatus*) maintained in laboratory avoided water at pH 5.4, which was slightly above the lethal level of 4.8-5.0, and showed a vague negative reaction to pH 5.8, when the

Table 1 - pH adaptation of *Rhamdia quelen* juveniles and pH preferred 1, 6 and 12 hours after the transfer. Different letters indicate significant difference compared to the groups observed at the same time.

Adaptation	-----Preferred pH-----		
	1h	6h	12h
4.21±0.09	7.46±0.06 <sup>a</sup>	7.41±0.08 <sup>ab</sup>	7.38±0.04 <sup>a</sup>
5.23±0.13	7.33±0.14 <sup>a</sup>	7.05±0.18 <sup>a</sup>	7.03±0.18 <sup>a</sup>
6.35±0.12	7.56±0.16 <sup>a</sup>	7.29±0.07 <sup>ab</sup>	7.28±0.02 <sup>a</sup>
7.20±0.05	6.85±0.09 <sup>a</sup>	7.09±0.13 <sup>a</sup>	7.44±0.10 <sup>a</sup>
8.02±0.06	7.54±0.15 <sup>a</sup>	8.40±0.37 <sup>b</sup>	7.6±0.12 <sup>a</sup>
9.00±0.10	7.42±0.30 <sup>a</sup>	7.71±0.16 <sup>ab</sup>	7.48±0.49 <sup>a</sup>

alternative choice was water at pH 6.8. In addition, stickleback avoided solutions of sodium hydroxide with pH above 11.0. The pH range 7.0-11.0 produced no avoidance response from this species given the choice between water at pH 6.8 and the experimental solutions (JONES, 1948). Common carp (*Cyprinus carpio*) and goldfish (*Carassius auratus*) avoided pH values in the range 5.5-7.0 with preference values of 8.4 and 7.2, respectively. The avoidance of alkaline water for these species is pH 9.3 for common carp and 8.6 for goldfish (ISHIO, 1965).

Fish populations from a slightly acidic lake (pH 6.4-6.6) and from an slightly alkaline lake (pH 8.4-8.6) placed in a gradient tank where there was a choice between these two waters, the fish from the acidic lake preferred the acidic water and those from alkaline lake, the alkaline water (ALABASTER & LLOYD, 1984). So, it is believed that the long time of maintenance of fish at different pH may influence its pH preference, and it is possible that the time of acclimation in the present experiment (20 days) was not long enough to alter permanently silver catfish preference.

In conclusion, silver catfish juveniles preferred neutral pH irrespective of acclimation pH, probably to avoid disturbances in homeostasis occasioned by alterations in hydrogen-ion concentration. Furthermore, the described methodology can contribute in the evaluation of other abiotic factors preferences in aquatic species.

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