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GROWTH OF JAGUAR CICHLID *(Cichlasoma managuense)* JUVENILES AT DIFFERENT OXYGEN LEVELS

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RESUMEN

Se investiga la relación de la tasa específica de crecimiento de juveniles del guapote tigre, ***Cichlasoma managuense,*** *con el nivel de oxígeno disuelto en un sistema recirculado. El guapote tigre demuestra ser muy tolerante a condiciones hipóxicas, con una reducción en la tasa de crecimiento de sólo 17% por ppm de oxígeno disuelto en el rango investigado desde 2 a 5 ppm.*

ABSTRACT

The dependence of growth on the dissolved oxygen level was analyzed in juveniles of the guapote tigre, ***Cichlasoma managuense,*** *in a recirculated system. The guapote tigre is relatively tolerant to low oxygen levels, averaging only a 17% reduction in growth rate per ppm oxygen in the range between 2 and 5 ppm.*

INTRODUCTION

The dependence of growth on the dissolved oxygen level is an important factor in the commercial culture of fishes, especially in extensive tropical culture with high levels of fertilization, where oxygen depletion is a common phenomenon (Hopkins and Cruz 1982). The jaguar cichlid *(Cichlasoma managuense* Günther, local names: guapote tigre, guapote barcino), a common piscivore of Central America, has been recommanded (Dunseth and Bayne 1978, Lovshin 1982), and is currently being used (COPESCAL 1984,1986) as a recruit control in tilapia extensive pond culture. In Costa Rica the guapote tigre is commonly found in very warm, oxygen depleted innondation lakes in the San Juan region, a fact which points to some degree of tolerance to oxygen-poor waters.

The present study quantifies oxygen growth dependence of the jaguar guapote in order to determine his growth capability in the low oxygen levels commonly encountered in heavily manured tilapia ponds.

MATERIALS AND METHODS

The experiment was conducted in twelve 45-liter aquaria, part of a recirculating system with biological filter and sedimentator. Each aquarium was divided into two compartments by a glass wall, with a volume relation of 1:10. The small compartment received the incoming water at a flow rate of 0.8 liter/aquarium and contained the air diffusers, so that the fishes in the bigger compartment were not affected by water agitation. Twenty five, 7 g (CV: 30%), 92 days old, full-sib fingerlings were stocked per aquarium. Fishes were fed with an artificial diet (50% protein, 15% lipid, 15% carbohydrate) somewhat in excess, with a metabolic ration of 20 $g/Kg^{0.8}$/day.

Dissolved oxygen was measured twice daily (8 a.m., 6 p.m.) in every aquarium. The air diffusers were adjusted daily in order to maintain oxygen levels of 2, 3, 4 and 5 ppm, each repeated three times and randomly distributed into the 12 aquaria. The mean oxygen levels during the experiment (see

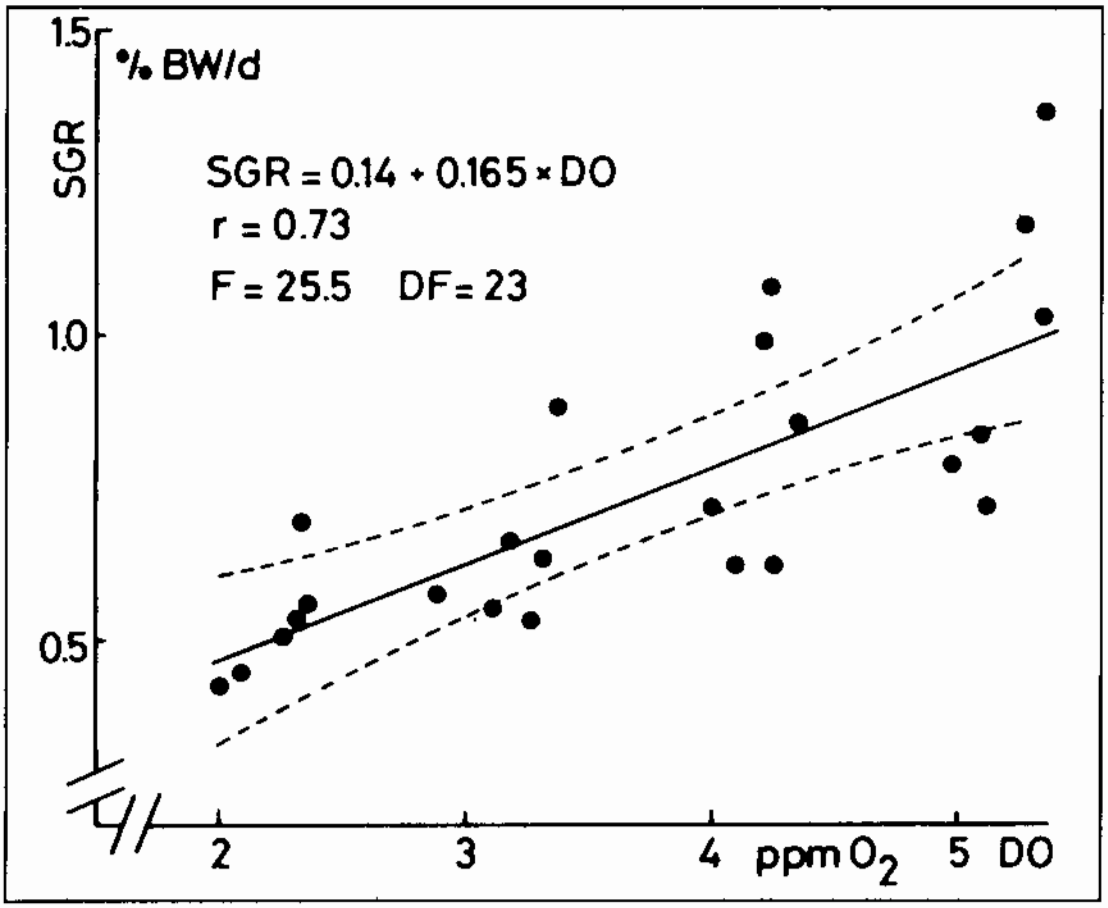

FIGURE 1
Dependence of the specific growth rate (SGR) from dissolved oxygen level in juveniles of *Cichlasoma managuense*. Data points, regression line, 95% confidence limits and regression equation, r: correlation coefficient, F: value from the analysis of variance, DF: degrees of freedom.

Fig.1) were kept with a deviation of ± 0.15 ppm, mean temperature was 28.3 ± 0.5 °C, pH 6.9 ± 0.14 and nitrite 0.27 ± 0.1 ppm (95% confidence limits).

Fishes were weighted individually at days 0.14 and 28. Mortality, specific growth rate (SGR = (LN Wf-LN Wi) /14*100) and mean dissolved oxygen level (DO) were calculated in all aquaria per 14 day period. Mean mortality over the full period was about 10% in all treatments. Since there was no significant correlation between weight (W) and SGR, the data from both periods were pooled and the relation SGR versus DO was analyzed by linear regression.

RESULTS AND DISCUSSION

Fig. 1 shows the regression parameters as well as the individual data points and 95% confidence limits. While growth variability was rather high (r^2 0.53), the growth rate showed a highly significant linear dependence on the DO in the range between 2 and 5 ppm, with about a 17% reduction of growth rate per unit DO, relative to the highest growth rate at 5 ppm DO.

Brett (1979) and Brett and Blackburn (1981) summarizing data from juveniles of several species found a 47% decrease in growth per ppm DO in *Oncorhynchus kisutch*, 27% decrease in *Cyprinus*

carpio, and a 34% decrease in *Micropterus salmoides*. Kim (1986) calculated for *Cyprinus carpio* a growth reduction of 45% per ppm DO. Andrews et al. (1973) found a decrease of 15% in 100 to 200 g channel catfish. Thus, our data characterize the jaguar guapote as relatively tolerant to low DO and hence well adapted for extensive polyculture with tilapias in manured ponds.

As the oxygen level increases, a critical level has been often found above which there is no further increase in growth (Limiting factor hypothesis, Brett 1979). Brett (1979) and Brett and Blackburn (1981) situate this critical level for the above mentioned species at about 5 ppm oxygen, Kim (1986) found maximal growth in *Cyprinus carpio* between 3.5 and 4 ppm, Stewart (1966) and Andrews (1972) found in *Micropterus salmoides* respectively *Ictalurus punctatus* increasing growth rates until about 8 ppm oxygen. Our data in *Cichlasoma managuense* do not show any decline in growth approaching 5 ppm, so that a further increase over this level seems quite possible. It will be interesting to test the growth of *Cichlasoma managuense* over the 5 ppm level, since the concept of critical oxygen value has not been unchallenged in other investigations (Brett 1979).

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