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GROWTH OF PACIFIC SNOOK (*Centropomus nigrescens*) JUVENILES AT DIFFERENT SALINITIES

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ABSTRACT

Juveniles of the Pacific snook, *C. nigrescens*, between 2.5 and 125 g in weight, were grown at three salinities, 0, 18 and 36 ppt. The results indicate no statistical differences between growth rates or feed conversion at these salinities. It is concluded that the Pacific snook is well suited for culture in brackish waters of varying salinity.

RESUMEN

Se evaluó el crecimiento de juveniles del róbalo del Pacífico, *Centropomus nigrescens* con salinidades de 0, 18 y 36 ppt. No hubo diferencias estadísticas significativas ni en el crecimiento ni en el factor de conversión. Se concluye que *C. nigrescens* es una especie adecuada para el cultivo en aguas salobres de salinidad variable.

INTRODUCTION

The marine fishes of the genus *Centropomus* (english snook, spanish róbalo or lubina) are described as diadromous and euryhaline fishes (RIVAS 1986). Whereas juveniles are commonly found in mangrove areas of varying salinity and in coastal freshwater habitats, the adults are estuarine dependent coastal fishes found in a variety of habitats from marine to freshwater (GILMORE *et al.* 1983). In Costa Rica snooks are reported to swim long distances up into the greater rivers of the Atlantic and Pacific slopes (VINCENZI and CAMACHO 1979).

The atlantic snook (*Centropomus undecimalis*) has been shown to be an excellent osmoregulator, adapting well from freshwater to full salinity saltwater (PEREZ-PINZON and LUTZ 1991). As it has been established also in other fishes (FEBRY and LUTZ 1987) maintenance metabolism of snook is lower at intermediate salinities than in freshwater or full strength saltwater. This reflects probably lower metabolic costs for osmoregulation in isosmotic situations. However, in active fishes, PEREZ-PINZON and LUTZ (1991) found no differences in the osmoregulatory costs between freshwater and saltwater. They observed however a slightly decreased activity performance (decreased aerobic scope, higher muscle lactate) in freshwater as compared with isoosmotic and full strength saltwater.

In the last years, the salinity tolerance of growth in several freshwater fishes has been assessed and it has even led to commercial aquaculture of freshwater species in brackish or saltwater (MCKAY and GJERDE 1985, SURESH and LIN 1992). The salinity tolerance for growth of marine fishes is also important regarding to their possible culture in brackish water environments (WU and WOO 1983). In the euryhaline red drum (*Sciaenops ocellata*), CROCKER *et al.* (1981) found a slightly better growth in saltwater than in freshwater but WURTS and STICKNEY (1993) could not confirm this difference. In the euryhaline *Dicentrarchus labrax*, DENDRINOS and THORPE (1985) found decreasing growth performances as salinity decreases from 33 ppt towards freshwater. The effect of osmoregulatory costs are not apparent in these growth studies, probably because they are

masked by other effects of salinity like activity changes (SWANSON 1992) or other physiological adaptations (PEREZ-PINZON and LUTZ 1991).

In the Atlantic snook, *C. undecimalis*, BRUZEK *et al.* (1987) analyzed growth of juveniles between 0 and 30 ppt salinity and found a slightly better growth (not significant) at an intermediate salinity of 20 ppt. TUCKER (1987) found for juveniles of the same species a slightly better, but statistically not significant growth in fresh water. The purpose of this paper is to assess the salinity dependent growth of juveniles of the Pacific snook, *C. nigrescens*.

MATERIALS AND METHODS

Fish: Thirty six fish between 2.55 and 12.10 g wet weight were used. As described earlier (GÜNTHER 1993), they were obtained as larvae from mangrove ponds in Punta Morales, Costa Rica. In the laboratory they were first grown with *Artemia* and then weaned to a formulated moist feed.

Experimental facility and water quality: The experiment was run on six 45-liter aquaria, arranged in pairs as recirculating units, with two aquaria of each pair sharing the same biological filter. Temperature was set at 30 °C, salinity was kept around 0, 18 and 36 ppt, in each pair of aquaria, respectively. Temperature, salinity, pH and oxygen were recorded every two or three days in every aquarium. Table 1 presents the mean values of each parameter as well as the maximum and minimum values during the experiment.

Feed and feeding: The fish were fed *ad libitum* 3 times per day with semimoist pellets formulated according to GÜNTHER (1993). Small pellets were formed by hand and thrown one by one into the aquarium until the first pellet was left uneaten. All feed given was recorded.

Experimental design: At the begin of the experiment 4 fish of similar weight (mean weights between 2.55 and 10.13 g) were put in each aquarium and grown for periods of 21 days. Every 21 days all fishes were weighed and the coefficient of variation, mean specific growth rate (% body weight/day) and the feed conversion calculated. In 4 instances where the coefficient of variation became greater than 20%, the extreme weights were substituted by new fishes which were held in the laboratory in similar conditions and at 15 ppt salinity. The experiment lasted for 6 growth periods, so that at the end, 36 growth periods were analyzed, 12 for every treatment.

Data analysis: Specific growth rate (% body weight/day) and feed conversion were calculated for each one of the 36 growth periods. GÜNTHER (1993) found for Pacific snook juveniles the following relation between specific growth rate and mean fish weight:

SGR = 9.27 * MW^(-0.46), where MW = mean weight in g

Thus, in order to compare growth rates from fishes of different weights, the specific growth rates of the 36 growth periods were weight-corrected using the exponent -0.46:

Weight-corrected SGR = SGR/(Mean weight^(-0.46)).

Table 1.
Water quality parameters during the experiment

	Treatment 1				Treatment 2				Treatment 3			
	t °C	O_2	pH	SAL	t °C	O_2	pH	SAL	t °C	O_2	pH	SAL
mean	29.7	6.1	8.7	0.1	29.8	5.6	8.5	18.1	29.9	5.0	8.2	36.5
max	30.4	6.6	9.2	0.2	31.3	7.4	9.2	20.5	29.9	5.4	8.9	41.2
min	28.8	5.7	8.1	0.0	27.6	5.1	6.7	16.9	27.6	4.5	7.6	33.5

Table 2.
Weight corrected growth rates and feed conversion at different salinities

SALINITY	GROWTH RATE	C.L. 95%	FEED CONVERSION	C.L. 95%
0	8.03	±1.1	1.34	±0.11
18	8.18	±1.1	1.38	±0.11
36	8.97	±1.3	1.36	±0.12
15.4*	9.27*		1.30*	

* data from Günther (1993).

The weight corrected SGR corresponds to the SGR of a 1 gramm fish. Five data points with feed conversions above 1.8 were left out of the analysis as the fishes were obviously stressed during the respective growth periods. The remaining corrected growth rates were compared between salinities by t-Student tests.

RESULTS

At the end of the experiment the mean weights of the fish in the different aquaria were between 46.4 and 98.2 g. The biggest fish attained 125 g. Table 2 shows the weight corrected growth rates and the feed conversion values at the different salinities 0, 18 and 36 ppt together with the 95% confidence limits. There is a small tendency of the growth rate to increase towards full salinity, but the differences are not significant. There are not significant differences in the feed utilization among salinities.

DISCUSSION

Salinities were kept fairly constant at 0, 18 and 36 ppt during the experiment in the three treatments (Table 1). There were no differences in temperature, but dissolved oxygen and pH were somewhat higher in the freshwater environment. However, these small differences in this range did probably not affect growth.

The overall growth performance in this experiment (weight corrected SGR 8.34%) and the feed utilization obtained (feed conversion 1.36) replicate fairly well the values obtained by GÜNTHER (1993) for Pacific snook grown in an intermediate salinity of 15.4 ppt: weight corrected SGR 9.27% and feed conversion 1.3 (Table 2).

The results indicate that in juveniles of the Pacific species *C. nigrescens* the differences in growth at the different salinities from 0 to 36 ppt are, if any, only very small. This species would also be well suited for culture in coastal ponds with varying degree of salinity. PEREZ-PINZON and LUTZ (1991) found in *C. undecimals* a slight decreased physiological fitness in freshwater. This would agree with the small tendency observed to lesser growth in freshwater as compared with saltwater.

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