# STOCKING DENSITY AND GROWTH PERFORMANCE OF SENEGALESE SOLE *(Solea senegalensis)* PRELIMINARY RESULTS

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## Introduction

*Solea senegalensis* and *S. solea* are 2 developing species for aquaculture, often perceived by consumer as a single product.

Stocking density has been demonstrated as a crucial variable in fish farming, being usually inversely correlated with growth in several species. Mechanisms relating stocking density and growth are not fully understood, but it is generally accepted that, when water quality and feeding are not limiting factors, then social relationships, the development of hierarchies and stress are in the base of differences in growth performance.

Given that no stocking density studies have been carried out in *S. senegalensis*, the aim of this work was to make an approach to the understanding of how stocking density affects Senegalese sole growth performance.

## Materials and methods

A total of 96 *S. senegalensis* (318.7±7.85g) were individually tagged and were distributed in 2 stocking densities (low density, LD; and high density HD). LD was defined as 60% of bottom surface covered by fish (8.6±0.24kg·m$^{-2}$), and HD as 180% of bottom coverage (26.61±0.24kg·m$^{-2}$). Fish surface estimation was calculated assuming that sole shape could be assimilated to a perfect ellipse. Soles were randomly distributed among 6 experimental tanks (16 fish each) and were kept in a flow-trough circuit at a renewal rate of 30% per hour. $O_2$ (>5mg·l$^{-1}$), temperature (20±1ºC), and water renewal rate were monitored daily. Daily ratio (ProAqua, Solea 3) was set *ad libitum,* and was offered at night with electronic programmable feeders.

The experiment lasted a total of 195 days, and biometric data were gathered on days 1, 20, 40, 61, 77, 103, 126, 134, 147, 161 and 195. From day 134 to 195 treatments were reverted, in a way that fish under low density conditions were then under high density and vice-versa (albeit keeping their original names LD and HD), thus defining 2 experimental periods: period 1 ($P_1$) from day 1 through day 134, and period 2 ($P_2$) from day 134 through day 195. Percent of daily body weight increase in g was calculated as the standard growth rate (SGR).

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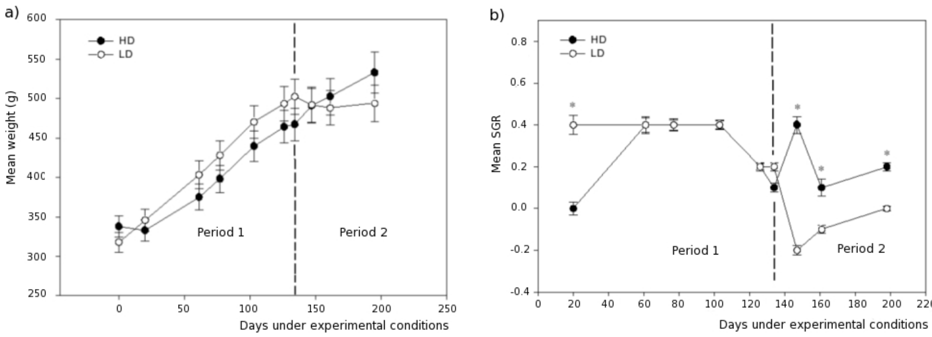


Fig. 1: a) mean weight for both LD and HD treatments. b) mean SGR for both LD and HD treatments. White and black circles represent LD and HD respectively. A vertical dashed line shows the day when treatments were reverted. An * indicates significant differences.

## Results

Time-course of mean weights and the evolution of average SGR for HD and LD groups are shown in figures 1a and 1b respectively. No significant differences (ANOVA, $p<0.05$) in weight were found between groups at any of the biometry days, neither in period 1 nor in period 2. Significant differences in SGR were observed among stocking densities during the first 60 days (ANOVA $p<0.001$), but not for the rest of the period until reverting treatments. After day 134, significant differences in SGR were found among HD and LD groups (ANOVA $p<0.0001$) at all biometry days, LD showing worse growth performance than HD once density conditions were interchanged. Final densities reached 10.85±0.64kg·m$^{-2}$ for LD and 42.8±1.49kg·m$^{-2}$ for HD at the end of $P_1$, and 11.9±0.63kg·m$^{-2}$ for HD and 41.4±2.19kg·m$^{-2}$ for LD after reverting the treatments.

## Discussion

While no differences in weight were found among treatments, SGR was significantly lower for HD during the period comprising days 1 to 61. This delay in growth of HD fish was fully recovered after acclimatisation, growing from then on at the same pace than LD fish. After reverting treatments, former LD fish experienced a significant drop of SGR, while former HD fish momentarily showed a peak in growth rate and then remained over LD's SGR. Our results suggest that adult *S. senegalensis* could be successfully reared intensively at high densities such as 180% of bottom coverage (42.8±1.49kg·m$^{-2}$), caring to avoid sudden increases in density. This contrasts with works by Schram et al (2006) in *S. solea*, who obtained an inverse correlation of SGR and stocking density from 7.7 through 194.9% of bottom coverage (0.5 to 12.0kg·m$^{-2}$). It suggests that eventually *S. senegalensis* could bear higher rearing densities following acclimatisation.