

EVALUATION OF SOLE (*Solea senegalensis*) PREFERENCES FOR DIFFERENT SUBSTRATE TEXTURES AND COLOURS

Duarte, S.*, Reig, L. and Oca, J.

Departament d'Enginyeria Agroalimentària i Biotecnologia
Universitat Politècnica de Catalunya
Spain
sonia.duarte@upc.edu

Introduction

Soles, as most of flatfishes, live in sandy bottoms in order to guarantee food availability and protection from predators (Kruuk, 1963). In commercial sole culture, the use of sand has been considered a serious obstacle to maintain hygienic conditions (Howell, 1997), but problems arise when they are kept on hard-bottomed tanks without sand. A higher occurrence of Black Patch Necrosis (BPN) (McVicar & White, 1979, 1982), a significant increase in metabolic rate (Howell & Canario, 1987), and even pigmentation abnormalities (Dinis et al 1999) have been attributed to sand deprivation.

Colour adaptation for cripsis is an innate response appearing also in cultured soles to adapt the skin colour to that of the substrate in order to achieve a sufficient level of welfare (Ellis, et al. 1997). Tank colour has further implications, since a relationship between tank colour and growth rate has been reported in several species, among them a flatfish (Yamamone et al 2005). Tank texture has also an influence in fish health and appearance as reported by Ottesen & Strand (1996) in *H. hippoglossus*.

Considering the harmful effects of sand deprivation in sole and the potential detrimental effects of tank colour and texture, other materials should be searched for culture. The aim of the present work was to offer several materials, differing in texture and colour, to *Solea senegalensis* and evaluate their preference. Several combinations were tested, and images were taken during a 72 hours experimental period for each combination. The frequency of election for a specific material was used to evaluate fish preference.

Material and methods

A rectangular tank, divided in four plots in order to test four different substrates each time, was used. Fish was free to swim all over the tank and choose a specific location in one of the four plots. Water inlet was located providing an equal water flow in the whole tank, avoiding differences in water quality. Water temperature was $13 \pm 0.5^\circ\text{C}$.

Different substrates were used. The materials were plastic (P), sand (S) and concrete (C), differing in texture (rough, R, and smooth, S) and colour (dark, D, and white, W). Each combination has a three-letter code expressing first type of material, second texture and third colour, for example Plastic Rough and White PRW. A group of 10 cultured *S. senegalensis* were used (mean weight $54.9 \text{ g} \pm 12.5\text{g}$). They were individually tagged using a ball tag of phosphorescent polymeric clay attached to the ocular face with seam thread. Blue fluorescent lights were placed at each lateral of the tank allowing phosphorescent tag to shine and be recorded with a CCD monochrome camera equipped with an orange filter to enhance the tag. Image acquisition was done using a specific image analysis software (Image Pro Plus 5.0) and a frame grabber (PCVision Plus). Each substrate combination was recorded during a continuous period of 72 hours at $1 \text{ frame } 2\text{min}^{-1}$. Fish position was set by identifying the tag with its x,y coordinates in the tank. Preference was expressed as a percentage of times that a specific material has been chosen in a four plot combination during the 72 h-experimental period.

Results and discussion

Sand is the preferred substrate of sole in nature (Nasir & Poxton, 2001). When they can choose between different textures, they prefer fine textures since they can bury easily (Gibson & Robb, 2000). According to literature, also in the present work sand is mainly chosen, in front of other materials. Colour seems to be a decisive criterion to choose between materials. When different textures and colours of sand are offered, soles always chose white sand, independently of the texture. Among the plastics, rough and dark plastic seems to be preferred for soles in front of smooth and white. The preference between concretes is not consistent, both between textures and colours.

The results show that an adequate selection of the binomial texture-colour could be found for sole culture which guarantees the welfare and easy maintenance. Long-term experiments would be needed to assess potential effects on growth and health.