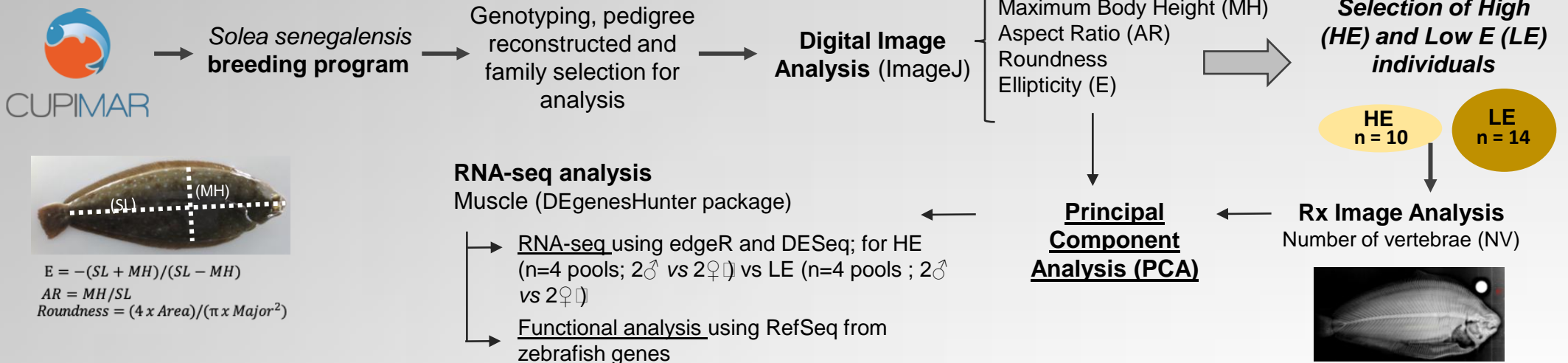


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## Introduction

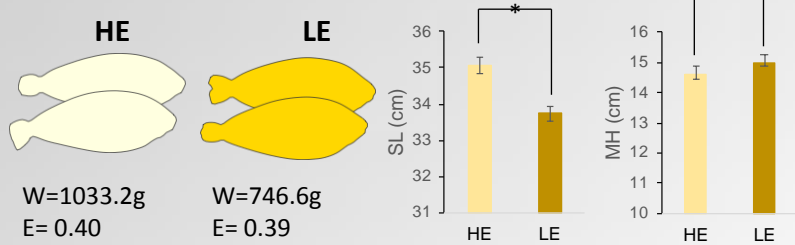
The Senegalese sole is an economically important species whose aquaculture is rapidly growing in Southern European. Recirculation aquaculture systems (RAS) provide a stable environment to grow juveniles until harvest size in a competitive way, even though morphology quality still needs to be optimized (Manchado, et al., 2019) due to the high plasticity of the skeletal components in this species (de Azevedo, et al., 2017). **Ellipticity** is the major indicator by consumers of high-quality sole morphology but there is a lack of studies dealing with shape quality. Here, the meristic and molecular regulatory pathways that determine differences in ellipticity in a fast-growing family were investigated using digital image analysis (DIA).

## Materials and methods

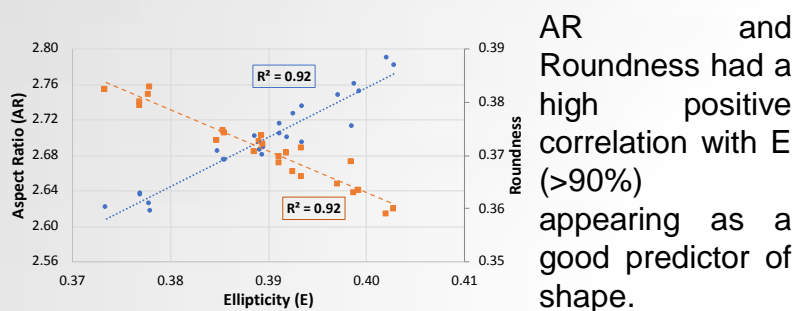


## Results

### 1. Digital image analysis



SL and MH were measured and E estimated as an indicator of high quality shape. Two groups were set according to E: high (HE) vs low (LE). HE had a higher weight and it was considered as a high-quality group (E = 0.40). Overall, HE group soles were significantly longer and with lower height (than LE group).



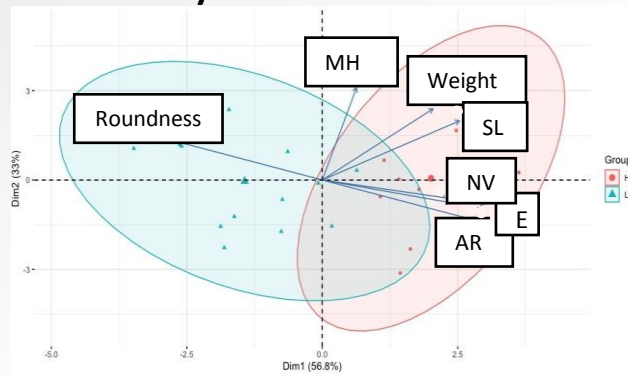
AR and Roundness had a high positive correlation with E (>90%) appearing as a good predictor of shape.

### 2. Radiography analysis



Rx analysis indicated that LE group had a higher proportion of animals with a lower number of vertebra (36 vs 37) and a higher incidence of vertebral fusions (VF).

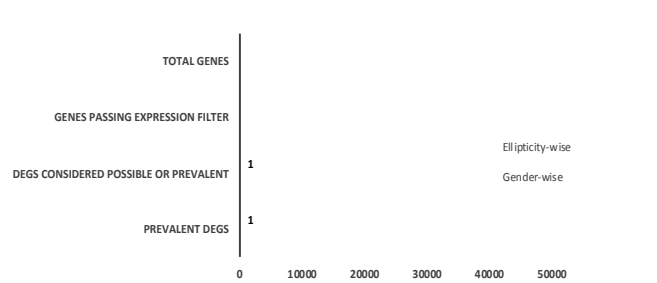
### 3. PCA analysis



PC1 explained 56.8% of the variation associated with SL, AR, Roundness and E. PC2 explained 33% of the variation associated with MH. NV and fusions were associated with E and AR → important role on elliptical shape.

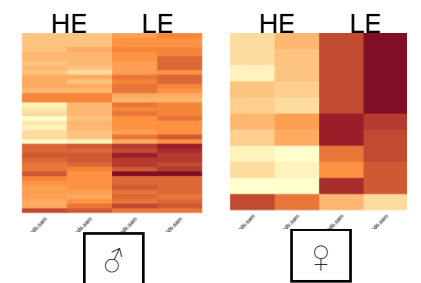
### 4. Gene Expression Analysis

#### 4.1 Global DEG



In a 2x2 design (♂ vs ♀ and HE vs LE), only 1 differentially expressed gene (DEG) related to E was found. In contrast, 7 451 DEGs associated with gender were determined.

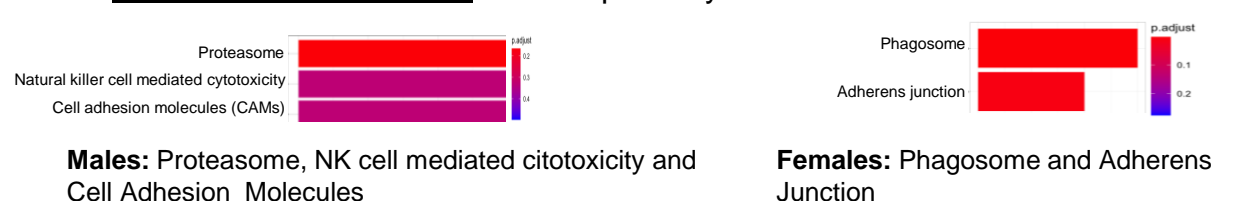
#### 4.2 DEG by gender



To avoid the effects due to gender, analysis was carried out separately by gender: ♂, 105 DEGs; ♀, 45 DEGs.

#### 4.3. Functional analysis

Main pathways enriched for DEGs:



## Conclusion

AR and Roundness are good predictors of ellipticity that are highly influenced by number of vertebra and fusions. RNA-seq analysis revealed structural pathways modified associated with E in males and females. These data are relevant to understand the mechanisms that determine shape quality in sole.