17. Prediction of production traits by using body features of gilthead seabream (*Sparus aurata*) obtained from digital images

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Gilthead seabream (*Sparus aurata*) is a key aquaculture species in the Mediterranean and surrounding regions. While many traits are of interest in seabream breeding programs, phenotypes of them cannot always be easily or accurately measured. Therefore, the objectives are to predict phenotypes of production traits by using automated measurements of body features from digital images and to obtain genetic correlations between measured and predicted phenotypes. The production traits analyzed were harvest weight (HW), fillet weight (FW), fillet percentage (F%), and fillet fat percentage (FF). Each image feature was tested for prediction of phenotypes by using 10-fold cross-validation. For genetic analyses, phenotypes were predicted by using a linear model that included the combination of image features that yielded the highest correlation with measured phenotypes based on cross-validation. Genetic correlations (rg) were estimated between measured and predicted phenotypes in a bivariate animal model. The phenotypic and genetic correlations of measured and predicted phenotypes were 0.98 and 0.996 for HW, 0.93 and 0.99 for FW, 0.27 and 0.70 for F%, 0.53 and 0.64 for FF, respectively. The genetic correlation was almost unity between measured and predicted harvest weights and between fillet weights. Heritability estimates were higher for predicted phenotypes, except for HW. Heritabilities for measured and predicted phenotypes were 0.54 and 0.52 for HW, 0.47 and 0.52 for FW, 0.10 and 0.35 for F%, and 0.40 and 0.50 for FF. Relative efficiency was calculated as the percentage of selection response obtained by using predicted phenotypes instead of measured phenotypes. The relative efficiency of phenotypic selection on predicted phenotypes was 98% for HW, 104% for FW, 119% for F%, and 72% for FF. Results show that in seabream breeding programs, it is possible to select for HW and FF by using image measurements of gilthead seabream without a major loss in selection response. For FW and F%, the selection response will be higher if predicted phenotypes are used instead of measured phenotypes.