Domestication and selection for growth induce a genetic sex-ratio shift towards females in a European sea bass (Dicentrarchus labrax) population

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DOMESTICATION AND SELECTION FOR GROWTH INDUCE A GENETIC SEX-RATIO SHIFT TOWARDS FEMALES IN A EUROPEAN SEA BASS (*Dicentrarchus labrax* L.) POPULATION.

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In cultured populations of the European sea bass *Dicentrarchus labrax*, sex ratios are usually highly male-biased (75 to 95%). While temperature during larval rearing is known to influence sex-ratio, low (feminizing) temperatures remain little applied in hatcheries as they cause a growth delay.

In a first step, we analyzed published papers from the fisheries literature, where sex was recorded in wild sea bass from 13 population samples, representing altogether 4872 individuals covering the major part of the distribution range of the species. We found that as a whole, the sex ratio of wild populations is biased towards females (59.4% females, $P<0.001$), but that the sex ratio of the younger fish (<30 cm total length) is balanced (52.0% females, $P=0.15$), while the sex ratio of the older fish is heavily biased towards females (69.5% females, $P<0.01$). We conclude that the excess of males in culture is not a characteristic of the species, but rather a consequence of the environments used in culture, in a complex system where both environmental and genetic influences interact to govern sex determination in sea bass.

In a second step, we have shown previously that there is a high between family variance in sex ratio, with a positive genetic correlation between growth and percentage of females. Our prediction was then that domestication (i.e. use of captive-bred broodstock) should lead to an increase in female percentage in the subsequent generations, and we further predicted that selection for growth should speed up this process, and could eventually lead to populations with a majority of females. In the present experiment, we verified those hypotheses comparing the sex-ratios in the offspring of wild, domesticated and selected for growth sea bass males.

We showed that there were more females (46.4%) in the offspring of captive-bred males (1st generation domestication) than in the offspring of wild males (37.5% females) when reared in the same environment. A further shift in sex ratio was observed in the offspring of males selected for fast growth rate (55.0% females). Simulations of selection for growth with a stochastic model show that almost monosex populations of sea bass could be achievable combining selection for growth and environmental manipulations.