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# OLD AND RECENT INBREEDING EFFECTS ON FEMALE SIZE AND REPRODUCTION TRAITS IN A RAINBOW TROUT SELECTED LINE

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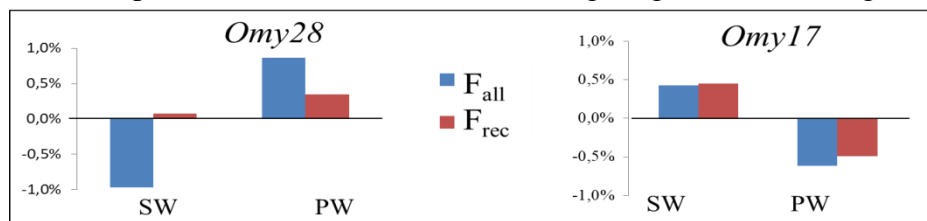
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## SUMMARY

Selection for production traits in closed and small broodstock populations of rainbow trout over the last 30 years have induced significant levels of inbreeding [1]. Inbreeding can be derived from the identification of homozygous genomic segments, named ROH for run of homozygosity [2]. The size of the ROHs makes it possible to estimate how long there has been inbreeding in the population. From this ROH property, the aim of the study was to assess the age of inbreeding events affecting rainbow trout size and reproduction traits in a French selected line.

We analyzed the performance of 1,366 females under mixed linear animal model including the fixed effects of the two study cohorts and the spawn week within cohort. A first model fitted the pan-genomic inbreeding coefficient as a unique covariate and a second model fitted altogether the chromosomal inbreeding coefficients as 30 covariates explaining performance. For both models, we consider the cumulated effects of inbreeding over all generations ( $F_{all}$ ) or only the effects of recent inbreeding events ( $F_{rec}$ ) through ROH sizes longer than 10Mb, which correspond to inbreeding approximatively occurring the 3 last generations. The study traits were the female post-spawning weight (PW), the spawning date (SD), the spawn weight (SW), and the egg average weight (EW).

At the all genome scale, we observed significant effects of inbreeding only for SD and EW, with +10% in F level leading to performance variations of +12.3% and -3.8%, respectively. While both recent and ancient inbreeding effects were significant for SD, only recent inbreeding events affected EW. At the chromosome scale, both recent and ancient events of inbreeding affected all the study traits with negative but also positive effects (Fig1). As largely described in the literature, the main observed effects for all traits were negative impacts of recent inbreeding. However some positive effects of recent inbreeding (see Omy17 for SW) or old inbreeding (see Omy28 for PW) were also observed (Fig1). A unique case of inbreeding depression due to ancient inbreeding events (see Omy28 for SW) was detected (Fig1). To conclude, for all traits, both recent and ancient inbreeding events affect female size and reproduction traits in rainbow trout. Despite a global trend towards inbreeding depression due to recent inbreeding events, positive impacts of local inbreeding are also commonly encountered for all traits. These results shed light on the genetic architecture of inbreeding depression for female size and reproduction traits and its evolution along the genome and over generations.



**Fig1.** Effect of a +10% increase in inbreeding coefficients for Omy28 and Omy17 on SW and PW performance.

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[1] D'Ambrosio et al. 2019, Genetics Selection Evolution, 51:26.

[2] McQuillan et al. 2008, The American Journal of Human Genetics 83:359.