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CAN SELECTIVE BREEDING FOR GROWTH OR FILLET YIELD DECREASE ENVIRONMENTAL IMPACT OF FISH FARMING? A GILTHEAD SEA BREAM (*Sparus aurata*) CASE STUDY

Haffray P.^{1§}, Acosta Alba I.², Cariou S.³, Bruant J.S.³, Bugeon J.⁴, Vandeputte M.^{5,6}, Aubin J.²

¹ SYSAAF, Campus de Beaulieu, F-35000 Rennes, France

² INRA, UMR1069 Sol Agro et Hydrosystème Spatialisation, F-35000 Rennes, France

³ FMD, F-17840 La Brée les Bains, France

⁴ INRA, LPGP, UR1037, Campus de Beaulieu, F-35000 Rennes, France

⁵ INRA, UMR1313 GABI, F-78352, Jouy-en-Josas, France

⁶ Ifremer, UMR 9190 MARBEC, F-34250 Palavas-les-Flots, France

Life Cycle Assessment (LCA) was applied to assess the environmental impact of genetic selection of growth or fillet yield from input production up to consumer's plate in the gilthead seabream *Sparus aurata* as a case study for farmed fish species.

In a first step, genetic parameters of growth and quality traits (gutted yield, head yield, headed and gutted carcass yield, filet yield, fat muscle content, morphological traits) were estimated in 241 DNA-pedigreed mixed families from 25 dams and 86 sires reared in 2 environments, in a land-based sanitary protected breeding site (Oléron, France) and a growing site in sea cage (Corsica, France). As GxE interactions between the two environments were limited for processing traits ($r_A = 0.89$ to 0.94), LCA impact categories were assessed using only genetic parameters estimated from the breeding site. Functional unit for the LCA evaluation was 1 kg of fillet consumed.

LCA results show that the farming first step contributed to 79-100 % of the impacts depending on categories (acidification, eutrophication, climate change, land occupation, energy use and primary production use). Commercialization, consumption and recycling represented less than 5 % of the impacts except for energy use and climate change. The cooking step represented close to 18 % of the energy and waste incineration accounted for more than 12 % of climate change.

The impact of selective breeding was estimated after simulating 5 generations of selection with a pressure of 10 % or 3 % on growth or 20 % or 10 % on fillet yield. Genetic improvement of growth had limited impacts on environmental performances, mainly associated with the decrease of the fixed environmental costs (facility). In the other hand, genetic improvement of fillet yield induced a 19 % to 24 % decrease in environmental impacts, mainly associated with a more efficient use of artificial feed per kg of flesh produced, which directly influenced all impact categories.

These results illustrate large indirect effect of selection on fillet yield, on environmental impact and provide original evidence to link genetic selection and the enhancement of environmental performance of aquaculture and livestock, the main goal of aquaculture being to produce flesh for human consumption.

Keywords: aquaculture, genetic parameters, fillet yield, Sparus aurata, life cycle analysis

[§] Corresponding author: Tel: (33) 2 23 48 53 78; Fax (33) 2 23 48 50 20
E-mail address: haffray@rennes.inra.fr