Integrating selective breeding into commercial production of aquaculture species

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Family-based nucleus fish breeding programs are expensive operations. The cost of such fish breeding programs is not justified for many fish species cultured globally. An alternative to nucleus breeding programs is to integrate selective breeding into commercial aquaculture production. In integrated breeding programs the selection is performed on animals that are kept under commercial production circumstances using the data collected in the production environment.The objective of this PhD project is to understand the principles of and develop methods to optimise the design of integrated breeding programs for fish species. The first step is developing data collection strategies for economically important traits directly from the commercial production environment to uniformly represent all individuals within the production system. Second step is developing precise and high-throughput measurement techniques to phenotype large numbers of animals in the commercial environment in a fast and accurate way in combination with prediction of slaughter traits for alive fish (*e.g.* fillet yield) using computer vision. Third are methods for making a selection decision as soon as a fish is phenotyped by combining data collection, statistical analysis and selection of animals into one single step using computer vision and machine learning. Final step is designing and optimising an integrated breeding program, based on novel phenotyping and single-step selection techniques. Phenotypic data collection, imaging and genotyping of fish will be performed within the context of experiments in different EU projects. Throughout the PhD project, the analyses will be carried out and simulations will be performed based on commercial production data of gilthead seabream and parameters of various breeding companies.