

Precision fish farming in recirculated aquaculture systems - from theory to implementation

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Body of the Abstract

The concept of Precision Fish Farming (PFF) was introduced in 2018 to stimulate transition from experience- to knowledge-based production. PFF builds on Precision Livestock Farming (PLF) - an established way to manage livestock production. PLF consists of three components: Automatic continuous monitoring of animal-centric variables (often by sensors), a prediction model, and an analyzing algorithm for automatic monitoring and/or feedback. The ultimate goal of PFF is to improve animal health and welfare while increasing productivity, yield and environmental sustainability in intensive aquaculture. PFF is used in the intensive marine farming of Atlantic salmon, where video and AI are used to monitor fish growth and feeding.

However, the use of PFF in other aquaculture systems is limited. The project "Intelligent farming and health control in land-based recirculating aquaculture systems (IntelliRAS)" aimed to create a PFF system for RAS production of rainbow trout and Atlantic salmon, as a proof that PFF can also be applied in RAS farming.

We collected data from 15 Danish RAS farms to explore which animal-centric variables are measured, focusing on automatic measurements. As oxygen, pH and temperature are strictly controlled, we found CO₂ to be the most promising variable for detecting variation. In addition, video monitoring of surface activity was explored. The biggest challenge when modelling growth and health we found to be the lack of control weighings and registrations of mortality causes. In addition, most land-based farms split, move and sort fish continuously, making it difficult to establish baseline predictions in individual fish groups.

While reducing feedcost would give the highest economic return, at the moment there does not seem to be any solutions to incorporate this into PFF in RAS-farms. We argue that the focus of R&D should be on validating standards for animal-centric variables, including welfare monitoring before moving towards PFF.