

Enhancing productivity and sustainability in freshwater aquaculture (2015-2017)

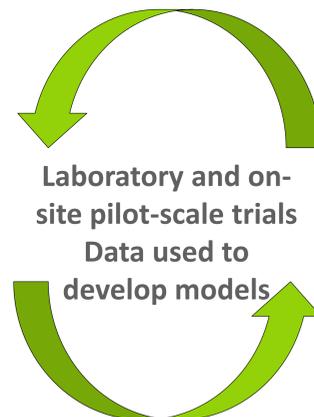
Irish Inland aquaculture context

MOREFISH is a Dept. of Agriculture, Food and the Marine (DAFM) funded project. The legislative framework concerning inland aquaculture is evolving via the water framework directive (WFD) through increasingly stringent discharge limits (e.g. ammonium, phosphorus) and existing or potential limitations on freshwater abstraction rates. Irish freshwater aquaculture mostly produce salmonids such as rainbow trout and salmon smolts. The MOREFISH project will bring recent significant progresses achieved worldwide in aquaculture practices to an Irish aquaculture context ^[1]. Irish freshwater aquaculture systems are generally traditionally run with open systems involving high water abstraction volumes, with limited water recycling in place. Therefore, this industry has a need to reduce costs and enhance productivity in a sustainable way as recommended by Irish government (e.g. Harvest 2020 program ^[1]) (Figure 1) and the European Union ^[2]. Developing reuse or partial recirculation involving oxygenation and nitrification appears to be a potential solution to improve Irish aquaculture practices and to increase production in a sustainable way ^[3]. The MOREFISH project have both engineering and biological objectives to be fulfilled in parallel. This project is currently launching and is a collaboration between NUI Galway, Athlone Institute of Technology (AIT) with industry stakeholders (i.e. fish farms and industry bodies).

MOREFISH Objectives

OVERALL ENGINEERING AIMS

- 1. Aeration technologies:**
 - Increase aeration efficiency of fish tanks
 - Removal of carbon dioxide from process water
- 2. Wastewater treatment**
 - Energy efficient wastewater treatment
 - Ensure quality of re-circulated wastewaters
 - Ensure effluent quality (for discharge waters)
 - Assessment of disinfection on-site
- 3. Development of novel technology and process design**
 - Efficiency of aeration technologies
 - Improve wastewater treatment and sludge removal processes
 - Improved tank design
- 4. Waste sludge treatment**
 - Re-use of sludge for energy and/or compost
 - Reduction of waste sludge volumes
- 5. Process efficiency**
 - Improved fish tank design to enhance aeration



OVERALL BIOLOGICAL AIMS:

Monitor the effect of engineering modifications/enhancements on fish production and fish health. Advise on proposed engineering changes.

- 1.** Monitor fish growth rates, feed usage and production efficiencies
- 2.** Develop feeding strategies to optimize the efficiency of engineering enhancements
- 3.** Monitor water quality parameters in inflow, in-tank and effluent waters
- 4.** Assist in establishing cost and energy savings

Overall Vision

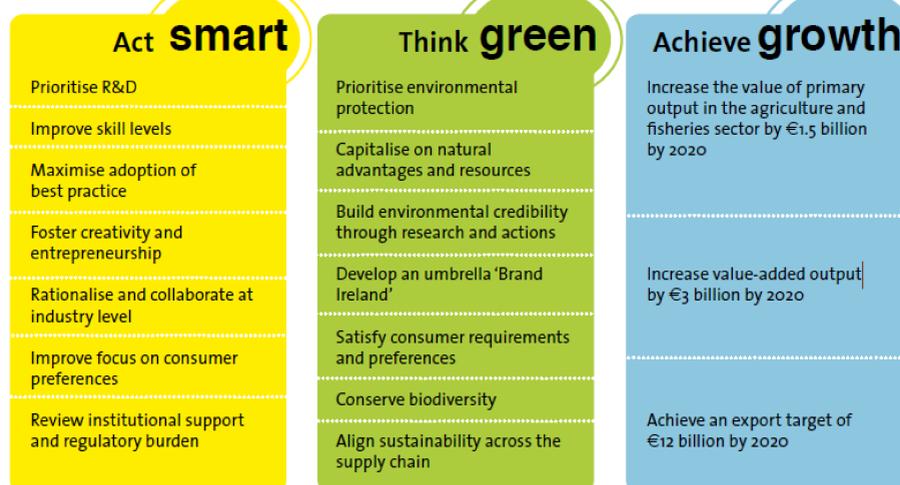


Figure 1: Overall vision of the Irish aquaculture objectives from Harvest 2020 ^[1]

The industry stakeholders

The fish farms were chosen in order to be representative of the Irish freshwater fish farming industry (Figure 2, Figure 3)

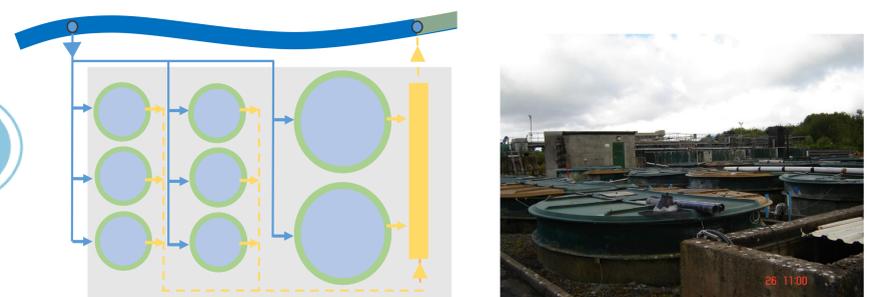


Figure 2: tank based salmon smolts production unit (left: schematic representation, right: picture)

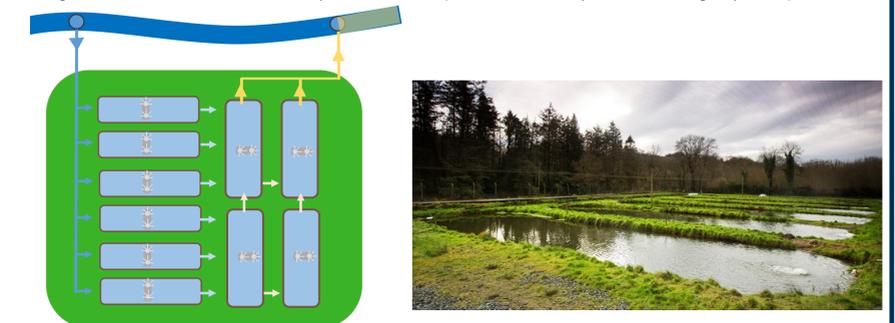


Figure 3: pond based rainbow trout production unit (left: schematic representation, right: picture)

Conclusion – take home message

- MOREFISH project undertakes a multi-disciplinary approach (i.e. engineering, toxicology, water treatment, management).
- Long term study on real-sites representative of the Irish fresh water aquaculture situation
- Improvement expected in the fields of production control, production efficiency, energy efficiency
- Specific fields to be studied: aeration (i.e. microbubble technology), minimizing outbreaks by disinfection (e.g. pulsed UV), water treatment (e.g. constructed wetlands), waste management and treatment; all with the objective to lead to a better environmental footprint of the aquaculture industry as recommended by the legislative framework
- Enhancement of environmental efficiency to be checked by life cycle analysis (LCA) and risk assessment approaches
- Cost efficiency studies to validate the proposed evolution from the aquaculture industry productivity point of view

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References:

- ^[1] DAFM (Department for Agriculture, Food and the Marine), National strategic plan for sustainable aquaculture development (2015)
^[2] EU – COM Strategic guidelines for the sustainable development of EU aquaculture, 229 pp. (2013)
^[3] Warrer-Hansen Ivar, Potential for Land Based Salmon Grow-out in Recirculating Aquaculture Systems (RAS) in Ireland, A report to The Irish Salmon Growers' Association, IFA aquaculture (2015)

www.MOREFISH.ie @MOREFISHproject