



REFISH

Enhancing production and sustainability in Irish aquaculture

Dr Richard Walsh
National University of Ireland, Galway
Ireland

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Presentation overview

- Project rationale
- Overview of project background
- Project
 - Team members
 - Overview
 - Objectives

MOREFISH

- MOREFISH is a multidisciplinary project funded by the Irish Department of Agriculture, Food and the Marine.
- Joint project between NUI Galway and Athlone IT.
- Involves industry stakeholders in project advisory capacity.

Rationale

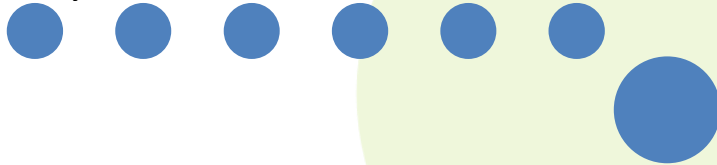
- EU & SEAFOOD SUPPLY
 - Largest seafood market (huge trading deficit)
 - Wild catch fishing (plateau and falling)
 - Aquaculture (Flat-lining for over a decade in EU)
- EMFF (European Maritime & Fisheries Fund)
 - More Efficient (but less) Fishing
 - EXPAND Aquaculture
- Ireland – Food Harvest 2020

Rationale

- Freshwater – Unique Subset of Aquaculture
 - Salmon – FW phase – Smolt output for Salmon Farms
 - Rainbow Trout – Staple Food Item
 - Minor spp – Char, Perch.....
- Greater quantities of high quality (Organic) produce

Project background

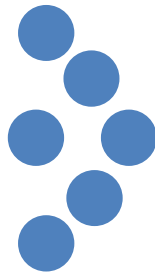
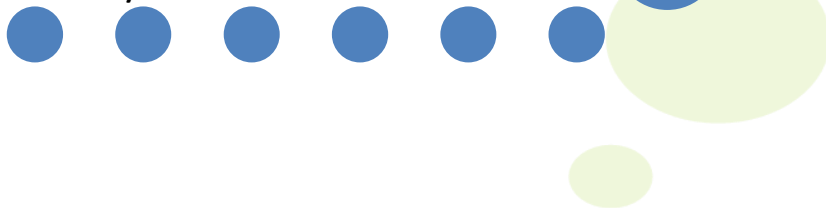
Wastewater and aeration technology development at NUI Galway and with Industry



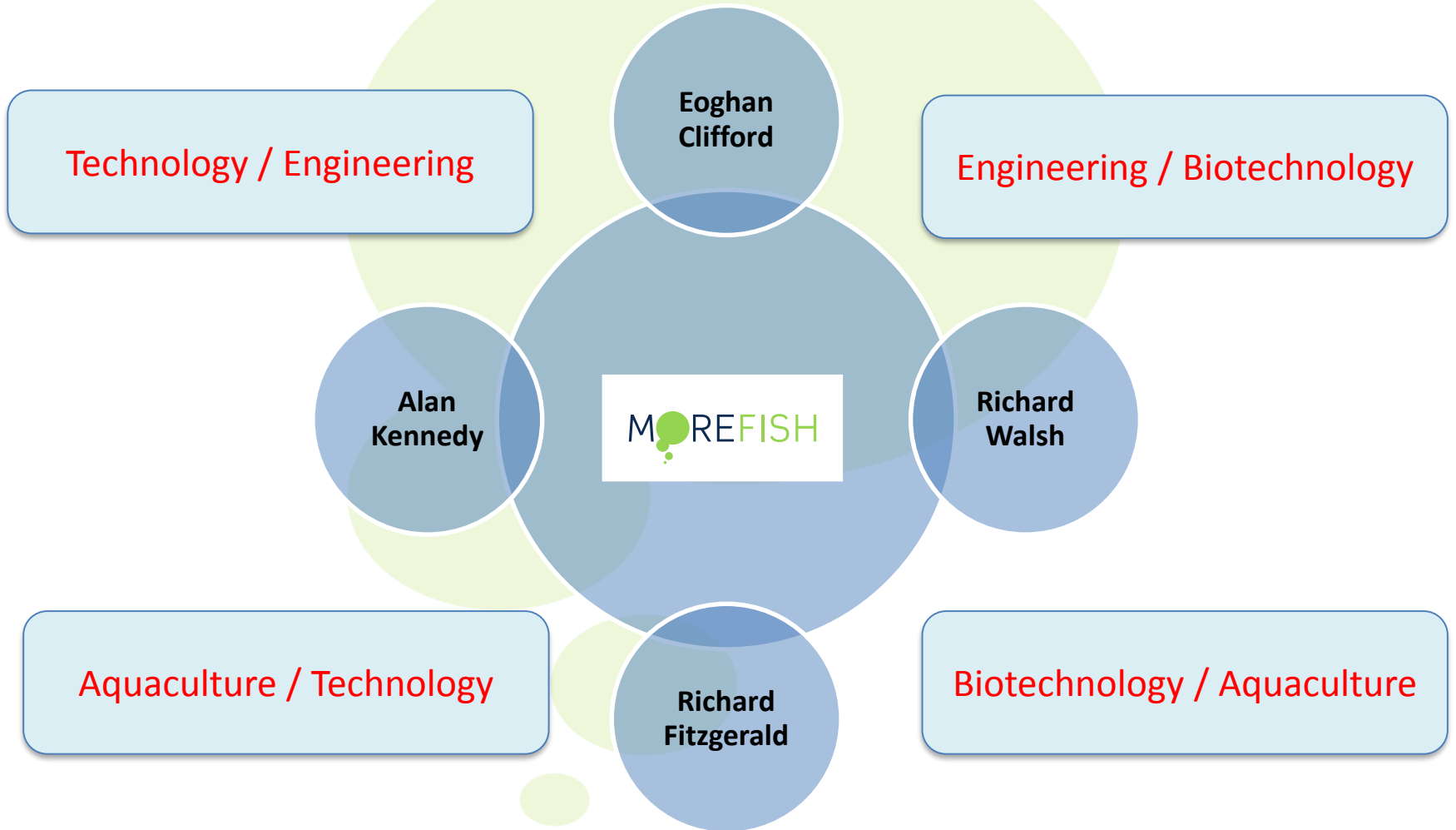
Opportunities in Aquaculture sector explored industry



Merge previous work on water treatment/re-use carried out with AIT



NUI Galway - Project Team

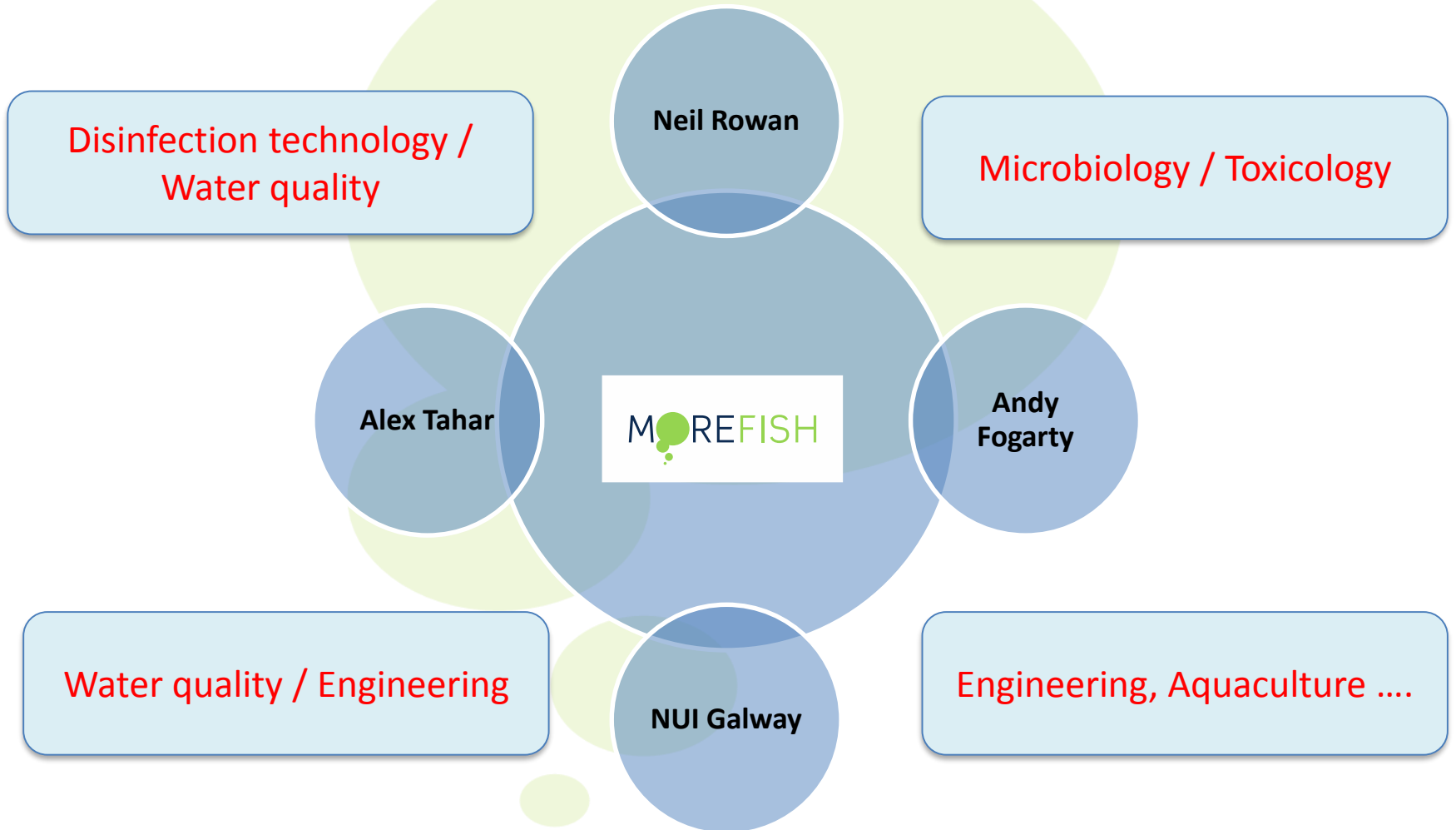


Project Team

- **Water/wastewater facilities** (Tuam Co. Galway; Moneygall, Co. Offaly)
- **WATERNOMICS** – www.waternomics.eu
- **ITWAT project** – www.itwatproject.com
- **MARMED** – www.marmed.eu
- **Dairywater** – www.dairywater.ie
- **EPA projects (Irish Water advisory board)** – resource efficiency in water sector

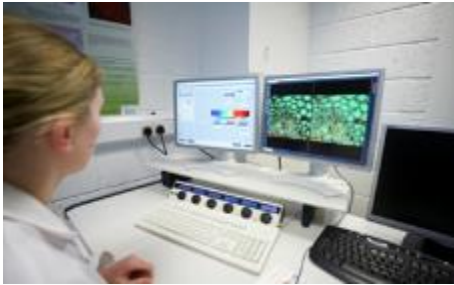


AIT - Project Team



Project Team

- **Water/wastewater facilities** (Tuam Co. Galway; Moneygall, Co. Offaly)
- **Sharebiotech** – www.sharebiotech.net
- **Dairywater** – www.dairywater.ie
- **SFI/HRB projects** (development of real-time in vitro and in vivo diagnostic and/or infectivity methods and novel sanitation technologies)
- **EPA projects** (pulsed light; parasitology including Crypto and Giardia; priority hazardous chemical detection and sanitation; ecotoxicology)



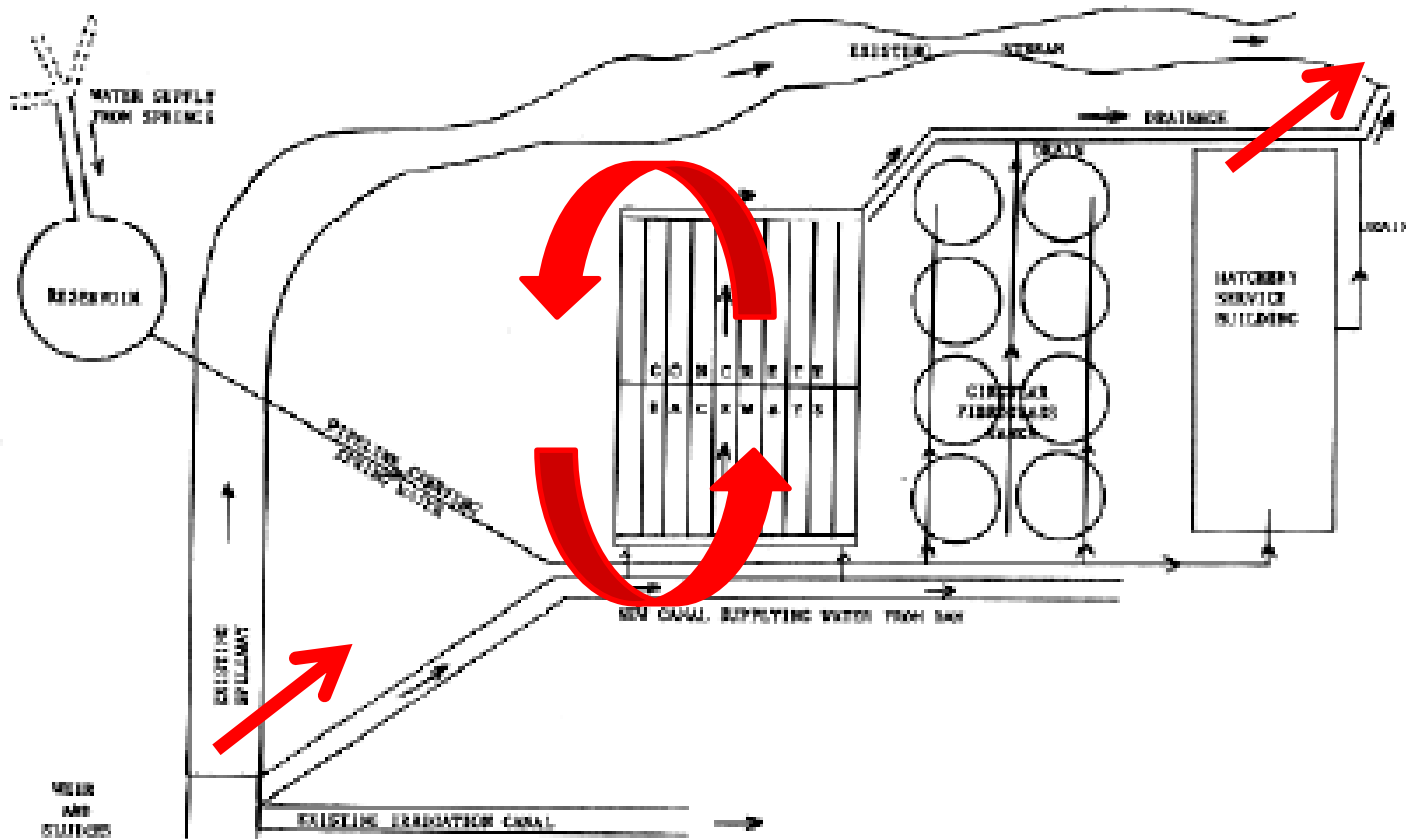
Project objectives

- Increase fish biomass output per unit input (e.g. energy, feed).
- Increase production efficiency and competitiveness.
- New production management strategies that minimise environmental impacts (e.g. wastewater treatment; WFD).
- Develop and demonstrate the use of innovative technologies that improve efficiencies and can accommodate organic classification.

Project objectives

- Develop benchmarking tools that enable end-users monitor production efficiency and inform key process decisions.
- Undertake comprehensive cost-benefit analysis of all implemented technologies.
- Develop new funding opportunities (e.g. HORIZON 2020), in collaboration with industry and key stakeholders.

Impact areas



Project overview- Engineering

Aeration technologies:

Increase aeration efficiency of fish tanks
Removal of CO₂ from process water

Wastewater treatment

Energy efficient wastewater treatment
Ensure quality of re-circulated / discharged water

ENGINEERING

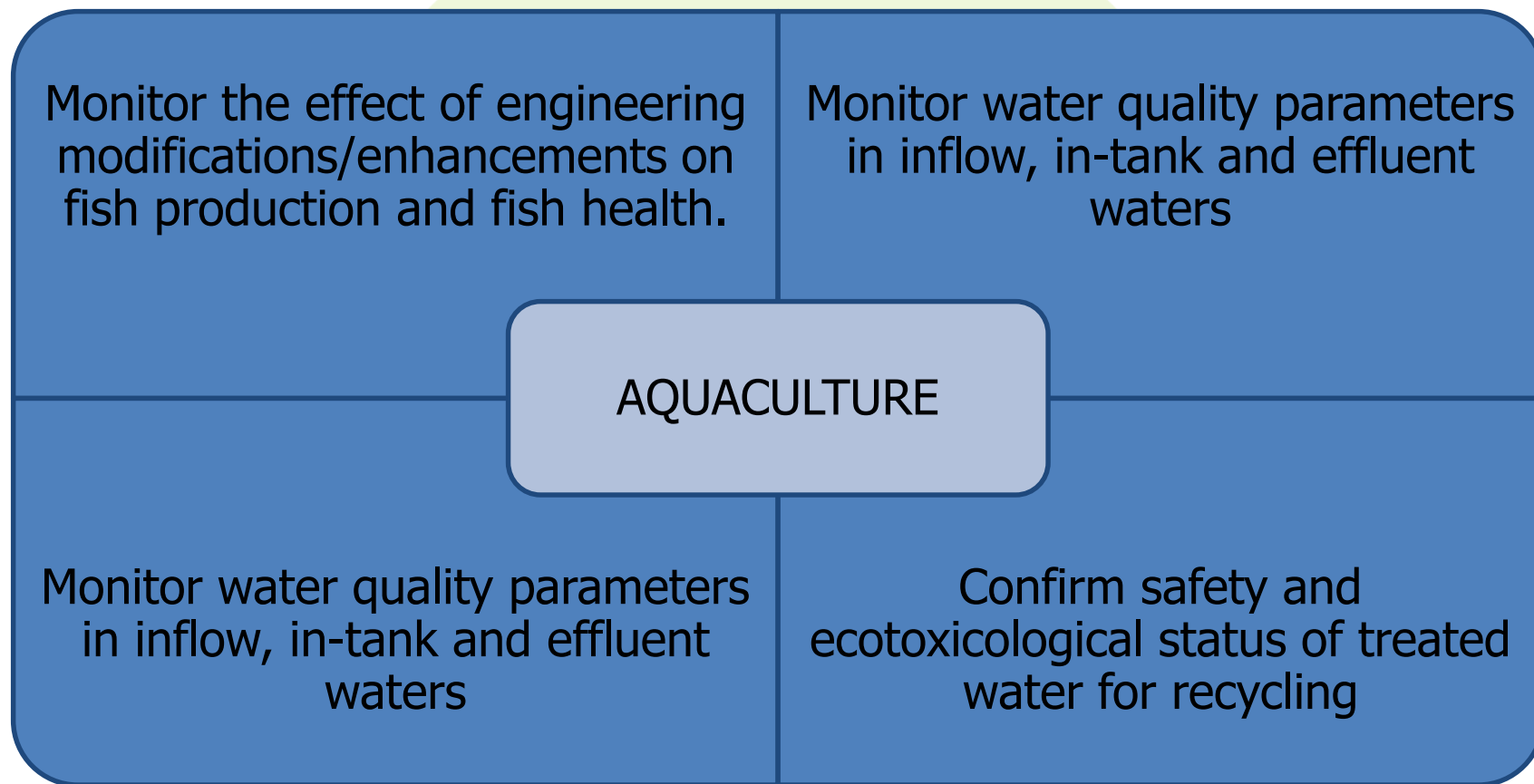
Waste sludge treatment:

Re-use of sludge for energy and/or compost
Reduction of waste sludge volumes

Process efficiency:

Ensure maximal feed uptake by fish
Ensure efficiency of feed dispersion in tanks

Project overview- Aquaculture



Aeration Technologies

- Assessment of existing & emerging Aeration/Degassing technologies in Water/Wastewater Treatment and Aquaculture sectors.
- Assessment/Development of Microbubble Generating technologies for Aeration, Oxygenation, Degassing, SS separation and Wastewater treatment.
- Development & Optimisation for freshwater finfish aquaculture.

Microbubble Technologies

- Bubbles in the range of 5 – 50 micron
- Unique Characteristics
 - High Surface Area to Volume – increased contact area for oxygen transfer – high air-water interface area
 - Low rise rates – increased time for gas transfer
 - Negative charge – limits coalescence of bubbles & attracts suspended solids - floatation
 - Self pressurisation of bubbles with decreasing size – increased dissolution
 - High oxidising/sterilising capacity – generation of + OH free radicals at collapse of bubbles

Microbubble Technologies

Bubble Diameter	Rise Velocity	Surface area for fixed volume of 1 Litre
μm	cm/min	m^2
10	0.2	600
50	6	120
100	24	60
300	217	20
500	602	12

Microbubble Technologies

Technology	Standard Aeration Efficiency	Standard Aeration Efficiency
	From Air	From Oxygen
	kgO ₂ /kWh	kgO ₂ /kWh
Aerator		
Paddle wheel	2.2	
Propeller Aspirator	1.6	
Pump Sprayer	1.3	
Oxygenator		
Oxygen Cones		4
Low head oxygenator		2 - 5
Microbubble	4	16

Aquaculture wastewater treatment

- Traditional flow-through systems
 - High volume of income water
 - Discharged water very diluted
 - Difficult to manage from a wastewater treatment point of view
- ➔ Environmental impact (e.g. ammonia (NH_4) discharge)
- ➔ REUSE could be a solution
- ➔ Evaluation of aquaculture wastewater treatment

Reuse of treated water

Photo: Jokumsen

Why reuse?

- Water consumption
- Water discharge quality problems
- Control of water quality
- Pressure of legislative framework
- Production intensification

Water usage

- Aquaculture wastewater treatment
 - Disinfection process
 - Nitrification process
 - Solid/liquid separation

- Waste/sludge treatment and management
 - Onsite treatment opportunities
 - Potential routes

Photo: Nielsen



Progress

- Collated historical data (water usage, energy usage, environmental parameters of water intake/discharge) from the past 10 years from 3 farms.
- On site data gathering ongoing.

Thank you

Funded by the



Department of
**Agriculture,
Food and the Marine**

An Roinn
**Talmhaíochta,
Bia agus Mara**

www.MOREFISH.ie
[@MOREFISHproject](https://twitter.com/MOREFISHproject)