AquaIMPACT
Nutrition and breeding

2023

AquaIMPACT policy brief on integrating land- and sea-based aquaculture for more resilient and green aquaculture in the EU

The current Policy-paper on 'Land-based aquaculture' contributes to the objectives of EU strategies of *European Green Deal*, *Farm to Fork Strategy*, and *Strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021 to 2030* with the objectives to stimulate the blue bioeconomy and create jobs while accelerating the green transition.

The benefits of land-based farming

- ✓ It can be either integrated to provide added value for the current aquaculture practiced in oceans, seas and lakes, or practiced autonomously on land.
- ✓ Potential to control abiotic production conditions and biotic environment, including diseases such as sea lice.
- ✓ Potential to re-locate farms from oceans, sea and lakes on land and closer to the main markets.
- ✓ Potential to reduce impacts of aquaculture on eutrophication, aquatic environments and wildlife.
- ✓ Potential to produce sea food products all-year round, in a stable controlled manner not influenced by seasonal and annual variation in environmental conditions.

What is land-based aquaculture

Land-based aquaculture refers to the rearing of aquatic organisms on land, and not in oceans, seas or lakes as has been traditionally done.

Land-based aquaculture has recently emerged as a novel industrial-scale production system.

There is a diversity of land-based systems, starting from open flow-through systems, and at the other extreme, nearly closed recircular aquaculture systems (RAS).

Challenges

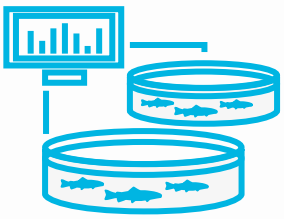
Yet, major challenges still remain. These include issues in profitability, fish performance, fish quality/pigmentation, early maturation, off-flavouring, implementation of early-phase technology, high energy use, lack of trained personnel and consumer perception.

'AquaIMPACT - Genomic and Nutritional Innovations for Genetically Superior Farmed Fish to Improve Efficiency in European Aquaculture' has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 818367

Priority topics for land-based aquaculture

1. Production systems that utilize combinations of open and closed land-based and sea-based farming technologies

The novel land-based aquaculture technologies can be integrated into the existing aquaculture practices and infrastructures, to solve some of the current issues and to provide novel opportunities not existing before.

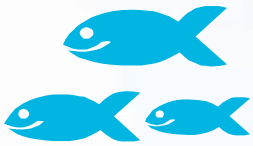


KEY MESSAGES AND NEEDS

- ✓ There is a need to find optimal combinations of open and closed land-based and sea-based farming technologies that fit for target species and their different stages of life cycle.
- ✓ Optimisation of smoltification processes in salmonids.
- ✓ There is an urgent need to increase profitability and to reduced climate impacts of asset-heavy and energy demanding land-based systems such as recircular aquaculture systems (RAS).
- ✓ Land-based facilities provide opportunities for more effective use of robotics, automatization, sensors, artificial intelligence and digitalization, to monitor and predict, to control rearing, feeding, environmental parameters (O2, pH, water flow, temperature, water quality, diseases) and fish performance and welfare.
- ✓ In land-based systems, both the production technology and monitoring technology could be used to manipulate the abiotic and biotic conditions, to amplify the factors that effect production in a positive manner and to minimize the negatives.

2. Animal welfare and resource efficiency of the fish

Production of sea food can be made more economically profitable and socially acceptable, and the improvements in animal welfare and resource efficiency are key components to achieve this.



KEY MESSAGES AND NEEDS

- ✓ Land-based systems can be used to completely block occurrence of some diseases and pathogens, yet simultaneously novel welfare and behavioural issues rise and other disease (e.g. bacterial) may become more prominent.
- ✓ Microbiome of the production system and of fish themselves request further studies, to understand the way microbiome can be controlled to improve fish welfare, flesh quality and performance.
- ✓ Resource efficiency of fish is composed of growth rate, feed efficiency, retention of nutrients, energy and protein, fish survival and processing yields, which still need improvement in land-based systems.
- ✓ Collection, handling and utilization of sludge as a resource as fertilizer or biofuels.

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Priority topics for land-based aquaculture

3. Breeding and genomics and species

Selective breeding has been the key way to domesticate animals and to adapt them to novel production environments and feeds. Moreover, selective breeding can result in around 5 % genetic improvement per generation in resource efficiency (ratio of feed input to product output), via improvements in growth, feed efficiency, survival and processing yield.

KEY MESSAGES AND NEEDS

- ✓ Selective breeding and genomic selection can adapt species to land-based systems, and there is a need to study novel traits that are expressed only in land-based systems (e.g. diseases, product quality, social effects between fish).
- ✓ Land-based systems provide opportunity for high throughput phenotyping technology, digitalisation, and video monitoring, that can be utilised in breeding programmes.

5. Communication and consumer awareness

Balanced fact-based communication is a key to maintain consumer confidence on aquaculture practices, and to increase consumption of sustainable and healthy sea food products produced in the EU.

KEY MESSAGES AND NEEDS

- ✓ There is a need for effective communication towards consumers, to ensure that consumer perception is based on balanced and unbiased facts about aquaculture and sea food products.
- ✓ Land-based aquaculture has several clear sustainability advantages, but it can also be seen as more intensive industrial production towards which consumers may be sensitive.

4. Feeds and feeding

The requirements of feeds for land-based systems differ from the feeds used in traditional sea-based systems, and new feed products are needed.

KEY MESSAGES AND NEEDS

- ✓ The challenge for feed development in land-based systems is the need to find the optimum that balances the nutritional needs of selectively bred organisms, product quality, water quality, biofilter activity, microbiota composition, and waste water content.
- ✓ The overall system has interactions between feed, microbiota (of water and fish), biofilters and fish. The fish are only one part of the system, all parts need to work together.
- ✓ Can we apply beneficial biological interventions to control, direct or treat (closed) land-based production systems by adding microbiota, bacteria, probiotics to the water or feed?

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The expected long-term impacts

The development of land-based aquaculture in accordance with the defined priorities can help building EU aquaculture sector that:

- ✓ Is competitive, resilient and more environmentally friendly.
- ✓ Ensures the supply of nutritious and healthy food produced in the EU.
- ✓ Creates economic and technological opportunities and jobs.
- ✓ Becomes reference for green transition and sustainability.
- ✓ Ensures knowledge and technology development within the EU, making it a hub for innovative aquaculture development (technology, biology, digital, sustainability).

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AquaIMPACT partners: