FISH2.0
INVESTMENT INSIGHTS

Land-based Recirculating Aquaculture Systems (RAS)

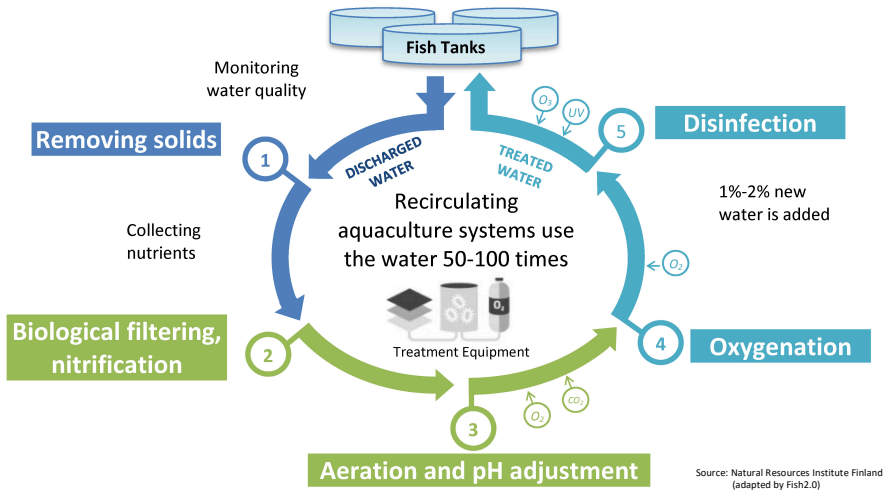
Seafood production using land-based recirculating aquaculture systems (RAS) is among the hottest topics in the industry today. It steadily gained momentum over the last decade and has now reached an inflection point, with RAS projects springing up globally, especially in the Nordics, U.S., and Canada, and with investor attention growing. Thus far, land-based RAS has predominantly been used and refined for salmon smolt production, but is now being considered for full life-cycle production as an alternative to traditional cage-based farming in the ocean.

Land-based RAS has notable advantages over marine aquaculture. Unlike sea-based cages, closed-loop RAS provides operators with near-full control over growing conditions and inputs, allowing them to avoid disease, optimize growth and quality, and supply seafood according to highly predictable production plans. RAS may be located near important consumer markets, which provides significant advantages in transportation costs and product freshness. Moreover, RAS may be better for the environment: there is no risk of escapes or the spread of diseases that could harm wild stocks, and virtually no impact on the wider ecosystem from effluents, antibiotics, or other inputs of farming. RAS systems also are generally more efficient with feed, and use 99% less water (compared with flow-through aquaculture systems).

The young RAS industry is not without its challenges. Mimicking a natural system and continuously regulating all parameters is an energy-intensive process that calls for RAS to be co-located with cheap, abundant energy sources. Also, great care must be taken to not introduce pathogens in these systems, risking absolute contamination. However, the greatest current challenges are getting RAS projects to scales at which they are economically viable, and securing the sizeable start-up capital needed to build large, sophisticated facilities.

While several early RAS projects failed to deliver returns, the industry believes that the time for RAS is now. Surging market demand for seafood, high market prices, and the increasing operating costs of traditional marine farms make land-based RAS an increasingly attractive option, especially for high-value species such as salmon. As growth in traditional marine aquaculture is slowed by caps on licenses, lack of viable locations, and the challenges of disease outbreaks, many now look to RAS to deliver the next wave of growth.

Recirculating Aquaculture Systems



Source: Natural Resources Institute Finland (Luke) (adapted by Fish2.0)

Opportunities and Innovation Areas

Go big or go home

Industry analyses have generally concluded that RAS projects must be large to achieve the necessary economies of scale and be commercially attractive. Now that the industry is progressing from pilot projects to full-scale operations, RAS projects are growing in scale, giving rise to sophisticated mega-RAS farms. Several projects costing hundreds of millions of dollars are underway, and many more are in the planning phase.

Wanted: specialty feeds and inputs

Thus far, a large proportion of investment in this emerging industry has gone to the development of novel feed ingredients, which is the biggest production-cost factor. RAS requires specialized feeds and inputs that can work harmoniously with its sophisticated systems. This, in turn, offers feed manufacturers new avenues for value add and premiumization. RAS fish feeds are being formulated to optimize animal growth while reducing waste outputs, especially ammonia and non-digestible fiber, which is important in maintaining water quality and biofilter performance.

Aquaponics—adding greens to the system

"Aquaponics" combines the hydroponic production of leafy green vegetables and herbs with the RAS production of fish—a symbiotic partnership in which the excrements of fish provide nutrients to plants, the plants clean and oxygenate the water, and the conditions for fish are optimized. It's a prime example of a circular, no-waste economy. Such systems promise to revolutionize the continuous supply of hyper-fresh vegetables and fish to urban markets, especially in landlocked, northern areas where food can't be grown year-round (e.g., Chicago, Berlin, London).

Bigger, faster, cheaper—GMO seafood

Production of genetically modified salmon—designed to grow bigger, faster, cheaper, and be more disease resistant—is a controversial topic. The advent of land-based, closed-loop aquaculture has made GMO seafood (e.g., AquAdvantage salmon) a more viable proposition, as it eliminates the risks of interaction with wild species and ecosystems. GMO seafood may make RAS operations more economically viable through improved growth rates, higher harvest weights, and shorter production cycles (sometimes up to 50% shorter). In brief, GMO fish and land-based RAS are ideal partners that could be optimized to work harmoniously together.

Sources:
- Aukner A, Hanstad TB. Deep dive into land-based farming, special report. DNB Markets, February 2017.
- Land-based Salmon Farming, Industry Report. IntraFish, August 2018.

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