

# Sustainable seafood

A Nordic consortium headed by Nordic Aquafarms is working to bring onshore seafood production into mainstream aquaculture. New standards for sustainability and documented profitability are at the forefront of the effort

Over the last few decades fish farming has become the leading source of a variety of important consumer seafood products, taking pressure off the increasingly overfished wild stocks to meet growing global demand. In recent years, however, large segments of the fish farming industry have begun to approach their upper limit as current production methods such as net cages leave environmental footprints in fragile marine environments. Meanwhile, a range of international institutions estimate that global fish supply must double in the next three or four decades to meet demand. Onshore production methods hold the promise of delivering additional growth with a low environmental impact.

## Norway enters the onshore arena

Nordic Aquafarms (NAF), with head offices in Norway, is dedicated to developing the production of seafood with a low environmental footprint. The company works exclusively with next generation onshore production designs based on recirculation technologies. In contrast to the established salmon industry that exclusively produces smolt in these systems, NAF is committed to industrialising the production of marine fish to harvest size in onshore systems.

NAF's main development hub is located in Fredrikstad, Norway, where the daughter company, Fredrikstad Seafoods, is currently developing a facility for Atlantic salmon in collaboration with Norwegian research institutions and Nordic suppliers. In addition, NAF is investing in two facilities in Denmark, working with the yellowtail kingfish, a sought after species in the sushi industry.



Ongoing construction of the Sashimi Royal project in Denmark

The Fredrikstad Seafoods facility is the world's largest onshore salmon grow-out facility ready for construction, financed by Norwegian risk capital. Plans have been laid out for a 8,000 tonne annual production facility to be built in two stages.

A number of early innovators have built and now operate onshore facilities, but most are small scale. A few facilities exist for salmon production, but onshore production of yellowtail is completely novel. Even though a range of challenges have been identified and solved in existing facilities, various design and biological challenges require further development efforts. Significant improvements in designs are also required on a large scale. NAF is committed to accelerating the learning curve on designs and production to prove the financial viability of the production method on a large scale for select marine species.

## New designs emerging

Some of the main historical challenges for onshore facilities have been construction costs and a lack of standardisation in designs. Many facilities have also gone into production with incomplete infrastructure, resulting in very steep and expensive learning curves. The treatment of effluent water has also been limited mostly to sludge removal in existing facilities, thus resulting in discharges that still produce negative effects for local environments. Innovation in designs for the entire production process is required to move onshore production into a competitive position for large-scale production.

Improved designs show a strong promise of providing:

- A reduced physical footprint of the facility;
- Lower capital cost;
- Lower energy cost;
- Cleaner discharge;
- Reduced CO<sub>2</sub> footprints;
- Improved fish welfare;
- Improved production logistics; and
- Improved product quality.

NAF has designed and is implementing a complete production chain that seeks to harness and industrialise these benefits for onshore production. In a five-year timeframe, dramatic leaps in knowhow and improvements are expected, completely changing the value proposition of onshore fish farming internationally.

Some of this development will occur among technology suppliers. The contribution from NAF will be large-scale production development and demonstration supported by multidisciplinary research resources.

### Environmental imperative

The environmental benefits of these designs include elimination of fish escape, prevention of parasites and disease, a clean water discharge, and significant prevention measures in terms of disease spreading. As an example, discharge of phosphorus, nitrates, faeces and feed waste will be reduced dramatically compared to existing onshore producers and sea pen production. The company has designed the most advanced water treatment infrastructure in the industry for this purpose.

With environmental change rapidly impacting world oceans and potentially existing fish farming operations in the future, onshore production can compensate for many negative impacts of environmental change in a controlled environment to ensure optimal conditions for the farmed species. As an example, changing PH levels, temperature changes and algae blooms in oceans can be managed in these systems.

The various technologies to achieve these environmental objectives do exist, but no-one has fully integrated emerging environmental technologies to document the true potential in commercial-scale onshore production.

### Development efforts

Further de-risking of production involves the optimisation of the overall production chain, design improvements, further knowledge development related to biological risks, and investment in environmental technologies. The end-game objective for this segment must be highly scalable production models with competitive fish welfare performance. NAF seeks to demonstrate that a competitive rate of return can be achieved for investors while also documenting a superior environmental footprint in the salmon industry.

Key biological issues to be optimised in achieving consistent results include:

- Solutions for maintaining stable water parameters throughout the year;
- Consistent fish growth to an approximate harvest size of four kilos;
- Significantly lower mortality than sea pen production;
- Strategies for minimising early maturation of the fish;
- Strategies for consistently preventing ‘off-flavour’ in the fish; and
- Superior product quality.

To accelerate the development in this segment, the above challenges must be solved and transformed into operating models in large commercial environments. With the support of



Architect's illustration of the Norwegian facility

Norwegian investors and researchers, this will now be possible in Norway.

### Market awareness

A key challenge for the onshore segment is low consumer awareness of the benefits of land-produced seafood. Sustainability, potential for superior product quality, and local production and supply are key selling points. Partnering with actors in sales and distribution to reach key target customer groups with a good value proposition is also a key success factor for expanding the market for these products.

Development efforts are currently underway to increase consumer awareness in targeted markets. Consumers concerned with the environment and with consistent high quality will find attractive products from professional onshore producers.

### Conclusion

NAF is currently pursuing a range of feasibility assessments and development efforts to implement production models in 2017 and 2018. Findings from the development of best practices will be shared through scientific publications and publications on our homepage. The aim is to promote sustainable practices and to contribute to lowering the barriers for more producers of various species in onshore systems.

A diversification of various production methods, including onshore production, is very likely necessary to meet future demand for seafood in a sustainable manner.



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