



Nordic
Innovation

The Nordic Marine Innovation Programme 2.0

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The Nordic countries are world leading in fisheries and aquaculture. Nevertheless, business actors are still challenged on demand for new products, better quality, lower production costs, and stricter environmental requirements. A clear goal of the Nordic Marine Innovation Program 2.0 has therefore been to create more business opportunities, increase profitability and sustainability in the sector through Nordic solutions.

Nordic Innovation is very pleased to present the results from the eight projects in the Nordic Marine Innovation Programme 2.0, where new networks, products and technologies were developed through Nordic collaboration.

The initiative is co-funded by Innovation Norway, the Nordic Working Group for Fisheries and The Icelandic Centre for Research (Rannis).



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A Nordic consortium represents a wider perspective on the challenges, which has brought the project results to a higher level.
– Åsbjørn Karlsen, Eukaryo AS



Seaweed as a promising, sustainable ingredient in fish feed

At present, soy protein and fish cuttings are the most commonly used sources of protein in fish feed. Given the rapid pace of growth in the seafood industry, this is not a sustainable source of protein. Finding an alternative is therefore vital if the Nordic fish farming industry is to stay competitive.

Macroalgae contains significant amounts of the ingredients needed to help solve the protein challenge. The CapMafi project has developed a new method for using seaweed that may lead to a sustainable alternative for protein supply in the fish farming industry.

The technologies tested in the project resulted in a method to stabilise and preserve the macroalgae without using

expensive chemicals or energy to dry the biomass after harvesting. This makes it easier to process and utilise all the valuable ingredients in the macroalgae and makes all-year production of protein supply possible. Based on these results, a pilot test will be carried out to see if they can be implemented on an industrial scale.

The project consortium consisted of R&D partners and companies from Iceland, Faroe Islands and Norway, encompassing different professions and parts of the macroalgal value chain. The results of the project will contribute to the next generation of Nordic sustainable fish feed and help to improve the Nordic marine industry and its export possibilities within sustainable products.

Project name:	Conservation and Processing Marine Macroalgae for Feed Ingredients (CapMafi)
Project owner:	Eukaryo AS, (NO)
Project leader:	Eukaryo AS (NO)
Project participants:	Matís (IS), Akvatik (NO), DUE MILJØ AS (NO), TARI Faroe Seaweed (FO)
Funding from:	Nordic Innovation and Innovation Norway
Total budget:	NOK 7 842 000 million

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We foresee that the network that has been established will help boost the export of Nordic products and services and strengthen sustainable use of Nordic raw marine materials.

– Margrét Geirsdóttir, Matís



Turning unutilised fish skin into collagen

Fish skin has low value and is therefore usually discarded during processing. However, fish skin can be turned into Collagen Hydrolysate (CH), a type of gelatine that is in high demand on the global market.

By producing CH from fish skin, the yield of gutted fish would increase by 3-5% and reduce the amount of waste. CH is becoming more and more important to the nutraceutical market because of its strong links to positive health effects. It is also an excellent alternative to collagen produced from pigskin and calfskin, as it is not associated with religious restrictions.

The aim of the project has been to create new solutions for utilising fish by-products from both wild caught fish and aquaculture to increase business opportunities for fish-derived products in the CH market. The Nordic partners in the project have developed new enzymes to work as activators, accelerating the chemical process to produce CH products from the fish skin.

In the beginning of 2019, construction will start on a plant to be owned by four major Icelandic fish producers. The plant will produce collagen from fish skin and thus commercialise the project results.

Project name:	Production of Hydrolysed Collagen from Fishery By-products
Project owner:	Codland
Project leader:	Matís
Project participants:	Biomega (NO), Technical University of Denmark, DTU – The Novo Nordisk Foundation Center for Biosustainability (DK)
Funding from:	Nordic Innovation and Innovation Norway
Total budget:	NOK 8 319 000

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Nordic cooperation makes us more competitive. I think if you do not look abroad to develop as a company, like we have done in this project, you will not be in this business for long.

– Sindri Sigurðsson, Síldarvinnslan hf



Nordic competitors work together to optimise the processing of mackerel

The Nordic region represents 41% of the global catch of Atlantic mackerel. It is sold block-frozen, either whole or as headless and gutted fish, unlike the salmon or trout fillets found at fish counters. While there is a market demand for filleted mackerel, there is a lack of knowledge of how factors such as seasons, catching methods and processing affect the quality of this fish. This limits the industry in producing high-quality mackerel fillets that could be sold at a high price and would reduce food waste.

In this project, Nordic pelagic competitors, universities and research institutions have brought their experiences to the table and

addressed these issues. Together, they have assessed the impact of seasons, storage environment and temperature of the meat on the quality of the final product.

The results and knowledge gained give these Nordic producers an international competitive advantage. Now they are able to better utilise the fish and optimise meat quality, energy use, and means of transportation and packaging. Altogether, the innovations developed in this project will be both financially and environmentally beneficial to the participants and the industry as a whole.

Project name:	Improved Quality and Value of Nordic Mackerel Products for the Global Market
Project owner:	Pelagia (NO)
Project leader:	Matís (IS)
Project participants:	Síldarvinnslan hf (IS), Gjögur hf (IS), Varðin Pelagic (FO), Arenco VMK AB (SE), Nofima (NO), Chalmers University of Technology (SE) and University of Aarhus (DK)
Funding from:	Nordic Innovation
Total budget:	NOK 9 000 000



The experience and knowledge we gained from this project have been invaluable to us, and gave us a leading position internationally within the macroalgae cultivation business

– Olavur Gregersen, Ocean Rainforest



Nordic collaboration spearheads global seaweed expertise

Seaweed has been hailed as the ideal solution to meet the growing global nutritional and energy needs, as it does not rely on land, fresh water or fertiliser for growth. The potential contribution of seaweed to climate change mitigation and ocean health is therefore substantial.

Today the industry is not rigged to meet the demand for seaweed products. Lack of knowledge on cultivation and production has been one of the main obstacles to succeeding in large-scale production of macroalgae.

The MacroValue project has enhanced knowledge about macroalgal cultivation and harvesting. As a result, this project has pushed the industry closer to industrialisation and up-scaling. It has also contributed to developing a

bigger market for seaweed, where the Nordic region, is well positioned to be a front-runner, with its knowledge of the ocean.

The project has been a collaboration between the Norwegian seed and cultivation experts Hortimare, the Icelandic research and innovation specialist Matís, and the Faroese North Atlantic seaweed cultivator Ocean Rainforest. The results have demonstrated that large-scale offshore kelp cultivation is possible using multiple partial harvesting in the Faroe Islands.

The project has helped to optimise seeding technique and provide a unique understanding of how seasonal variations impact seaweed production and has entailed major advancements for all three partners.

Project name:	Improving the Understanding of Seasonal Variation in Cultivated Macroalgae (MacroValue)
Project owner:	Ocean Rainforest Sp/F (FO)
Project leader:	Ocean Rainforest (FO)
Project participants:	Hortimare AS (NO) and Matís (IS)
Funding from:	Nordic Innovation and Innovation Norway
Total budget:	NOK 7 925 00

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This project has opened up new markets for products enriched with seaweed and has the potential to increase the international market share of the Nordic companies.

– Kolbrun Sveinsdottir, project leader



Nordic seaweed, a new super-ingredient?

There is an increasing demand for functional ingredients as more and more people are making dietary changes for a healthier lifestyle. Seaweed, which today is underutilised, is a potent source of bioactive ingredients. The abundance of seaweed in the Nordic region means there is a major business opportunity to develop seaweed-based health products. The results of this project show that seaweed ingredients can be used as a functional ingredient in food, nutraceuticals and cosmetics. Intake of encapsulated seaweed extract led to a significant improvement of the glucose metabolism

in participants in risk of diabetes. Skin cream containing seaweed extract also has a positive effect when applied to skin.

Nordic cooperation has helped to find new ways of utilising seaweed and given the Nordic companies involved a competitive advantage. The positive results will boost both Marinox and UNA skin-care towards expanding their product range, and FinnSnack and Pharmia are continuing to develop their production of functional ingredients based on the promising results of this project.

Project name:	Seaweed Bioactive Ingredients with Werified In-vivo Bioactivities
Project owner:	Marinox EHF (IS)
Project leader:	Matís (IS)
Project participants:	VTT Technical Research Centre of Finland LTD (FI), University of Iceland (IS), Kristianstad University Sweden (SE), FinnSnack Oy (FI), Pharmia Oy (FI) and UNA skincare ehf. (IS)
Funding from:	Nordic Innovation
Total budget:	NOK 7 439 500

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It made sense to do this on a Nordic level. There are certain competencies that can only be found in the individual countries. The project would not have been this successful if it was not for the Nordic cooperation.

– Ingrid Undeland, project leader



Paving the way for new Nordic seafood by-products

Every year, significant amounts of water containing valuable proteins and lipids are wasted during seafood production in the Nordic countries. The results of the NoVAqua project will enable Nordic seafood producers to produce novel food products from water that today ends up as sewage. This is an opportunity for the marine industry to optimise seafood production and develop new sustainable value streams.

By means of close cooperation between Nordic research institutions and industries, the NoVAqua project has measured the amounts of proteins and lipids in process waters from the shrimp, herring and mussel industries. Additionally, the consortium has developed tech-

nologies that separate and extract these biomolecules from the process water.

This has traditionally been done by adding non-food grade chemicals, which means that further use of the separated biomass in food and feed products is excluded due to health and safety regulations. NoVAqua developed a new and innovative food graded technology that allows the proteins and lipids from the seafood process waters to be further developed as food by-products. This opens new market opportunities for Nordic seafood producers. Based on the feedback and high interest from industrial actors, it is estimated that several businesses will have implemented this technology within the next 5 years.

Project name:	Extracting Novel Values from Aqueous Seafood Side Streams – NoVAqua
Project owner:	Chalmers University of Technology (SE)
Project leader:	Chalmers University of Technology (SE)
Project participants:	Räkor & Laxgrossisten AB (SE), Bio-Aqua A/S (DK), Skretting Aquaculture Research Centre (NO), Technical University of Denmark (DK) , University of Gothenburg (SE)
Funding from:	Nordic Innovation
Total budget:	NOK 6 044 042

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ProffAqua is a good example of industry and research coming together to drive forward novel concepts, in order to increase sustainable food production in the Nordic countries and beyond.

– Birgir Örn Smárason, project leader



From wood to fish feed

Aquaculture is the most rapidly expanding food production industry in the world, and several Nordic industrial actors are leading producers. However, there is a shortage of sustainable feed resources that can sustain the industry. The main raw materials for fish feed production stem from fish by-products and plant-based raw materials, mainly soy, neither of which can meet the high demand alone or is a sustainable solution. The industry's growing need for feed therefore provides an opportunity for Nordic sustainable alternatives.

The ProffAqua consortium have demonstrated how the production of new and more sustainable protein sources, insects and single cell protein, can be used as substitutes for soy protein and fishmeal in fish feed. The new protein sources were produced from residual streams or waste.

One of the residual streams the consor-

tium utilised was from a pulp mill, which is highly innovative. This raw material has very little value and is an under-utilised biomass. This means Nordic protein created from a new source, not in competition with current protein production. Large scale production would mean less use of land as compared to the growing soy, less resource input i.e. water, and less GHG emissions.

Moreover, the processing activity could create 10-20 jobs and generate a turnover of EUR 25-50 million per pulp mill. However, the most important finding was that this source of protein could be used in feed for both salmon and trout, which is attractive in the context of turning Nordic biomass into fish feed for the Nordic aquaculture industry. The project illustrates how Nordic synergies lay the foundation for new markets, and this "wood to food"-concept holds a great deal of promise for future Nordic innovations.

Project name:	ProffAqua – Proteins of the Future in Feed for Recirculating Aquaculture Systems
Project owner:	RISE Processum AB (SE)
Project leader:	Matís ltd. (IS)
Project participants:	Laxá Feedmill (IS), Víur ehf. (IS), Domsjö Fabriker AB (SE), Danish Technological Institute (DK), Technical University of Denmark – DTU Aqua (DK)
Funding from:	Nordic Innovation
Total budget:	NOK 8 000 000



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Nordic Innovation is a Nordic organisation working to promote cross-border trade and innovation.

Nordic Innovation is a vital instrument for the Nordic ministers of business, energy and regional policies and shall contribute to make the Nordic region a leading region for sustainable growth. Nordic Innovation aims to increase entrepreneurship, innovation and competitiveness in the Nordic region.

Nordic Innovation supports projects and programmes to stimulate innovation and works to improve the framework conditions for Nordic markets and exports.