

Nordic Marine Innovation Programme

2012-2015
Fact sheets



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P 11056

Automatic pin bone removal in cod and whitefish

MAIN OBJECTIVES:

The project's main objective is to develop and test a fully automatic machine for real-time high-resolution x-ray detection and automatic removal of pin bones in cod as primary raw material focus.

Automation, efficiency and optimized use of fish raw material are essential to keep the Nordic whitefish industry profitable, environmentally sustainable and globally competitive. Automated pin bone removal has the potential to increase the sustainability, profits and market for cod and other whitefish and plays an important role in the automation of the industry.

METHOD/IMPLEMENTATION:

Overall, increased rate of the pin bone removal, to a level where the system will become commercially interesting, has been solved via three main innovations: A high-resolution sensor providing 3D position of the complete pinbone, a precise cutting unit, and using measured positions to optimize cutting.

This technology has been built in one machine, the FleXicut.

At this moment the prototype is in testing phase and the objective is to have a fully developed product ready in the coming months. Full implementation will be when the FleXicut is formally free for sale.

CONCRETE RESULTS AND CONCLUSIONS:

Results show that this is technically possible and economically feasible.

With the FleXicut we can measure the fillet, process the data and cut at current processing speed in processing plant. By using water-jets for the bone removal process, which is more flexible than blade cutting alone we have more variety in cutting patterns which enables processors to optimize their product offering.

The FleXicut will deliver higher quality material, through improved product handling and bone free products. By moving cutting decisions from manual operation to FleXicut we get higher value products and more flexibility.

RECOMMENDATIONS:

The industry needs to move into inline automated processing in the near future.

The next steps in this development and missing links:

- Inline Quality Control, early process stages for whitefish and salmon industry: nematodes, filleting defects and blood spot detection. Such a quality measurement can be used for data collection and as part of processing decision as well.
- Production planning: For full tracking and traceability of the catch as well as to optimize, usage of raw material with regards to the finished product. This is where we have seen the poultry industry going.
- Automatic Packing for whitefish and salmon; logistic, packing, give away and fixed weight. These are all very important factors when considering the automation in processing of whitefish and salmon.



P 11057

Enriched Convenience Seafood Products

MAIN OBJECTIVES:

The objective was to increase the value of ocean-based raw materials, reach new seafood consumer groups and increase market share of the companies involved as a step forward for production of enriched seafood dishes for targeted consumer groups. The overall goal was successful product development of enriched seafood dishes with bioactive compounds such as seaweed, fish proteins and fish oil and an increase in variety of seafood products with functional properties for targeted consumers.

Seafood dishes enriched with bioactive compounds from the ocean, such as seaweed and fish oil were successfully developed using results from consumer concept testing in both Iceland and Finland. A marketing strategy for the enriched seafood dishes was developed for the seafood processors aimed for successful marketing of the innovative product. The effect and bioavailability of the omega fatty acids in consuming enriched seafood dishes for use to calculate individual protection of persons against lifestyle diseases was verified.

METHOD/IMPLEMENTATION:

This innovative seafood product development was based on collaboration between fish processing companies, ingredient companies and food research institutes with emphasis on consumer oriented product development, consumer testing and marketing. An intervention study was

performed where fatty acid profiles of the blood of a certain group of consumers using enriched seafood dishes for a period of time were measured. This was done via intervention study in collaboration with the Unit for Nutrition Research, Landspítali University Hospital and Faculty of Food Science and Nutrition, University of Iceland.

CONCRETE RESULTS AND CONCLUSIONS:

The Icelandic company has now developed various prototypes of enriched seafood and vegetable dishes nearly ready to the market. The plan now is a new healthy product line with various products in the Icelandic market and the company is now in their first real steps to exporting their products. Main interest for the Finnish company was in relation to consumer understanding as an important tool for further marketing activities. It was of very high importance for the ingredient and the seafood producers to verify the effect and bioavailability of the omega fatty acids in consuming enriched dishes. The positive outcome in concept tests for the relatively unknown food ingredient seaweed extract showed various possibilities for future product development of enriched convenience seafood products. The omega-3 could be an interesting option for lean fish species, and the fish protein for products aimed at more specific consumer groups, such as groups more interested in functional foods. The seaweed powder producer succeeded in

developing his product ready for enrichment of food and is in the phase of stabilising the production.

RECOMMENDATIONS:

Enrichment of convenience seafood products with marine based ingredients is a realistic option for the seafood producers, but it is very important to consider labeling and information provided to the consumers. There is a tremendous potential for better utilization of marine raw materials and conversion of these materials to high value ingredients in a production of high value enriched seafood dishes. More variety of consumer seafood with health effect will be beneficial for consumers. This Nordic collaboration have now led to European possibilities (www.enrich-mar.eu) both regarding further funding for research, innovation and marketing in this field including more food categories. The competitiveness of the SME's will increase for the growing markets of food with bioactive compounds. The verification of physiological health effect of consumption of enriched food is of high importance to the food ingredients and the food producing companies. The option for consumers to choose enriched food instead of food supplements will be of benefit and appeal to certain consumer groups. There is great interest for diet for elderly people in Europe in the near future and the concept of this project is highly interesting for further work in that area.

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P 11058

North Atlantic Ocean Clusters

MAIN OBJECTIVES:

There were two main goals in the project, one short term and the other long term. The primary short-term goal was to build a strong and stable relationship with the clusters and high tech firms around the North Atlantic developing new solutions in niche markets. The long-term goal was to build both a stronger identity of the North Atlantic regions as world class provider of technology for the marine sector and more cooperation in high-cost and high-risk production that take several years to develop and to market.

We have achieved our short term goal of building strong and long lasting relationships within the participating clusters. This was achieved by several meetings, conferences and other events in Iceland, Denmark, Greenland, Maine, Newfoundland and Norway. The strength of the relationship enabled us to work on several short-term projects named "the low hanging fruits" that aid us in achieving our long-term goal of a stronger identity and as a world class provider of technology for the marine sector.

METHOD/IMPLEMENTATION:

The initial work of the project was to map cluster activities in the North Atlantic and to a certain degree the marine-related industries in the different countries. The report was seen as a basis for further discussion about how to increase cooperation between the countries covered in the report. In the report, the focus was both on ocean-/marine related clusters in

industries connected to transport by sea and on the exploitation of resources in the ocean and beneath the seabed. The main emphasis was on marine-related food, energy, transportation, biotechnology and research.

The second stage of the project was to start building relationships between the clusters. Formal meetings of the clusters were held in Iceland, Denmark and Norway.

In the initial project proposal, the second phase of the project was called "The low hanging fruits" - seeking the opportunities for cooperation. This is in line with the most important part of cluster models in relations to the relationship building between clusters. Through the concept of the "low hanging fruits", emphasis is on possible projects, which can lead to positive results in a short period of time.

Concrete results and conclusions: Overall, the NAOCA project has been a success, paving the way for collaboration across borders and the ocean; expanding the network of all participants, establishing a platform for knowledge sharing and creating new business opportunities in the ocean related industries. Challenges lie ahead in the North Atlantic and the Arctic, but economic growth and business development through sustainable and responsible measures can be achieved in the region. Collaboration of different stakeholders across borders will prove necessary to the realization of this prosperous future. The NAOCA - our mission

and the diverse projects we take on - is our contribution to that end.

The next meeting of NAOCA will be held in Iceland October 30, 2014. At the meeting a representative from a new cluster in Maine, will be introduced as a new member. A project in Maine with the aim of building a sister house to the Ocean Cluster House in Iceland will also be introduced. This house is estimated to be around 2500 sqm and open a great opportunity to increase collaboration between New England and the Nordic region. Other projects ongoing as a result of the NAOCA project are: The Green Fishing Vessel with participation of companies from Iceland and Norway, development of Arctic Oil and Gas cluster in cooperation with Offshoreenergy.dk in Denmark and their sister company in Greenland, Project sharing and Turning Waste into Value meeting series.

RECOMMENDATIONS:

We see a great opportunity in strengthening relationships with North America in ocean related affairs. NAOCA has been received very favorably in both Canada and the US. The project leaders have also been in relationships with Alaska and through these relationships, we see an opportunity in extending our network to the Arctic. Pan-Atlantic projects are still difficult to finance as most European project emphasize on European partnership. There is an opportunity in the European-North American relationships in ocean affairs, which should be prioritized.



P 11065

Local fish feed ingredients for competitive and sustainable production of high-quality aquaculture feed

MAIN OBJECTIVES:

The main objectives of the project are to test new and local raw materials for aquaculture feed and their implementation into the production chain. This will result in the following:

- Moving the Nordic aquaculture industry towards a more competitive and sustainable production, with focus on efficient and responsible use of local feed sources.
- Identifying novel fish feed ingredients and optimizing their use as feed raw materials.
- Creating added value of local feed sources like seaweed, microalgae and mussel meal.
- Decreasing dependency on fishmeal and fish oil as fish feed ingredients.
- Lowering carbon footprint of aquaculture production

Due to failure of funding from Canada, evaluation of the carbon footprint of the different raw materials tested has not yet been subject to Live Cycle Assessment (LCA) but all the objectives of the project have been met.

METHOD/IMPLEMENTATION:

Mussel meal production was developed in pilot industrial scale ready for upscaling. The nutritive value of mussel meal, different seaweed meals and different types of microalgae was determined through different chemical analyzes. The raw materials were then used in formulation of feed for fish and the formulas tested in feeding trials on three different types of fish, Rainbow trout, Arctic charr and Tilapia.

CONCRETE RESULTS AND CONCLUSIONS:

The pilot processing of blue mussel proved to be successful for the production of good quality meal that according to test results could replace fishmeal almost 100 % in diet for Rainbow trout. Extra advantage with the mussel meal was that it stimulated pink color in the flesh of the fish. Two types of Seaweed meals incorporated as 15% substitution of fishmeal in diets for Tilapia and Arctic charr neither affected growth nor feed utilization in the fish. However, analyzes of the seaweeds revealed that both the total content of Arsenic and the content of inorganic Arsenic was on the borderline or higher than accepted by EU regulations for feed stuffs.

On the other hand, different inclusion in diets did not affect the content of inorganic Arsenic in file of Arctic charr.

The available microalgae varied considerably in chemical composition and only three of them could be formulated into starter diets for Tilapia. A comparison with fishmeal and fish oil is currently being analysed, but preliminary results indicate that at least one of the tested microalgae species is suitable as raw material into fish feed.

The project has created new knowledge available for the fish feed industry as well as for present and future industries interested in the production of the three types of raw materials tested.

RECOMMENDATIONS:

The results from the project still need analyzes for environmental footprint as originally intended through the use of LCA analyses in the project. It is the hope of the partners that some Nordic fund can support such a project to fill out the entire picture. Furthermore, investors should evaluate the economic potential of the new raw materials tested in the project.

P 11070

Future fish counter

MAIN OBJECTIVES:

- Increased turnover of Norwegian seafood in the Nordics
- Increased knowledge about open innovation processes and tools
- Development of new concept for the fish counter

The project has led to increased turnover in all the involved stores. The highest change came in the store that was willing to adapt to the complete new concept for the fish counter.

The retail chains have been involved in the development process from day one. We have been working according to the principles of open innovation – and it has opened many eyes for new ways to cooperate.

We have presented and tested a new concept for the future fish counter based on inputs from the understanding phase and the open innovation process. The counter, the communication and the products are all developed to meet revealed consumer preferences and trends as well as the business models of the retailers and suppliers.

METHOD/IMPLEMENTATION:

The project has been working according to the following main phases:

In the understanding phase we have been looking at mega trends and translated them into possible future consumer and shopper preferences. We have not done any new consumer research, but worked on existing knowledge and how future

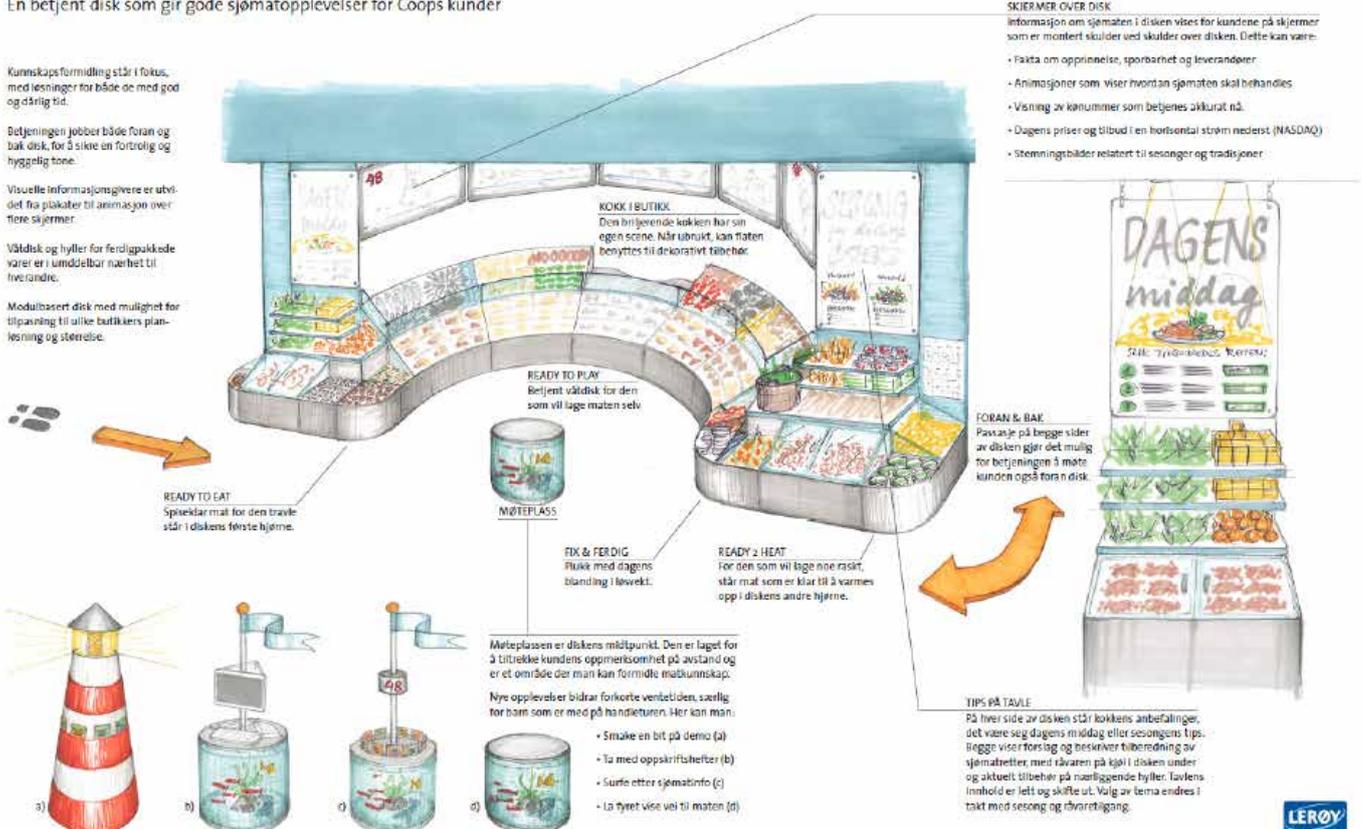
trends may influence already known consumer and shopper behavior.

In the innovation phase we have been working in groups using open innovation tools like visualization and storytelling. We have also been using the business model canvas to get a better understanding of the involved business models.

In the concept development we used industrial designers to translate the ideas from the innovation phase into feasible counter concepts covering communication and product categories. These were taken further into product development focusing on bringing the overall concept into products and packaging.

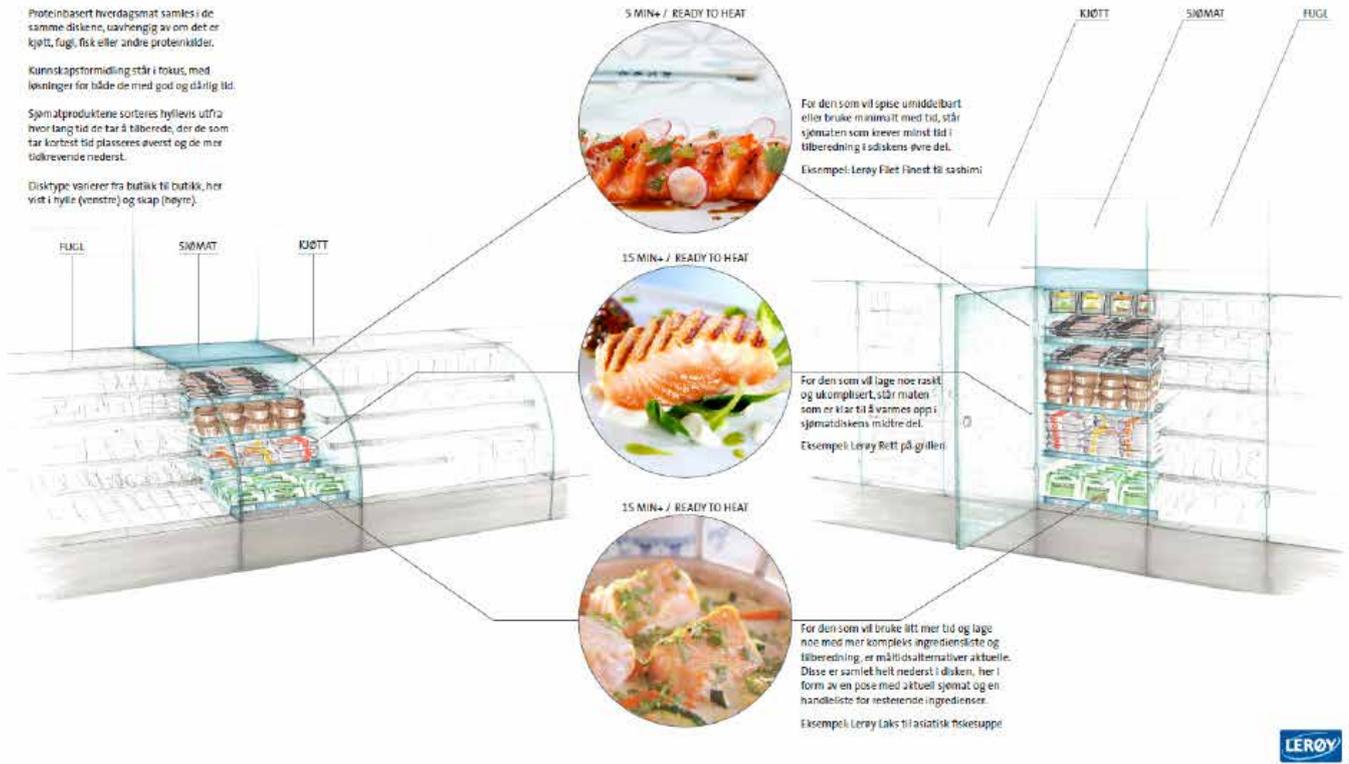
Fremtidens fiskedisk

En betjent disk som gir gode sjømatopplevelser for Coops kunder



Fremtidens fiskedisk

En selvbetjent disk med gode løsninger for rask og enkel sjømattilberedning for Coops kunder



CONCRETE RESULTS AND CONCLUSIONS:

The project has been the first in its kind in bringing the retailers and a seafood supplier into a common open innovation process and we think this in itself is a very important result. All parties have given excellent feedback both on the positive side and on areas of future improvement.

In addition we are very proud to have launched the first version of the future fish counter and that we have experienced immediately as well as steady growth of seafood turnover in the selected store.

By focusing on the business models this project has also contributed to an even better understanding of the different players in the value chain. This has resulted in concrete activities to improve the value chain both creating higher consumer quality and better economical results in all part of the chain.

All the participants have given us great feedback on the Nordic perspective in the project. The Nordic markets are different, but the learnings points between the markets are many. We have exchanged products and communication solutions across markets and learned from each other's successes and failures.

RECOMMENDATIONS:

The Future Fish counter project hope to see more of these open innovation projects in the seafood industry. We now know that the retailers are ready for it and that they appreciate being a more active part in development processes. Our recommendations for future projects are as follows:

- Management commitment is important and make sure to involve them in the progress of the project
- Involve the store management and the involved people in the piloting

stores at an early stage – their inputs and commitment are crucial for success

- Make sure that the piloting is done stepwise focusing on different aspects at the time – then you get an unique change to immediately feedback on what is working and what is not.

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P 11071

Novel bioactive seaweed based ingredients and products

MAIN OBJECTIVES:

Marine seaweeds are a highly underutilized resource in Scandinavia with great potential. Seaweeds are known to contain unique compounds that can find many uses in consumer products. Scandinavia is in a unique position to create significant value from its very abundant seaweed resources.

The overall objective of the project was to create new high value ingredients and products from this highly underutilized Nordic resource, marine seaweeds. Furthermore, the ultimate objective of the project was to start a commercial production of novel bioactive marine seaweed based ingredients and products containing them. Those overall objectives have been reached and a new industry has started based on the projects results.

METHOD/IMPLEMENTATION:

The bioactivity and properties of seaweed extracts have been characterized and defined. Results of the project have shown that the extracts are stable and keep their positive properties through storage for over a year both at room temperature, cold or frozen storage. Characteriza-

tion techniques include HPLC and NMR analysis. Among bioactivities measured was ORAC value, a method measuring the antioxidant capacities in vitro, where the seaweed extracts showed excellent antioxidant activity compared to other better known natural compounds like rosemary extracts and tea. Furthermore, new products containing the seaweed extracts were developed and are now commercially produced.

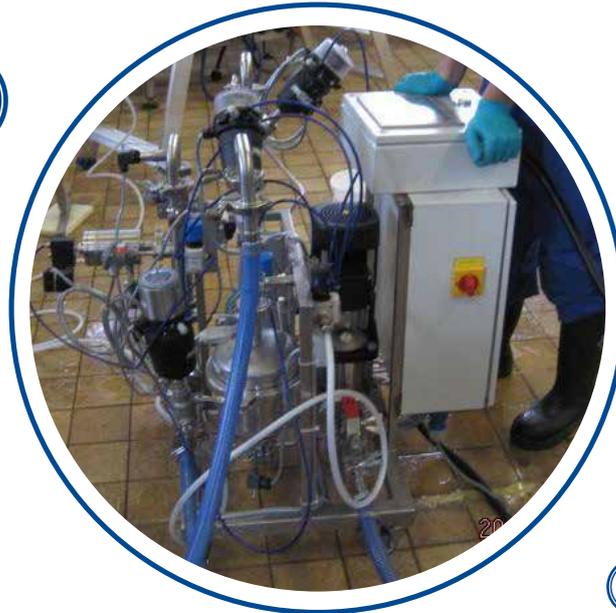
CONCRETE RESULTS AND CONCLUSIONS:

Based on the scientific work in the project, extraction methods have been developed, activity and composition of extracts and their stability has been analysed and tested. The process techniques developed are all environmental friendly and the seaweeds are collected in a sustainable manner. This has resulted in a broad know-how in manufacturing and use of the seaweeds. Thorough investigation of the market for ingredients and products has been performed. Based on this work a marketing and sales plan has been put in action for two types of products, a line of high end marine bioactive skincare products named UNA Skincare and Marinox™ extracts. Other types of products

are in the pipeline waiting for marketing. The project has shown that there is a demand in the market for products with bioactive seaweed ingredients and market potentials are good. The project has resulted in a new industry in the Nordic and significant value creation has been reached beneficial for the biomarine industry.

RECOMMENDATIONS:

The project participants recommend that research parties and companies should aim at utilizing the ample marine areas surrounding the Nordic countries in a sustainable manner. It's important that the utilization is built on thorough research and technology of this natural resource where bioactivity is investigated. Furthermore, it is essential that the work coming out of this project will be followed up with clinical trials as well as more market and consumer based studies. Thereby a successful sustainable new industry based on sound science and technology can be started up, beneficial for both health and business of the Nordic countries.



P 11079

PIPE – Pelagic Industry Processing Effluents Innovation and Sustainable Solutions

MAIN OBJECTIVES:

The main objectives of the PIPE project are to: (i) test technologies such as ceramic membranes and electrochemistry for their efficiency in separating organic matter from effluents from marinated herring production, (ii) characterize the chemical composition, antioxidant activity and functionality of different streams and fractions before and after separation and (iii) evaluate the market potential for the recovered fractions. Throughout the PIPE-project, effluent streams covering all steps in the marinated herring production i.e. from boat to the final marinated products, have been carefully characterized including different products type and over different seasons. Several pilot scale separation trials have also been carried out, and the fractions generated have been investigated for their basic composition, antioxidant activity and functional properties.

METHOD/IMPLEMENTATION:

Samplings of different streams were carried out on site at the herring producers and covered all steps from the boat to the barrel production. Careful chemical characterization was conducted (dry matter, proteins, amino acids, fatty acids and trace elements) together with

antioxidant and enzyme activity analysis. The richest effluents were subjected to separation trials using electro flocculation and ceramic membranes, alone or combined. The results generally show that the technologies have to be further optimized to be able to perform a high efficiency separation of organic matter. With effluents from early steps of the process chain, the organic load could be reduced significantly; whilst for effluents generated later in the marinated herring production (herring maturation), this could not be achieved. Many of the effluents have a notable antioxidant activity, some enzymatic activity besides a high protein and fatty acids content. Partitioning of key components into concentrates and outlets were followed. In some cases also emulsification and foaming properties were evaluated. Finally, a survey at the Nordic level was performed together with a cost benefit analysis in order to demonstrate the cost of implementation of new technology and the market value of collected fractions emerging from marinated herring production effluents. Thus, their potential market segment has been investigated.

CONCRETE RESULTS AND CONCLUSIONS:

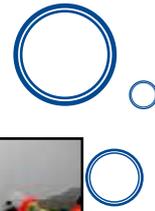
The herring industry is losing between 10% and 20% of the biomass in the water, an amount that is equivalent to several million Krone/year. Indeed, the effluents are heavy loaded with protein, non-protein nitrogen, fatty acids and trace elements e.g. iron and phosphor. The also present some very promising antioxidant capacity such as reducing power, radical scavenging and iron chelation, as well as enzymatic activity such as peroxidase and protease activity. Separation technologies were tested, however needs to be further optimized e.g. regarding flux or combined with other technologies in order to efficiently recapture the lost biomass for its potential commercialization to high-end products.

RECOMMENDATIONS:

We strongly recommend further characterization and purification of seafood production effluents for identification of nutrients and potentially bioactive compounds for use e.g. in food, feed or as nutraceuticals. In some cases, expensive separation technology might not be necessary if effluents are treated as food grade and are used directly in food, however this need to be evaluated further.

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P 11072

NIMMP

Nordic Innovation Marine Marketing Program

MAIN OBJECTIVES:

The project Nordic Innovation Marine Marketing Program (NIMMP) was designed to raise attention for students' job and education possibilities within the marine sector in the Nordic countries and encourage young people to consider the sector as a field of study or career. Many countries in the Nordic region are heavily dependent on the marine industry and the demand for people with diverse education, willing to work in a creative and fast growing environment, has never been greater or more urgent.

The project goal was to produce videos that should:

- (1) Lead to more students applying for numerous educational programs within the marine industry
- (2) Lead to more students applying for jobs within the marine industry
- (3) Change the way numerous marine institutions, companies and key players view innovative methods to optimize and improve all kinds of working processes within the industry.

METHOD/IMPLEMENTATION:

The project organized a marine boot camp in the Faroe Islands where 18 university students from the Nordic region were selected to take on a marine related challenge. The whole trip to the Faroe Islands was documented with the aim of

creating a 5-minute promotional video that captured the experience of the boot camp. In addition to the 5 minute video, 1 minute info-graphic video was designed to raise attention to the many opportunities within the marine industry in a more simple and appealing way.

The students approached an industry related challenge in a 32 hours long workshop. The challenge was designed in collaboration with Nordic companies in the marine sector and the problem at hand was a real issue that companies in the fields are currently dealing with.

CONCRETE RESULTS AND CONCLUSIONS:

The findings of the boot camp were displayed in a promotional video and gathered in a report that will aid companies in the sector to come up with innovative solution. The videos were marketed within universities, in the marine sector and towards the general public with the attention of more students applying for numerous educational programs within the marine industry. Further, more students applying for jobs within the marine industry and changing the way numerous marine institutions, companies and key players view innovative methods to optimize and improve all kinds of working processes within the industry. We believe that the project and its videos have and can continue to help change the image of the marine industry in the long-term. In our opinion, highlighting the

innovative processes and startup scene within the marine industry will eventually establish new associations to the industry and lead to more young people applying for educational programs and jobs within that field.

RECOMMENDATIONS:

We believe that in the long run the project can truly impact the number of young people applying for jobs within the marine sector as well as change the way marine institutions, companies and key players view innovative methods within the sector. Our hopes for the future is that players within the field; universities, marine institutions, companies and key players will continue to show interest in the project and its two remaining videos.

The project can be considered as a great pilot project, which can be replicated to other industries looking to take innovative approach e.g. agriculture, transportation, tourism and the health care industry. We also see possibilities with more local approaches. After the boot camp in the Faroe Islands, Klak Innovit received an offer by Innovasjon Norge to facilitate a similar marine boot camp in Trondheim, Norway. In January 2014, Klak Innovit travelled to Norway to facilitate a boot camp with 17 university students from Norway. In 2015, Klak Innovit will facilitate three more workshops for University students in Norway funded by the Norwegian Seafood Research Fund.



P 11087

WhiteFishMaLL

(North Atlantic Whitefish Marine Living Lab)

MAIN OBJECTIVES:

The main objective of the project is to build a branding platform for whitefish from the N-Atlantic that differentiates in terms of sustainable production and superior consumer benefits. The project is also to demonstrate how to establish Living Lab methodology in the marine sector, where innovation solutions are co-created, explored, demonstrated and evaluated with a user-centric approach in a real-world environment.

In order to identify consumer perception of whitefish products from the N-Atlantic, fish consumers and other stakeholders in the value chain have been approached through direct interviews, focus group sessions and large qualitative survey. Furthermore, the project outcome and development process has been open to everyone with interest in these matters, through open webinars and workshops.

The consumer studies show that people who regularly buy seafood in the UK often mistrust the information associated with the products. The consumers would like to have more comprehensive facts available on the actual product they are buying. The WhiteFishMaLL project has therefore focused on communicating favourable characteristics of N-Atlantic

whitefish products directly to the consumers with the help of a web-based information sharing solution accessible by QR codes (Quick Response Code). The main consumer preferences identified regarding product information are value chain transparency, sustainability, health benefits and personalised buying experience. Consumers want to see the product story from catch to plate and the project work has therefore been directed at information gathering and developing a web-based solution to disseminate that information on a batch level. The projects' Living Lab approach has facilitated end-users to be involved in the development phase of the project solutions from the beginning to end.

The retail sector has shown interest in the solution, but is hesitant in displaying to their customers such detailed information regarding the fresh fish they are selling, especially information on fishing date. However, they like the concept and wanted it up and running, but only as a tool to inform their sourcing manager and for own staff, so they can be better informed. The project has also directed its efforts towards the Fish & Chips sector in UK, which is mainly using frozen whitefish. Currently the projects' web-based solution is being tested in two F&C chains

in the UK and it will be interesting to get their feedback before the project end.

METHOD/IMPLEMENTATION:

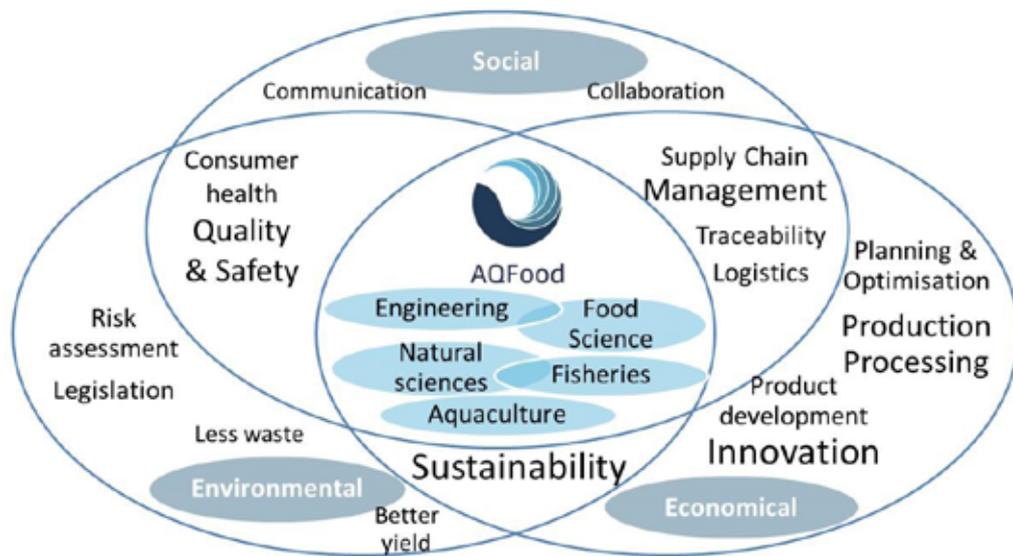
The Living Lab approach has engaged fishermen, processors, distributors, wholesalers, retailers, foodservice and consumers in the development and testing phase of the project from beginning to end. The solution that has been developed is currently being tested out in real-life circumstances and preliminary results are encouraging.

CONCRETE RESULTS AND CONCLUSIONS:

The project has produced concrete results in the form of a web-based solution that can be used to disseminate favorable characteristics of N-Atlantic whitefish and provide transparent batch-based information on the products. It has also demonstrated how the Living Lab approach can be applied in the Nordic marine sector.

RECOMMENDATIONS:

The project participant's recommend that the web-based solution will be further developed and made available for Nordic producers on commercial basis. They also recommend that the Living Lab approach will be applied in other Nordic R&D projects.



P 11073

InTerAct Industry - Academia Interaction in the Marine Sector

MAIN OBJECTIVES:

The main objectives were to strengthen the image of the marine sector, to demonstrate interesting future career opportunities for students and to support the development of a higher education programme with a focus on the aquatic food value chain.

The objectives were met by:

- Interacting with stakeholders in the aquatic food value chain to assess the industry's challenges and identify gaps in the education.
- Defining sustainable platforms for industry- academia interaction in educational programmes.
- Promoting the marine sector's image as an attractive career opportunity for students with higher education.
- Strengthening the image of the Nordic marine sector by using new media to reach to students and stakeholders

METHOD/IMPLEMENTATION:

- Focus groups were conducted to obtain the stakeholders view towards the need for higher education and to compare the industry's challenges with the content of a current master programme dedicated to the aquatic food value chain.
- Interviews were applied to analyse the internal image of the marine sector by performing a stakeholder analysis.
- The external image of the North Atlantic marine sector was explored by conducting surveys among the general public in Iceland, Norway, Sweden, Denmark and Canada.
- The views of students towards the marine industry and higher education as well as analysis of what factors influence their choice of education and career were obtained by on-line surveys in the Nordic Universities.

- Finally, the results from the image analysis and student surveys were applied to create promotion material to present a new image and a value proposition for the AQFood programme.

CONCRETE RESULTS AND CONCLUSIONS:

Activities in the InTerAct project were aimed at positioning higher education with a focus on the needs of the aquatic food sector and using as a case study the new international master programme AQFood - Aquatic Food Production - Safety and Quality (www.aqfood.org). Based on the findings of the InTerAct project, an image film for the higher education was created and linked to prospects for interesting job opportunities in the aquatic food sector for students graduating from master programmes such as the AQFood (See AQFood Image Film). The results of the project are important to understand the challenges better when establishing collaboration between indus-



try and higher education and what factors influence students' choices regarding education and future careers. In particular, the results of the surveys among students in the Nordic countries indicate that their interest areas are linked to e.g. innovation, product development and sustainability, which are potential areas for collaboration between higher education programmes and the seafood industries to enhance their competitiveness.

Final report: Ólafsdóttir, G., Jónsdóttir, G.A., Ómarsdóttir, I.L., Tryggvadóttir, G.B., Fredriksen, M., Kirkegaard, H.P., Baron, C., Lekang, O.I., Rustad, T., Kiessling, A. and Bogason, S.G (2014) InTerAct Industry - Academia Interaction in the Marine Sector. Marine Innovation Programme, Nordic Innovation, Oslo <http://nordicinnovation.org/en-GB/Publications/>

RECOMMENDATIONS:

The following recommendations are aimed at universities and the aquatic food industry's stakeholders.

The research has created a benchmark for the marine sector and a clear message that the external image of the sector should be improved.

- Information about the various activities and the dynamic and innovative characteristics of the marine industry should be disseminated much more effectively to the general public.

The image and visibility of the relevant industries in the respective countries appears to have had an influence on the students' interests and their choice of career.

- The industry needs to communicate its activities much better to students.
- Explain the various roles of qualified staff with higher education in the enterprises.

- Describe prospective job opportunities that will meet the interests of the students.
- Promote the marine sector as an attractive career opportunity for students.

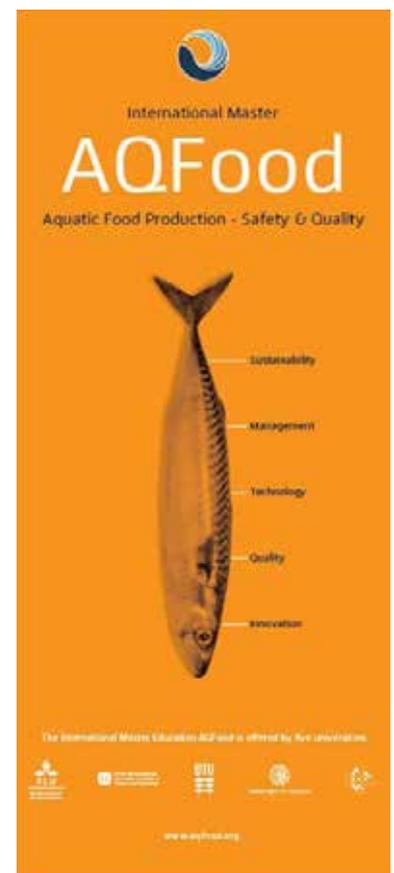
Despite the diversity of the seafood sector in the Nordic countries all participants believed that the educational level of the industry should be improved. They expressed a great need for people with higher education dedicated to the marine industry and were interested in a closer collaboration between the academia and the industry sector as an effective approach to enhance the education level in companies and boost innovation.

- Increase the cooperation between enterprises in the aquatic food industry and higher education.
- Create a structured collaboration and communication platform between the marine sector and universities.
- Establish formal links between the industry and academia through students' projects.
- Provide opportunities for internship in companies as a way to bridge the gap between the two different worlds, the industry and the academia.

Based on the fact that a minority of students were aware of the AQFood programme, it needs to be much better communicated and promoted by the universities

- The university websites are the key source of information about education programmes. Videos and promotion materials need to be disseminated to raise the awareness of the programme.

- Provide examples and clear description of students' projects and link the basic academic skills to problem solving in the aquatic food industries.
- Focus on the values that students are interested in like sustainability and innovation.
- Demonstrate how academic skills can give value and benefits for the society and the companies.



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Profitable Arctic charr farming in the Nordic countries

MAIN OBJECTIVES:

The objective of the project was to reduce the production cost of Arctic charr by 10-15% by reduction of the raw material cost of the feed by the following actions:

- Reduction of the protein content in the diet according to the actual needs of the fish
- Use more of plant protein raw materials instead of fishmeal

The objectives of the project have been fully met through testing of diets with lower protein content and less use of fishmeal. The substitution of the fishmeal was partly done by use of well documented plant proteins (In Norway and Sweden) and partly by novel alternatives such as Canola meal (Iceland).

METHOD/IMPLEMENTATION:

In the project the new types of feed were compared to commercial Arctic charr feed in tests at practical fish farms.

Following presentations of the results for the Icelandic Arctic charr farmers, Laxá feed mill ltd in Iceland which is the

world's leading producer of Arctic charr feed, has changed their commercial diets for Arctic charr in a successful way and thereby reducing the feed cost for their customers. Similarly, Polarfeed AS in Norway is working on adding new specially designed diets into their portfolio addressed for Arctic charr farmers in Norway and Sweden. So far, there has not been an opportunity to present the findings for Arctic charr farmers in Norway and Sweden.

CONCRETE RESULTS AND CONCLUSIONS:

The most important results of the project new feed compositions, giving 10 – 15% lower feed cost than the present commercial feeds in the market, with minimum effects on growth and feed utilization.

Results from the tests and trials undertaken in the project confirmed that the protein need of the Arctic charr is lower than earlier anticipated. The results also show that Arctic charr can grow well on feed with much lower fishmeal content than used in the commercial diets. The alternative diets have proven to give

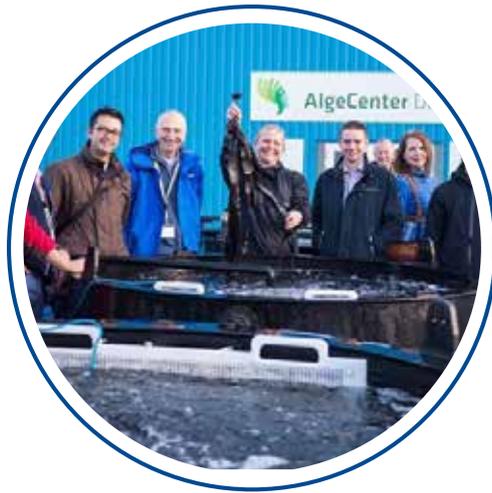
the farmers similar quality of the fish produced.

There were no marked effects of the new type of feed on the welfare of the fish or on the environment.

In addition to the two feed companies participating in the project, the Arctic charr industry in Iceland, which is world leader in production of Arctic charr, already has benefited from the project in the form of lower feed cost leading to lower production cost.

RECOMMENDATIONS:

Based on results from the project, a reduced ratio of fishmeal and oil is recommended in Arctic charr aquaculture. However, this must be done through appropriate substitution alternatives. The future work in finding new raw materials to replace fishmeal and fish oil should take more into account the effects of the composition of the fish feed on the environmental footprint of Arctic charr aquaculture. This would be an issue for the fish feed producers and the aquaculture industry alike to work on in the future.



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Nordic Algae Network

MAIN OBJECTIVES:

The project aim is to help the participants to a leading position in the field of utilizing algae for energy purposes and for commercial exploitation of high value compounds from algae. An additional aim is to increase the synergy and facilitating collaboration between the participants involved in the project and thereby increase their ability to compete in this new field. The workshops have been a good tool to open discussions between industrial partners and academia, and the industrial partners have been quite open although there were competitors among in the workshops. Furthermore, the algae conference in Denmark, which was held in cooperation with Nordic Algae Network in 2012 and 2013, is now an internationally established event in the algae community and is held for the fourth time in October 2014. Project partners from Nordic Algae Network has participated and presented results at the last two conferences.

METHOD/IMPLEMENTATION:

The methods used in the project are:

- Workshops with short presentations, group discussions and plenum discussion
- International conference
- Poster sessions at workshops and conference
- Newsletters distributed by email
- Information on two websites: www.algecenterdanmark.dk and www.nordicinnovation.org
- Press release to newspapers and TV

CONCRETE RESULTS AND CONCLUSIONS:

It has been very important that this project was an inter-Nordic project, because the partners had only little knowledge about what happened in the other Nordic countries in the algae field and this project was a bridge between stakeholders. Several new activities derived from the project. This includes Horizon 2020 applications, the MacroBiotech project funded by NORA in Torshavn and Nordic cooperation with industries in Faroe Islands has started because of the project:

- Matis in Iceland is cooperating with Danish Technological Institute
- Danish Technological Institute is cooperating with Syntesa, Faroe Islands
- DUE Miljø, Norway met 2 new partners and has 1 new project as a result of Nordic Algae Network
- Norges Vel met 5-10 new partners and has 1 new project as a result of Nordic Algae Network
- Havets Hus, Denmark made 10 new contacts for use in upcoming projects.
- The Swedish SeaFarm project has invited Danish Technological Institute in the Advisory Board of the project.
- Danish SME's have been more active involved in R&D algae applications.

The overall conclusion of the project is that the focus on industrial involvement has been a successful approach, because

many companies are new in the algae field and many are SME's with limited capacity to look for other industrial partners and to look for support from the academia in their R&D efforts.

RECOMMENDATIONS:

- There is an entrepreneurship and innovative spirit among industries and academia in the countries, which is a very important tool for development of this new area.
- The technology for large-scale production of algae is not developed yet. There are large industrial companies in the food and feed processing sector, which are ready to use algae as raw material if a large and stable supply is possible.
- The consumers market both in the Nordic countries and Europe are immature and not ready to use algae in the daily food. The organic food trend and the Nordic Brand can maybe help the algae products to a faster acceptance from the consumer's side. Among the industries, producing algae products there are only limited market knowledge.
- No clear laws and regulations for production of algae offshore exists. There is a need for both spatial and environmental regulations in order to cope with problems from fishery, maritime traffic, tourists, aquaculture, windmills, wild life protecting areas and environmental impacts.



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Aquaponics NOMA (Nordic Marine)

- New Innovations for Sustainable Aquaculture in the Nordic countries

MAIN OBJECTIVES:

The main objective of AQUAPONIC NOMA is to establish the concept of Aquaponics in Nordic region through close cooperation between businesses and knowhow centers in Nordic countries. The focus is to increase scientific and practical knowledge base when applying ECO-SYSTEM approaches in aquaculture and horticulture combined, investigate suitable fish and crop species for Nordic aquaponics in terms of growth, quality, effluents, temperature and nutrient balances. Further, optimize management practices and technologies in Aquaponics, e.g. treatment of wastewater and solid wastes to protect the environment from pollution and pathogens. Develop new designs for commercially viable aquaponic production models for Nordic region and investigate consumer market potentials including possibilities for Eco-labeling, and secure efficient dissemination and knowledge transfer necessary for a viable scientific and practical Nordic cluster formation in aquaponics.

The project has achieved to establish the concept of Aquaponics in Nordic region, and through a targeting professional network, our region is starting to be known for our expertise of aquaponics in Europe within this field. During the project, our concepts have been discussed with pioneers in field (Dr. Rakocy (Virgin Island, US), Dr. Schultz (CA), Dr. Savidov (CA), Dr. Nichols (NZ), Dr. Lennard (AU) and Mr. Price (UK). Nordic countries are in

the Management Committee of EU COST Action FA 1305 – Aquaponics HUB and EU LE004027125 - EUROPEAN AQUAPONICS. Investigation of suitable fish and crop species for Nordic aquaponics is ongoing, and interesting results is becoming to show. There are available new designs for ECO-SYSTEM fitted to Nordic region, and business designs and code of practice will soon be available from project group.

METHOD/IMPLEMENTATION:

All partners in this project have contributed with expertise, knowhow and knowledge about markets, productions, designs, economy analysis, and professional network with more. Project meetings have been at all Nordic participants' facilities, and important discussions carried out. Important information have crossed between partners, and suitable information implemented in the companies.

CONCRETE RESULTS AND CONCLUSIONS:

All of the participant countries have now aquaponics facilities up and running, ready for further innovations, used as showcases and developing of concept. On the way here, there are achieved a lot "hands-on" experience and regulation awareness. Either businesses have gone for the concept or they have decided not to go further. We can see an increasing demand for nationally knowledge of aquaponics. Through articles, media (radio, TV, newspapers), visitors at aquaponics facilities, we have also a demand from other researchers, consumers and businesses

to make a platform to share information, make vocational training courses and teach the concept to interested people. Schools and several knowhow-centers have expressed wishes for this concept into their enterprises and Bioforsk wants establishing national aquaponics research center (Grimstad), were knowhow and knowledge achieves in same place.

RECOMMENDATIONS:

Project participants recommend continuing further work within aquaponics and sustainable production methods within blue-green sector. This project was a great beginning to understand importance of common knowledge, collaboration between companies/consumers/researchers and those innovation products needs new research. New things takes time to understand and implementing. Companies' needs knowledge for complement new system modules as sales product, consumers want knowledge/courses to have aquaponics systems home or start small enterprises to make local food rural or urban and job-opportunities to younger or un-employed people. Aquacultural and horticultural production sites need manuals to understand how to combine the two production methods for common goals – resources management (water, nutrients, energy, ...) and achieves less discharge during the production to secure as little impact as possible of environment.



