

2015



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With increased investment in food safety, Mátís has now been nominated as a National Reference Laboratory (NRL) in seven fields in 2015. In 2016 the company will receive nominations for an additional seven fields.



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A few of Mátís' Partners



Building on a Solid Foundation

Matís is an international knowledge company that builds on a solid foundation. The knowledge on which Matís bases its operations builds on decades of research and collaboration with domestic and international companies and institutions.

Former institutions and companies, that Matís builds its existence on, have contributed to the Icelandic society in many ways in the past decades. The fishing cluster in Iceland, as Professor Michael Porter at Harvard Business School called it in 2007, benefited from one of Matís' predecessor, the Icelandic Fisheries Laboratory (IFL) to a great extent and has since then gained momentum with Matís' operation.

Matís has emphasised collaboration since the company began operating in January 2007. It has, for example, collaborated with domestic and international research, innovation and development funds, like AVS (R&D Fund of Ministry of Fisheries and Agriculture in Iceland), the Technology Development Fund and Horizon 2020, international companies like PepsiCo, domestic and foreign universities and numerous progressive companies in Iceland.

Over the last year, Matís strengthened its international network of contacts. Iceland's global location provides opportunities for collaboration in all directions, and Matís has increasingly emphasised collaboration with Canada and the United States. In collaboration with the minister of fisheries and minister of agriculture, Matís organised a visit for Icelandic companies to Canada in the fall of 2015. Matís visited the fisheries exhibition in Boston, and received numerous representatives of companies, institutions and ministries from North America. Changes in the

international business environment and changes in Iceland's biosphere and the ocean surrounding the country call for broad vision in international collaboration.

Foreign parties seek out Matís' knowledge and experience. A recent announcement that World Seafood Congress will take place 10-14 September 2017 in Iceland is an example of this interest. Matís will organise the event, which FAO, among others, originated. The congress has been a key event for many years for the fishing and fish processing industries. We are very proud of this and view World Seafood Congress as a tremendous opportunity to join hands with our numerous collaborators in the fishing industry, in Iceland and globally, and present the major results achieved in parallel with looking toward the future.

Matís' results build on collaboration with companies, institutions and universities throughout the world. However, the results are primarily due to the great knowledge and human resources on which Matís' operations build. During times of rapid technical advancements and changes in all fields of society, there is great need for knowledge and the ability to cope with ever-changing conditions and challenges. Young people with a new vision and armed with technology play a key role in that picture, but experience is no less important. In this context it is worth considering the solid foundation of knowledge that Matís inherited upon the company's founding in 2007. On that foundation and with the values of integrity, initiative, creative vigour and ambition, Matís will continue progressing, with increased value creation, improved food security and improved public health as its goals.



Increased value creation builds on knowledge

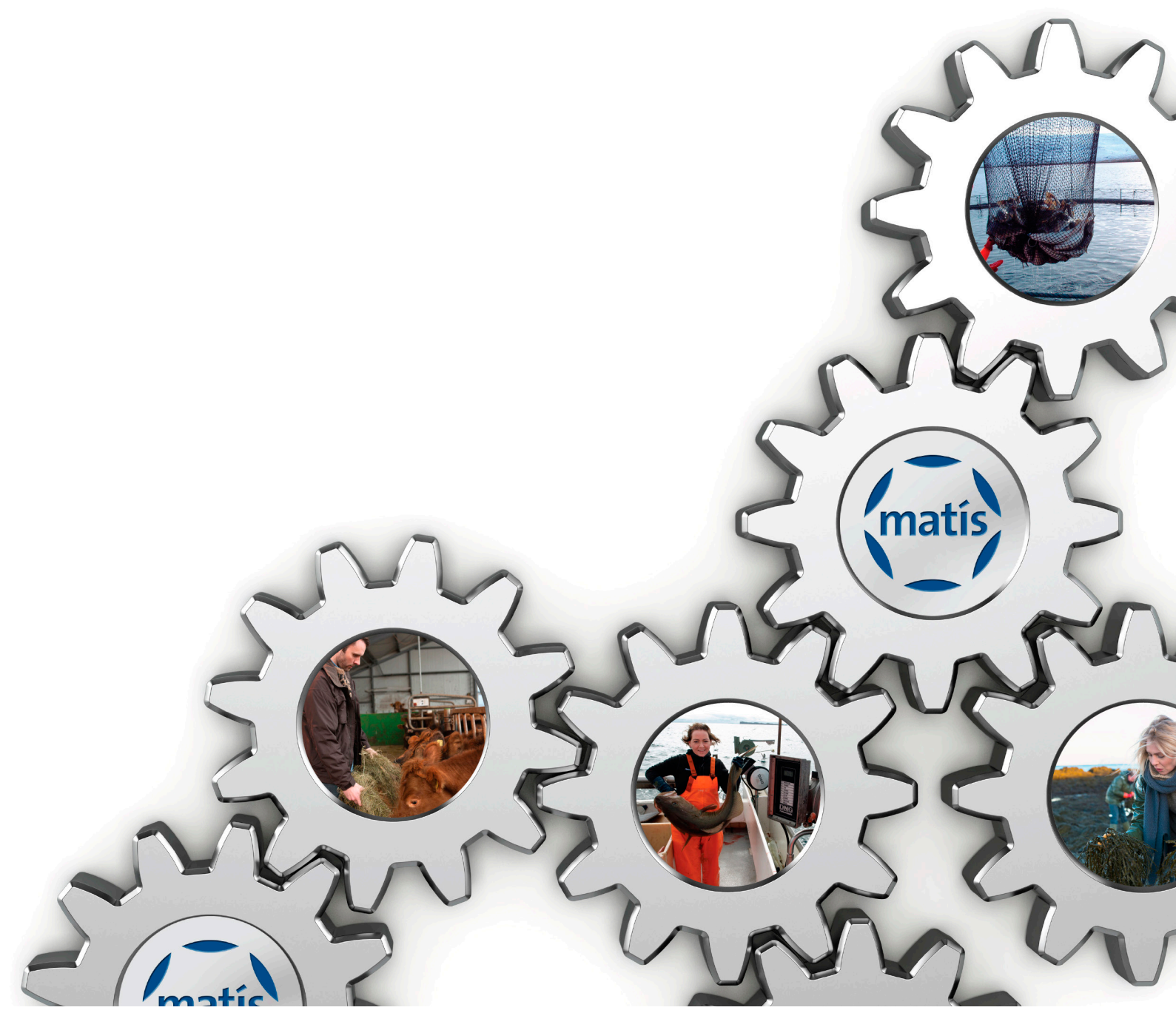
Icelanders owe a great deal to value creation in all parts of the business community. The opportunities are especially obvious in the fishery industry and food production, industries building on circumstances that are in many ways unique in the world. We have bounteous resources in the ocean surrounding the country; great land expanses can likewise lay the foundation for increased agricultural production, to take but two examples. We must also closely monitor nature and conserve its purity. It is so important to us both at sea and on land, and it will become still more precious each year because of sought-after food in the world. We must foster all of this, while at the same time stimulating innovation in production and being progressive, daring and imaginative.

The key to this future vision is knowledge. Knowledge about what we have done because we are doing best in production and innovation, and where we want to go. Knowledge of where the opportunities lie, and how they will best be utilised. This is the exact essence of Matis' operations and mission. Build-up of knowledge that is utilised for development of the business community. In recent years Matis has played a key role in many development projects in food production in Iceland, and the number of the company's projects steadily increases abroad. Since Matis was

founded in 2007, all aspects of it have expanded. It has built up its human resources and thereby its foundation of knowledge, developed processes and expanded its equipment. It has grown stronger with every challenge. The advent of the National Reference Laboratory (NRL) for food safety in the past year is still another confirmation of this and underscores Matis' competitiveness amongst institutions and laboratories worldwide.

Good results are also a challenge to do even better. Matis' Board of Directors and management share this goal with the company's dynamic group of employees. Constant efforts are made to connect ambitious employees together, integrate infrastructure and increase operational flexibility. This is how we prepare for the future, which is really exciting. In addition to opportunities in food production, we know from experience that they are nearly inexhaustible in the bio-economy, and Matis will continue playing a key role in its build-up in Iceland and the world.

Our foundation is reliable human resources, and we aim to increase collaboration with companies, investors and the university environment. With continuing ambition the future is bright. Matis is a good company that can become excellent if its resources are correctly handled.



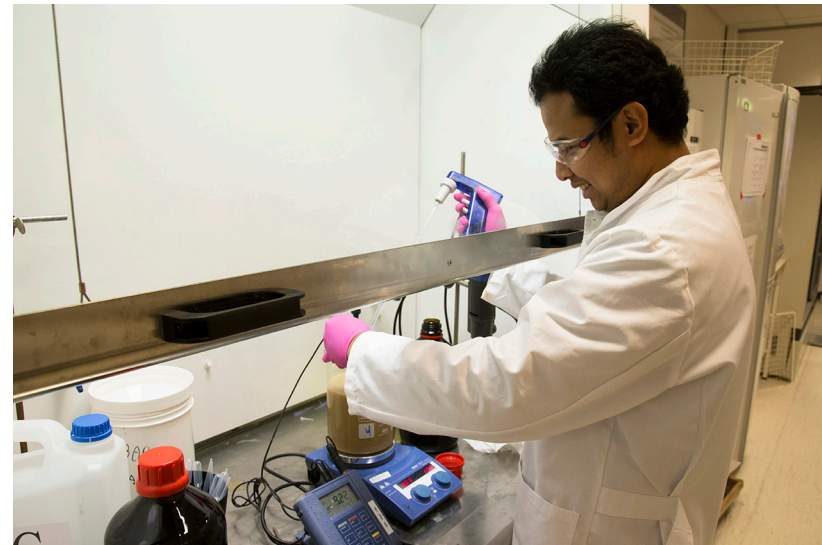
Nomination for a National Reference Laboratory – NRL

In recent years, Matis has invested in infrastructure and created a solid foundation for food safety research as well as other food and environment-related research. This effort has now made Matis a leading analytical laboratory in Iceland, and our specialists have extensive expertise and knowledge in microbiological and chemical analysis. Matis' emphasis on food safety will benefit consumers, industry and authorities. Increased social food safety debate will increase consumers' awareness of quality and safety, and producers can utilize the open knowledge Matis produces. This will enable industry to market Icelandic products as pure and wholesome as well as gain the opportunity to work with Matis in both developing safer products of higher quality and gaining assistance in marketing these products. This in turn delivers safe quality products to the market for the consumer, and the circle closes.

With increased investment in food safety, Matis has now been nominated as a National Reference Laboratory (NRL) in seven fields in 2015. In 2016 the company will receive nominations for an additional seven fields. This is tremendous quality recognition of Matis' work in the laboratory. It has to fulfil very strict conditions to qualify as an NRL, such as accreditation, qualified staff, infrastructure, etc. The NRL nominations will increase our capacity even more as the NRLs are linked to a European network of other NRLs and the European Reference Laboratory (EURL), all working to ensure and enhance food safety nationally and internationally. According to Iceland's food legislation, the government is obliged to nominate an NRL laboratory for 21 fields in food safety and 17 fields in animal welfare. The 2015 NRL Matis nominations are in the field of analysing zoonoses, viral and bacteriological contamination in bivalve molluscs, *Listeria monocytogenes*, *Staphylococcus aureus*, *E. coli* (VTEC), pesticide residues in food and feed, as well as heavy metals in food and feed.

Technical infrastructure is important in a growing and innovative R&D company like Matis. However, infrastructure in the form of employees should not be forgotten. Within our company, there is a strong group of young, prominent researchers and scientists. In recent years Matis has encouraged young researchers to step forward by increasing their responsibilities, knowledge and expertise. The newly formed "solution group" is a good example of this, where a group of young scientists is working together as a "think-tank" to solve challenges in research projects, product development and product line optimization, often with outside-the-box approaches. Nourishing young researchers and scientists is extremely important in moving Matis to the next level, ensuring its leading role in research and development, not only in Iceland but also abroad.

Matis has fostered fertile thinking, innovation, and quality research, where young scientists can flourish on a strong foundation, supported by good technical infrastructure and management's support. Very exciting and interesting projects are going on, and the future is full of new opportunities. I see that Matis will continue developing its contacts with the industry, in a combined effort to further ensure food safety and the quality of Icelandic products. Collaboration with the authorities will generate increased knowledge and sharper focus on food safety. Collaboration with universities and research institutes, both nationally and internationally, will generate state-of-the-art expertise and further ensure the solid foundation that Matis bases all its work on. This will give our company a unique advantage to consult, based on its own research and experience. Last but not least, Matis will nurture and enhance its constant communication with and dissemination to our main stakeholder, the general public. The goal is to lift the general consumer's awareness on issues related to food safety and ensure public health and society's wellbeing.



Assistance to Developing Countries – an Intergral Part of Matis’ Operations

Matis has been a cooperative partner in the teaching programme of the United Nations University Fisheries Training Programme since it started in 1998.

The programme is divided into two main parts, an introductory course and specialist training-academic training section. The programme is focused on practical knowledge, and students work closely with local trainers on project work. Usually 15-20 specialists from Matis are engaged in teaching and supervising the students’ projects.

Planning of the schedule can be a puzzle/problem. The first six weeks of the programme are mainly lectures followed, by visits to fish processing companies. The lectures are supervised not only by Matis’ employees but often by specialists from the fishing industry, specifically experts in transport and packaging. While visiting the fish processing companies, the students first observe the workflow and then hold informal, interesting and dynamic debates. These visits are engaging and educational for both students and supervisor, and I, as a supervisor, have greatly enjoyed the visits and brought home new knowledge.

Cooperation’s benefit to the UNU-FTP:

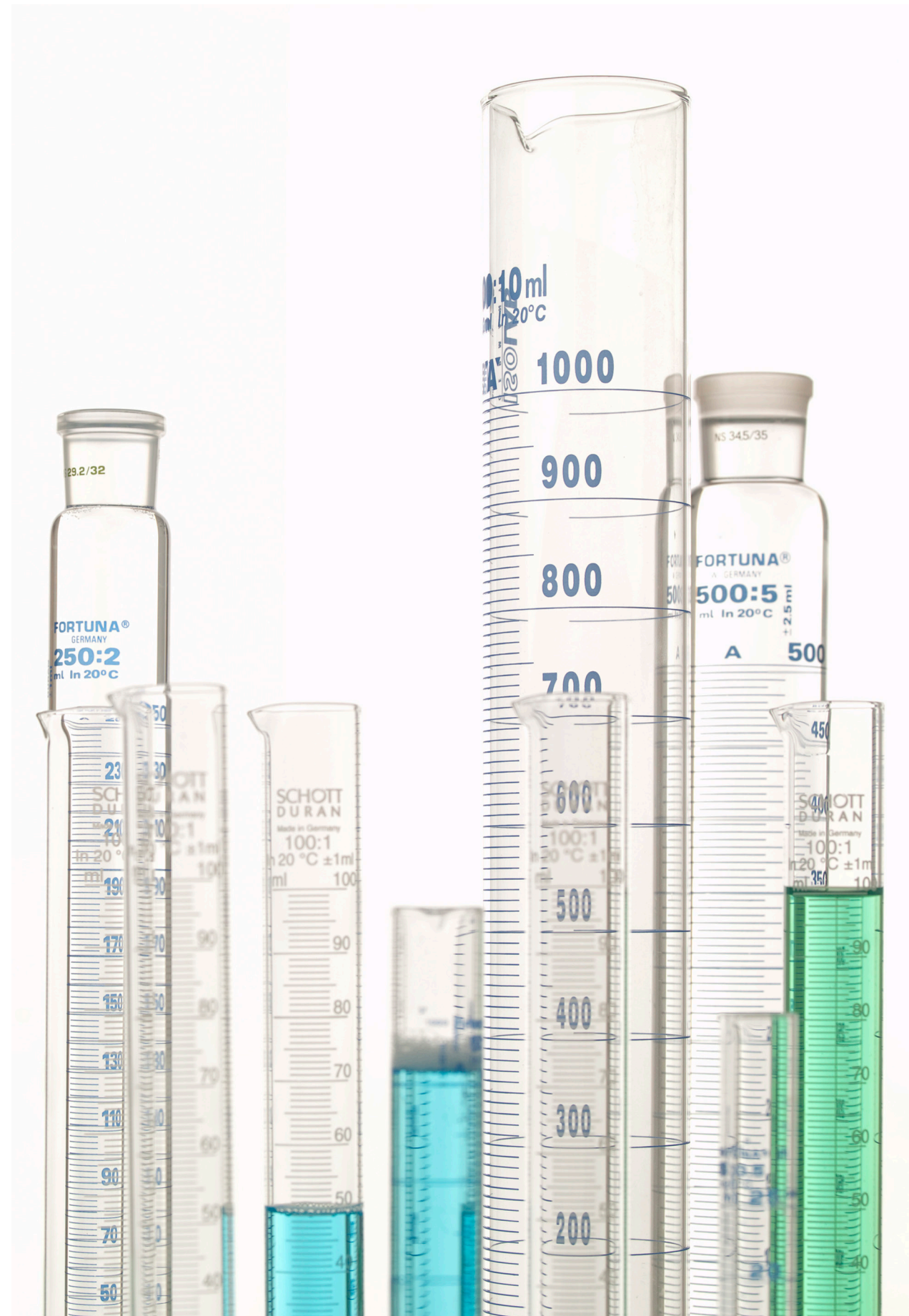
- Matis has many specialists in various fields with long experience in research and service to the fishing industry
- The specialists at Matis maintain good contact with the Icelandic fishing industry – from catch to consumer
- Specialists at Matis cooperate with Icelandic universities. They are involved in both basic and higher education and form a bridge between industry and universities
- Cooperation’s benefit to Matis:
 - By contributing to development assistance, Matis discovers new directions for its developmental programme
 - Matis specialists’ constant contact with the fishing industry updates their basic knowledge in the field
 - Matis finds new opportunities for further projects in the international market

Students work on their final thesis projects at Matis, and during this time we build strong relationships with the students. Many of them return to Iceland for further

education. Several have been studying for their Master’s and doctoral degrees in recent years. This results in strong and lasting relationships between employees at Matis and the students.

I am presently in touch with a student from Sri Lanka. The student is establishing a quality system and needs advice on the implementation of some measurements, such as quality measurements for fish, and also further explanations of the methodology. This assistance can be given through e-mail. This does not take much time, but it gives great pleasure to provide assistance in small ways.





Development of Food Service Analysis in Iceland

Since 1937, Icelanders have engaged in microbial research on and microbial analysis of food, first as a faculty of the University of Iceland, and later in various public and private organizations. In 1976, the Icelandic Food Laboratories (IFL) were founded. Their role was to do microbial analyses for food inspection and food production companies in order to ensure the quality and safety of food and drinking water. In 1982, IFL and several other organizations were merged into a new establishment, the Environmental and Food Agency (EFA).

Within EFA the food analysis services became a separate laboratory division within the agency. Following these changes the laboratory experts worked closer with the food inspection experts especially in planning of surveillance and research projects concerning food safety. The laboratory personnel also became more active in many cooperative research projects both in Iceland and abroad.

In 1993, preparations for accreditation began. This process finished in 1998, when the Swedish accreditation body SWEDAC granted the division certification. The accreditation process is designed to ensure that laboratory services meet the expectations of customers in terms of quality, safety and trust.

The main role of the organizations mentioned above was to provide regulators, companies and individuals with reliable analytical services in the field of microbiological and chemical analysis. Other activities of the laboratory personnel include:

- Participation in Nordic cooperation in development and validation of analytical methods for food and feed
- Guidance on sampling
- Organization of monitoring and surveillance studies
- Information and advice to government
- Microbiological research projects
- Reports on food-borne intoxications and infections in Iceland
- Training courses for laboratory technicians
- Teaching biology and food science at universities and other educational establishments

In 2007, four organizations, all of which had been active in microbial analyses and research, were merged in Mátis. This merger created an effective service provider with a broad spectrum of expertise, for not only microbial analysis of food but also analytical services for the environmental, pharmaceutical and bio-tech industries. Today, Mátis can offer versatile services in the field of microbial,

physical and chemical analysis. Mátis' service analysis are accredited under ISO 17025, and altogether 40 microbiological and chemical methods are accredited.

The microbial analysis cover, e.g., most of the important pathogens found in food, feed and the environment. Other analytical activities include the development of new analytical methods, research on survival and growth of microorganisms in food and the environment, monitoring of microorganisms and the effect of hygienic actions on microorganisms, and microbiological research and analysis for the pharmaceutical and bio-tech companies.

Chemical research and analysis are carried out to check the nutritional compositions of food, as well as the presence of undesirable substances, such as heavy metals and persistent organic contaminants in food. This includes research on organic and inorganic trace elements in marine products as well as various pesticides in vegetables and fruits.

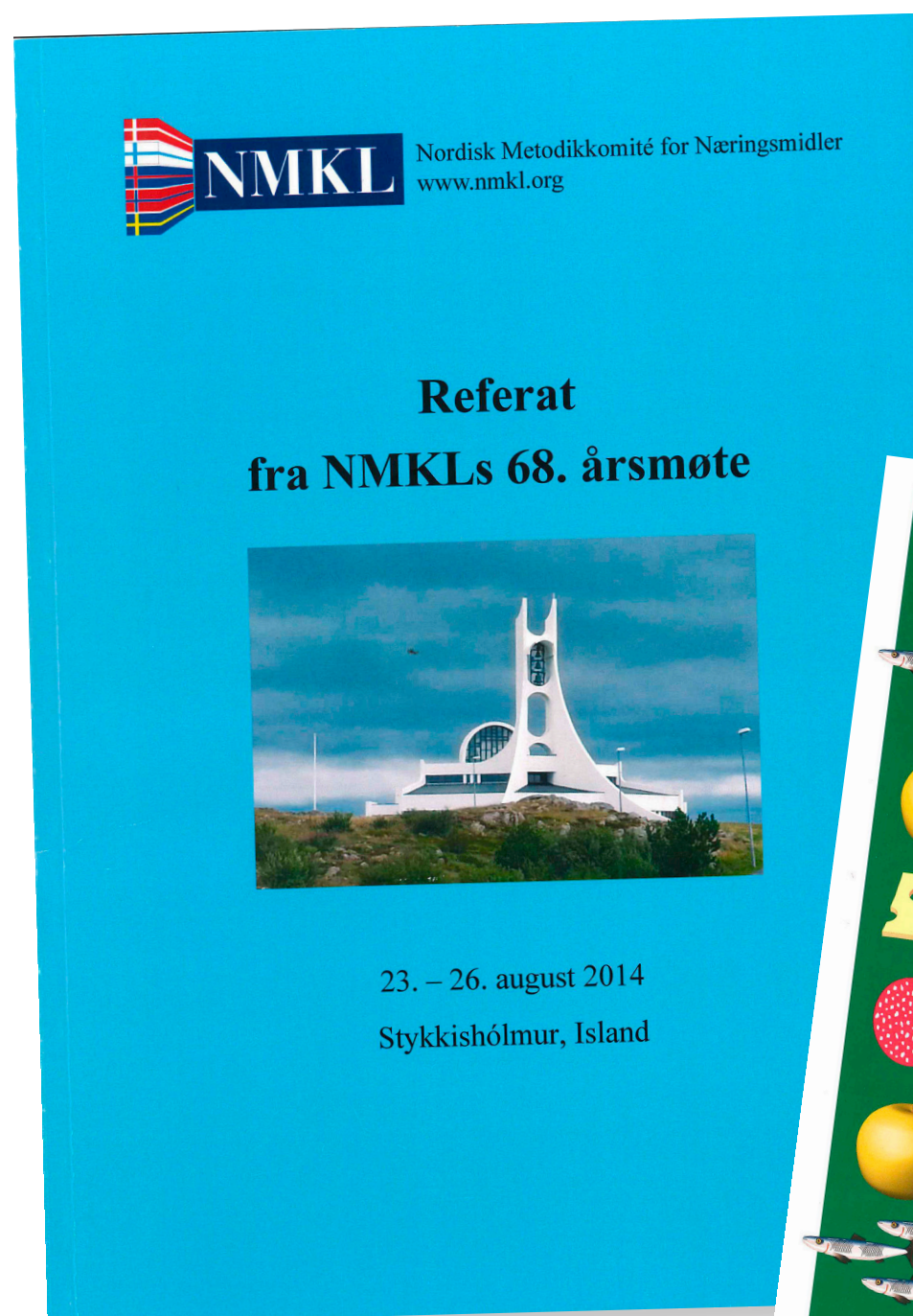
Mátis' main customers for service analysis are food producers, pharmaceutical companies and official control agencies. The analysis department also provides various services to other activities within Mátis.

The merger resulting in Mátis created Iceland's largest provider of microbial and chemical analytical services. The increased size and scope makes it possible to offer service that is broader, faster and more economical than the smaller units could offer.

Employees at Mátis participate actively in international cooperation for the development and review of analytical methods. This ensures that developments in this area is closely monitored and that the methods Mátis uses are authorized and validated. Mátis is also involved in the activities of reference laboratories (National Reference Laboratories - NRL) in the European Economic Area. Mátis' role in the NRL activities is to function as an information centre for authorities, industry and other laboratories in Iceland in certain analytical fields. NRL must, among other things, confirm that analyses are carried out in accordance with international validated methods. Mátis is also obliged to provide other laboratories support and guidance, whether they are private or public. The Ministry of Industry and Innovations has designated Mátis as a National Reference Laboratory for 7 different analytical methods, and in 2016 another 7 designations will be added.



See more



NMKL and the Nordic Committee on Food Analysis

The year is 1983, and the annual general meeting of the Nordic Committee on Food Analysis (NMKL), held at Laugarvatn in Iceland, is coming to an end. The host, Ingimar Sigurdsson, a lawyer at The Ministry of Health, arises and sings for the guests at a dinner party hosted by the ministry. He introduces the song by saying that this is the Icelanders' contribution to the NMKL co-operation and calls for contributions from the other countries. This raises certain vibrations and excitement that end in total disagreement between the Finns and Swedes, who both claim that the song "Hvem kan segla förtan vind", a song about friendship, originates in their country.

Iceland has participated in the activities of NMKL since 1979. This organization, which falls under the authority of The Nordic Council of Ministers (NMR), is one of the oldest cooperative associations in the Nordic countries. It was founded in 1947 after a Danish initiative. The committee consists of chemists, microbiologists, experts in sensory analysis and statisticians from the five Nordic countries: Denmark, Finland, Iceland, Norway and Sweden.

The foundation that this consortium has built its activities on from the beginning, is the need for research methods in food analysis and the belief that the most successful means to fulfil this need is to mobilize and combine the resources available in the Nordic countries. NMKL's aim is to harmonize, streamline, improve and develop strategies to use in food analysis.

In recent years, NMKL has also published methods and held workshops related to quality control in laboratories. No single Nordic country can develop and publish analytical methods as efficiently as the cooperation within NMKL makes possible.

NMKL has for many years made an impact, both within the Nordic countries and internationally. Many of those involved in the work of NMKL in their own countries are also active internationally, and methods and guidance material has been translated into many languages. Each of the Nordic countries has an operating committee, with members from laboratories, government agencies and the private sector. Today, Icelandic committee members are appointed by the Ministry of Industries and Innovation. Each country's committee meets several times a year, and the Nordic countries take turns holding the annual NMKL meeting.

Methods, technical reports and procedures from NMKL have received international recognition, where quality is the guiding principle. The analytical methods are validated, and many are written in cooperation with accreditation bodies. NMKL works closely with international organisations, such as AOAC International, CEN, IDF, ISO and Codex. The purpose is twofold, both to avoid duplication, but also to let the Nordic voice be heard. NMKL is a platform, steadily gaining increased importance, especially in light of the decreasing number of laboratories.

Following the annual meeting in Iceland, where the tradition of entertainment at the end of the meeting originated, all representatives have come well prepared to the game when it comes to saying thanks for the cooperation. Over the years, the Icelandic contributions have ranged from reading the Edda poems to singing in Finnish, where our group thought it delivered the Finnish melancholy flawlessly! However, we can proudly say that Iceland's participation in this Nordic cooperation and our contribution to analytical methods, guidelines and workshops have grown substantially over the years. A considerable part of the references we use in our analytical services are based on NMKL methods. Today, three employees from Matis participate in the committee, and one of them is the chairman of NMKL.



Matis' Work in Developing Countries

Matis and the former Icelandic Fisheries Laboratory that merged with Matis in 2007 have participated in developmental programmes for more than 10 years, through teaching and supervision at the United Nations University – Fisheries Training Programme (UNU-FTP). The cooperation has led to further work for the school with short courses in developing countries. Matis has conducted a total of eight short courses in five developing countries: Vietnam (2005), Sri Lanka (2006), Kenya (2008 and 2013), Uganda (2011) and Tanzania (2012, 2014 and 2015). The short courses have been from one to two weeks long and tailored to the countries' needs. Former UNU-FTP fellows have in recent years actively participated in the course preparation and implementation. This cooperation has been valuable for all participants and especially for Matis, with the growing number of projects in developing countries the past years.

In 2010 the Government of Tanzania tendered a consultancy service for the design of a research vessel, procurement assistance in connection with the vessel's construction, assistance in conducting a socio-economic study of the riparian communities on the Tanzanian side of Lake Tanganyika and improving the handling and processing of fish from the lake. Matis won the tender, in cooperation with the engineering firm VJI, the ship design company Rádgardur skiparáðgjöf, and the engineering firm GOCH in Tanzania. Matis led the project. It also handled the consultancy on fish handling and processing. The project management on behalf of Matis was in hands of Margeir Gissurarson. He has extensive experience in developmental projects and lived in Mozambique for over 6 years. The project areas were fisheries communities along the Tanzanian side of Lake Tanganyika. Most of the communities do not have access to electricity or running water, and the working environment was therefore different from what Icelandic professionals are used to. This area is among the poorest in Tanzania. It was therefore good that Matis could offer an employee who had lived and worked in a developing country for many years and was used to a working environment that is similar to the project area in Tanzania.

The main fish processing at Lake Tanganyika is smoking and drying. For fish drying the fish is spread on the ground, and solar energy evaporates the water from the fish. This practice attracts birds and insects, which compete with humans for the fish lying on the ground. Additionally, during the rainy season, a lot of the fish washes away and/or gets spoiled. It is estimated that post-harvest losses are around 30% of the catch from the lake. This is around 10,000 to 20,000 tonnes annually. Fish is smoked over an open fire, and the fish therefore gets burned. Mostly women do the smoking. This exposes them to heavy smoke during the process. This leads to eye irritation and respiratory complications. Matis' challenge was therefore not only linked to technical solutions but also to improving the health status of the fisheries communities.

The project's outcome was a unit that can be used for both smoking and drying in a closed environment. The amount of wood used for smoking in the new unit was only 20% of what was used in traditional smoking, and the post-harvest

losses were minimal. The new processing unit was a success, and Matis was asked to assist in continuing the work. However, the project was then coming to an end, and there was not much we could do at that time.

In 2014 the Nordic Climate Facility (NCF) advertised support for climate projects. NCF is under the Nordic Development Fund. Matis applied for support to improve the smoking/drying unit from the former project and to construct and distribute 100 units to the riparian communities by Lake Tanganyika. Matis' application was approved, and the project is currently ongoing in cooperation with UNU-FTP and the Tanzania Fisheries Research Institute (TAFIRI). The objective of the project is to reduce the amount of wood used in fish smoking in the project area by 80% and to improve the income of the fisheries communities. In Tanzania alone around 450,000 cubic meters of wood are used annually for fish smoking, and it may therefore be assumed that if the Matis design could be distributed to all fish-smoking operations in Tanzania, it would be possible to reduce the annual wood consumption for fish smoking by 350,000 cubic meters.

Matis has implemented a geothermal project in developing countries. In 2014 Matis conducted a prefeasibility study in Kenya and Rwanda on the use of low enthalpy geothermal energy for food production. Two Matis employees, Margeir Gissurarson and Franklin Georgsson, visited the country for two weeks to conduct the study. In Kenya there are many geothermal fields that provide high and low enthalpy energy, but in Rwanda high enthalpy fields have still not been located although in several places hot springs are found that can be used for food production.

In 2015 Matis agreed to implement a project in the Caribbean area to assess the Sanitary and Phytosanitary measures applied within the CARIFORUM states and determine whether the countries fulfil international requirements on food safety. The assessment emphasized wild fish and aquaculture. The main objective of the project was to set forth a roadmap or proposal on what the states can do on the national and regional levels to secure access to valuable markets like the European Union and the United States of America. Eight countries were visited to assess the competent authority and the environmental monitoring. The results were presented to the official authorities and stakeholders in each country. Final recommendations were submitted in October 2015.

In recent years Matis has increased work in developing countries, and with every assignment the company's reputation as a responsible and professional company for developing countries has grown.



See more



Global Warming Changes Icelandic Food Supply

The Icelandic Food Composition Database (ISGEM) provides information about nutrients in foods on the Icelandic market and foods for export. Information on healthy diet and nutrients in foods interests many people. Those struggling with obesity, diabetes and various other diseases need this information. Dieticians need food composition information in their work, and the food industry uses it in product development and labelling.

The work on ISGEM began in 1977 when the Food Science Department at the Agricultural Research Institute was established. The intention was to calculate Icelanders' nutrient intake. It was therefore necessary to know the chemical content of important foods. An extensive analytical project was launched, and each class of agricultural foods was analysed: meat and meat products, milk and other dairy products, vegetables and eggs. Proximates were analysed, also minerals and vitamins. In many cases, these materials had never before been measured in Icelandic foods. International development funding and grants from Icelandic agriculture made this project possible.

In the first 10 years, a significant data was acquired, and the development of the ISGEM database began. Participation in Nordic research projects made it possible to develop a database in accordance with the best available knowledge. Some chemicals in important foods have not been analysed again after nearly 30 years. This is regrettable. Analytical technology has advanced considerably; recipes have changed, and environmental factors can affect the chemical composition of food. The first Icelandic food composition tables were published in 1988, and in the next 10 years about 20,000 booklets were printed, both for public use and as handbooks in schools.

In 1998, the Food Department moved to the Technological Institute of Iceland, and in 2004 participation in European projects to harmonize databases for nutrients started. Researchers developed a standard for presenting data and food items, and this greatly facilitates transferring data between countries. Following the merger of food research in Iceland in 2007, Matis overtook the operation of ISGEM. A computer programme was developed in accordance with the presentation standard, and selected data were published in an online database.

Another legacy project Matis now manages is a cooperative effort on the use of cereals grown in Iceland for food production. Agriculture in the countries of the North Atlantic is exposed to cool temperatures and a short growing season. Despite this, farmers in Iceland have grown cereals in recent decades and acquired good knowledge of cereal production. Iceland is on the northern boundaries of the cereal cultivation belt and occasionally gets poor growing years. The Agricultural University of Iceland and its predecessor, the Agricultural Research Institute, have made crop production in Iceland possible by breeding new improved cereal varieties and by disseminating knowledge to farmers. The breeding of corn began shortly after 1960, and the work has gone on continuously for more than 50 years. Varieties suitable for Icelandic conditions are now available.

Some of Matis' activities today involve this work, and expertise is continually growing. Today Matis is a leading partner organisation in the North-Atlantic cooperation project, Northern Cereals – New Markets for a Changing Environment, funded by the Northern Periphery and Arctic Programme.

Iceland's domestic cereals are mainly types of barley, which fit well with a variety of foods. It is used in bread-making together with wheat. The barley improves the taste and provides important nutrients like beta-glucans that lower blood cholesterol and reduce blood sugar fluctuations. Other products containing barley are biscuits, breakfast cereals, porridge and ready meals. Barley is also used to produce malt that is one of the most important raw materials in beer making.

Global warming changes the conditions of cultivation, and the cultivation of cereals can in some southern areas become more difficult than before. This creates pressure on feed and food production in northern regions. The utilization of domestic cereals increases food security and sustainability in food and feed production in Iceland.



Local Food – Many Success Stories in Iceland

Many entrepreneurs and small producers come to Matís with ideas for innovations in food production. Some have been trying out their ideas in their own kitchen, serving their delicacies to family and friends, and they see an opportunity to develop their product for the general market. The road from one's own kitchen to the supermarket shelf is long and littered with laws and regulations. Most of these aim to ensure food safety and consumer information. The start-up cost for food production is significant. Beside raw materials and necessary equipment, there is microbial testing, chemical analysis, packaging design, as well as the production facilities and permits and approvals from all the concerned authorities. Matís' Food Innovation Centres have supported a fair number of entrepreneurs and have actually assisted them in making their dreams come true by making both facilities and the right equipment available to them as well as necessary professional advice.

Matís' Food Innovation Centres have operated in three different locations in Iceland, where a number of entrepreneurs have worked on their products. Some are still working there, producing small quantities, while others have moved to their own locations.

Ásthildur's popcorn production is an example of a successful entrepreneurial project. Ásthildur contacted Matís with an idea she had tried at home for her family. Her idea was to make popcorn coated with different sweets, put it in consumer packaging and sell it as a high-quality gourmet product. At first this production did not look like a good idea. Ásthildur had already invested in equipment and raw materials and was working on the packaging design. In two weeks we managed to create nutritional labelling, get a license and develop production processes. The day before the opening of the Icelandic Pantry Food Market, a considerable amount of popcorn in consumer packaging was ready. Before the first market day was over, the popcorn had sold out. The income from the sales this one day was enough to cover all Ásthildur's expenses, taken from household money (as is common with entrepreneurs), and there was some profit as well. Today, Ásthildur's popcorn has become a well-known product in gourmet stores in Iceland, and the production has moved out of Matís' Innovation Centre.

Svavar is another example of an entrepreneur who came to us with an idea. He had decided to become a vegetarian, and the only meat he missed was a "hot dog with the works" as we say in Iceland. He investigated what supermarkets offered, tasted it and found out he could probably make a better product himself.

He started product development in a Matís Innovation Centre, which resulted in the production of 200 kg of sausages per month, made from vegetables, beans and barley, and marketed under the name *Bulsur* (like Veggie-dogs in English). Svavar has outsourced the production but takes care of marketing, distribution and finances himself. He thus gets more time to develop other products which will be marketed in the near future.

The third example worth mentioning is a small-scale slaughterhouse, *Handverkssláturhúsid*, in Seglbúdir in Landbrot. There an entrepreneur sought Matís' assistance in solving some issues. A farmer there, Erlendur, had long planned to set up meat processing to produce products from his own raw materials. For this purpose, he thought of a large shed at the farm, which he had built several years ago but was rather poorly utilised—mainly for the storage of equipment and tools. After some thought on the matter, people agreed that the space could be utilised as a small slaughterhouse, in addition to traditional meat processing. It can be said that it is not possible to come closer to the "Farm direct" concept. Detailed preparations followed, entailing, for example, the design and planning of the slaughterhouse and the required work processes. In addition, a lot of time went into communications with governmental inspectors since this was the first slaughterhouse of its kind in Iceland. It was also necessary to convince permit issuers and inspectors that even a small slaughterhouse, with limited manpower, where work processes are based more on manual work than automation, could fulfil all of the requirements for slaughterhouses. Two slaughter seasons have now passed since the opening of the slaughterhouse. That time has confirmed that its products have become very sought after since their quality is renowned, whether considering healthfulness or flavour and texture. The next steps for Erlendur and his wife Þórunn, the entrepreneurs in Seglbúdir, in collaboration with Matís, are to expand the operations of the slaughterhouse. Preparations of a slaughterhouse for large animals (steers and horses) have already begun. Those activities will strengthen the operations and create several jobs in the nearby countryside, in addition to those created when the sheep slaughterhouse opened.

In recent months we have noticed a huge increase in interest in Matís' Food Innovation Centres, and many products are becoming marketable, such as schnapps with local herbs, products from wild game and whiskey.





Feeding the Family

I have worked in food production more than 30 years, and my development projects have been quite varied, in spite of my work being solely within the fishing industry. It is not without pride that I see products we developed years ago still on shelves in supermarkets abroad.

When invited to summarize interesting topics from my career, my mind sought back to my youth. Many of my childhood memories are related to food and the provision of food. In those days I did not realize how important the provision of food was to my parents and, especially, my grandparents. The life of previous generations turned largely around ensuring enough food throughout the year and this demanded both skill and cunning. The know-how was handed down from generation to generation, new methods and means being added occasionally. Food waste was unknown, bad tasting food was practically unheard of and almost everything from all animals was utilized.

Seal meat in my grandmother's sauce was the best, salted cod my grandfather made served with melted fat, singed seal flippers, lumpfish in the spring, horsemeat sausages and cows' first milk (colostrum), from my aunt's farm, sheep heads that my father and I singed on an open fire, the food from the lambs slaughtered at home, my mother's blood and liver sausages, flatbread my mother made from tiny potatoes, the swedes, potatoes and other vegetables my family cultivated. These are all a great part of my childhood memories of food.

One could not go to the nearest shop to buy food from our part of the country – the best meats, cheeses, butter, and so on. The policy at that time was that all food should conform to a standard. It should not be possible to trace products to individual producers. This could discredit those not meeting the standards. Also, it was not possible to buy directly from the producers. This would have been "smuggling" of the worst kind.

Bonds to the countryside weakened over the years, and people eventually purchased everything for feeding the family in shops. The importance of food self-sufficiency shrank to nothing, and the connection to the source disappeared. One can only speculate what the outcome would have been had there been more freedom of initiative, and if the framers had enjoyed more respect as food producers.

Words such as food waste, origin, food safety, healthy food, traceability, purity, honesty, animal welfare and sustainability were an integral part of homemade food in those days even if people never used these words. These terms came first into use when almost all food production had been moved to factories. Rules on state aid prevented home production. Requirements for safety, healthfulness and food security acted as barriers to potential small-scale production. This is comparable to today's regulations on importing food products to "protect" Icelandic consumers from contaminated food.

Everything has its own time, and what is "hip and cool" now was just life itself in the old days. Today it is everyone's right to know the origin of their food and even get a little story with it. We do not prepare the food now as we did before in the homes, but we keep better track of where the food originates, and how it is processed. "Small and beautiful" is what people want, and food safety should not be the consumers' concern, but the government's, to ensure that food producers follow established rules.

The new opportunities that small producers create arise from different demands, increased consumer knowledge and skills obtained, e.g., through education and travel, thus getting to know other nations' food culture. Certainly we must not compromise on safety and healthfulness. Without them "small and beautiful" food processing companies will not last.

It is interesting to look back and realise that our parents' and grandparents' food production was indeed a "small and beautiful" food production company that ensured good and plentiful food on the table all year round. This home production did not fulfil all our current requirements because knowledge was limited, but everyone did their best.

It may have been possible to develop "the old" home production and help those interested in such production instead of suppressing the possibility of value creation in the local community.



When Listeria Shook the Fishing Industry in Iceland

Before 1990 no one worried about *Listeria monocytogenes* in Icelandic fish products. In 1988 findings indicated that it could be found in frozen shrimp in the USA, whether the shrimp was raw or cooked, imported or caught in the USA. Also it was found in other seafood in the USA.

It became obvious that authorities in the USA would increasingly focus on *Listeria* in shrimp and other frozen seafood and all food on the market ready for consumption. *Listeria* is a bacterial disease that can, for example, cause miscarriage and meningitis in newborns. Because of this, the Icelandic fish producers had to declare whether *Listeria* was found in their products or not.

Producers who previously had not been particularly concerned about *Listeria* looked to the Icelandic Fisheries Laboratories (IFL) for guidance. The IFL set up methods for isolating *Listeria* from samples and collected samples from the fish processing plants, raw materials and final products. When the research began, it revealed that Icelandic fish- and shrimp-processing plants were not free of *Listeria*. It was in the environment, raw materials and even in the final products.

Listeria is an environmental bacterium that can be transmitted, e.g., by soil and seabird droppings. It was found in fish containers stored outdoors, tires of forklifts that transferred fish to processing plants, and some workers' footwear.

It was not sufficient to find out how *Listeria* could be transferred into the fish plants; a method of getting rid of it had to be developed. The first stage was cleaning. It turned out that *Listeria* was difficult to get rid of because it is very environmentally resilient and can well withstand cleaning materials like chlorine. When the cleaning of *Listeria*-contaminated places started, it also came to light that the machinery had not been designed for such cleaning. For example, drum scaling machines for ocean perch were usually contaminated with *Listeria* and difficult to clean. This led to a research project for IFL in 1988 that investigated improvements in machinery design and assessed the environment and characteristics of detergent used for cleaning fish processing plants.

Today, internal control and quality control have improved enormously in fish processing, and Matis has taken over from IFL to provide advice and assistance with establishing quality systems as well as designing systematic sampling and analyses of *Listeria* contamination. All this has resulted in Icelandic fish plants being almost free of *Listeria*, so it can be said that all this "Listeria-Hysteria" led to the revival of and better quality control and thus safer products for the consumer.

Production of Fish Feed – Cold Pressed Virgin Cod Liver Oil

As the demand for fish continues to grow, aquaculture production must increase to maintain the availability of seafood supply and reduce fishing pressure. The way to meet the demand is to farm fish. Fish meal is the dominant protein source in fish feed, but its production is decreasing since better direct utilisation of pelagic fish into more valuable human food products is envisaged with better techniques in fishing and chilling of the raw materials.

At Matis several scientist, including dr. Jón Árnason and dr. Ragnar Jóhannsson, have been working on various projects aimed at finding alternative feed for aquaculture and taking advantage of unused raw materials. Waste from cellulose factories in Sweden and microbial biomass grown in geothermal gases from Hellisheidi Geothermal Plant are potential sources for future aquaculture feed.

Ragnar, who is a project group leader, has been working with Swedish companies on a project to produce Single Cell Protein (SCP) from forest industry side streams. The project's main aim is to develop a replacement product for fish meal. The trick was to choose the best-suited microorganisms and the side streams in the cellulose and paper industry best suited for the production of SCP. The protein mass is dried and mixed with other raw materials, replacing fish meal in the formulation. This feed was first tested on tilapia and gave good results as a very good protein source. Now another project is in progress to develop feed for Arctic char.

Another method for producing aquaculture feed is to use hydrogen sulphide from Hellisheidi Geothermal Plant that can act as an energy source for specific bacteria. The bacteria grow rapidly in the hydrogen sulphide and are then dried and mixed with aquaculture feed. This project was recently completed after two years of research, but further research is needed to optimize the results.

Ragnar became involved in a problem quite different in origin when three entrepreneurs in Bolungarvík in the Westfjords, Birgitta, Anna and Sigrún, came to Matis with a new method of making cod liver oil. They wanted to make the oil without melting the liver at a high temperature, thus avoiding the loss of natural nutrients and antioxidants that in traditional production are added at a later stage. The idea originated in their shared MBA final project on the production and marketing fish liver oil for pets.

In Iceland the old traditional processing of cod liver was to let it self-disintegrate and extract the oil for human consumption. It was believed that this pure natural oil made people healthier and stronger and enabled them to endure the long and cold Nordic winter. The benefits of fatty acids in cod liver oil include helping to lower cholesterol and alleviating symptoms of arthritis.

The three entrepreneurs got Ragnar to develop a novel method mimicking the old method. It took some time to develop the final method, which involved heating the liver to 42°C, qualifying the fish oil as a raw food product. Experimental production at the plant in Bolungarvík followed. During this phase, they the three entrepreneurs were once surprised to see a carrot red product instead of pale yellow. The colour was due to the feed of the fish. The carrot red colour comes from feeding on zooplankton. It turned out that what the fish's feed also gives a different taste to the oil. Sometimes it tastes of seaweed and sometimes of shellfish. For the production fresh cod liver from local fishermen using eco-friendly line fishing is used.

The company, True Westfjord, has been founded, and the production and marketing of the oil under the name Dropi (Drop) started in beginning of 2015. Dropi is cold-pressed virgin cod liver oil sold in selected health and specialty stores in Iceland, elsewhere in Europe, North America and Asia.





One of the Most Interesting Geothermal Regions in the World

Iceland is one of the most interesting geothermal regions in the world due to the number and diversity of geothermal biotopes which is almost unmatched elsewhere. The biotechnological potential of thermophilic bacteria in these habitats was recognized early, and the R&D in Iceland has focused on enzyme bioprospecting for various industrial and uses. The Matís Biotech Group can trace its origin to the late eighties to the Technological Institute of Iceland (IceTech) and University of Iceland. A spin-off bioprospecting company from IceTech, Prokaria, was founded in June 1998. It merged with Matís in 2007. Since the merger, increased emphasis has been placed on enzymes and microbes for processing Icelandic bioresources, and direct marketing has strengthened commercialization efforts through a small daughter company, Prokazyme.

The Biotech Group's long history in the field has ensured important continuity, and Matís has invested major effort in the field, (1) targeting enzymatic and microbial activities for processing and developing marine polysaccharides and derivatives as novel substrates and products for industry, (2) developing enzymes for molecular biology and (3) metabolic engineering of thermophilic bacteria for the production of biofuel and valuable chemicals from lignocellulose and macro algal biomass. Matís is well-known internationally. It participates in a number of Nordic and EU projects, developing robust enzymes for various uses.

Matís has large collections of proprietary microbes and enzymes, developed over more than 30 years, and the Matís Biotech Group for molecular biology applications has developed enzymes and commercialized them for the chemical and the food industries, especially the carbohydrate industries.

Commercialization has targeted foreign markets, mostly through R&D contracts made with large industrial companies, including Roche, Epicentre, Nestle, Roquette Frères, Wacher Chemie and SudChemie. The Matís Biotech Group under Gudmundur Óli's leadership has employed sequence-based approaches to bioprospecting. This approach goes back to the EU's 5th Framework projects, but methodologies have developed enormously since then, and now Matís combines approaches of genomics, metagenomics and bioinformatics to obtain enzyme leads of interest to industry. Matís is also one of few research institutes working on the metabolic engineering of thermophiles. These have high potential as robust biorefinery organisms for consolidated biorefinery processes, utilizing a wide range of sugars; they are optimal for the harsh conditions encountered in industrial feedstock slurries.

For the past 10 years Matís Biotech Group has been developing a toolbox for marine biorefineries. A number of successful projects have been carried out, and enzymes have been developed for processing and modifying polysaccharides, such as alginate and laminarin from brown algae, chitin from shrimp shells and chondroitin from shark cartilage and sea cucumbers. Work on some of these enzymes started early this century when the global research effort in the field was still very limited, but leads identified a number of years ago have now been developed into highly commercial products and are being patented. There is now global interest in utilizing marine biomass resources more efficiently, and enzymes and microbes will be important parts of new industrial processes. Matís has set its sights on providing tools for these emerging bio-industries.



Pelagic Fish Has Always Been Important to Icelanders

The utilization of pelagic fish has completely transformed in recent years, and the processing and utilization of each species have greatly developed. The number of fishery companies has dropped, and processing has become more mechanized. Production now takes market demand more into account, leading to gains in productivity of the process. This development has also led to better utilization of equipment and personnel. The companies engaged in pelagic fishing divide the year into four fishing periods: capelin in winter, blue whiting in spring, mackerel in summer and herring in autumn.

The Icelandic Fisheries Laboratory, IFL, and later Mátis have collaborated with the fishery companies in developing products from pelagic fish. Since 1978, chief engineer Sigurjón Arason has supervised many of these projects. He, along with other scientists, has gathered good knowledge and experience in utilizing marine catches and made major contributions to the teaching and training of students and employees at Mátis.

Catching and processing capelin started more than 50 years ago. In the beginning the capelin was mostly used for fishmeal production, but later efforts led to removing the roe from the capelin, and employees of IFL, fish sales companies, fishery companies and other researchers jointly developed equipment for this purpose. Freezing whole female capelin began about 40 years ago, and most of the production is exported to Japan. About 20 years later freezing of male capelin started, and most of that production goes to Eastern Europe. About 30 years ago capelin was dried and exported to Africa. This production was successful but has

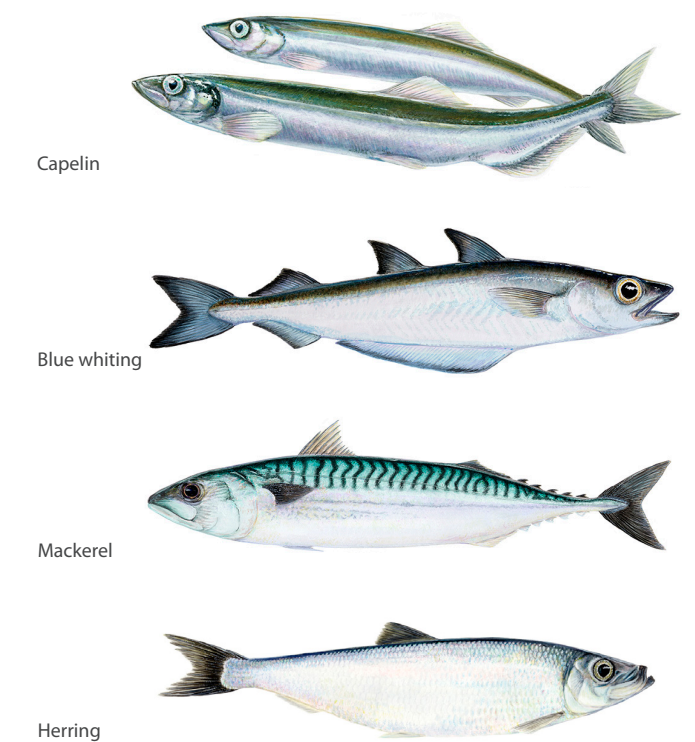
not continued. In Japan, female capelin is threaded on pins semi-dried and then frozen. This method was tried here for a few years. Skaginn, a leading company in the design and development of food processing equipment, developed drying and freezing equipment for capelin. In 2014, about 50% of the capelin catch was processed for human consumption. This production generated about 70% of the value of exports of capelin products. Through the years IFL and later Mátis have worked closely with fishery companies to develop capelin products.

When herring fishing started, part of the catch was salted, but most of it went into fishmeal production. Around 70 years ago fishery companies began freezing herring for human consumption. This production has increased steadily over the last 40 years, and now most herring is frozen for human consumption, either whole or filleted. In 2014, 55% of the catch was processed for human consumption, which generated about 70% of the value of exports of herring products. IFL and later Mátis have actively participated in developing herring products in close cooperation with most companies in the industry.

Mackerel is the most recent newcomer to Icelandic coastal waters. It has brought the fishery industry many opportunities and challenges in the last 10 years. In the first years the largest part of the catch was used in fishmeal production, but collaboration with the fishing industry companies made it possible to develop ways to use the mackerel for human consumption. This seemed difficult because when mackerel is caught in Icelandic waters, its fat content increases rapidly. The key factor was very rapid cooling to a subcooled storage temperature of -1.5°C.

Most mackerel is frozen with new refrigeration equipment developed by Skaginn, in collaboration with the fish processing companies and Mátis. This technology has since become useful for the fishing and processing of other pelagic species and has improved production processes and product quality. Mátis entered into the rapidly developing sub-cooling process and helped develop the refrigeration equipment. Parallel to this development, companies processing mackerel have joined Mátis and the University of Iceland to investigate the stability and shelf life of mackerel caught in different areas and seasons. This partnership has enabled companies to better meet the buyers' demands for quality and simultaneously increase the catch value.

The production of fishmeal and fish oil in recent years has greatly progressed. The number of factories has decreased while simultaneously achieving more efficiency. The raw material coming into the factories is now more consistent and fresher and therefore cooking whole fish into fishmeal has dropped sharply, and the raw material for fishmeal is mostly cuttings and waste from fresh fish processing. Blue whiting is the only pelagic fish species that is mainly used in fishmeal processing. The fishmeal factories have invested in equipment that utilizes raw material and energy more efficiently while simultaneously producing higher quality fishmeal. The factories have increased the use of domestic sustainable energy and, in addition, improved their capture and use of thermal energy, which was previously lost. Scientists at Mátis have been actively involved in this development.





University of Iceland – Fruitful Cooperation

Matis cooperates well and successfully with the University of Iceland with a formal agreement on teaching and research. Research, teaching and human resources are shared, with the goal of being at the forefront in food science and biotechnology. Combining available knowledge and skills is also important for innovation and adding value to the food and biotechnology industries. The agreement is the foundation for enhancing academic and practical training in food research and food safety as well as in other areas of teaching and research. About 60 M.Sc. and 20 Ph.D. projects have been completed at Matis since 2007.

The cooperation is most extensive in food science and nutrition, through sharing staff, cooperative projects and equipment, and by the University leasing classrooms and offices from Matis at Vinlandsleid 14. In all, 9 Ph.D. and 30 M.Sc. projects in food science have been completed at Matis since 2007.

Cooperation with food science at the University has a long history. Teaching the BS curriculum in food science started in 1978 with initiative and support from the Icelandic Fisheries Institute and the Agricultural Research Institute that Matis inherited when it was founded in 2007. At that time university education in food science was in crisis and was about to close due to too few enrolments of students. The decision was taken to join forces. The syllabus was reviewed; a formal Master's programme was launched, and new courses were designed. Matis took responsibility for designing the Master's programme. The programme was thoroughly publicised, and students were invited to Matis to inspect the new research facilities and meet the teachers of the food science courses and other Matis employees.

The number of students enrolled in food science increased from 20 to 70 since the campaign started in 2011. This is a very satisfactory result.

The enrolment for both undergraduate and postgraduate studies has grown. The running of the programmes has been very satisfactory, and the number of food scientists with a degree from the University has increased significantly.

The connection with the commercial environment, i.e. the fish industry, other food industries and bio-tech, as well as agencies dealing with food safety, is very prominent in the students' projects. The need for people with this education is obvious, since all graduates have been employed, working in industry, research and for food safety agencies.

Students have also been trained in innovation, product development and writing business plans, i.e. with professional assistance and by using facilities at Matis in order to prepare them better to work as employees in industry or start their own businesses. Most of them have participated in a contest to develop new eco-friendly food products, and the winners have participated in the new development contest Ecotrophelia Europe. These are excellent examples of how Matis connects academia and industry.

The scientists of the future have been trained during their doctoral work at Matis, many of them in cooperation with the University of Iceland, United Nations University – Fisheries Training Programme, UNU-FTP, and universities in other countries.

All students who are working on their postgraduate projects or doing an internship have access to facilities for studying and the canteen at Matis, as well as access to laboratories and processing facilities under the supervision of Matis' specialists and university teachers. Thus, Matis functions as a real workplace where students can stay all day. This mix of people of different origins with different educational backgrounds becomes a fountain of new ideas and contacts which will be valuable for Icelandic industry and society in the future.



See more

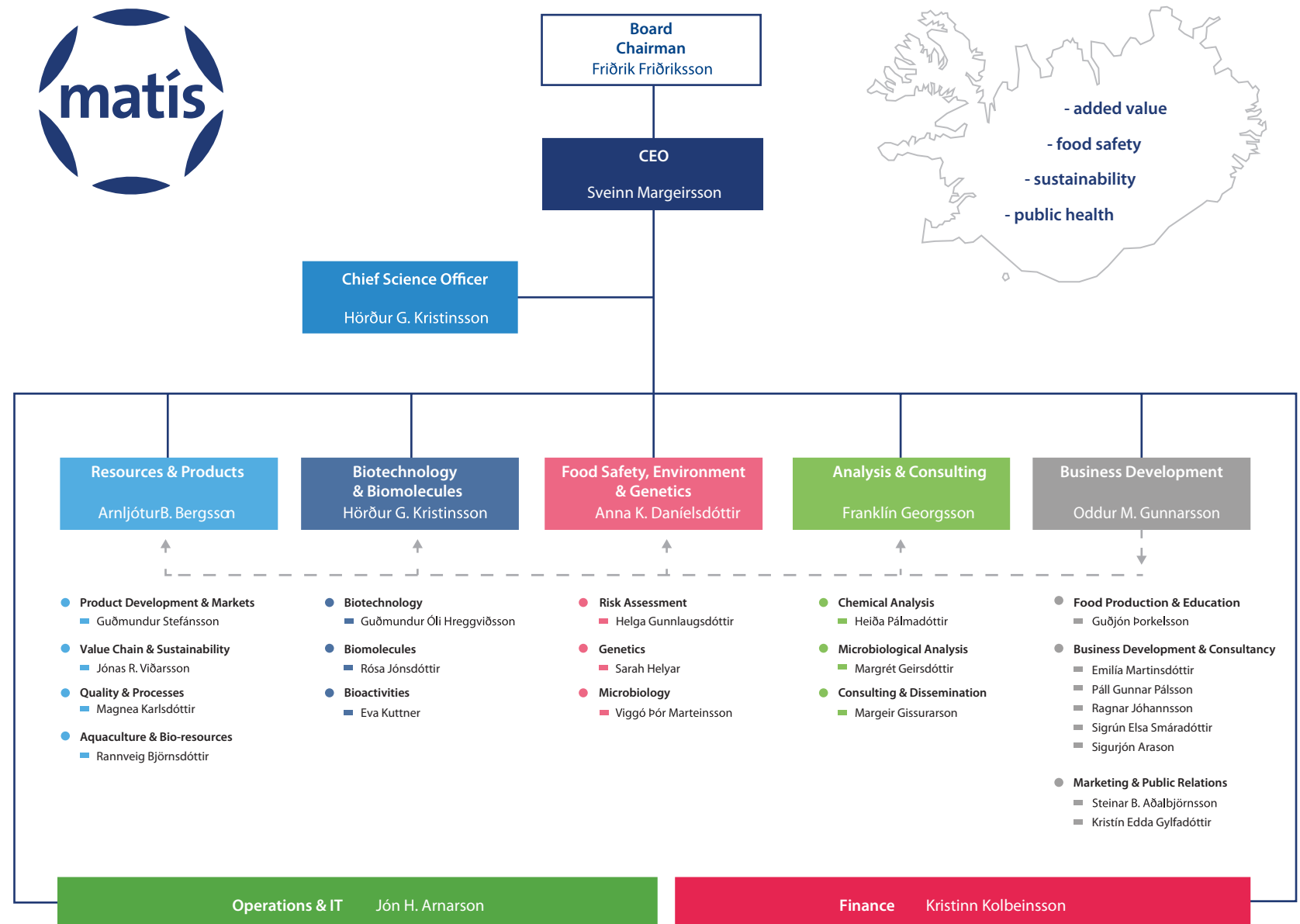
Employee Statistics

Education Degrees	Number
Ph.D.	29
M.Sc.	31
B.Sc.	18
B.A.	1
Cand. Oecon	1
Specialty	8
Other Education	14
Total	102

Number of Employees per Division	Positions	Number
Analysis and Consulting	17	19
Biotechnology and Biomolecules	20,92	23
Food Safety, Environment and Genetics	15,75	17
Resources and Products	20,65	21
Business Development	7,75	8
Finance	5,8	6
Operation and IT	7,18	8
Total	95,06	102



General information	
Number of Employees	102
Number of Positions	95,06
Average Age of Employees	43,6
Average Number of Years at Matis	9,6



Graduated Matís Students



[See more](#)



Student	Professor	Speciality	Title	Degree	University
Erla Sturludóttir	Helga Gunnlaugsdóttir	Engineering	Statistical analysis of trends in data from ecological monitoring	Ph.D.	University of Iceland
Cyprian Odoli	Sigurjón Arason	Food Science and Nutrition	Drying and smoking of capelin (<i>Mallotus villosus</i>) and sardine (<i>Sardinella gibbosa</i>) - the influence on physicochemical properties and consumers acceptance	Ph.D.	University of Iceland
Andri Þorleifsson	Sigurjón Arason	Food Science and Nutrition	Effects of frozen storage on quality of Atlantic mackerel (<i>Scomber scombrus</i>) caught in Icelandic waters	M.Sc.	University of Iceland
Dana Rán Jónsdóttir	Sigrún Mjöll Halldórsdóttir	Food Science and Nutrition	Testing different antioxidants during hydrolysis of fish protein	M.Sc.	University of Iceland
Guðbjörn Jenson	Sigurjón Arason	Industrial Engineering	Aquaculture of freshwater crayfish	M.Sc.	University of Iceland
Hildur Kristinsdóttir	Magnea G. Karlsdóttir	Food Science and Nutrition	Utilization and stability of cod liver during frozen storage - effects of season, on-board handling and storage conditions	M.Sc.	University of Iceland
Hjalti Steinþórsson	Sæmundur Elíasson	Mechanical Engineering	Cooling processes for whole cod	M.Sc.	University of Iceland
Ildiko Oljajós	Helga Gunnlaugsdóttir	Food Science and Nutrition	Implementation and verification of an analytical method for the quantification of biogenic amines in seafood products	M.Sc.	University of Iceland
Jóna Sigríður Halldórsdóttir	Magnea G. Karlsdóttir	Food Science and Nutrition	Stability of lightly salted fillets during frozen storage	M.Sc.	University of Iceland
Liza P. Mulig	Sigurjón Arason	Food Science and Nutrition	Vinnslueiginleikar þorsklifrar	M.Sc.	University of Iceland
Stefán Þór Eysteinnsson	Sigurjón Arason Guðmundur Stefánsson	Food Science and Nutrition	Marinated and dried blue whiting	M.Sc.	University of Iceland

Projects

Europlanet

Europlanet links laboratories active in planetary research in Europe and around the world. Since 2005, Europlanet has provided Europe's planetary science community with a platform to exchange ideas and personnel, share research tools, data and facilities, define key science goals for the future, and engage stakeholders, policy makers and European citizens with planetary science. EU Horizon2020 project.

Valuable

The aim is to optimize productivity of selected North Atlantic microalgae species and develop sustainable technologies for production of microalgae biomass that will be formulated into feed diets and tested at different developmental stages in the production of various fish species. Selected microalgae constituents will be utilized for the development of high-end products to be included in skin care products or food supplements.

Novel high-end pet food ingredients

Innovative ingredients for pet food will be produced. Cuttings and other by-products from pelagic fish factories will be used, proteins broken down into peptides with enzymes plus seaweed. This results in a product containing antioxidants, omega-3 fatty acids and peptides. Great interest is for this type of active ingredients from the growing pet food market.

PAHs in smoked meet in Iceland

In Iceland, smoking to prepare food has a long tradition and smoked food, especially smoked lamb, is a large part of the traditional diet of Icelanders. Polycyclic Aromatic Hydrocarbons (PAH) are persistent pollutants produced by incomplete combustion of organic material. The variability of PAH concentration in relation to smoking method is not known and expert judgement indicates that PAH levels might be a risk for human consumers. The aim is to investigate the concentration of PAHs in traditionally smoked food, depending on smoking method. A reliable determination of PAH is a basic precondition to put the regulation of the European Commission about maximum level of PAH in food in practice.

Utilization of the arctic sea urchin resource

The aim is to gather existing expertise from Norway, Iceland, Ireland and Greenland, together with knowledge from Canada and Scotland to optimise the fishing of high value sea urchins in Northern and Arctic areas. Furthermore, roe enhancement technology for roe fattening to increase the value of low value sea urchins once they have been collected in the northern arctic regions will be developed in Greenland and Iceland. Sea ranching to repopulate areas that have been extensively overfished in Ireland will also be investigated.

MacroValue

The overall aim of the project is to study the seasonal variation in active and targeted compounds in cultivated macroalgae, *S. latissimi*, *A. esculenta* and *P. palmata*. The project, which is funded by Nordic Marine Innovation 2.0, is coordinated by Ocean Rainforest in the Faroe Islands in collaboration with Hortimar in Norway and Matís. The seaweed will be cultivated in the Faroe Islands and data of different oceanographic parameters (current direction, speed, temperature, salinity, wave height, nutrients, etc) on the cultivation site will be collected. The chemical composition will be analyzed and bioactive properties of the seaweed and seaweed extracts studied. Pre-treatment methods for different product applications will be developed and demonstrated. Finally, product and market tests of a range to identify added value in the process from cultivation to end-user industrial product will be conducted.

PROMAC: Energy efficient PROcessing of MACroalgae

Primary objective is to provide a knowledge base for energy-efficient and sustainable processing of macroalgae as human food and animal feed. Three different species of seaweed, all with significant potential for commercial cultivation in Norway as well as distinct raw material qualities, will be evaluated as alternative sources of proteins and energy in animal feed, and for their health benefits as human food.

Novel extraction of natural astaxanthin

The objective of the project is to establish sustainable production of astaxanthin derived from microalgae and to develop a green chemistry extraction method with an emphasis on cod liver oil.

Quality optimization of frozen redfish products

The aims is to increase the value of fish by analyzing ideal conditions for storage of frozen redfish while increasing their stability according to season, raw material quality and product categories. Very few studies have been conducted on these factors for redfish and important information will be gathered.

Colorants in sea cucumber

The possibility to use a natural resource that is currently regarded as waste material to create high valuable product in the form of natural colorant will be explored. Main novelty related to the project is related to the production of high valuable product, astaxanthin by processing the waste from sea cucumber production. Colorants such as astaxanthin with natural origin is highly sought after product mainly for producers aiming at organic labelling for their products.

Colouring salmon with natural pigment

It is of importance for Icelandic salmon farming to benefit from prices returned for products obtained by the „Naturally raised“-method. For this purpose, natural colorants are needed in the feed. The project aims on comparing different colorants and colorant quantities in feed with respect to fillet colouring. The results will make the market penetration of Icelandic salmon easier and support the present price premium obtained compared to other salmon products in the market.

Craft Reach

The aim is to develop and test services to help quality craft businesses to grow and prosper in peripheral areas by improving their business models and their premises, lifting the products onto the international market and use the businesses as focal points in the local community and as inspiration for young people.

Arctic Bioeconomy II

The project contributes to strategic development of the biotech industry in the West Nordic countries, identifying opportunities for value creation from bioresources including waste streams, underutilized biomass, and unique genetic resources. It contributes to the development of high tech industries for value creation in the West Nordic economy and provides foundation for building up a stronger and more diverse communities.

EuroMix

Every day, we are exposed to multiple chemicals by multiple routes of exposure: diet, inhalation and dermal contact. These chemicals may exert toxic effects. Risk assessment taking account of both exposure and toxicity is therefore necessary to monitor and control possible adverse effects on human health. Until recently, risk assessment is mostly performed separately for each chemical, considering only a single route of exposure. Therefore, there is a need to address combined exposure to mixtures of multiple food-related toxic substances and their combined risks as set out in EU Regulation, i.e. cumulative risk assessment. EU Horizon2020 project.

SilhouetteOfSeaweed

The project will contribute to consumer's safety by overcoming barriers in estimating toxicity of arsenic species in seaweed. Seaweed contains high amounts of arsenic, including arsenolipids (AsLp). Recently the first data on AsLp toxicity have elucidated that they are as toxic as the most toxic arsenic, the inorganic arsenic (iAs). Information gathered in this project will contribute to necessary risk assessment needed for algae used for human consumption. EU Horizon2020 project.

Northern Cereals - New markets

Warmer growing conditions, improved varieties and technologies, and concerns about sustainability are creating new opportunities in northern areas for greater cereal production. The project objectives are to increase cereal growing in the partner areas and to increase the growing of higher value cereals for local food and drink products. The main outputs will be increased numbers of farmers growing cereals for feed, malting or milling and production of higher value cereal products like seed, malt, food and beverages. These changes will increase employment, income and consumer choice in rural areas.

Improved quality and value of Nordic mackerel

A collaborative project in which the mackerel processing industries in Norway, Iceland and the Faroe Islands team up with a filleting machine producer in Sweden and get leading institutes and universities in Scandinavia to carry out research on the stability and quality of Atlantic mackerel, whole and fillets, and how the final food products are affected by season, catching, handling and processing. The results will form a basis for further innovation within the Nordic mackerel processing sector.

Macroalgal biorefinery

The goal is to develop a robust thermophilic biorefinery platform for economic exploitation of macroalgal 2nd generation feedstock. In the light of impending fossil fuel shortage, the development of efficient bio-conversion platform for such biomass may be one of the most important tasks of industrial biotechnology. The project is based on an extensive knowledge on thermophilic organisms and their capabilities and brings together expertise across a wide range of scientific disciplines and technologies.

Primefish

The overall aim is to enhance the economic sustainability of European Fisheries and Aquaculture sectors. PrimeFish will gather data and information from individual production firms, industry organisations, sales organisations and consumers, as well as from public sources on the competitiveness and economic performance of firms in the sector, price development, supply chain relationships, markets, consumer behaviour and successful product innovation. The data will be used to develop models and prediction tools that will be implemented into Decision Support Systems (PrimeDSS). EU Horizon2020 project.

Projects

Conservation and processing marine algae for feed

Cultivation and farming marine macro algae could be the significant resource for sustainable ingredients in feed to an expanding fish farming and agriculture. Though the cultivating is doing progress, there are no solutions for how to preserve, store and process the algae mass after harvesting without using high energy for drying. The main challenges of the project is to find methods for preservation and subsequent processing that could be transferred into a big scale algae industry.

DiscardLess

Practical, achievable, acceptable and cost-effective Discard Mitigation Strategies (DMS1) will be developed to either avoid or utilise unwanted catches, in order to reduce discards while maintaining viable fisheries. Knowledge tools and technologies at local, national, EU and international levels will be integrated to provide and promote the solutions needed to implement such strategies throughout the seafood supply chain. Effects of discard will be assessed and the effects of discard reduction policies on the ecosystem, economic and social sustainability. This will provide feedback for improved fisheries management and the results will be essential in the achievement of policy goals of reducing waste and increasing the net economic value of fisheries for society. EU Horizon2020 project.

MICRO-Feed

Cultivated microorganisms represent a sustainable resource that can meet the needs of the aquaculture industry on both short and longer terms. Since the essential fatty acids EPA and DHA will be the first limiting factors for further growth in marine aquaculture, microorganisms producing high levels of these fatty acids will be the target in MICRO-Feed. Thraustochytrids and photosynthetic microalgae have been selected as target organisms, with the main goal to make these groups to significant contributors of sustainable DHA/EPA, as well as protein.

Proff-Aqua

This project focuses on turning waste streams into valuable products. Organic chemicals found in pulp mills steam from cellulose fibre production can be used to grow fungi and turned into Single Cell Proteins (SCP), suitable as protein-rich components in fish feed. Due to the low protein content of waste materials from agriculture and fish processing, this raw material is not suitable for direct use in fish feed. The black soldier fly larvae are very efficient in transforming such waste streams into high quality protein.

SustainLarvae

The projects goal is to modernize culture of seawater invertebrates and fully develop a new rearing system, SustainCycle, an on-land system for seawater invertebrates where microbes and mechanical components modify the living environment towards optimal levels. A new and revolutionary monitoring tool, SustainDiagnostics, to monitor animal wellbeing will also be developed.

Cultivation of microalgae in aquaculture effluent

The aim is to start microalgae cultivation in effluent from aquaculture. The products will be omega-3 fatty acids and proteins for fish feed. The project will focus on choosing species of algae and production and processing techniques that suit Icelandic conditions and laying the foundation of algaculture on an industrial scale. Algaculture cleans the aquaculture effluent and at same time produces valuable and highly demanded products, promotes import of new technologies and establishing of a new industry.

SAFEFISHDISH

The main objective of the project is to improve the microbial and sensory quality and safety of fish from harvest to consumer. The project will focus on farmed salmon and wild cod, which are the major species traded in Europe. Novel handling techniques and combination of innovative preservation technologies involving biopreservatives, superchilling and modified atmosphere will be evaluated.

Authenticate

Growing societal demand for food authenticity, safety and broader food security is creating both new opportunities and increased challenges for Nordic suppliers, manufacturers and retailers. The mislabelling of food products came to great prominence during the 2013 "horse meat scandal" in Europe, when a range of supposedly beef products were found to contain horse meat. It was only through the use of DNA based methodologies for identifying species that this fraud was detected. This demonstrates the utility of DNA based authenticity techniques as a tool in food control, and has been shown to be particularly useful in the specific case of testing seafood, particularly fish, due to astounding biological diversity that underpins this complex market.

SAF21

The SAF21 project provides research, training and networking opportunities for early stage researchers who will use latest research tools, such as simulation and participatory approaches, with an aim to inject social intelligence into EU fisheries management systems. EU Horizon2020 project.

Nordic biorefineries needs and opportunities

The major opportunities and needs of biorefinery stakeholders in the Nordic bioeconomy will be mapped and analysed. The survey will cover areas such a current operations, business opportunities, obstacles and support requirements. The analysis will report the findings and list the trending learning lessons and best practises, as well as give recommendations on the major opportunities and needs of the industry. The work will be led by a specialist in bio-based biotechnology, with insight into both industry and research sector.

Superchilling of salmon

The ultimate goal is to increase quality of fresh products, increase security in the cold chain of fresh product, and lower production and logistic costs. Fish will be packed in a superchilled state of -1.5°C, thus extending self-life and quality. This will have several advantages for the primary producer, resulting in products with higher yield and of better value, and in products of higher quality for customers of secondary processing. No ice will be needed in logistic, saving enormous transportation cost, especially in airfreight. By superchill, the ice is moved within the muscle without freezing.

The NEMO project - Roundworms in Icelandic seafood

The aim is to analyse the status of roundworms in Icelandic fisheries products and look for ways to detect them and remove from fisheries products. Requirements of buyers and consumers for worm-free products are becoming more intense. It is therefore necessary for Icelanders to find a solution for this problem that can have tremendous negative impact on the Icelandic fishing industry.

Strengthening the bioeconomy in the NORA region

The purpose of the project is to strengthen the bioeconomy in rural areas in NORA region by focusing on local production. The economy of the NORA region depends heavily on the utilization of biological resources, therefore this Nordic focus on bioeconomy is a welcomed opportunity for the NORA countries to strengthen their foundational industries and thereby having a positive economic impact.

Optimization of fresh fish transport

The project aims to improve the handling of fresh fish in transport containers to increase the shelf life and increase the possibilities of maritime transport from Iceland. Shelf life of fresh fish transported in tubes cooled with slush will be compared with the shelf life of fish in 3-7 kg styrofoam boxes with regards to temperature control, product quality, transport costs and environmental impact.

The BSR-Nordic Sustainable Protein Production Initiative

The overall objective is to contribute to create sustainable jobs, prosperity and environmental balance in livestock and aqua-cultural production by identifying potential new cross-sectorial value chains in Nordic bioeconomy.

QualiFish

The overall objective of the project is to develop necessary knowledge and technology to increase sustainability and profitability of Atlantic cod production, enabling actors to meet market demands for safe products with high quality and at sufficient volumes all year round.

FoodIntegrity

The objective of the project is to develop methods to detect and prevent food fraud within Europe. Food Integrity "the state of being whole, entire, or undiminished or in perfect condition". Providing assurance to consumers and other stakeholders about the safety, authenticity and quality of European food (integrity) is of prime importance in adding value to the European agri-food economy. The integrity of European food is under constant threat from fraudulently labelled imitations that try to exploit that added value. The project will directly address this issue and will be an international focal point for harmonisation and exploitation of research and technology for insuring the integrity of European food. EU FP7 project.

EnrichMar

The goal is to increase the value and nutrition of fast-food/prepared meals by enriching them with natural supplements that are produced from by-products from seafood. Biomaterials like algae extract with defined biological activity, fish protein and omega-3 fatty acids in powder form are examples of products that will be used for this purpose. EU FP7 project.

Coastal communities in the North Atlantic

Coastal communities in the North Atlantic have experienced difficulties over the past years and the fishing industry in many of these places has been struggling. Few young people seek jobs in the industry, most of them are moving away. These communities have had to rely on small fishing boats sensitive to the bad weather, which is common there. The project aims to examine the value creation in these areas and how it affects the economy of the country and its importance for rural development.



[See more](#)

Publications

- Adalbjornsson, B.V., Jonsdottir, R. 2015. Enzyme-enhanced extraction of antioxidant ingredients from algae. *Methods in molecular biology*. 1308, 145-150.
- Ara, K.Z.G., Lundemo, P., Fridjonsson, O.H., Hreggvidson, G.O., Adlercreutz, P., Karlsson, E.N. 2015. A CGTase with high coupling activity using {gamma}-cyclodextrin isolated from a novel strain clustering under the genus *Carboxydocella*. *Glycobiology*. 25(5):514-23.
- Bekkevold, D., Helyar, S.J., Limborg, M.T., Nielsen, E.E., Hemmer-Hansen, J., Clausen, L.A.W., Carvalho, G.R. 2015. Gene-associated markers can assign origin in a weakly structured fish, Atlantic herring. *ICES Journal of Marine Science*. 72(6), 1790-1801.
- Dellarosa, N., Laghi, L., Martinsdottir, E., Jonsdottir, R., Sveinsdottir, K. 2015. Enrichment of convenience seafood with omega-3 and seaweed extracts: Effect on lipid oxidation. *LWT-Food Science and Technology*. 62(1), 746-752.
- Gudjonsdottir, M., Traore, A., Jonsson, A., Karlsdottir, M.G., Arason, S. 2015. The effects of pre-salting methods on salt and water distribution of heavily salted cod, as analyzed by H-1 and Na-23, Na-23 NMR, low-field NMR and physicochemical analysis. *Food Chemistry*. 188, 664-672.
- Hermund, D.B., Yeşiltaş, R., Honold, P., Jonsdottir, R., Kristinsson, H.G., Jacobsen, C. 2015. Characterisation and antioxidant evaluation of Icelandic *F. vesiculosus* extracts *in vitro* and in fish-oil-enriched milk and mayonnaise. *Journal of Functional Foods*. 19(Part B), 828-841.
- Hinriksdottir, H.H., Jonsdottir, V.L., Sveinsdottir, K., Martinsdottir, E., Ramel, A. 2015. Bioavailability of long-chain n-3 fatty acids from enriched meals and from microencapsulated powder. *European Journal of Clinical Nutrition*. 69, 344-348.
- Honold, P.J., Jacobsen, C., Jonsdottir, R., Kristinsson, H.G., Hermund, D.B. 2015. Potential seaweed-based food ingredients to inhibit lipid oxidation in fish-oil-enriched mayonnaise. *European Food Research and Technology*. Advance online publication 10/2015.
- Jackson, M.D., Gudmundsson, M. T., Bach, W., Cappelletti, P., Coleman, N. J., Ivarsson, M., Jónasson, K., Jørgensen, S. L., Marteinsson, V., McPhie, J., Moore, J. G., Nielson, D., Rhodes, J. M., Rispoli, C., Schiffman, P., Stefánsson, A., Türke, A., Vanorio, T., Weisenberger, T. B., White, J. D. L., Zierenberg, R., Zimanowski, B. 2015. Time-lapse characterization of hydrothermal seawater and microbial interactions with basaltic tephra at Surtsey Volcano. *Scientific Drilling*. 20, 51-58.
- Jonsdottir, R., Geirsdóttir, M., Hamaguchi, P.Y., Jamnik, P. Undeland, I., Kristinsson, H.G. 2015. The ability of *in vitro* antioxidant assays to predict the efficiency of a cod protein hydrolysate and brown seaweed extract to prevent oxidation in marine food model systems. *Journal of the Science of Food and Agriculture*. Advance online publication 08/2015.
- Kale V., Fridjonsson O., Jonsson J.O., Kristinsson H., Ómarsdottir, S, Hreggvidsson G.O. 2015. Chondroitin Lyase from a Marine Arthrobacter sp. MAT3885 for the production of chondroitin sulfate disaccharides. *Marine Biotechnology*. 17(4), 479-492.
- Kopf, A., Bicak, M., Kottmann, R., et al. The ocean sampling day consortium. 2015. *GigaScience*. 4, 27.
- Kristinsson, H.G., Bergsten, P., Sargsyan, E. 2015. Palmitate stimulates insulin secretion by enhancing mitochondrial respiration via intracellular metabolism and FFAR1 signalling. *Diabetologia*. 58(1), S214.
- Kristinsson, K.G., Georgsson, F. 2015. Innflutt fersk matvæli og sýkingaráhætta fyrir menn. *The Icelandic Medical Journal*. 101(6).
- Larsson, K., Istenic, K., Wulff, T., Jonsdottir, R., Kristinsson, H., Freysdottir, J., Undeland, I., Jamnik, P. 2015. Effect of *in vitro* digested cod liver oil of different quality on oxidative, proteomic and inflammatory responses in the yeast *Saccharomyces cerevisiae* and human monocyte-derived dendritic cells. *Journal of the Science of Food and Agriculture*. 95(15), 3096-3106.
- Marteinsson, V., Klonowski, A., Reynisson, E., Vannier, B.D., Sigurdsson, B.D., Olafsson, M. 2015. Microbial colonization in diverse surface soil types in Surtsey and diversity analysis of its subsurface microbiota. *Biogeosciences*. 12(4), 1191-1203.
- Odoli, O., Nguyen, V. M., Sveinsdottir, K., Jonsson, A, Arason, S. 2015. Influence of lipid content and blanching on capelin (*Mallotus villosus*) drying rate and lipid oxidation under low temperature drying. *Journal of Food Process Engineering*. Advance online publication 03/2015.
- Odoli O.O., Nguyen, M.V., Sveinsdottir, K., Jonsson, A., Tomasson, T., Thorkelsson, G., Arason, S. 2015. Influence of smoking and packaging methods on lipid stability and microbial quality of Capelin (*Mallotus villosus*) and Sardine (*Sardinella gibbosa*). *Food Science & Nutrition*. 2(5), 404-414.
- Olafsson, K., Einarsson, S.M., Gilbey, J., Pampoulie, C., Hreggvidsson, G.O., Hjørleifsdottir, S., Gudjonsson, S. 2015. Origin of Atlantic salmon (*Salmo salar*) at sea in Icelandic waters. *ICES Journal of Marine Science*. Advance online publication 11/2015.
- Pampoulie, C., Skirnisdottir, S., Star, B., Jentoft, S., Jonsdottir, I.G., Hjørleifsson, E., Thorsteinsson, V., Palsson, O.K., Berg, P.R., Andersen, O., Magnusdottir, S., Helyar S.J., Danielsdottir, A.K. 2015. Rhodopsin gene polymorphism associated with divergent light environments in Atlantic cod. *Behaviour Genetics*. 45, 236-244.
- Pampoulie, C., Slotte, A., Oskarsson, G.J., Helyar, S.J., Jonsson, A., Olafsdottir, G., Skirnisdottir, S., Libungan, L.A., Jacobsen, J.A., Joensen, H., Nielsen, H.H., Sigurdsson, S.K., Danielsdóttir, A.K. 2015. Stock structure of Atlantic herring *Clupea harengus* in the Norwegian Sea and adjacent waters. *Marine Ecology Progress Series*. 522, 219-230.
- Petursdottir, A.H., Sloth, J., Feldmann, J. 2015. Introduction of regulations for arsenic in feed and food with emphasis on inorganic arsenic, and implications for analytical chemistry. *Analytical and Bioanalytical Chemistry*. 4707(28), 8385-8396.
- Petursdottir, A.H., Fletcher, K., Gunnlaugsdottir, H., Krupp, E., Küpper F.C., Feldmann, J. 2015. Environmental effects on arsenosugars and arsenolipids in *Ectocarpus* (Phaeophyta). *Environmental Chemistry*. Advance online publication 07/2015.
- Plotka, M., Kaczorowska, A.-K., Morzywolek, A., Makowska, J., Kozłowski, L.P., Thorisdottir, A., Skirnisdottir, S., Hjørleifsdottir, S., Fridjonsson, O.H., Hreggvidsson, G.O., Kristjansson, J.K., Dabrowski, S., Bujnicki, J.M., Kaczorowski T. 2015. Biochemical characterization and validation of a catalytic site of a highly thermostable Ts2631 endolysin from the *Thermus scotoductus* phage vB_Tsc2631. *PlosOne*. 10(9):E0137374.
- Rueckert, C., Albersmeier, A., Busche, T., Jaenicke, S., Winkler, A, Fridjonsson, O.H., Hreggvidsson, G.O., Lambert, C., Badcock D., Bernaerts, K., Anne, J., Economou, A., Kalinowski, J. 2015. Complete genome sequence of *Streptomyces lividans* TK24. *Journal of Biotechnology*. 199, 21-22.
- Santiago, J.L., Ballesteros, M., Chapela, R., Silva, C., Nielsen, K.N., Rangel, M., Erzini, K., Wise, L., Campos, A., Borges, M. F., Sala, A., Virgili, M., Vidarsson, J.R., Baudron, A., Fernandes, P. G. 2015. Is Europe ready for a results-based approach to fisheries management? The voice of stakeholders. *Marine Policy*. 56, 86-97.
- Sigurdardottir, S., Stefansdottir, E.K., Condie, H., Margeirsson, S., Catchpole, T. L., Bellido, J. M., Rochet, M-J. 2015. How can discards in European fisheries be mitigated? Strengths, weaknesses, opportunities and threats of potential mitigation methods. *Marine Policy*. 51, 366-374.
- Silva C., Mendes H., Rangel M., Wise L., Erzini K., De Fátima Borges M., Marta Ballesteros, Santiago J.L., Campos A., Vidarsson J.R., Nielsen K.N. 2015. Development of a responsive fisheries management system for the Portuguese crustacean bottom trawl fishery: Lessons learnt. *Marine Policy*. 52, 19-25.
- Skåra T., Axelsson L., Stefansson G., Ekstrand B., Hagen H. 2015. Fermented and ripened fish products in the northern European countries. *Journal of Ethnic Foods*. 2(1), 18-24.
- Vannier P., Michoud G., Oger P., Marteinsson, V.Th. Jebbar, M. 2015. Genome expression of *Thermococcus barophilus* and *Thermococcus kodakarensis* in response to different hydrostatic pressure conditions. *Research in microbiology*. 166(9), 717-725.
- Yarnpakdee S., Benjakul S., Kristinsson H.G., Bakken, H.E. 2015. Preventive effect of Nile tilapia hydrolysate against oxidative damage of HepG2 cells and DNA mediated by H2O2 and AAPH. *Journal of Food Science and Technology*. Advance online publication 12/2015.
- Yarnpakdee S., Benjakul S., Kristinsson H.G., Kishimura, H. 2015. Antioxidant and sensory properties of protein hydrolysate derived from Nile tilapia (*Oreochromis niloticus*) by one- and two-step hydrolysis. *Journal of Food Science and Technology*. 52(6), 3336-3349.



See more

Reports

- Franklín Georgsson. Consulting report for Hvalur hf. from a visit to Japan. Matís Report 04-15, 13 s.
- Gunnar Þórðarson, Magnea Karlsdóttir, Roger Pedersen, Magnús Jóhannsson, Albert Högnason. Sub-chilling of salmon. Matís Report 11-15, 33 s.
- Hélène L. Lauzon, Eyjólfur Reynisson, Aðalheiður Ólafsdóttir. Chitosan treatments for the fishery industry – Enhancing quality and safety of fishery products. Matís Report 05-15, 41 s.
- Hrönn Ólína Jörundsdóttir, Hrólfur Sigurðsson, Natasa Desnica, Vordís Baldursdóttir, Helga Gunnlaugsdóttir, Margrét Geirsdóttir, Franklín Georgsson. Matís National Reference Laboratory, report 2015. Matís Report 10-15, 16 s.
- Jónas R. Viðarsson, Gunnar Þórðarson, Edgar Henriksen, Audun Iversen, Durita Djurhuus, Tønnes Berthelsen, Heather Manuel, Tom Brown, David Decker. Coastal fisheries in the North Atlantic. Matís Report 01-15, 56 s.
- Jónas R. Viðarsson, Gunnar Þórðarson. Landing obligation on cod heads from factory vessels. Matís Report 07-15, 28 s.
- Magnea G. Karlsdóttir, Paulina E. Romotowska, Sigurjón Arason, Ásbjörn Jónsson, Magnús V. Gíslason, Arnljótur B. Bergsson. Effects of temperature fluctuations during storage and transportation on quality and stability of frozen mackerel products. Matís Report 14-15, 21 s.
- Margeir Gissurarson, Helga Gunnlaugsdóttir. Consultancy to provide technical support to develop national and regional environmental monitoring programmes related to SPS for fishery and aquaculture products in Cariforum states. Matís Report 09-15, 140 s.
- Margeir Gissurarson, Franklín Georgsson. Use of geothermal resources for drying of agricultural commodities in East Africa – Kenya Report. Matís Report 03-15, 34 s.
- Margeir Gissurarson, Franklín Georgsson. Use of Geothermal resources for drying of agricultural commodities in East Africa – Rwanda Report. Matís Report 02-15, 34 s. Lokuð skýrsla.
- Margrét Geirsdóttir. Full utilization of proteins from Lumpfish. Matís Report 12-15, 130 s.
- Paulina E. Romotowska, Magnea G. Karlsdóttir, María Guðjónsdóttir, Sigurjón Arason, Hordur G. Kristinsson. Seasonal and geographical variation in chemical composition and lipid stability of Atlantic mackerel (*Scomber scombrus*) caught in Icelandic waters. Matís Report 17-15, 29 s.
- Paulina E. Romotowska, Magnea G. Karlsdóttir, María Guðjónsdóttir, Hordur G. Kristinsson, Sigurjón Arason. Influence of seasonal variation and frozen storage temperature on the lipid stability of Atlantic mackerel (*Scomber scombrus*). Matís Report 16-15, 24 s.
- Paulina E. Romotowska, María Guðjónsdóttir, Magnea G. Karlsdóttir, Sigurjón Arason, Ásbjörn Jónsson, Hordur G. Kristinsson, Telma B. Kristinsdóttir. Effect of brining and frozen storage physicochemical properties of well-fed Atlantic mackerel (*Scomber scombrus*) intended for hot smoking and canning. Matís Report 15-15, 22 s.
- Paulina E. Romotowska, Björn Margeirsson, Gísli Kristjánsson, Sigurjón Arason, Magnea G. Karlsdóttir, Sæmundur Eliásson, Arnljótur B. Bergsson. Effect of salt content in slurry ice on quality of fresh and thawed Atlantic mackerel (*Scomber scombrus*). Matís Report 13-15, 38 s.
- Rósa Jónsdóttir, Ásta Heiðrún Pétursdóttir, Halldór Benediktsson, Hilma B. Eiðsdóttir, Karl Gunnarsson, Jóna Freysdóttir. Ecological impact on bioactive chemicals in brown seaweeds and their utilization. Matís Report 08-15, 50 s.
- Sophie Jensen, Sæmundur Eliásson, Magnús Gíslason, Hrunn Ólafsdóttir, Ragnar Jóhannsson. Utilising minkfat – Urðarköttur. Matís Report 06-15, 18 s.



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Conferences

NordBio - Nordic Bioeconomy

NordBio, the Nordic bioeconomy initiative, was presented at a meeting in the Nordic House in February. NordBio is a priority programme of the Icelandic Presidency of the Nordic Council of Ministers 2014. Its aim is to utilize the enormous potential of building on bioeconomy in the Nordic Region. Matís plays an integral part in the project. NordBio is a collaborative project involving five Nordic Councils of Ministers: Environment; Fisheries and Aquaculture, Agriculture, Food and Forestry; Trade, Energy and Regional Policies; Education and Research; and, finally, Culture. Nordic experts in these fields will pool their efforts in working on projects promoting sustainable utilisation of living natural resources. The focus will be on the interests of both society at large and the environment per se, and facilitating structuring of a competitive economy as well as new methods in youth education.

Green Days Lectures: Plastic in the Ocean

The organization of students in the Environment and Natural Resources programme at the University of Iceland is called Gaia, and Green Days is its annual event. This year the subject was the Ocean. Helga Gunnlaugsdóttir, Research Group Leader at Matís, gave a lecture on ocean pollution, which is a massive problem. Around 80% of marine litter originates on land, and most of it is plastic. Seabirds, whales, sea turtles and other marine life often ingest marine plastic debris, and such debris can cause death from choking, intestinal blockage and starvation.

POLSHIFTS Conference

Poleward shifts in the pelagic complex, an effect of climate change? The POLSHIFTS conference is supported by the Nordic working group for fisheries, AG-FISK, founded in 2009 to implement the strategies established by EK-FJLS (Fisheries and Aquaculture) and the Nordic Council of Ministers, NMC, and to advise EK-FJLS and the NCM. The scientific body of POLSHIFTS is composed of the Marine Research Institute of Iceland (Coordinator), Matís, the Faroe Marine Research Institute (FAMRI), the Greenland Institute of Natural Resources (GINR), the University of the Faroe Islands (UFI), the Institute of Marine Research of Norway (IMR), and the Fisheries and Ocean Institute, Canada. In this year's conference Sarah J. Helyar, Research Group Leader at Matís, gave a presentation: Genetic structure and population assignment in Atlantic mackerel.

Successful Nordic Seminar in Brussels

In 2015, the Nordic Fisheries and Aquaculture Cooperation, under the chairmanship of the Faroe Islands, is focusing on bio-economy and Blue Growth, with an emphasis on making better use of our valuable marine living resources and developing new products from marine biomass. As part of this programme a joint meeting of the Nordic Council of Ministers and the European Bureau for Conservation and Development (EBCD) was held in Brussels. The Faroese Ministry of Fisheries organized the meeting, in cooperation with the Mission of the Faroes to the EU. The Minister of Fisheries of the Faroe Islands, Jacob Vestergaard, who chairs the Nordic Fisheries and Aquaculture Cooperation in 2015, hosted the meeting. Sigrún Elsa Smáradóttir, a research group Leader at Matís, participated in the programme, focusing on the West Nordic Bioeconomy under the title: Managing marine residue streams in Nordic Countries.

Money, jobs or food. Who needs fisheries and why?

Ian Goulding, an internationally renowned expert on fish quality, processing and international aspects of fisheries management, was in Iceland as a guest lecturer at the United Nations University – Fisheries Training Programme. He held a series of open lectures at Matís on topics related to issues of quality control, processing, and fisheries as a tool for development. Too often these days issues of sustainability alone drive fisheries policy, ignoring the need for management of the sector's economic contribution. Apart from the ecosystem, there are only three reasons why fisheries might be important: economics, employment and food security.

Dr. Christian Patermann visits Skagafjörður

Dr. Christian Patermann visited Matís in May. He gave a presentation at a meeting in Verid Science Park in Skagafjörður. Many consider Dr. Patermann the "father" of the Bioeconomy, and many of the companies in the science park are biotechnology companies.



Interesting Sensory Workshop in Norway

This event is organized every other year in a different Nordic country. Matís sits on the scientific committee of the workshops, and this year's workshop was titled: A Taste of the Future. The central topics for the symposium were children and food preferences, tailor-made healthy food and Nordic food trends. Matís has extensive experience in the sensory analysis of food products and operates a sensory laboratory with a trained sensory panel. Matís has broad experience in consulting and guiding the food industry in product development and sensory analysis. In past years Matís has conducted several consumer studies, using both qualitative and quantitative methods, including product concept and marketing testing and studies on consumer aspects, attitudes, and behaviour in net-surveys among consumers in various countries. Dr. Kolbrún Sveinsdóttir, Adalheidur Ólafsdóttir and Emília Martinsdóttir, employees at Matís, gave a presentation: Healthy foods containing marine-based ingredients.

Growth in Blue Bioeconomy

The Conference was hosted by the Faroese Ministry of Fisheries as a flagship project in the 2015 Nordic Council of Ministers Chairmanship Programme. The objective of the Conference was to provide an overview of the huge growth potential in marine bioeconomy. The target audience was ministers, parliamentarians, industry, investors, decision makers and policy advisers. The focus was on essential policy initiatives to support growth in the marine sector. Sveinn Margeirsson, CEO of Matís, gave a presentation: Can we learn from Icelandic success and failure? It was part of the theme "Potential growth in marine industries".

Distinguished visitors at Matís!

The Rector of United Nations University (UNU), Dr. David M. Malone, along with the UNU's Vice-Rector and Executive Officer Max Bond, visited the Training Programmes of UNU that are being hosted in Iceland. Since 1978, Iceland has hosted various training programmes for the UNU, including Geothermal, Fisheries, Land Restoration and Gender Equality programmes (UNU-GTP, UNU-FTP, UNU-LRT, and UNU-GEST). The operation of these programmes is part of Iceland's international development activities, under the auspices of Iceland's Ministry for Foreign Affairs.

Iceland School of Fisheries - Executive Programme

The Open University at Reykjavik University, in collaboration with Matís and the Federation of Fisheries Iceland, has started an executive programme in advanced learning in modern fisheries management, marketing, innovation and processing. Combining expert instructors, hands-on visits, and best practice case studies, Reykjavik University's Iceland School of Fisheries covers the latest developments in management, operations and sustainability within the fishing industry. The Iceland School of Fisheries welcomes managers and executives from around the world who want to increase their expertise in fisheries, deepen their knowledge of a related topic and gain insight into how Iceland has become a world leader in sustainable fisheries.

NORDIC NEXUS - Nordic Connections and Solutions for a Developing Arctic

Sigrún Elsa Smáradóttir gave a presentation at a breakout session at the Arctic Circle Assembly. Her talk covered the potential of investing in the growth of the bioeconomy in the Arctic. The Arctic has a wealth of resources, not least living marine resources. These resources provide an opportunity to develop new and innovative products, thereby increasing value throughout the value chain, creating local growth potential, as well as ensuring resource efficiency.

