matís

Annual Report 2016

4 FACING THE FUTURE WITH SCIENCE

Sveinn Margeirsson, Ph.D., CEO

Over the next 10 years, food production will be transformed. The world population will face even greater challenges in the field of sustainable value creation, food safety, climate change and nutrition in general. In part, these challenges will be met with revolutions in automation, the sale of food products on the World Wide Web, and information technology and biotechnology.

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Matís and the former Icelandic Fisheries Laboratory that merged with Matís 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).

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International cooperation is a vital part of the day-to-day operation of Matís. This is evident in a number of ways. One way this becomes clear is the company's work with foreign institutions in research and development projects, another is when foreign parties hire Matís for research directly.

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International concern over contamination of the marine environment by microplastic has grown rapidly over the past decade, demonstrated in reports from the UN, EU, USA, and leading academic societies. Micro-scale plastic particles (< 1mm) pose a particular threat as a result of a) their physical and chemical properties, which allows them to concentrate chemical pollutants from the surrounding water, and b) the fact that they are consumed by many marine organisms.

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Sveinn Margeirsson, Ph.D., Chief Executive Officer

FACING THE FUTURE WITH SCIENCE

Over the next 10 years, food production will be transformed. The world population will face even greater challenges in the field of sustainable value creation, food safety, climate change and nutrition in general. In part, these challenges will be met with revolutions in automation, the sale of food products on the World Wide Web, and information technology and biotechnology. The emphasis must switch to public health – nutrition and exercise – to mitigate or even avoid expensive treatments of poor health. Otherwise, there is a risk that changed social structure and fewer taxpayers, will not be able to pay for the healthcare systems in its current form.

Matís began operations on January 1, 2007. Since then, the company has slowly, but surely, built itself up and become a stronger science and know-how community, as a domestic as well as an international research company. Over the last decade, Matís has progressed in a very positive manner, emphasizing that its establishment at the time was the right decision. Matís' employees and board members are prepared to face future challenges and opportunities.

There are significant opportunities for Iceland in maritime resources and other parts of the bioeconomy. Investors, the OECD, the World Bank and other international institutions are increasingly looking to the sustainable utilisation of the oceans' resources to ensure economic growth and welfare for the Earth's 9 billion inhabitants in the future.

For years, Icelanders have emphasised sustainable value creation on the basis of their bioresources, where research and innovation have played key roles. If Icelanders play their cards right, the new bioeconomy policy that has been presented, will become the foundation for further value creation in fisheries, agriculture, forestry, tourism and related industries and create future opportunities for new generations.

International revolutions drive change

Last year, following extensive strategy work, Matís changed its organisation. We who work at Matís are conscious of constant changes in our environment. Change calls for reassessment of procedures and organisation. This way, we can best fulfil our customers' needs. Globalisation is here to stay. It affects investments, research, production, marketing and the value chain of the entire bioeconomy. It has driven technical revolutions the last several years and will continue to do so in coming years. The international research environment has taken this into account, for instance through "Food for Future", an ISK 200 billion research and innovation program that was announced last year. Matís is a key participant in Food for Future, along with 50 of the most powerful food companies, research organizations and universities of Europe.

Integrity as capital

Science strengthens all achievements. It is built on integrity. It demands that we face facts and build our understanding of the world on observations, not opinions. If we are to use opinions for making decisions, we must check whether they have a foundation. These times of rapid change in technology and social structure, truly put this to the test.

Matís' values are integrity, ambition, creativity and initiative. With these values as guidelines, over the last 10 years, Matís' employees have built up ample capital in the form of infrastructure, processes and skills. Today, we are a strong science and knowhow community, possessing research infrastructure that promotes sustainable value creation and improves food safety and public health. In the next 10 years, we want to further influence these areas for the Icelandic State and our other customers, in Iceland and abroad — investors, companies, institutions, associations and individuals.

Anna Kristín Daníelsdóttir, Ph.D., Chief Research Officer

INCREASED NEED FOR A HOLISTIC APPROACH TO RESEARCH ON SUSTAINABLE UTILIZATION

Matís' scientific activity has increased every year since the company's establishment in 2007. Our research and developmental work has increasingly been funded through international cooperation, through institutions, companies and funds in the Nordic countries and in Europe, but also in other locations, both in North America and in Africa.

Within the Research and Innovation division, our work has been focused on research directed at improving food safety and supporting the sustainable management of natural resources. The aim is always to ensure the quality of food products and the environment through the application of advanced chemical, microbial and genetic research. The division also provides monitoring and security services for the government in these disciplines aimed among other things, to assess the risks caused by harmful substances, microorganisms and genetic changes in food and environment. We increased our focus on research and innovation even more, during organizational changes in the middle of last year. As technological disruptions are taking place all around us, increased emphasis on research and innovation is an obvious step for Matís, to continue the company's participation in future scientific work. Already, the division has received funding for important research that can determine future sustainable living not only for Icelanders but others as well.

In line with increased focus on sustainable food manufacturing and food security, the focus on safe food value chain, has strengthened Matís' existence. Innovations driven by creativity and the consumers' requirements for comprehensive research and scientific integrity, have brought innovation towards research and development in the field of ingredients and product development; for consumers, unsupported opinions no longer suffice, consumers want scientific data to support claims made about their food.

Over the last twelve months, the division have worked on large international projects. These include MareFrame, ClimeFish, SAF21, Prime Fish, DiscardLess, EuropPlanet, EuroMix, Virus-X, Macro Fuels, SilhouetteOfSeaweed, Authent-NET and Astro Lakes and other projects are in the pipeline. It is important to look comprehensively to the resources utilized in Iceland and elsewhere. Trusted, unpolluted resources will ensure health and the use of resource must be sustainable. It is believed that the world population will reach 8.5 billion in 2030 and to 9.7 billion in 2050, indicating increased pressure on earth's resources, suggesting that holistic approach to the utilization is the only way forward. The term bioeconomy is used to explain such approach, where all things are considered when evaluating the effects of the resource utilization by humans – this approach includes an economy based on the exploitation of living resources of land and sea that seeks to maximize the benefits without depleting the limited resources.

A number of projects within our division specifically address these aspects of sustainable utilization of resources. New industrial projects that put focus on sustainable use of biological materials (Bio-based Industries) have been part of our focus during the last year. Such project, MacroCascade, are increasing in number as all stakeholders, governments NGOs, companies and other business are considering ways for their competitive edge to remain while using limited resource in a sustainable manner.

It is safe to say that 2016 was an eventful year. We have worked on and completed challenging and ambitious projects, reflecting the great skill and the creativity of Matís' employees.

Pressure to put into use a comprehensive strategy for sustainable use of the bioeconomy has never been greater. Just over a year ago, delegations from over 195 nations reached a historic agreement to reverse climate changes that have and will caused global warming. Governments of all states must also reach an agreement on the sustainable use of bioeconomy as a whole, not just its individual constituent parts.

When that happens, Iceland will be prepared for full participation.

Hrönn Ólína Jörundsdóttir, Ph.D., Chief Infrastrusture Officer

IMPROVED UTILIZATION OF INFRASTRUCTURE AND KNOWLEDGE

The Analysis and Infrastructure Division came out of the Matís organizational changes last year. Multiple goals for strengthening Matís' operations as a whole underlie the changes—increased utilization of the infrastructure for the Research and Innovation Division, cutting across all internal work. At the same time, opportunities open up for more tailored services for customers in the food industry in Iceland, at governmental companies and institutions, amongst researchers, etc.

The basis for work in the Analysis and Infrastructure Division involves Matís' internal work, i.e. services for the company's other divisions, in addition to the research the division itself is doing. In this sense, Matís is one of the division's numerous "customers".

Every day, we are aware of performing, with integrity, the important function we have regarding food safety in Iceland. The operations of the "National Reference Laboratory", to which the division belongs, reflect this. States in Europe are duty-bound to nominate such a laboratory to enforce the provisions of European food legislation. Iceland has adopted this duty through the EEA Agreement. Together, these laboratories form a network throughout the entire continent. The National Reference Laboratories' operations are therefore an important part of facilitating the transport of food products between European countries and opening the European market for Icelandic producers. At the same time, they increase all aspects of such shipments' safety since everyone works in accordance with the same requirements and rules. The Groups of Chemical Analysis and Microbial Analysis comprise 21 fields. At the end of 2016, Matís had been designated as the National Reference Laboratory for 14 of these fields. This is an example of Matís' growing role in food safety in Iceland.

The groups have many customers, and they ask for diverse services. Matís has provided analytical services since the company was founded 10 years ago. It still provides them. This involves services for companies in industry as well as governmental units.

In its research in previous years, Matís has built up knowledge and equipment infrastructure. We deem it important to offer this to other parties engaging in research, for example, parties in the university environment. In this way, the knowledge is better utilized. As researchers' cooperation increases, there is better utilization of equipment and funding. Researchers have certainly cooperated for many years. However, with the changes in our organizational chart and operations, we deem that Matís is contributing to the furthering of increased cooperation in the research community here in Iceland.

In coming years, Matís' research and services will emphasize the bioeconomy and future opportunities in it. Like all things in our world, research changes and evolves over the long run. Today, research projects are more interdisciplinary and more integrated than before and more consideration goes into the overall context of research projects. This precisely entails one of Matís' strengths diversity of knowledge as well as knowledge of very delimited research.

Arnljótur Bjarki Bergsson, Chief Impact Officer

IMPLEMENTING WITH IMPACT FOR INCREASED VALUE CREATION

Matís is a science and knowledge community. The community is built on strong research infrastructure and solid industrial collaboration. The biggest part of Matís' operations is in science especially in research and innovation; diverse projects (big and small), and projects done with domestic companies and international research projects alike. Results are deliverd through research and innovation and it is of great importance to to see to that the results are adapted efficiently for change and evolution. In order for the research efforts to yield the intended outcome, it is important to introduce and apply new knowledge purposively into daily operations.

The creation of the Implementation and Impact Division following the organizational changes in the first half of 2016, further underscored this function. Those of us who are working in the division have a goal to maximise the effect of investments in research and innovation. We do this best by supporting our customers in achieving increased value creation, food safety and public health. This happens through good collaboration with companies and associations and cooperation amongst themselves — all in the spirit that has always shaped Matís' work. By introducing solutions based on knowledge and research into companies' operations, we believe we can positively influence their evolution, growth and value creation.

The collaboration between the division and companies comes in different forms. Consultancy is tightly entwined in our work, and the goal is to increase this facet in coming years. This includes advising our customers on the best ways to introduce change and development projects. For this purpose, there is sometimes a need for more extensive projects. Other cases could involve holding courses or assisting by telephone and Internet communications. The technologies vary, but the goal is the same.

Our hope is that, through new organisation, we have laid the foundation for broader communications with companies in Iceland, based on their wishes and needs. We have extensive knowledge and creativity to offer. Backing us up is Matís' robust research, which is of great value to the business community.

Research effort bring about opportunities. There is no doubt about it. Statistics show that more money is invested in research and innovation than before, in the form of both support from research funds and increased funding that companies contribute to this activity. However, we have quite a way to go to achieve an acceptable ratio between national income and research and innovation effort.

One influential factor is understanding, including understanding of the essence of Matís' efforts. Through sharing, we can open individuals' eyes to the importance of research and development regarding public health, value creation and food safety. As the President of Iceland pointed out when opening Seafood Conference Iceland 2016, the connection between community and fisheries has unravelled as it did for agriculture not so long ago. Opportunities are entailed in shedding light on how things are set up with value creation in the bioeconomy, both for agriculture and fisheries sector. Mutual understanding can facilitate efficient decision-making for evolution.

Long-term commitment is required when doing research and innovation but the results of the hard work are great in most case. Our function is to ensure gain for our customers — results from the hard work, benefitting the whole society.

Hörður G. Kristinsson, Ph.D., Chief Science and Innovation Officer

NEW APPROACHES IN A CHANGING WORLD – TECHNOLOGICAL DISRUPTIONS WILL CHANGE THE FOOD AND BIOTECH INDUSTRY

"The times they are a-changing" wrote the 2016 Nobel Laureate Bob Dylan in 1964. These words have never been truer when it comes to the world we at Matís are working in. We are tackling some major challenges that will grow even larger in the future if we leave them unaddressed. These include, sustainably providing enough nutritious and safe food for our growing population, developing new and more environmentally friendly energy sources, and tackling global warming which can have major disruptive effects on land and the oceans. We are also seeing changes in our demographics, which calls for new solutions. Matís is well prepared to help tackle these challenges to find lasting solutions for society and the environment. With our state-of-the-art facilities, highly qualified experts and our expansive network of global collaborators we are ready and eager to provide solutions.

There are truly exciting times ahead for food and biotech research and development. Significant changes are needed in these industries to meet the needs and demands of our future consumers. The consumers today are very different than yesterday's consumers. The future consumers will be even more different and will put greater demand on the industry for transparency and custom solutions to fit their preferences and needs. The next generation of consumers will be the most diverse, most educated, most self-aware and socially responsible, and socially connected than the generations before them. Current business and innovative practices will not work for this generation. Companies therefore need to better engage consumers in the product development process as well as adapt new and emerging technologies. We also need to create mechanisms which will fuel and foster great innovations and lead to tangible impacts.

The industry is realizing that changes are greatly needed and we that work on R&D need to make sure we are equipped and ready to take on these changes. We have seen Uber disrupt the taxi industry, Airbnb the hospitality industry and iTunes the music industry. The next big wave of technological disruptions will be in the food industry, and it is already happening. We are seeing entrepreneurs developing 3D food printers which will enable consumers to custom make their own foods in their homes with respect to nutrition, taste, texture and appearance. Companies are developing the kitchen of the future, which will be so interconnected to us that it will know our preferences, tell us when and what to buy, know when our food is expiring or becomes unsafe, and even prepare and cook the food on demand and to our liking. Lines are also blurring between biotechnology and food science. For example, advances in stem cell research are now being applied to the food industry where we have succeeded in growing the first lab made meat. Automation and robotics will also greatly change our industry and our lives. We are seeing the birth of precision farming via robots, which is also moving into the marine and aquaculture sector. Companies are also experimenting with innovative ways to deliver food on demand to people via unmanned aerial vehicles (drones). These are indeed truly exciting times.

The business models in the industry are also changing. The larger multinational companies have seen little growth as a result of being conservative and lagging in innovation. To grow, they have been investing heavily in smaller more agile and innovative start-up companies. Some have even set up large venture capital funds, which is something very new for the food industry. Major investments are now flowing into food and biotech from the same investors that were behind the technology revolution in Silicon Valley. They know that the next big wave of disruptions will be in these industries. Companies are also more taking advantage of open innovation by outsourcing their R&D to companies like Matís. The models of funding research and innovation are also changing. A great example of that are the Knowledge Innovation Communities (KICs) funded by the European Institute for Innovation and Technology (EIT). Matís is a proud member of the newly established EIT Food KIC, the only KIC focused on food research and development. The KICs are an independent group of top educational, research and business partners that are funded after successfully winning a proposal bid to establish a KIC. They set the objectives, develop a business model and devise a structure to deliver its results. They get seven years to deliver, with the goal to lead to the most impact possible. This is a great model which will undoubtedly have an effect on how we develop the funding programs of the future.

The times are indeed changing and there is no business as usual anymore. To succeed in this changing environment and tackle all the grand challenges, we need to be fearless and think in very different ways than we have before. We need to understand the market and the consumers and where they are heading, find new solutions and work across sectors with partners we never imagined working with before. To accomplish this, we at Matís have set out a long term vision to invest in strong infrastructures and our people, be part of shaping the business models of the future and not just be part of the technological disruptions, but create them. We need to dare to go where no one has gone before. All of us at Matís look forward to this journey as we move our company into its second decade of operations.

Sjöfn Sigurgísladóttir, Ph.D., Chairman of the Board

MATÍS INFLUENCES PROGRESS AND INCREASED VALUE CREATION AMONG ICELANDIC COMPANIES

In truth, it can be stated that the goal with Matís' establishment in 2007, to be a leading R&D institute, has been achieved. The planning for the establishment of Matís took several years and several organizations and ministries played an important part in this phase. With the merger of several well-established organization in the field of food research, public health, food safety and food innovation, the foundation for a strong unit that participates in and leads with initiative, the partnership between businesses, consumers, authorities and academia was set – the operation of Matís has surpassed our initial hopes and goals.

Matís has been a leading force in the development of food science and played an important part in the development of food-related engineering education and at the same time bridged the gap between the industry and academia. This has resulted in an applied, hands-on education and work experience for our students, which they have taken with them into their own careers. This is just one example of the effects that Matís has on the workforce within partners' companies. Related to this important role of Matís, the Food and Science Department at University of Iceland and Matís were honored at the Annual Meeting of Food Scientists and Nutritionist this fall, for the creation of a strong academic curriculum in food science within the University, where focus has been on establishing a strong link between the academia and the industry.

Valuable knowhow, experience and skills have been developed through Matís and our partners, all of which are key factors in the development, progression and buld-up of the Icelandic economy. The know-how that has been created in research and developmental projects is applied each day within the Icelandic industry.

We are satisfied with the progress of Matís. In fact, the achievement for science and innovation, through the important partnership of the industry and academia, is above and beyond our dreams, not only when looking towards Iceland, but also in other countries – our foreign projects and the number and the names of our partners demonstrate that.

Today Matís is a well-established R&D company, both in Iceland and elsewhere. Matís' employees are well educated, creative and determined individuals, who lead large international projects in cooperation with domestic and foreign companies. This success is our motivation to continue, and to do even better than before, for our partners, for consumers, for our owners and for the Icelandic economy with innovation and value creation as the foundation for all our work.

WHY WE INVEST IN SCIENCE – INDUSTRY IMPACT

"It is so important to have a data bank of information, to further improve the industry through understanding of the background of the raw materials, quality measurements, as well as history of handling and storage. To build up knowledge for retail products, work done on quality measurements in relation to the raw value chain is the base for companies to improve their bottom line and product quality. It is very important to work closely with the views of the consumers and we need to continually go back to the optimization of the raw value chain."

Sigurjón Arason, Matís Chief Engineer
and University of Iceland Professor

Matís on location with the United Nations University – Fisheries Training Programme (UNUFTP

MATÍS – OUR SUCCESS STORY

Matís is an independent, governmentally owned, non-profit, R&D company headquartered in Iceland, founded in 2007 following the merger of three former public research institutes. The company has a leading role in food and biotechnology research and innovation in Iceland and has years of experience in increasing value creation in a small economy based on marine resources, through bridge building between funding agencies, investors, academia, research and industry.

The industry cooperation focuses on optimization of processes and creating new products from marine biomass for commercial markets and industrial use, including food and feed products, medical products, enzymes and specialty compounds. Our clients include many leading international food processing companies, as well as smaller companies and institutions.

Matís is a founding partner of the United Nations University – Fisheries Training Programme (UNUFTP) and leads the quality management curriculum of the program. The company's experience includes capacity building around the world, in collaboration with funding agencies and local stakeholders, especially focusing on fish processing and value chain management.

Additionally, Matís is a well-known partner within global food and biotech research and has played a leading role in large projects such as PrimeFish (H2020), EcoFishMan (FP7), Whitefishmall (Nordic Innovation), SAF21 (H2020), Amylomics (FP7), DiscardLess (H2020), Virus-X (H2020) and MareFrame (FP7), just to name a few, and has an ongoing fruitful cooperation with many of the largest food companies in the world such as Nestlé and PepsiCo.

The total turnover in 2016 was estimated at about $USD 15.5 million, 25% coming from the Icelandic government and 37% from international research and consultancy projects. Approximately 110 people work at Matís and roughly 30% have a Ph.D degree. Matís employees are many of Iceland's most competent scientists in the fields of food technology, food research and biotechnology, vs; chemistry, biology, engineering and fisheries.

Matís has been and continues to help companies, agencies, institutions and governments all over the world improve their competitive edge by providing practical and scientific knowledge and assistance, resulting in maximum impact of the investment they have made in research and innovation.

MATÍS – OUR NUMBERS

Division	Employees	Full time positions
Operations	11	10,3
Analysis & Infrastructure	34	31,75
Research & Innovation	45	43,6
Implementation & Impact	19	18,45
CEO Office	5	5
Total	114	109,1

General infomation	
Average age of employees	44
Average number of years at Matís	9,1

THE LAST DECADE

A FEW SUCCESS STORIES FROM THE LAST TEN YEARS

MATÍS' WORK IN DEVELOPING COUNTRIES

Matís and the former Icelandic Fisheries Laboratory that merged with Matís 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. Matís 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 Matís, with the growing number of projects in developing countries in 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. Matís won the tender, in cooperation with the engineering firm VJI, the ship design company Rádgardur skiparádgjöf, and the engineering firm GOCH in Tanzania. Matís led the project. It also handled the consultancy on fish handling and processing. The project management on behalf of Matís was in the hands of Margeir Gissurarson. He has extensive experience in developmental projects and lived in Mozambique for over six 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 accustomed to. This area is among the poorest in Tanzania. It was therefore good that Matís could offer the expertise of an employee who had lived and worked in a developing country for many years, working in an environment that is similar to the project area in Tanzania.

Smoking and drying

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. Matís' 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 Matís 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. Matís 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. Matís' 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 Matís 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.

Matís has implemented a geothermal project in developing countries. In 2014, Matís conducted a prefeasibility study in Kenya and Rwanda on the use of low enthalpy geothermal energy for food production. Two Matís 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. However, there are hot springs in serveral places that can be used for food production.

Food Safety and global environmental monitoring

In 2015, Matís 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, Matís 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.

UN Video Channel

FISHERIES QUALITY CONTROL EDUCATION – ADVANCING WORLD KNOWLEDGE

The UNU Fisheries Training Programme (UNU-FTP) is a postgraduate training program that offers applied training in various areas of the fisheries sector for practicing professionals in less developed countries. Matís plays an important role in the program.

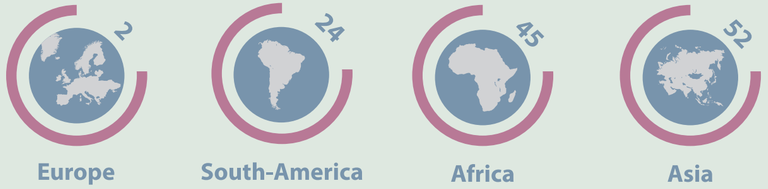
The programme was established in 1998 after a feasibility study conducted by the UNU and has since then offered over 220 fellowships to qualified fisheries experts from over 40 countries and has developed short courses on important topics in fisheries in partner countries. The programme is led by the Marine Research Institute in formal cooperation with the Matís - Food and Biotech R&D, University of Iceland and the University of Akureyri. UNU-FTP draws expertise from academia and the fishing industry to assist fellows in studies of great importance to their home countries.

From the day the United Nations University Fisheries Training Programme (UNU-FTP) was established here in Iceland, Matís has handled the specialist training in Quality Management of Fish Handling and Processing. During their training in Quality Management and Fish Processing, students receive daily lectures from specialists at Matís and are given assignments under their supervision. Students that stand out may be offered to enter the Master or Ph.D. programmes at the University of Iceland or universities in other countries. The connections that have been established between Matís and the United Nations University Fisheries Training Programme mean a great deal both to Iceland and to our company. Through this cooperation, Matís has received projects in many developing countries directly through partnership with the United Nations University Fisheries Training Programme and former students. For example, our courses have been held in Uganda, Tanzania, Kenya and other developing countries.

UNU-FTP Homepage

UNU-FTP:
QUALITY MANAGEMENT TRAINING GLOBALLY

WHO HAVE COMPLETED THE QUALITY
MANAGEMENT LINE AT MATÍS



CONSULTING TANZANIA IN FISHING AND PROCESSING

In autumn 2011, Matís signed a contract with the Tanzanian government regarding a project at Lake Tanganyika in Tanzania. The project is funded by a loan from the Nordic Development Fund (NDF) located in Helsinki. It was offered to Nordic research groups of which Matís proved most capable.

Lake Tanganyika is among the largest freshwater lakes in the world, approximately nineteen thousand square kilometres in size. It is also the second deepest freshwater lake in the world, with fifteen hundred metres at its deepest. Four countries border the lake: Tanzania, Congo, Burundi and Zambia. Tanzanians fish in Lake Tanganyika, but both fishing and processing are done with primitive methods. Matís' task was, among other things, to assist with the development of methods that would better use the qualities of the fish and make it more valuable. Matís has made a deal with the Icelandic companies Radgard Skiparadgjof ehf. and Verkfraedistofa Johanns Indridasonar ehf. (VJI) for a portion of the project. Radgard will provide advice and oversee the construction of a special ship to be used to research Lake Tanganyika and the fish stock in the waters while the VJI offices will direct the project's purchases. In addition, Matís has come to an agreement with the Gosh Company in Tanzania which will oversee the socioeconomic area of the project and interaction with fishing communities by Lake Tanganyika.

"This project is a great challenge for us as conditions there are very primitive and unlike what we're used to dealing with. Thus we will need to find ways to develop their fish processing using what is available and cannot assume the presence of electricity, oil or other sources of power like we can elsewhere."

A large part of this project also revolves around training and teaching locals to handle the fish and we have taken to sending out people who pick a few villages by the water and travel there to instruct the locals. It could be said that part of the project will be done here at home and in the later stages we will be working on site, according to our plans. This will be a very exciting project and we hope for it to be among the high points of 2012," says Oddur Már Gunnarsson, director of Business Development at Matís, who is also in charge of the Tanzania project. Margeir Gissurarson, project manager at Matís, leads it alongside Oddur.

EXPORTING DRIED SEAWEED

Among the food companies utilising Matís' specialised knowledge is Icelandic Blue Mussel & Seaweed in Stykkishólmur. The company was founded in 2007. It collects and cultivates mussels and harvests seaweed in an environmental and sustainable manner from several places in Breidafjördur. "Our several years of collaboration with Matís has been enjoyable. They have many very capable scientists with extensive experience that it is good to turn to," said Símon Sturluson, one of the owners. He said it was very important that Matís' knowledge network stretched far beyond Iceland. Thus, if they do not have the knowledge required, they know where to look and can get it. Following the cultivation of mussels, the company has now started experimental exports of dried seaweed to Denmark, Norway and Spain. Símon said that the seaweed sold was generally dried, in fact, that is by far the best method of storage. "The market for seaweed products is very big. We believe we have high quality, and we therefore want to get a good price for our products. For this reason, we avoid all unnecessary middlemen. For example, we try to sell directly to restaurants. This is all moving along – calmly," said Símon.

THE GREAT VALUE OF A FISH PROCESSING COURSE

"We commissioned Matís to develop a course for the employees of Íslandssaga and Klofningur. About 110 people attended and the course covered matters related to production, hygiene, marketing and more. It is very valuable for us to have access to courses like the ones supplied by Matís and I am in no doubt that they will have significant effects," says Óðinn Gestsson, managing director of Íslandssaga in Suðureyri, about a course Matís held in the beginning of December 2009.

Íslandssaga is a fishing company specializing in catching and processing fish products for export and Klofningur handles fish drying. Matís handled the topics related to production, processing procedures and hygiene whereas the companies' management handled the discussion on marketing. Almost half of the town attended the course, which is not a daily occurrence! "The course was a gift from Íslandssaga to its employees to mark the company's 10-year anniversary. There is no doubt in my mind that our employees gained significant benefits from attending the course and listening to the informative lectures given by Matís' specialists as well as the discussion that followed, concerning matters relating to production and cleanliness.

ONE OF THE LARGEST GENERIC DRUG MANUFACTURURES IN THE WORLD IS UTILIZING MATÍS' SPECIALIZED RESEARCH SERVICES

"Ever since its formation, Matís has handled the microbial research of our materials and finalized products, as well as environmental samples. The cooperation is a regular part of Actavis' production and has been highly successful since the beginning," says Herborg Hauksdóttir, responsible for quality assurance at Actavis pharmaceuticals (now TEVA Pharmaceutical Industries Ltd.). She also says that Matís saves the company the cost of building a specialized research facility. Herborg says that updated methods in microbial analysis have always run smoothly with Matís' specialized staff. "Our work is conducted under certain requirements from the drug administration, both in Iceland and in other markets, and we chose to utilize Matís specialized staff and facilities for this purpose," says Herborg. As well as handling microbial analysis on materials and finalized products for Actavis, Matís handles the processing of environmental samples where, for example, water is monitored as well as other environmental factors within the company. "We must hold out strict requirements and that is why we choose the best research service available to us," says Herborg Hauksdóttir.

TRACKWELL PARTNERS WITH MATÍS – SEADATA ELOGBOOK IN ACTION

"In recent years, TrackWell has developed an electronic fishing logbook. We are, in cooperation with Matís, carrying out various projects that utilize the data from the logbooks and integrate them with data related to production, environmental issues and more. Matís has contributed their specialized knowledge to the projects, which has helped us to build on our knowledge of fishing procedures," says Kolbeinn Gunnarsson, manager of sales and services at TrackWell, the company that produces the SeaData e-logbook software. The logbook is well known to the Icelandic fishing fleet, and will be compulsory from mid 2010. The system has become increasingly popular internationally as well. The SeaData e-logbook contains in-depth information on the volume of the catch, fishing locations, sea temperature, information on gear type quality assurance and more. Part of this information goes directly to the Directorate of fisheries, but seafood production companies can use the system for their internal management. SeaData provides its customers with an overview on a range of factors and enables them to share and compare data. "The progress from our cooperation with Matís in developing the system has been highly successful and has resulted in software that gives our customers many functions and a good overview of their work. The primary aim of fisheries is to add value to their production and SeaData is intended to further improve this," says Kolbeinn Gunnarsson of TrackWell.

Helga Gunnarsdóttir, Ph.D. Research Group Leader

FOOD SHOULD NOT THREATEN OUR HEALTH

"It is a fundamental point that we as consumers be able to trust that the food we eat will not harm us or threaten our health. In order to ensure the safety of food products, it is therefore necessary that our monitoring and testing of food raw materials and production to be active and abreast of the rapid development and innovation going on in the food industry," said Helga Gunnlaugsdóttir, Research Group Leader of Microbial and Chemical Analysis and Risk Assessment at Matís.

"Various things can affect the wholesomeness of food products. In addition to disease-causing microbes that people can ingest with food, food products can also contain substances that can affect our health over the long run. For example, these include persistent organic pollutants like dioxin and PCB. These substances are fat-soluble. People can ingest them in their food, and they can slowly but surely threaten our health. "Long-term research into the effect of harmful and polluting substances in food is of enormous importance to our public health and well-being. We need sufficient equipment and specialised knowledge to enable us to meet consumers' and government units' increased demands for food safety. Food legislation in Iceland is mostly the same as elsewhere in Europe. Proving that food product and environmental testing are competitive and comparable requires dynamic collaboration of the agencies and units involved in this issue category. Examples of this include laboratories, food producers, universities and governments," said Helga.

People at Matís work energetically to promote improved food safety in Iceland. The company's diverse operations involve food safety and the wholesomeness of products. A big part of operations is microbial and chemical measurements. Matís annually performs these measurements on thousands of samples from various parties in the food industry and governmental monitors. This involves microbial and chemical analysis of samples of food products, drinking water and seawater. In addition to processing samples from food producers, Matís also sees to monitoring and safety services for the government. The part of the operations involving safety and monitoring for undesirable substances in food products consists, for example, of measuring traces of herbicides and pesticides in food products and persistent organic substances like PCB. Measurements of herbicides and pesticides are based on scans for various aids used in the cultivation of fruits and vegetables, like insecticides, herbicides and traces of pharmaceuticals.

"We have certified measurements for governmental monitoring agencies in Iceland. This means that our measurements have attained a certain quality assurance status. The government and other monitoring agencies can turn to us for measurements since we must follow certain quality standards. In addition, Matís has been designated as Iceland's reference laboratory for microbial testing of shellfish and for measurements of salmonella in food products. We have proven that our measurements in this research area accord with European standards. We are responsible for having recognised procedures at hand, and we can instruct other laboratories on such measurements," said Helga.

"Our goal is to be a leader in food product and environmental research. The results of our research have yielded important information on consumer products and the environment here in Iceland. Not only Icelanders but also people in other countries will utilise it," said Helga. She added that an important project has now begun on building up food safety. It was scheduled to conclude at year-end 2014.

This project involves enabling competent Icelandic governmental units, the Icelandic Food and Veterinary Authority and municipal health authorities to enforce regulations on food safety and consumer protection that Icelanders have already legalised through the EEA Agreement.

"The key goal of this project is to increase food safety in Iceland. Examples include creating better research facilities and improving the capability to perform chemical tests for the most common risks in food products and developing new measurement procedures and processes for competent food monitoring. The project is therefore necessary so that Iceland can abide by the increased obligations we have undertaken by enacting the food legislation," said Helga.

A WORLD HOTSPOT FOR GEOTHERMAL MICROBE RESEARCH

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 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 efforts 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 and 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 thermophiles 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.

VALUABLE ENZYMES IN ICELANDIC HOT SPRINGS

"Exogenome" is the name of a biotechnological project and the beneficiary of an SME grant from the European Union, a grant given to laboratories, growth companies, and small or medium- sized enterprises (SMEs). The project originated with Matís' and Prokazyme's experts, and built upon the pioneering work of the growth company Prokaria, now a part of Matís. The name Prokaria is still used by Matís as a label for its project on the development of industrial enzymes. Matís collaborates with Prokazyme when it comes to the production and selling of these enzymes. It is the study of enzymes from thermophilic viruses found in Icelandic hot springs which constitutes the subject of research in the Exogenome projects.

Prokaria was a former company that concentrated, amongst others things, on seeking out and then defining viruses that infect micro-organisms in hot springs. One of their findings was the discovery of a unique enzyme which can connect single-stranded DNA molecules. This enzyme is now marketed by the US company Epicenter, where it is the basis for a variety of new methods in genetic engineering. The continued research of thermophilic viruses can therefore be highly profitable. Participants in Exogenome are research labs and companies in Iceland, Denmark, Poland, and the UK, although Matís from Iceland plays the largest part. The other participants are focusing their efforts on how to find applications for these enzymes. Exogenome is directed by Dr. Jakob V. Kristjánsson, CEO of Prokazyme.

COMPUTATIONAL MODELS FOR FISHERIES

"At Vísir, we have had effective and diverse cooperation with Matís. The collaboration enables us to study and develop new methods and technologies - which has brought about significant improvements to the company," says Erla Pétursdóttir at the fishing and fish production company Vísir, in Grindavík. Erla, on behalf of Vísir, took part in a project with Matís in the beginning of the year 2009 called FisHmark, a project designing margin computational models for fisheries. "The model is based on large amounts of information on fishing trails, catch, ships, production, goods, etc. The software takes data from electronic logbooks into account, as well as data from information systems from production and is supposed to help managers get overview of their operations. This is a very interesting tool for a company such as ours," says Erla. TrackWell and Maritech as well as other Icelandic fish production companies are also involved with the project. "Our role in the project is to assess the equipment's user value" Amongst various production related projects in the last couple of years, Matís has collaborated with Vísir and TrackWell on a project relating to the traceability of products. This was also carried out in the year 2009. "Traceability is becoming an important factor in food production and I think there is a lot to gain from developing it further," says Erla Pétursdóttir at Vísir.

MAKING RAW ANIMAL COMPANION FOOD A REALITY

"The facilities and consultations we received in Matís' food centre in Höfn in Hornafjörður was the key to making the company a reality," says Kristín Þorvaldsdóttir, who is a trade expert for the company Hundahreysti (DogHealth) which released a new kind of feed for dogs in the beginning of April last year. The feed is based on a Swedish recipe but it contains Icelandic produce. Krístín and her husband Daníel V. Elíasson, who is a food specialist, own the company. They were first introduced to fresh feed for dogs in Sweden, and after moving back to Iceland they planned on importing the feed but it was impossible due to import restrictions on fresh food. Kristín works within the Icelandic Kennel Club and so she decided to combine her education and her interest and start a company around the production of the feed. This decision was made in fall of 2008, just as the country fell into an economic recession, which suddenly halted all funding opportunities.

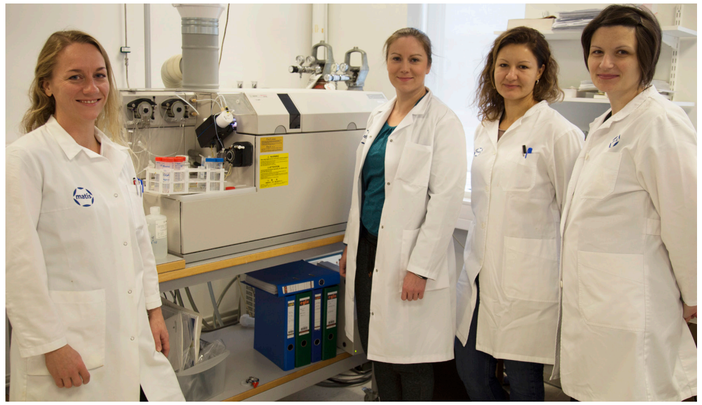
"The cost of setting up the production was very difficult for a small-scale producer, but in the beginning of the year 2009 we were informed of the possibility to start our production in Matís' food centre in Höfn. So, we went and started experimenting with adapting the Nordic feed to Icelandic conditions, after which the production process started. In Höfn, we were able to work in the surroundings needed for the production and access to Matís' specialists who assisted us throughout the process. We then moved to a 270 square meter production facility in Kópavogur 10 months after the product was launched," says Kristín. A group of dog owners were brought in for preliminary testing of the product most of which are devoted customers of Hundahreysti today. About four tons of feed is produced monthly. The feed contains raw Icelandic lamb meat, beef belly and beef blood. Other ingredients include: potato fibres, wheat bran, calcium, minerals and vitamins. The feed contains raw meat – which explains why it is fresh feed. The feed is sold frozen and it can be stored for about a year in a freezer. Nordic fresh feed is an all-round feed for dogs that requires no supplementary feed or added ingredients. Fortunately, we did not allow the economic collapse stop us from carrying out our dream and this is thanks to Matís' specialized assistance," says Kristín at Hundahreysti.

VALUE CREATED FROM NOTHING!

The year 2009 saw the end of an interesting project in decreasing deterioration in the value-chain of meat, a project in which Matís employees from the 'Value Chain and Processing' division took part. The project was based on a very simple principle but nonetheless an important one – to create value out of nothing.
The project's primary aim was to decrease post-harvest losses from the value chain of meat products, for instance because they pass their sell-by date. The project was conducted by a wide group of specialists. Matís conducted mapping of the whole value chain with partners included Sláturfélag Suðurlands (SS), Norðlenska meat productions, Nóatún and Krónan (retailers), AGR software company and the Commercial Research Center (Rannsóknarsetur Verslunarinnar). The results from the projects were quite satisfying. AGR implemented software solutions for improved management based on the mapping of the value chains and improved utilization.

MATÍS ADVANCING THE DAIRY INDUSTRY

"It is important for production companies, such as us, to have access to a research company with the caliber of Matís. The milk production industry in Iceland is small, which does not enable us to focus on performing basic research or develop new methods and technologies – that knowledge is mostly acquired from overseas. However, this does not stop us from using Matís' specialized knowledge and resources in various beneficial ways," says Jón Thór Jósepsson, quality manager for Mjólkursamlag KS in Sauðárkrókur. Matís and Mólkursamlag KS have recently collaborated in two projects. One of the projects focused on the utilization of the vast amounts of cheese whey produced at Mjólkursamlag KS. The company Iceprotein in Sauðárkrókur has also been involved with the project; one third of the company is owned by Matís. Such projects include product development, production planning, as well as budget planning and ROI calculations for the production. "The other project involved getting students in industrial engineering at the University of Iceland, under the guidance of Sveinn Margeirsson, director of Value Chain and Processing at Matís, to go over all of our operations, production- and work processes. This was done as a masters' project. The research has been carried out at our facilities and we have been working on ideas on how we can improve the efficiency of our entire operations – such as amounts of hours worked to specific factors in our production process," says Jón Thór.



THERE IS NO FOOD TRADE WITHOUT SAFE FOOD – A BILATERAL PROJECT BETWEEN GERMANY AND ICELAND

Food businesses that participate in the global food trade must ensure that their food products are safe and competent authorities must implement food safety measures according to international standards in order to ensure consumer protection.

A bilateral project between Germany and Iceland that came to an end in 2014 has contributed to the strengthening of food safety in Iceland. This bilateral project has been carried out in collaboration with the Federal Ministry of Food and Agriculture, Federal Institute for Risk Assessment (BfR) and Lower Saxony State Office for Consumer Protection & Food Safety (LAVES) from the German side and the Icelandic Food and Veterinary Authority (MAST), Matís and the Ministry of Industries and Innovations from the Icelandic side.

The main priorities of the bilateral project were to improve and implement the analysis of pesticide residues, food contaminants such as PCBs as well as the detection of genetically modified food and feed. Another important aspect was the establishment of modern analytical methods for detecting marine biotoxins in shellfish. To achieve this goal, new state of the art laboratory equipment for chemical analysis was set up at Matís and the relevant staff has been trained on site to carry out official analytical methods according to EU standards. A number of experts from the German partner institutions supported this comprehensive training.

Another focus was to develop methods of food monitoring in collaboration with the Icelandic Food and Veterinary Authority. These included support from German experts regarding risk assessment and risk management in official controls, for both the central monitoring authorities (MAST) and the ten independent local authorities, responsible for controls at the retail level. The program also included internships and training professionals from the Icelandic surveillance authorities in Germany. This part of the project was under the responsibility of the Lower Saxony State Office for Consumer Protection and Food Safety and was carried out by pursuing a practical approach, in which the Icelandic visiting scientist were working on location in the field in Germany.

"The Safe Food project paved the way that Matís was appointed National Reference Laboratory for Iceland in 14 different measurement areas, which also enables Matís to participate in the European network of national laboratories. Furthermore, it has built the base for a long standing collaboration and understanding between the German and Icelandic participants." says Helga Gunnlaugsdóttir, Research Group Leader.

Safe Food

MATÍS FACILITATES ENVIRONMENTAL MONITORING

"We have collaborated with Matís on a few projects and two of them started in the year 2009. These projects deal with automatic cleaning methods and rapid measuring methods" says Kristinn Andersen research director at Marel - an internationally established company in the field of food processing technology. Automatic cleaning refers to the development of equipment, which is attached to Marel's food product lines and the cleaning process is somewhat automatic. Matís' employees collaborate with Marel's development department and the meat production company Norðlenska. "The technology has been used in meat production but we hope to be able to transfer the development into fisheries and chicken production. The benefits of this would be a more efficient utilization of cleaning chemicals and water, which is scarce in many parts of the world. The cleaning process would be more efficient and the quality of the product would increase, as well as consumer safety. Matís contributes as well their expert knowledge in microorganisms that might affect the production process and safety." Microorganisms found in the processing area come mainly from three different sources; from the raw materials such as meat that is handled in the processing line, from the working environment and from people working on the production site. "Matís will also perform bacterial measurements and analysis of the various techniques and technologies that are being developed," says Kristinn.

SERVICING ANALYTICAL NEEDS "GLOCALLY"

Síldarvinnsla, one of the largest seafood companies in Iceland and the largest in pelagic species

"We at Síldarvinnsla utilise Matís' services here in Neskaupstadur in considerable measure. [The services] are very important to our operations," said Thórhallur Jón Jónasson. Thórhallur manages quality control of Síldarvinnsla's Fishmeal and Fish Oil Production in Neskaupstadur. Síldarvinnsla orders a broad range of analytical services from Matís. These services include both chemical and microbial testing. Matís customarily renders services for Síldarvinnsla at the branch in Neskaupstadur. However, it does more specialised measurements in Reykjavík. The company regularly sends samples from its production regarding both its internal monitoring and processing of export samples. In addition, there is considerable cooperation between the company and Matís regarding research projects and monitoring of, for example, contaminant substances and certain kinds of microbes in both raw material and processing water.

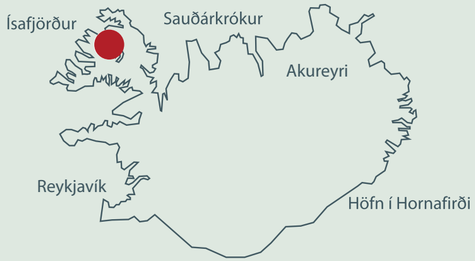
"We utilise this for our factories in Nordurfjördur and Seydisfjördur, as well as the factory in Helguvík. We just have very good experience with Matís' analytical services in Neskaupstadur, and we really want to see that service centre add more tests. This could expedite findings. That is simply our dream situation, to have this testing almost next door to the company and thus get testing services fast, as we have. Right now, nearly all of the company's operations go on in Neskaupstadur," concluded Thórhallur.

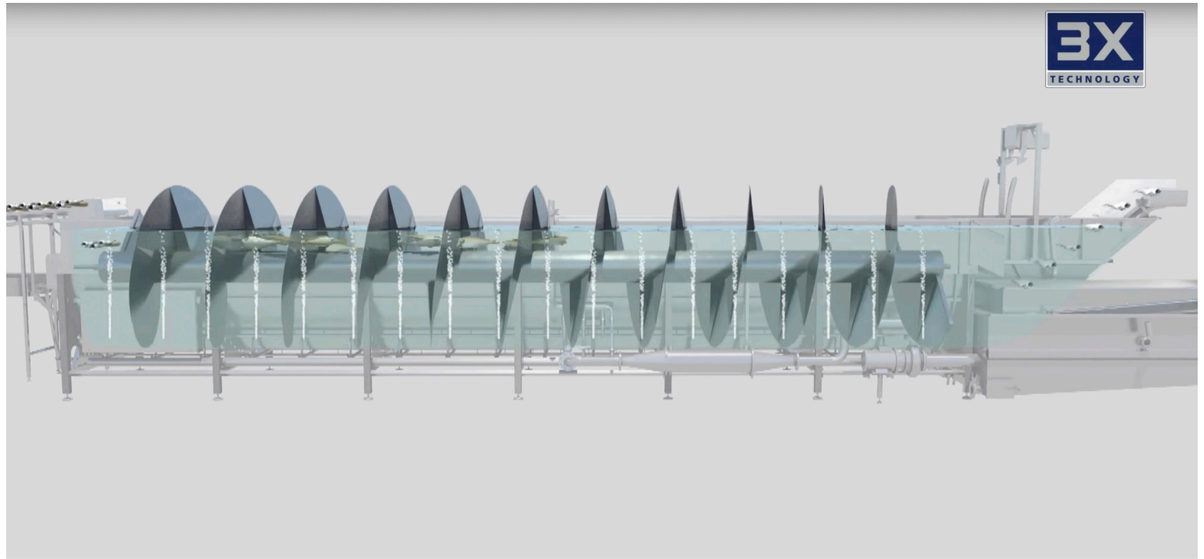
WATER MONITORING

"We are very pleased with Matís' services in Neskaupstadur. We send them as many samples as we can because we want to save on transport costs and utilise operations in our home area," said Helga Hreinsdóttir, public health representative and managing director of the Public Health Board of East Iceland. Helga said that samples of drinking water and samples from swimming pools and ice cream machines are amongst those the Public Health Board sends to Matís in Neskaupstadur. On the other hand, not all of the facilities they require for testing samples are available there. That is why they send some of the samples south to Reykjavík. Samples from the Hornafjördur area go south because shipping from there to Reykjavík is quicker than shipping to Neskaupstadur. "The services that Matís' employees in Neskaupstadur provide are both flexible and professional. I will mention an emergency that urgent required testing of samples. They opened up for us in the evening. In other words, they have really flexible and good service," said Helga Hreinsdóttir.

CONTINUOUS INNOVATIONS IN FISHERIES EQUIPMENT

"Matís operations in Ísafjördur are useful to us in various ways. One example is as a collaborator in trilateral projects where we are jointly working with fishing companies here in the area. Having Matís here in the area as a collaborator strengthens us when it comes to procuring grants to launch new development projects. We can therefore say that the gain from its operations here in the area has many facets," said Albert Högnason, development manager for 3X Technology in Ísafjördur. "The projects we do with Matís' service centre involve the development of fisheries equipment. This can involve further development of processing procedures and our older equipment or complete innovations, where we design and develop new equipment from the ground up. A good example of the former is a project where we have been considering how we can use line ships' bigger processing systems in smaller boats. An example of innovations is a project where we are developing new equipment for thawing headed and gutted roundfish for processing. All this revolves around the goals of improving processing procedures in fisheries, ensuring and preferably increasing product quality and increasing profitability. Matís and we share these emphases. Adding other interested companies in the fisheries industry to this will create an environment and collaboration producing solutions and innovations. For both our companies and the fishing industry as a whole, access to the human resources and specialist knowledge at Matís is very important. In addition, it is important for everyone that this access continues to be as open as it has been up to now," said Albert.





BIOACTIVE COMPOUNDS INCREASE THE HEALTHY GROWTH OF COD FINGERLING

Marine Research Institute's Experimental Aquaculture Station in Grindavík

"Matís in Akureyri has been our collaborator on research projects, primarily in the field of cod farming, or, more specifically, research related to the production of cod fry. You can say that we see to the aquaculture research per se, but Matís does the measurements and processing of samples up north," said Agnar Steinarsson, biologist at the Marine Research Institute's Mariculture Laboratory in Grindavík. Agnar said that ideas for research projects usually come from Matís' employees. The experiments are then carried out at the Mariculture Laboratory in Grindavík. Samples are regularly sent north for analysis. All of this aims at improving the results of fry production, and Agnar said that these projects generally last about one year.

"Examples of good results from this collaboration are recent tests on bioactive substances in the rotifers we feed the cod larvae during the first stages of rearing. In this research, we utilise the knowledge and experience of Matís employees with bioactive substances, gained through their biotechnology research. We saw in feeding our fry that the larvae matured better. There were also fewer deformities when mixing in bioactive substances. Such deformities have been a production problem. The findings from this project indicate that the quality of fry can increase with bioactive substances in the cultivation of rotifers at the initial stage of rearing."

"Such research information is important for us to achieve our goal to increase the efficiency of this production. Better fry later lead to better results in rearing edible fish," said Agnar.

CONTRIBUTING TO DEVELOPMENTS IN CHILEAN FISH FEED

Jón Árnason, feed expert and Senior Researcher at Matís, has been part of the development committee of one of the largest producers of fish feed in Chile, Salmofood S.A., for several years. The company is owned primarily by Chilean fish farming groups and produces approximately 60 thousand tons of feed per year. The development committee includes representatives of the company who direct its efforts, two representatives of Nofima in Norway and Jón, as a representative of Matís. Nofima is one of the world's largest companies where the research and development of fish feed is involved. Jón says that his position there is without a doubt a recognition of the knowledge and experience that Iceland has accumulated in the matter of fish feed over the past few years.

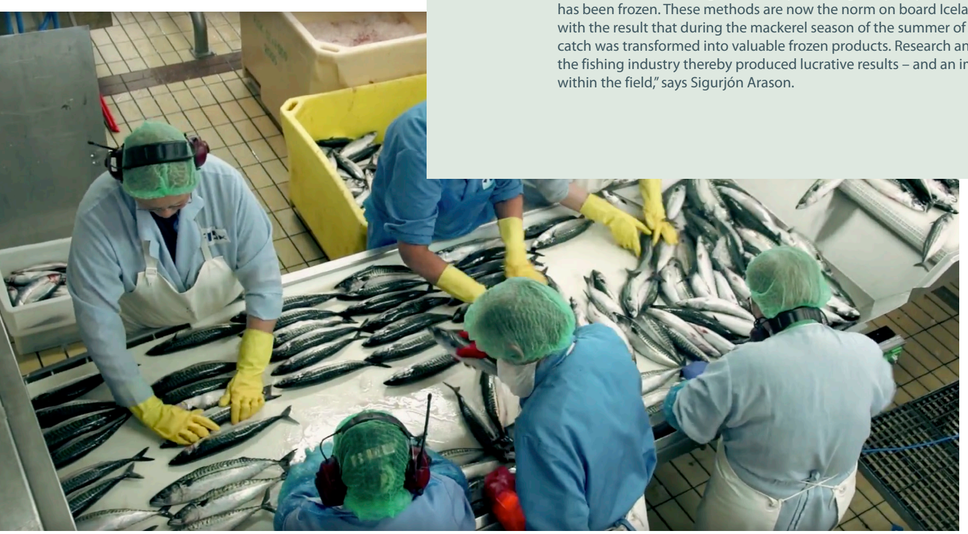
"It began ten years ago, when I was singled out for participation in this project, though at the time I worked with the feed producer Laxá hf. Since then we have spoken regularly at work meetings in Chile, and the time I've been with the group shows that they feel they gain valuable knowledge for the development of their feed production by my experience from Iceland," says Jón. The committee has worked with information regarding the nutritional requirements of the fish, the composition of the feed and elements that directly affect efficiency in the production process. "Our work has brought changes that have strengthened this company and thereby strengthened the standing of the owners, primarily fish producers in Chile. Most of the produce is Atlantic salmon, Pacific salmon and rainbow trout, and thus the development of feed has to be aimed at those types," says Jón. The committee meets on average twice a year in Chile and works consecutively for a week afterwards.

"We observe all the latest advances in the study of feed, discuss specific issues that have come up in farming or production, go over quality issues and at the same time often visit customers of the company in Chile and talk to them directly. Being a part of this is to me a very valuable asset for us at Matís and for Icelandic fish farming, both to keep up with the latest developments in the field and to form connections with groups on the level of Nofima in Norway. Within that company are leading individuals in the study of fish farming and feed production and forming ties with them is of vital importance," says Jón.

SUCCESSFUL MARINE RESEARCH FOR FISHING AND PROCESSING OF MACKEREL

"Over the last few years, mackerel has been seen – and caught – around Iceland in ever increasing amounts, resulting in the speedy development of processing techniques of the product," says Sigurjón Arason, Matís' Chief Engineer. Matís was the lead partner in research on the fishing and processing of mackerel in close collaboration with fishing and service companies, with the goal of making as much of the catch as possible suitable for freezing and human consumption. The project utilized information from others with experience in the fishing and processing of mackerel. Although fishing of mackerel is increasing, little is known about its habit or nature. It is caught during the summer months around Iceland, when the sea is warmest. Mackerel enter Icelandic waters rather slim but fatten up in a short period of time. As it is a fish with high fat, it grows quite fast and is therefore delicate to handle and can spoil quickly when it is caught fresh around the island.

"Through collaboration with the Icelandic fishing companies, it has been revealed that by using the ships' powerful cooling systems and by taking in only a small catch with a short haul each time, you can cool down the mackerel quite quickly, or to -1.7°C. By doing so, the effects of digestive enzymes on the fish are decelerated. By then keeping the mackerel cool through on-shore processing, its quality is maintained until the catch has been frozen. These methods are now the norm on board Icelandic mackerel ships, with the result that during the mackerel season of the summer of 2011, nearly all of the catch was transformed into valuable frozen products. Research and collaboration with the fishing industry thereby produced lucrative results – and an improved performance within the field," says Sigurjón Arason.



ADVANCING THE SALTED FISH INDUSTRY

For years and decades, the fish processing companies Thorbjörn and Vísir in Grindavík have engaged in extensive research collaboration with Matís and before that with the Icelandic Fisheries Laboratories. This research was of various types. However, it ought not to come as a surprise that, more often than not, it was related to salt fish processing. After all, many people regard Grindavík as the salt fish capital of Iceland. "The collaboration with the scientists has gone on a very long time. I remember the first research was in 1972, and it has gone on nearly without pause ever since," said Gunnar Tómasson, chairman of Thorbjörn's Board of Directors. In part, the research in Grindavík has focused on the handling of fresh raw material and the effect of different salting methods.

Fish-salting processes have developed. The aims are to optimise utilisation and increase the value of products. People have also experimented with drying both stockfish and salt fish. Today, Thorbjörn and Vísir jointly operate a drying plant, bearing the venerable name "Haustak". They use geothermal heat for the drying. The Icelandic Fisheries Laboratories originally developed this method. Gunnar said that the people of Grindavík saw great benefit in the research collaboration with Matís. It has given their community important and valuable knowledge through the years. "Both parties benefit from this collaboration, and we have done our utmost to pave the way for the scientists. It is pleasing to note that the projects in Grindavík have produced two doctorates in salt fish, Kristín Anna Thórarinsdóttir and Minh Van Nguyen (Vietnamese). Both of their doctoral dissertations dealt with different methods of processing salt fish."

Gunnar could not assess the financial gain from the research collaboration with Matís. However, he said that the annual amount was clearly tens of millions of kronur. "The research has led to better handling and utilisation of raw materials that yield increased value. This has also produced a better position for us in markets since we are very much in the forefront. We have been able to incorporate various innovations in the processing. This says a lot," said Gunnar Tómasson.

IMPROVEMENTS IN THE RAW VALUE CHAIN - ACCOUNTS FROM MATÍS CHIEF ENGINEER AND UNIVERSITY OF ICELAND PROFESSOR

Increased Value in the Icelandic Seafood Industry

The value of exported fresh fish from Iceland has increased significantly with improved methods of handling and cooling of the catch. The annual export of fresh fish amounts to about ISK 40-45 billion. If the same volume was to be exported frozen, the value would be only half this amount.

The great success achieved in handling and cooling sea products can largely be attributed to research carried out by experts from Matís and universities, in close co-operation with fishing companies, and to endless urge to improve the handling, cooling and utilization of the catch. The shelf-life of cod filets has almost doubled with proper handling and cooling, which results in higher value of fresh fish. Sigurjón Arason, professor and chief-engineer at Matís, says that much has been achieved during recent years, but the tasks ahead are also numerous.

Close co-operation with industry

The research and scientific work of Matís is usually done in close co-operation with Icelandic companies and also with companies in other countries. Sigurjón says that this aspect of Matís' work, which has been the fundamental reason for the great progress made in handling and processing of sea products in Iceland, has been noticed abroad. Ms. Solveig Anspaker, Norwegian Minister of Fisheries, was impressed to learn about this close co-operation of the academia, institutions and companies in the seafood sector. The international corporation, Nestlé, had heard of Matís' good results with handling and cooling of fish and approached Matís with a large research program concerning better process control for frozen fish. Sigurjón says the findings from such projects are partly in the public domain. This widens Matís' knowledge-base and will eventually also be useful for Icelandic companies. The project resulted in key knowledge about different species outside of Icelandic areas and that the compositional differences can be highly variable in global waters. This all affects the quality criterion and quality link of raw materials to products being retailed: handling on board, improved suppliers and quality of product.

"That a corporation with 270.000 employees comes to us is a fantastic opportunity for Matís. To work with them creates a lot of knowledge within our ranks" says Sigurjón.

The tail stuck out

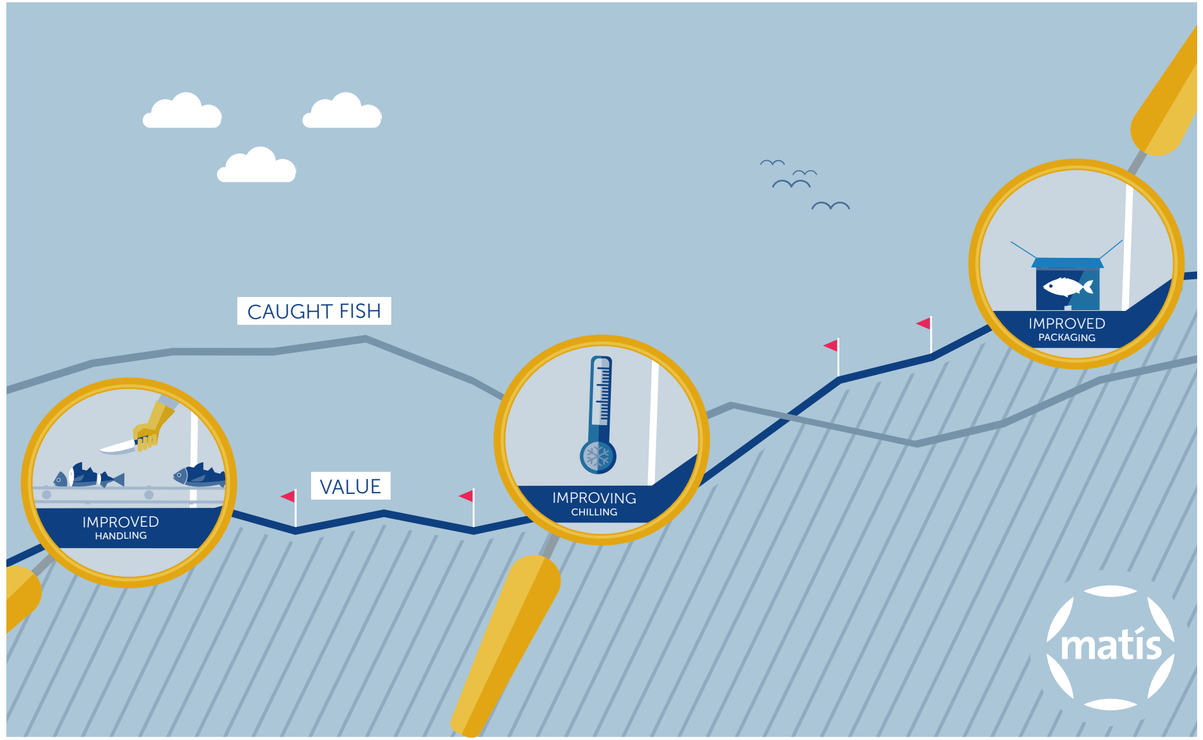
Sigurjón says the crusade for better handling of sea products started some time ago. He himself participated in efforts starting a long time ago to change fish boxes on-board fishing vessels. The boxes were 86 cm long but the fish was 90-100 cm so the tail would sometimes stick out of the box. The boxes were then stacked up causing the fish to bruise. Bigger boxes were designed with the aim to bring better catches ashore. This was the beginning of the use of plastic tubs.

In these years, it wasn't unusual that a fishing tour would last seven to twelve days. At the turn of the century, the demand rose for fresher catch to be brought ashore and the fishing industry began to shorten the fishing tours. Instead of 24-28 tours per year, wet-fish vessels now make 50-60 tours per year. The fish is landed fresher, is better cooled and better handled. The product now merits to be branded fresh and the value of the catch has increased considerably. Sigurjón says that ultimately the outcome was better, even if the operating cost was higher with the additional number of fishing tours. Sigurjón also emphasises the importance of cooling before the product is packaged.

The time it takes the fish to reach rigor varies by species. Thus, this process is considerably longer for carp than for cod, or five days for carp and two days for cod. Therefore, fisheries like HB Grandi, one of the largest fishing companies in Iceland and a leader in its field, have adapted an efficient schedule for mixed catching. The catching starts with carp and then reverts to cod. By the time the catch is landed, both species have reached full death stiffness and are optimally ready for processing.

Round boxes and optimal transport routes

Shorter fishing tours are also effective for better cooling, which Sigurjón says is the fundamental issue in all handling of raw material, from catching and processing to transportation to the market. Much has been achieved in this matter and fishing companies have a good understanding of this. There have been many milestones in this development process, for instance the EPS box with round corners, which was a break-through in cooling fish products. The design of the box is based on research by Dr. Björn Margeirsson then at Matís, which was a part of his Ph.D. work at the University of Iceland. In 2010, production of this box was launched, in co-operation with Promens Tempra. The box keeps the fish fresh two days longer than the traditional "square-corner" box. Björn is now employed by Promens as chief of research.



Sigurjón says that scheduled flights by Icelandair and Icelandair Cargo are very advantageous for the export of fresh fish from Iceland. Flight destinations are numerous and fresh fish can be delivered to all major markets in a short time.

The AVS-fund (Added Value Seafood) has been instrumental in stimulating research which has the purpose to improve the handling and quality of seafood. One of the projects, says Sigurjón, was to increase the value of salted fish which is exported to Spain, Italy and Greece. The customers in these countries want white fish, but salted fish tends to turn rancid and obtain a yellow colour. In co-operation with partners in Norway, The Faroe Islands and Denmark, research was launched into using phosphates in curing the fish. This was followed up with a time consuming process which involved obtaining the EU's endorsement for using phosphates as an additive in salted fish. Now, salt fish producers use this method for curing salted fish for Iceland's most valuable markets in Spain, Italy and Greece.

New technology

Sigurjón says the co-operation with Icelandic fishing companies hasn't only led to development in the handling of fish, but also the development of new technology. Mackerel processing is one example. Many have said that Icelanders could not exploit the mackerel because it is caught in Icelandic waters at different times than elsewhere and the mackerel is then full of krill which makes the processing very difficult. With funding from AVS and in co-operation with Matís, the tech-company Skaginn developed a novel box-freezer. Already, three large companies in Iceland have installed such freezers for their mackerel processing and companies in The Faroe Islands have purchased this freezer technology for several billion ISK.

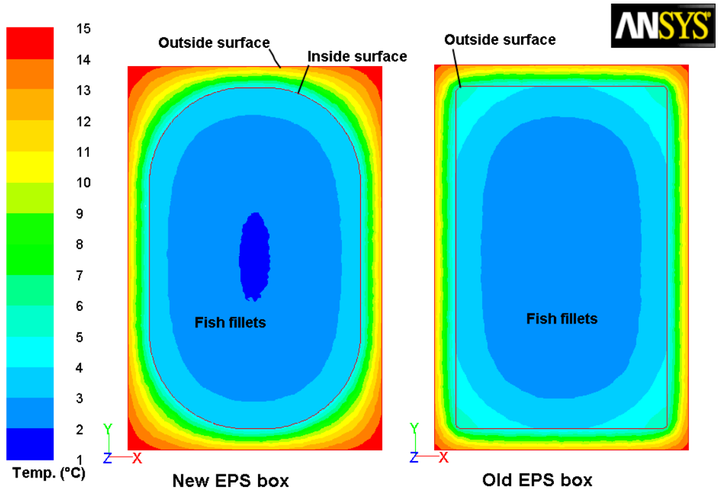
According to Sigurjón, research is on-going into further processing of mackerel, such as smoking and fileting, a processing that could be suitable for mackerel caught with hand line. Among projects at Matís today are studies on the stability of fresh and frozen mackerel, a study of processing methods and more. This research will later be applicable for herring, as such research has been sorely needed.

COOLING IMPROVES IN FRESH FISH CONTAINERS

Matís, Eimskip hf. and Samherji hf. recently collaborated on research for improving the distribution of cold air in fresh fish containers. Björn Margeirsson, a research group leader at Matís, said that certain measures would make it possible to improve the heat distribution in containers. "Even though the refrigerated containers are good, they are not perfect, any more than anything else. We have discovered in our work that the set temperature and the actual temperature can differ by as much as 1 to 1.5°C. In addition, locations inside a container can differ by 1-2°C. We have therefore been testing different loading configurations in containers. We have likewise been experimenting with covering the bottom of containers with plates or tarps to force the coldest air farther back in containers, i.e., farther from the cooling equipment. Both methods have produced results for us and have equalised the distribution of cold air in the containers," said Björn. The research on refrigerated containers is an extension of Björn's doctoral project on the simulation of temperature changes during transport of fresh fish products. It is also an extension of Saemundur Elíasson's Master's project at Matís. That project dealt with the distribution of heat in containers. Saemundur has borne the main brunt of the collaborative project with Eimskip and Samherji. "The project has gone on for a year and a half and yielded the main conclusion that it is possible to improve containers without changing their basic structure," said Björn.

NEW STYROFOAM BOX PROLONGS SHELF LIFE OF EXPORTS

Over 90% of fresh fish shipped airfreight is exported in Styrofoam boxes, manufactured by Promens Tempra ehf. in Hafnarfjördur (near Reykjavík). Likewise, a high proportion of fresh fish exports via sea freight is in Styrofoam boxes. We can therefore say that this packaging is very predominant in the seafood production sector. Matís was involved in the research and development of Styrofoam boxes with Promens Tempra. The result was a new type of box that is now on the market. The new box makes it possible to prolong the "shelf life" of fresh fish during shipment by 2-3 days. "Preceding this new box was a research project we did with Matís, the University of Iceland, Brim hf. and Samherji hf., along with several other smaller companies. The research revealed that the heat load was greatest at the corners of the Styrofoam box. With this finding, we changed the shape of the box. In the summer of 2010, we brought out a new type where the inner layer was thicker in the corners. We actually did this by making the cover and bottom thinner. Thus, the box is the same weight as before. This change increased the storage time by 20%. It went from 6 to 8 days on average. In some instances, the time lengthened even more. We are pleased with this success—especially that it promoted more quality of exported products," said Kristín Magnúsdóttir, factory manager at Promens Tempra. The company manufactures these boxes in 3-, 5- and 7-kg sizes.



DELIVERING ANSWERS TO THE FISH INDUSTRY – UTILIZING MATÍS' KNOWLEDGE

Ísfélag Vestmannaeyja; one of the largest seafood companies in Iceland, focusing on pelagic species.

"We have collaborated with Matís on diverse projects related to our operations. We also tap into the knowledge of Matís employees when needed—both here in the Westman Islands and at the headquarters. Matís has a wealth of knowledge useful to us, for example, regarding the handling of catches, refrigeration, etc. Access to this knowledge is necessary for a company like ours," said Eythór Hardarson, fleet manager of Ísfélag Vestmannaeyja hf. In 2010, the company participated in three projects with Matís service centre in the Westman Islands. Two of these projects focus on catching, processing and marketing mackerel. The third has to do with the pelagic fish pearlside.

"The goal of such research work—regarding new fisheries and processing, for example, mackerel and pearlside—is to get answers to various questions important to achieving results in value creation. One can say that results often do not come out until later, but for us it is important to be able to collaborate with researchers when looking for answers. However, Matís importance to us also entails our other operations, such as fishing and processing of roundfish and other species. We are constantly looking for ways to improve the process from fishing to when a product goes to market, and we utilise the knowledge of Matís employees regarding this process. Matís has built up a great deal of invaluable knowledge related to the cooling of catches at sea, which is important to results when it comes to processing" said Eythór.

Ragnheiður Sveinþórsdóttir, Consultant at Matís

Guðlaug Th. Marinósdóttir, Office Manager

CONFIDENCE IN MATÍS' FINANCIAL MANAGEMENT – VITALITY OF INTERNATIONAL PROJECTS

"Finances are a vital part of our research projects and this is especially clear when it comes to Matís' international projects, which are constantly expanding. This is an element that depends heavily on those who finance and fund our projects, our partners in those projects and the staff at Matís that directs them. Of course our scientists follow the financial elements of these projects but it could be said that our job is to ensure that they can devote themselves first and foremost to their specialty and their scientific work," says Guðlaug Th. Marinósdóttir, Office Manager at Matís. She says that a good project finance system is one of the keys to generating trust among our associates and backers, "and our experience is that we are increasingly given financial oversight of projects. It varies by the nature and size of the project and how they are handled financially, but in many large projects the financial oversight is entirely in our hands. This means that we follow projects from start to finish, ensure that the payments make it to us so we can pay our associates per agreements and thus ensure the projects proceed efficiently," says Guðlaug and names Amylomics, EcoFishMan, NordChar and SAFE Consortium as examples of large, important international projects that their staff oversees. Guðlaug mentions that Matís is on good terms with the Icelandic National Audit Office, which oversees the audit of the annual financial statements for the company. "We want to keep everything in order and have been working with the National Audit Office over the last few years on improvements to our bookkeeping and procedures regarding internal controls. Overall we feel a great sense of confidence from our international partners regarding financial management and the frequently discussed financial collapse here in Iceland has not affected that confidence. We felt the effects for the first year after the banks collapsed but the only echoes we feel today are over the amount of paperwork involved in starting new bank accounts for a new project."

"A large part of our international profits comes from EU and Scandinavian funds. Our associates in these projects are companies and institutions located in Scandinavia and other European countries and as such we need to maintain banking transactions in numerous countries and with several currencies. Our goal at Matís is to do a good job in all fields, both in the scientific sector and in our handling of projects, including the financial factor. In fact, they are vitally important in our work when all is said and done," says Guðlaug.

THE NEW BIOECONOMY

The European Bioeconomy Panel was established in 2013 by the European Commission with the aim to improve coherence and synergies between policy areas related to the bioeconomy and to pave the way for more innovative and resource efficient thinking. The Bioeconomy Panel consists of 30 members, all experts in their field of the bioeconomy.

Hörður G. Kristinsson, Chief Science and Innovation Officer at Matís, was a member of the panel. He says that after establishing the Bioeconomy Panel, the Bioeconomy has received more attention. The Bioeconomy Panel is very important, supporting interactions among different policy areas, sectors and stakeholders in the bioeconomy.

"The Bioeconomy Panel was established to answer the Europe 2020 strategy calls for a bioeconomy as a key element for smart and green growth in Europe. We at Matís, however, want to highlight the importance of talking about both the green and blue growth", says Hörður. "Blue refers to the marine and freshwater environment and is of particular importance to Iceland and our neighbours sharing the Atlantic Ocean resources and holds great untapped future potential for sustainable utilization and added value. The synergy between the green and blue growth is also of great importance as land and aquatic based resources often have strong connections. People working in each area can benefit and learn much from each other, introducing new ideas and innovations from one area to another. The Bioeconomy Panel will facilitate this transfer of technology and information between different disciplines.

Europe is facing many challenges at the moment, such as increasing global population, increasing age and age related diseases, climate related issues, potential depletion of many resources and increasing environmental pressures. Therefore, Europeans needs to rethink how they treat the environment and radically change the approach to production, consumption, processing, storage, recycling and disposal of biological resources. Our goal is to maintain a healthy and sustainable bioeconomy in Europe which has a positive impact on our citizens.

These kind of challenges can, however, inspire new thinking and innovations and lead to new discoveries. The bioeconomic thinking will support industrial development in rural areas as well as positive population growth. This will also awaken Europeans about the necessity of improving the management of renewable biological resources and about how they affect the bioeconomy in every step they take. This new view can open up new markets for sustainable food and bio-based products. It is also necessary for primary producers to rethink their methods and do all they can to become more sustainable and environmentally friendly.

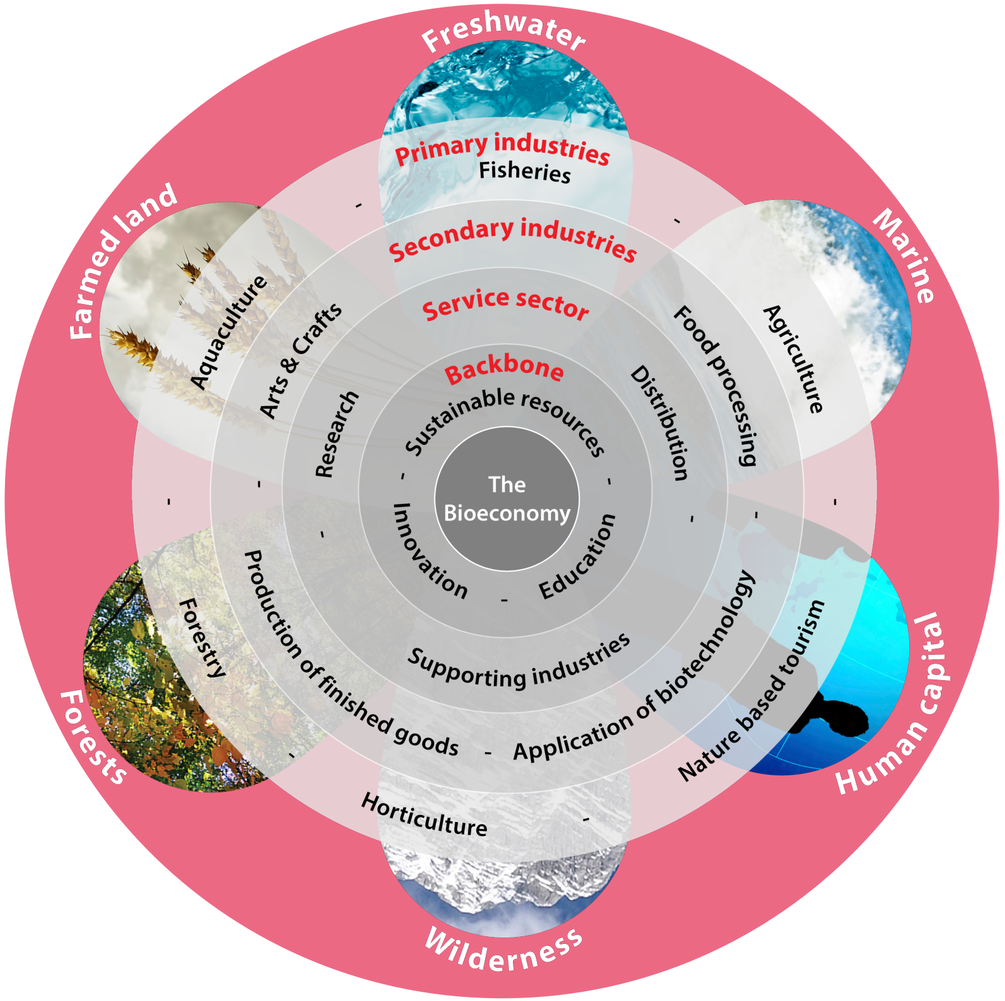
When proposing new types of food or new raw material sources and asking food producers to become more sustainable, we are not only ensuring environmental protection but also addressing food security and safety at the same time."

Hörður says that the Bioeconomy Panel also encourages the creation of national and regional bioeconomy panels. "The importance of better and increased sustainable utilization of our biological resources has never been as important, and requires great efforts by the research community, companies and governments. More innovation and value addition is needed to make the best use of our limited resources. Transnational collaboration is the key to accomplish our goal of meeting growing demands on products from our biological resources. Many countries share the same resources and therefore it is of much importance to create coordinated, regional efforts in sync with the European bioeconomy initiative.

As an example, the Nordic countries are working on establishing a bioeconomy panel which addresses our shared and unique Nordic and Arctic bioresources. In addition, it is essential for us to work closely with other countries, for example our neighbors to the west, US and Canada, who share many of our resources and face similar challenges.

The Bioeconomy Panel's biggest projects include creating a Bioeconomy Observatory, with the goal to map and track the progress and impact of the European bioeconomy and create tools with a long term vision that can help develop our bioeconomy further. We have also put significant work into defining, mapping and forming recommendations on the biomass supply that is available to us in Europe. This work is very important in order for us to make the most use of bioresources in a sustainable and high value manner. Our bioresources are highly diverse, with broad applications in the food, feed, energy, pharma and agricultural industries, each with its own unique challenges. In this analysis, we have to take into account various economic, social and environmental considerations, which makes this task quite complex. Our aim is to come up with several key prioritized recommendations for the European Commission on the European biomass supply and its utilization."

The bioeconomy panel has put forward a strategy and an action plan built on the Seventh Framework Programme for Research and Technological Development (FP7) and the EU Framework Programme for Research and Innovation (Horizon 2020).



BIOECONOMY IN THE NORTH

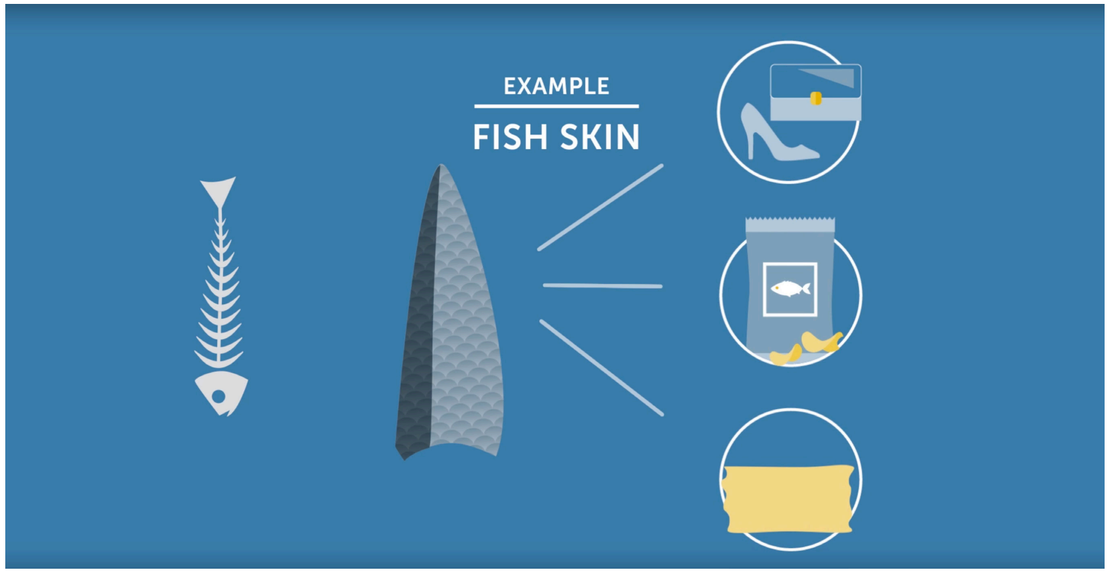
The chairmanship of the Nordic Council of Ministers (NCM) rotates between the five Nordic countries and is held for a period of one year and followed by a three-year chairmanship program. Iceland chaired the NCM in 2014. Matís worked closely with Icelandic authorities on the development and implementation of the presidency program "NordBio". The focus of the Icelandic chairmanship program is on the bioeconomy, which is the basis for almost all research and innovation projects at Matís. The main tasks of the presidency hinged on innovation in the Nordic bioeconomy with the aim to strengthen regional economic growth.

Matís led the innovation and product development projects under NordBio during the presidency program. Sigrún Elsa Smáradóttir, Program Director of Business Development, is the project manager.

The project is aimed at innovation, product development and improved possessing for increased value and sustainability in the bioeconomy. By focusing on underutilized bioresourses and waste, means are sought to increase production of biomass to use in biorefineries and to introduce new technologies, including biotechnology to increase the value of products from biological resources.

In cooperation with industry partners, Matís has already made good progress in creating value from underutilized resources and still attempts to improve utilization of resources that are already utilized. This is done by active research and innovation as well as by actively supporting entrepreneurs and industries. Innovation projects within the chairmanship program are therefore a natural extension of Matís goals. Also, this combines Icelandic and Nordic knowledge with the aim of identifying opportunities, decreasing waste and increasing the value of the bioeconomy.

The innovative programs within the chairmanship program are selected and designed on the basis of analyses carried out in a Nordic cooperative effort. Part of this work included regional analysis, done in certain regions of the Nordic countries by Nordregio, a Nordic research institute specializing in research on settlement issues. Nordic Innovation, a Nordic institution that works to improve international trade and innovation, has also done some analytical work in this field. There is also an ongoing Nordic taskforce, with representatives from Matís, working on identifying opportunities and industry needs connected with bio refineries and biofuel production in the Nordic countries.



The first part of the innovation projects under the chairmanship program was based on the project "Arctic Bioeconomy". The project was led by Sigrún Elsa and was completed in December 2014. It focused on the bioeconomy of the West Nordic Region, focusing on Iceland, Greenland and The Faroese Islands. This was a two-year project where bio resources were mapped to identify opportunities within the bioeconomy of the West Nordic countries.

The goal of the project was to compile information about biological resources and utilization in the west Nordic countries and identify opportunities for value creation and societal transformation. The project's conclusions and the action plan put forward will facilitate the participation of this region in Nordic and European cooperation projects in the bioeconomy sector. If successful, this will contribute to more focused policy-making, encourage sustainable utilization of natural resources, and promote value creation and minimization of waste in the bioeconomy. These results will lead to a positive impact on social demography and rural development in the region.

Objectives of NordBio

- Develop and improve methods of sustainable production and utilization of products in order to stimulate innovation and economy, and to reduce strain on the environment in the Nordic countries.
- Strengthen knowledge that is beneficial in policy-making in economic and environmental affairs by increasing collaboration in research, development, and innovation.
- Strengthen innovation in energy efficiency, food safety and public health, and facilitate Nordic production in markets to meet the growing need for food as world population increases.
- Report the achievements of projects in the field of education for sustainable development.
- Make research and academic work in the fields of sustainable production and utilization more attractive to future generations.
- Bring together science, technology, education and culture at various school levels, in institutions and the economy.
- Offer a joint Nordic venue and platform for cooperation, collaboration and exchange of views across ages and fields of expertise.

Dr. dr. Christian Patermann a former director at the European commission, often referred to as the father of Bioeconomy in Brussels, wrote a foreword to the final report of the project and facilitated the final meeting of the project where the action plan was created from the project's conclusions.

An interview with dr. dr. Patermann can be found on Matís webpage: http://www.matis.is/drpatermann. In the interview dr. dr. Patermann describes the bioeconomy and its importance for the West Nordic Region and the unique features of the West Nordic Region. Further, dr. dr. Patermann reflects on the importance of a West Nordic Bioeconomy Panel in order to focus the strategy and priorities for the region as well as the importance of establishing a Centre of Excellence, to optimising the research, and the technological and innovative activities in the region.

Blue Bioeconomy Video

NordBio Homepage

Interview with dr. dr. Patermann

SCIENCE AND TECHNOLOGY POLICY COUNCIL MOTIVATION AWARD

SECOND TIME A MATÍS EMPLOYEE RECEIVES THIS AWARD

From the Chairman of the Icelandic Science and Technology Policy Council: Hörður G. Kristinsson, Ph.D., currently the Chief Science and Innovation Officer (CSIO) at Matís, received this award, which was granted to him at the Research Forum of the Icelandic Centre for Research (Rannis) June 8, 2011. This is the second time an employee of Matís has been afforded this award, the first being Anna Kristín Daníelsdóttir in 2000, then employed at the Marine Research Institute. Hörður received the award directly from the prime minister who is also the chairman of the Science and Technology Policy Council. This award is recognition of Hörður's contributions and the work that goes on behind Matís' doors.

Hörður was born in 1972. He completed basic biology studies at the University of Iceland in 1996 and moved from there to the United States for further education. As he studied for his master's degree at Washington University in Seattle he researched the use of seafood by-products through the application of enzymes using the same techniques widely used today with good results. In 2001 he completed his doctoral studies in food biochemistry at the University of Massachusetts where he studied the properties of fish proteins. The results of his doctoral research have been used to develop new methods of isolating and using new proteins from by-products and underused fish types, such as blue whiting and capelin. These methods have added to our understanding of marine resources and have had great practical benefits. In the last year of his doctoral studies he was offered the position of associate professor at the Food Science and Human Nutrition Department at the University of Florida, one of the largest and most progressive in the USA. There he built for himself a potent laboratory devoted to the field of food biochemistry with a particular emphasis on the useful applications of seafood. Hörður moved back to Iceland in 2007 and began working with Matís a year later but still maintains a position at the University of Florida.

Hörður has acted as a trailblazer in improving our understanding of bio-chemicals and bioactive chemicals in Icelandic nature. He was instrumental in building up the Matís Biotechnology Centre at Saudarkrokur which opened in 2008. There specialists work on both local and international research projects, often working closely with the food industry in Skagafjordur and elsewhere in Iceland.

An emphasis is placed on offering facilities and professional assistance to develop both products and methods with the goal of speeding the process of idea to product and thus lower the cost of its development. On that note the new facility for companies just starting up, known as Bruin (the Bridge), bears mentioning. There, one can find powerful biotechnology firms such as Kerecis and Primex which have their headquarters in the vicinity of Hörður and his co-workers.

Hörður's research has yielded great practical benefits, and he is in fact the holder of three published patents. Hörður has published articles about his research in highly respected scientific magazines and given lectures at conferences the world over. He is an active participant in international cooperation and currently heads up a number of multinational research projects. He has also been active as a teacher and no fewer than ten of his students have thus far completed their doctorates, with another nine holding their masters' degrees.

Through his work Hörður has shown himself to be an excellent scientist, teacher and director. He has shown initiative and led the way to building a new area of science that has already begun to bear fruit. He is an excellent role model to his students and colleagues as well as a key member of a growing company.

It was the unanimous decision of the judges that Hörður G. Kristinsson fulfils all the requirements for the Motivation Award and is a more than worthy recipient of the award for 2010.

ABOUT THE AWARD

The Science and Technology Policy Council's Motivation Award is awarded to scientists who distinguish themselves early on in their careers and raise expectations for the advancement and give rise to expectations that will contribute to the advancement of science and that will improve the quality of life in Iceland. The prize, which now totals two million kroner, has been awarded each year since 1987, the first time being on the fiftieth birthday of the employment department of the University of Iceland. The purpose of the Motivation Award is to encourage scientists through incentive and raise the public's awareness about the value of research and the tasks of scientists.

LAST YEAR

A FEW SUCCESS STORIES FROM 2016

HOW DO YOU MAKE AN IMPACT?

International cooperation is a vital part of the day-to-day operation of Matís. This is evident in a number of ways. One way this becomes clear is the company's work with foreign institutions in research and development projects, another is when foreign parties hire Matís for research directly. This is not counting various cooperative ventures on foreign soil, such as meetings and forums, where Matís employees meet foreign professionals in their own field of study. At any given time, there are many foreign researchers and specialists working with Matís, often all year. All of this results in direct benefits for the structure of Matís as well as aiding the understanding of its employees.

With modern technology, it is constantly becoming easier to take part in multinational scientific endeavors and Matís takes full advantage of this.

It grants both opportunities to aid the sale of the company's research services, thus adding to its foreign income, and the chance to strengthen the knowledge base Matís is building up for global and local customers.

Perhaps the best way to make an impact is through partnership. Our employees travelled more last year than they have ever done before in a single year to strengthen Matís' partnership. Most trips were related to cooperative projects within the scope of Nordic and other European partnerships. Several of Matís' employees were also asked to speak at major events and meetings all over the world, where the company's knowhow was at the center of attention; below is a listing of just a few of them and their activities.

Aðalheiður Ólafsdóttir, Sensory Panel Leader
- Presentation of the EnrichMar EU Project at the Societal Challenge 2 Dissemination Day organized by DG AGRI, DG RTD and the Research Executive Agency. Brussels, Belgium.

Dr. Anna Kristín Daníelsdóttir, Chief Research Officer
- Celebration of the 20 years of South-Africa-European Union Science, technology and innovation cooperation (SA-EU STI). Cape Town, South-Africa.
- International Workshop on Environmental Protection and Sustainability. Tulcea, Romania.
- International Conference on Research Infrastructure on behalf of Mare-Frame EU Project. Cape Town, South Africa.

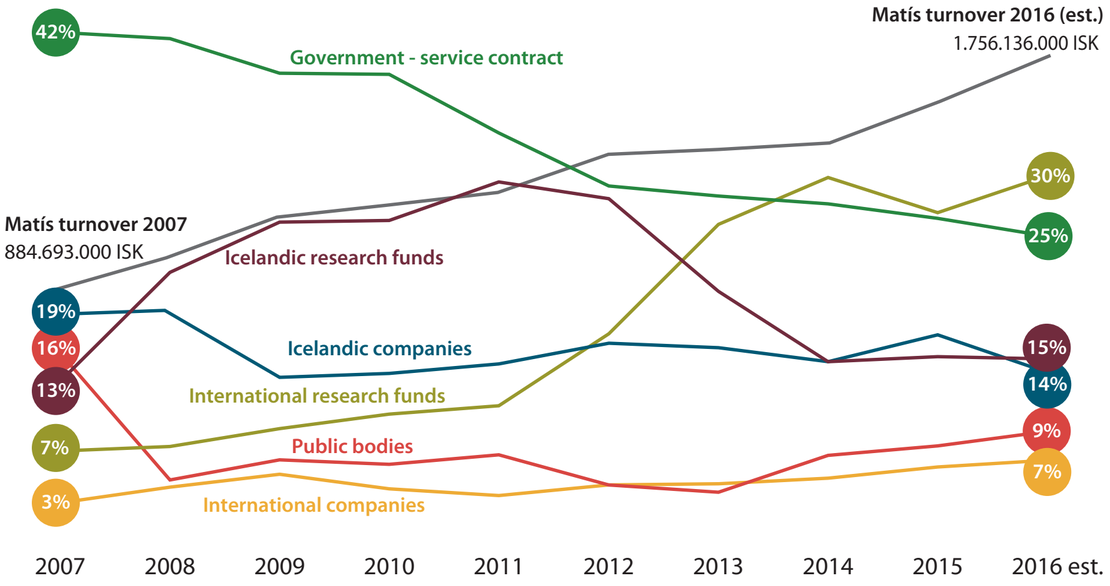
Sigrún Elsa Smáradóttir, Head of Industry Solutions and Consulting
- Keynote speaker at Biotown 2016. A conference where the spotlight was on the opportunities in the bioeconomy, including new industrial utilization of raw materials from agriculture and forestry. Hamar, Norway.
- European Bioeconomy Congress. The purpose is to create a friendly atmosphere around the innovative, effective and competitive approach to activities intended to support the development of bioeconomy. Lodz, Poland
- International Advisory Committee on Bioeconomy, Global Bioeconomy Summit. Berlin, Germany.

Dr. Magnea G. Karlsdóttir, Research Group Leader
- Marel's Whitefish showHow guest speaker. Copenhagen, Denmark.

Dr. Sveinn Margeirsson, CEO
- Presentation at the International Union of Food Science and Technology (IUFoST). Dublin, Ireland.
- Presentation at the Blue Week - Blue Growth and Investment Conference by FAO. St. George's, Caribbean Grenada.
- Meeting on discards and full utilization of marine catch. Valparaiso, Chile.

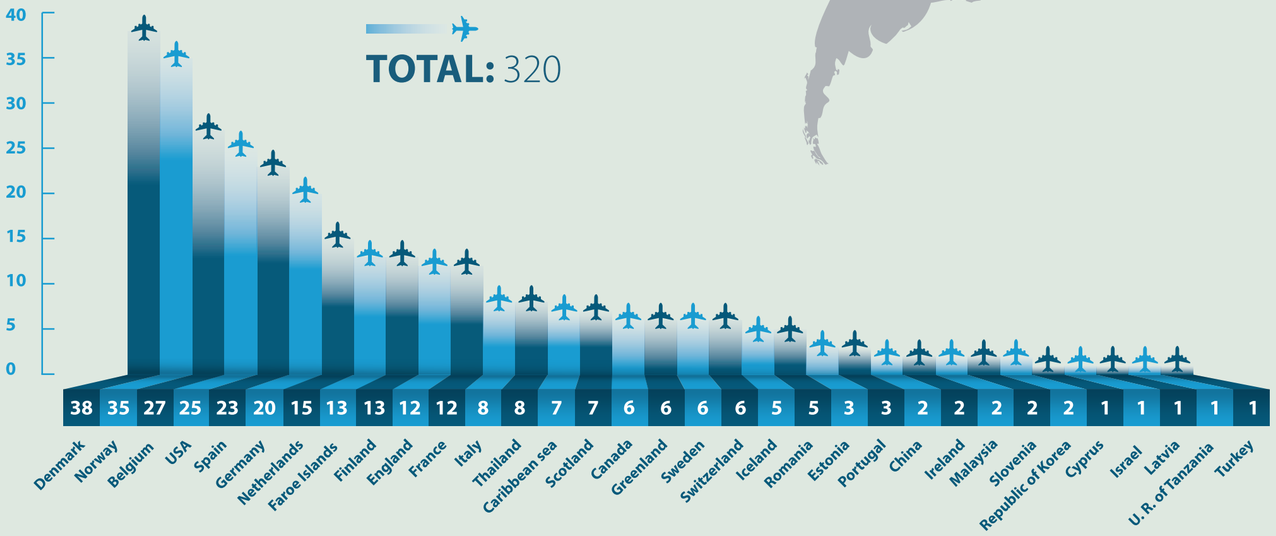
Dr. Hordur G. Kristinsson, Chief Science and Innovation Officer
- The Nordic Bioeconomy Panel, Chairman – first meeting. A common strategy for the future of the Nordic Bioeconomy. Copenhagen, Denmark.
- Thai Union Scientific Advisory Board meeting. Bangkok, Thailand.
- PepsiCo meeting. Purchase, New York, US.

MATÍS' TURNOVER



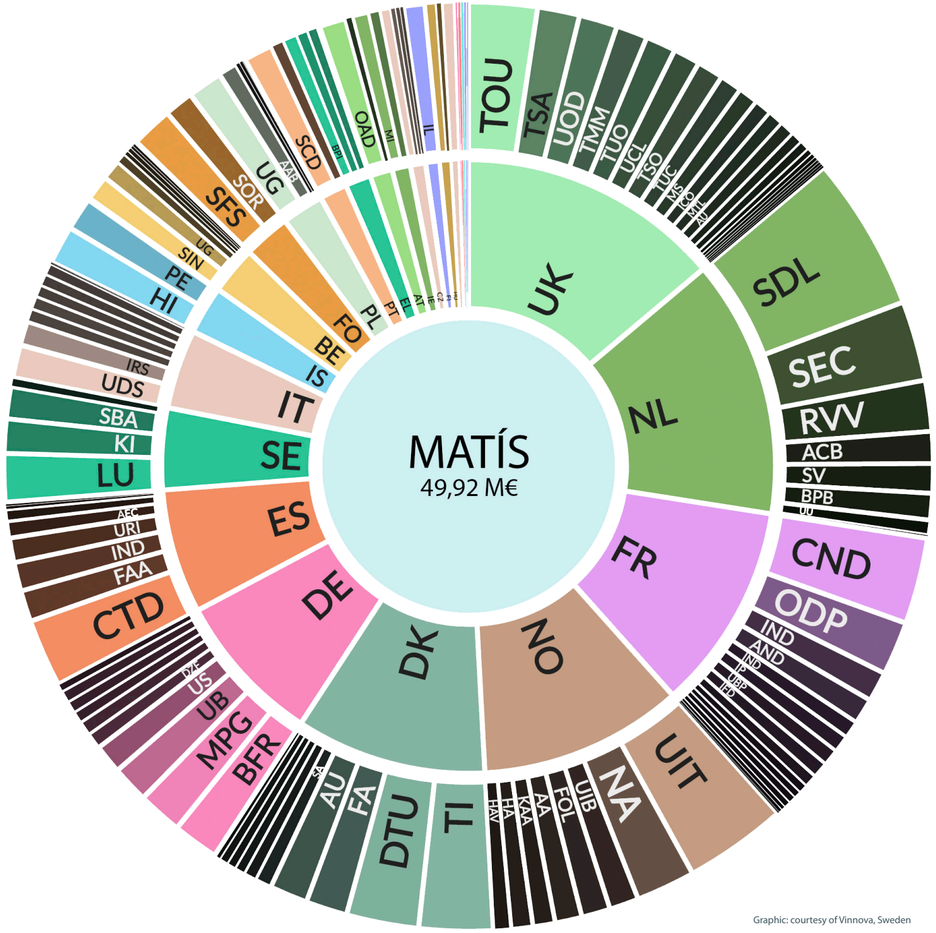
INTERNATIONAL COOPERATION – MATÍS' TRAVEL IN 2016

Truly International



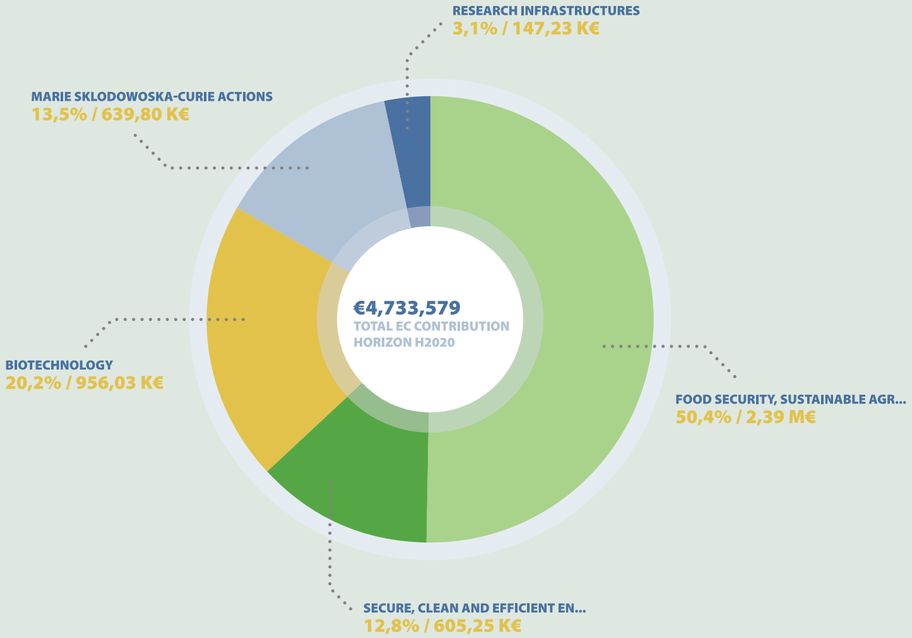
SOME OF MATÍS' PARTNERS

PARTNERSHIPS CREATED THROUGH RESEARCH & INNOVATION: MATÍS AND THE EU FRAMEWORK PROGRAMMES



Graphic: courtesy of Vinnova, Sweden

MATÍS AND THE HORIZON 2020 PROGRAMME FOR RESEARCH AND INNOVATION



€4,733,579

TOTAL EC CONTRIBUTION
HORIZON H2020

12	Projects
148	Collaboration Oragnization
29	Collaboration Countries

EIT FOOD – €1.6 BILLION INVESTMENT KIC

Matís is only one of two participants from Nordic countries in EIT food – €1.6 billion investment KIC, or the Knowledge Innovation Community, is a rather revolutionary program which is partly funded by the European Institute of Innovation and Technology (EIT). From 2014-2020, EIT will invest €2,4 billions in eight different KICs. One of the KICs will revolve around innovation and research in the food industry in Europe (EIT Food). The KIC applications are very comprehensive, with a minimum of 50 participants and are highly competitive. Participants finance 75% of the R&D work while EIT finances 25%, totaling a €9,6 billion investment. The KICs are independent legal entities with their own CEO and management team and the KIC team decides how funds are allocated for R&D among the group, following the specific rules and the business plan of the KIC.

What is the role of KIC?

The idea behind the KICs is to get small and large companies, universities as well as research institutes to work together in an environment which results in world-class innovation activities as well as fostering entrepreneurship. Europe has been lagging when it comes to innovation and there is a lot of emphasis now on reversing that trend and making Europe great again. The KICs are a key tool for that to happen.

The main goals are to:

- Increase the competitiveness of Europe and innovation activities in Europe
- Lead to increased economic growth and create new jobs by:
    - Developing innovative products and services
    - Starting new companies
    - Training a new generation of entrepreneurs

What is EIT Food?

"FoodConnects, the application Matís was a co-applicant in, won the EIT Food KIC after a lot of hard work and a very strict selection process. It is a seven-year project funded by EIT to transform R&D and innovation in the European food industry. It is a very comprehensive project with 50 participants from 13 countries, all top companies, universities and research institutes", says dr. Hörður G. Kristinsson, Matís' Chief Science and Innovation Officer. For example, two of the largest food companies in the world participate, Nestlé and PepsiCo, as well as Givaudan, the largest flavor company in the world. Large companies like DSM, Roquette, Nielsen, Siemens and Bosch are also participants, to give some examples. University of Cambridge, ETH Zurich and the Technical University of Munchen are examples of top involved universities. In addition to Matís, other top research institutes like VTT in Finland, Fraunhofer in Germany and Azti in Spain are participants. Over the next seven years, EIT will invest €400 million in the EIT food project and the participants will match that with €1200 million (mostly in-kind), ending in a total investment of €1600 million. This is unprecedented in Europe and is by far the largest action that has been taken with regards to funding for food research and innovation.

"Matís is only one of two participants from the Nordic countries in EIT food and the group is looking particularly to Matís for our extensive expertise and knowledge with regards to R&D connected to marine raw materials and products, or the blue bioeconomy. This is a great honor for Matís and all the hard work our employees have done over the last years, as well as Iceland. One could say this moved Matís from being in the first league to the Premier League, or Major League of R&D", says dr. Kristinsson. Matís is now formally a part of an extremely strong network of some of the best companies, universities and research institutes in the world which can lead to major opportunities for Matís and Iceland.

EIT Food will operate in five so called Co-location Centers (CLCs) in Europe, as listed below, but they will all work together closely.

Leuven – CLC West (Belgium, France, Switzerland)
London – CLC North-West (UK, Ireland, Iceland)
Madrid – CLC South (Spain, Italy, Israel)
Munich – CLC Central (Germany, The Netherlands)
Warsaw – CLC North-East (Poland, Finland)

What challenges will EIT Food tackle?

Next year a seven-year business plan will be put together to clearly define what will be done with regards to several major challenges facing Europe and its food industry. They are:

1. Overcome low consumer trust: support Europeans in the transition towards a smart food system that is inclusive and trusted.
2. Create consumer valued food for healthier nutrition: enable individuals to make informed and affordable personal nutrition choices.
3. Build a consumer-centric connected food system: develop a digital food supply network with consumers and industry as equal partners.
4. Enhance sustainability: develop solutions to transform the traditional 'produce-use-dispose' model into a circular bio-economy.
5. Educate to engage, innovate and advance: Provide 'food system' skills for more than 10,000 students, entrepreneurs and professionals through advanced training programs.
6. Catalyze food entrepreneurship and innovation: foster innovation at all stages of business creation.

EIT Food's vision is to put Europe at the center of a global revolution in food innovation and production, and its value in society. EIT Food will engage consumers in the change process, improve nutrition and make the food system more resource-efficient, secure, transparent and trusted. EIT food aims to, among others:

- Support the creation of 350 start-ups within seven years
- Train over 10,000 graduates from EIT-labelled Master and programs over seven years
- Develop 290 new or improved products, services, and processes by 2024
- Decrease greenhouse-gas emissions in the European food system by 40% by 2030

EIT Food will set up four Innovation programs targeting societal challenges:

1. Personalized healthy food (FoodConnects Assistant),
2. The digitalization of the food system (The Web of Food),
3. Consumer-driven supply chain development and new technology adoption in farming, processing & retail (Your Fork2Farm),
4. Resource-efficient processes, turning the food sector into the spearhead for transforming the currently linear "produce-use-dispose" model into a circular bio-economy (The Zero Waste Agenda).

EIT Homepage

FISHERIES ICELAND MOTIVATION AWARD

THE HISTORY OF ICEPROTEIN AND MATÍS NEW BIOTECHNOLOGY CENTER

Hólmfríður Sveinsdóttir, Ph.D., director of IceProtein and Protis, recently received the Fisheries Iceland Motivation Award. The award is a compliment to Hólmfríður and the employees at IceProtein and Protis, as well as to FISK Seafood, the owner of IceProtein and Protis, and an acknowledgement of the activities of these companies in Skagafjörður.

Furthermore, the award is especially gratifying for Matís because until recently Hólmfríður worked at Matís' biotechnology center in Sauðárkrókur. But, what is IceProtein and what is its operation?

IceProtein

At the Icelandic Fisheries Laboratories (IFL), a predecessor of Matís, selected R&D efforts involving utilization of marine proteins, formerly wasted in processing, were aggregated into a spin-off company IceProtein, founded on September 26th, 2005. In 2006, due to interest of FISK Seafood, the pilot plant was located in Sauðárkrókur and was placed in what became Verið Science Park.

FISK Seafood acquired 64% of IceProtein in 2009 and IceProtein has participated in numerous R&D projects with Matís. Matís held the remaining 36%. Strategy discussions included applying for research grants as well as developing IceProtein as service provider for Kaupfélag Skagfirðinga (KS; a cooperative store located in Sauðárkrókur) and related companies. KS established a development fund, designed to serve as a center of R&D for the entire KS group in 2010, with revenues of 0.15% of all operating income from each production unit. From the creation of the development fund, IceProtein operations increasingly evolved around servicing the production units of KS. By the end of 2012 FISK Seafood acquired the remaining shares in IceProtein from Matís and hired Dr. Sveinsdóttir as managing director of IceProtein. Soon after, IceProtein added new employees to the company and transformed the processing facility by scaling up the pilot plant for production.

In 2015, IceProtein's operations resulted in the launch of a new company, Protis, to handle productions and sales and the first product lines were launched under the new company's name shortly thereafter. Currently, Protis' protein selections include three products for consumer use and they are sold in most stores in Iceland. As of January 1st 2016, Protis and IceProtein employed four people with backgrounds in biotechnology and biochemical sciences.

Matís in Sauðárkrókur

In November 2008, Matís opened the Biotechnology Center in Skagafjörður, a fully operational biotechnology lab, with the aim of bringing together different active sectors of the bioeconomy in Skagafjörður applying modern biotechnology on a highly advanced lab pilot scale, through a spin-off company; IceProtein. The laboratory of Matís and complemented IceProtein's pilot scale operations, with investments in proteomics and equipment for bioactivity assays. Seeing the potential of future collaboration, FISK Seafood (tengill), one of the largest seafood companies in Iceland, supported Matís in their move to Sauðárkrókur through projects and business, in the form of chemical analysis and assays of products, as well as through renting facilities at a reasonable cost. On January 1st 2016, Matís' operations included four employees.

Dr. Hólmfríður Sveinsdóttir

In May 2008, Dr. Hólmfríður Sveinsdóttir defended her Ph.D. thesis at the University of Iceland and joined the Matís team in Sauðárkrókur, soon followed by other new employees and M.Sc. students. From that time, Dr. Sveinsdóttir has been in the forefront of research and development in the area of biotechnology and biomolecules. Dr. Sveinsdóttir has a Ph.D. degree in biotechnology and a M.Sc. degree in nutrition and her area of interest has been in research relating to bioactive compounds from the ocean, particularly proteins and peptides from wild Icelandic cod (*Gadus morhua*).

In 2011 FISK Seafood, which had earlier acquired a majority of shares in IceProtein from Matís, invested in brand new facilities for their headquarters. Verið Science Park, IceProtein and Matís moved their operations in Skagafjörður to the same location. Matís extended the lab operations simultaneously. In 2013, after FISK Seafood had acquired Matís' remaining shares in IceProtein, Dr. Sveinsdóttir left Matís and took the position of managing director of IceProtein, as mentioned earlier.

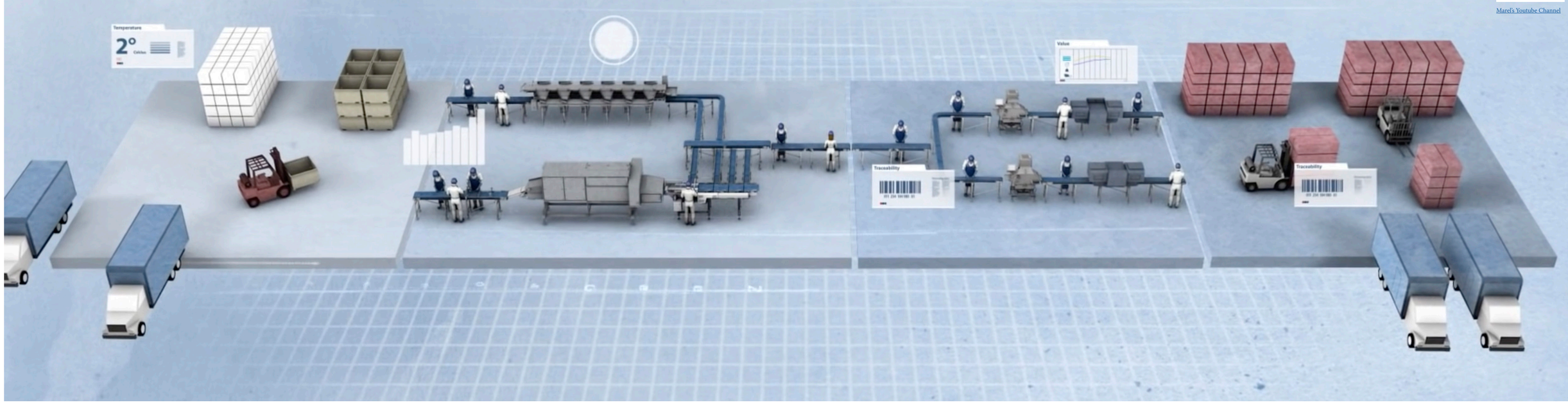
"I hope that this award will not only benefit us here in Skagafjörður to continue our close cooperation with entrepreneurs for innovations and development for FISH Seafood and the fisheries industry but also that the award will encourage companies in the fishing industry to increase their cooperation with entrepreneurs. Innovation leads to better quality of harvesting and processing, improved image, more varied market opportunities and increased value." Dr. Hólmfríður Sveinsdóttir

MAKING AN IMPACT IN THE DIGITAL AGE

Matís recently took part with Marel in the making of the video "From the Sea to the Supermarket - A Journey into High-tech Fish Processing" which has been well received since its release.

Marel´s description of the video: "It now only takes a few hours to process the catch and distribute to customers around the world. Marel has teamed up with Matís, the Icelandic Food and Biotech R&D institute, to create a video demonstrating how cutting-edge technology makes this possible."

Marel's Youtube Channel



INCREASED VALUE OF CONVENIENCE FOODS BY ENRICHMENT WITH MARINE BASED RAW MATERIALS

The EnRichMar project began in 2014 and came to a close in 2016. EnRichMar was a EU FP7 SME (Small and Medium-sized Enterprises) sponsored project with the main objective of increasing the value of convenience food by adding functional ingredients, produced from underutilized marine based raw materials and by-products from fish processing, with confirmed bioavailability. The focus was placed on the marine ingredients including omega-3 oil, omega-3 powder, and seaweed extracts.

The SMEs have obtained valuable marketing information about functional foods and consumer views on functional foods in important markets and have developed enriched food prototypes based on information collected from main target groups of interest. Matís provided assistance in formulations, flavor, and sensory evaluation to develop products in-line with consumer preference. SMEs also now have first-hand information about physiological effects of consuming the enriched foods.

Integral to the project was the development, for each SME, of a new higher value business model for the future that will impact positively their financial performance.

The increased value of the raw materials as well as the targeted products will contribute to a greater variety of healthy convenience foods and may therefore contribute to improved public health. The results are also relevant to global and European fishing and marine resource industry in general because of the increased value of side streams and underutilized marine based resources.

Grímur Kokkur (meaning "Grimur the Chef") was one of the SME partners in the project. Grímur Gíslason discussed the impact that EnRichMar has had on his business including, "Opportunities to launch and export fish and vegetable dishes enriched with omegas. Healthy meals will be even healthier and that is a big opportunity for our company. EnRichMar helped us to solve problems related to the production of meals containing omegas. We are launching two products from the product this summer." Grímur Kokkur launched two healthy products for the family: Vegetable stew with added Omega-3 and Fish cakes with added Omega-3.

EnRichMar

EnrichMar Video

EnrichMar Homepage

Fridrik Fridriksson, Matís' Chairman of the board, Sigurður Ingi Jóhannsson, Minister of Fisheries and Agriculture, Sveinn Margeirsson, Matís' CEO, Kristín Ingolfsdóttir, Rector of University of Iceland, Illugi Gunnarsson, Minister of Education, Science and Culture and Inga Thorsdottir, Dean of School of Health Sciences at University of Iceland.

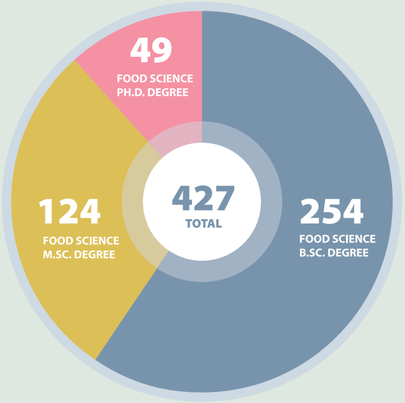
UNIVERSITY OF ICELAND – A FRUITFUL COOPERATION INTO 2016

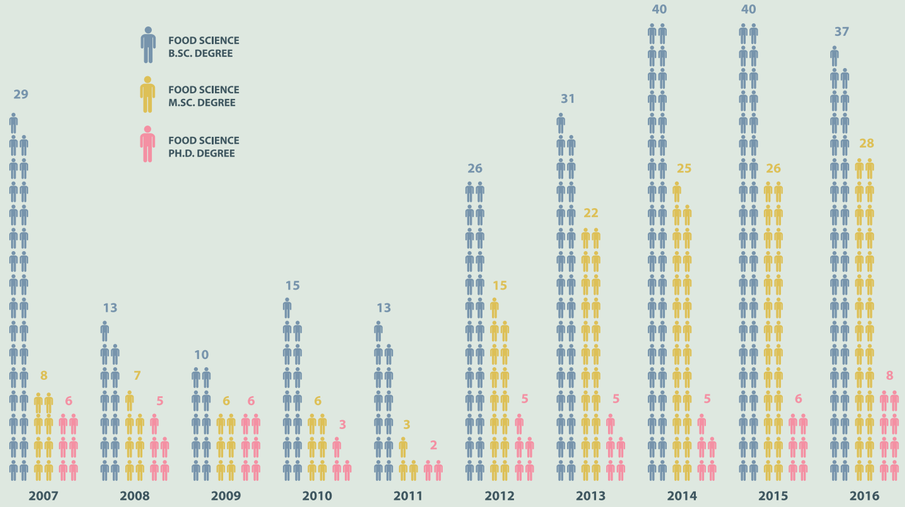
Matís cooperates well and successfully with the University of Iceland with a formal collaboration agreement on teaching and research. The scientists of the future have been trained during their doctoral and masters work at Matís, many of them in cooperation with the University of Iceland, United Nations University – Fisheries Training Programmeme , UNU-FTP, other universities in Iceland and other countries.

Cooperation with the Food Science Department 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 Matís 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 enrollment of food science students. The decision was taken to join forces in 2011. The syllabus was reviewed; a formal Master's programme was launched and new courses were designed. Matís took responsibility for designing the Master's programme.

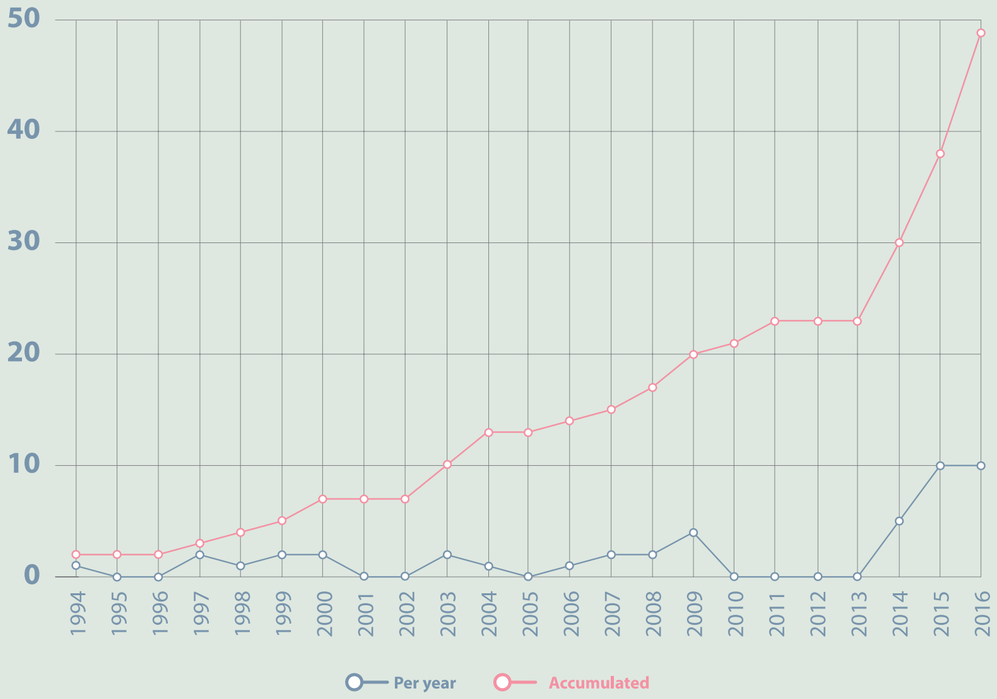
Research, teaching and human resources are shared, with the goal of being at the forefront in food science and biotechnology. Combining available knowledge and skills is also important for innovation and adding value to the food and biotechnology industries. The agreement is the foundation for enhancing academic and practical training in food research and food safety as well as in other areas of teaching and research.

NUMBER OF STUDENTS IN FOOD SCIENCE AT THE UNIVERSITY OF ICELAND





NUMBER OF STUDENTS GRADUATED WITH M.SC. IN FOOD SCIENCE FROM UNIVERSITY OF ICELAND (UI) COLLABORATIVE EFFORT BY MATÍS AND UI FROM 2011



WHERE ARE "OUR" STUDENTS NOW?

EMPLOYMENT LOCATIONS OF STUDENTS COMPLETING A MASTER'S DEGREE IN FOOD SCIENCE IN COLLABORATION WITH MATIS

Knowledge into Value

Matís fosters a knowledge-based environment and constructs a pathway to creating capital goods

Matís puts a great emphasis on collaboration with universities. At any given time, there are several graduate students doing their research at Matís, or in projects related to Matís with companies from all around the world. A large part of Matís' research is connected to Icelandic or foreign university-level educational institutions, involving graduate students. These students come from various places, enjoying the guidance of Matís' scientists and benefitting from the excellent research facilities the company has to offer. Also, Matís enjoys a good relationship with both domestic and foreign students working on research and other scientific work in today's large international community.

GRADUATED MATÍS STUDENTS 2016

Student	Supervisor at Matís	Speciality	Title	Degree	University
Anna Birna Björnsdóttir	Sigurjón Arason	Food Science	Seasonal variation in in cod and saithe liver chemical and physical properties.	M.Sc.	University of Iceland
Árný Ingveldur Brynjarsdóttir	Eva Kuttner	Environment & Natural Resources	Seasonal and in-plant variation in composition and bioactivity of Northern Dock *(Rumex longifolius DC.)* extracts.	M.Sc.	University of Iceland
Ásgeir Jónsson	Sigurjón Arason	Food Science	Optimized Sea Transport of Fresh Fillets and Loins. Quality and Cost.	M.Sc.	University of Iceland
Brynja Einarsdóttir	Björn Viðar Aðalbjörnsson	Food Science	Characterisation of bioactive fucoidan polysaccharides from Icelandic algae.	M.Sc.	University of Iceland
Dagný Björk Aðalsteinsdóttir	Margrét Geirsdóttir	Food Science	Isolation, hydrolysation and bioactive properties of collagen from cod skin.	M.Sc.	University of Iceland
Einar Sigurðsson	Sigurjón Arason, Magnea G. Karlsdóttir	Industrial Engineering	The effect of nematodes in cod processing.	M.Sc.	University of Iceland
Finnur Jónasson	Sigurjón Arason, Magnea G. Karlsdóttir	Industrial Engineering	Processing, logistics and storage of frozen herring.	M.Sc.	University of Iceland
Hildur Inga Sveinsdóttir	Sigurjón Arason, Magnea G. Karlsdóttir, Sæmundur Elíasson	Food Science	Effects of bleeding conditions and storage methods on the quality of Atlantic Cod.	M.Sc.	University of Iceland
Inga Rósa Ingvadóttir	Magnea G. Karlsdóttir, Sigurjón Arason	Food Science	Stability of lightly salted cod fillets (Gadus morhua) during frozen storage. Factors affecting the stability and the product variability.	M.Sc.	University of Iceland
Íris Mýrdal Kristinsdóttir	Birgir Örn Smárason	Mathematics	The natural entrepreneur	M.Sc.	University of Oslo
Lilja Rut Traustadóttir	Helga Gunnlaugsdóttir	Nutrition	Exposure to Selenium, Arsenic, dadmium and Mercury from seafood in the Icelandic population based on Total Diet Studies methodology.	M.Sc.	University of Iceland
Lilja Rún Bjarnadóttir	Guðjón Þorkelsson	Food Science & Nutrition	Shelf-life of fresh foal meat. Effect of modified atmosphere packaging.	M.Sc.	University of Iceland
Margrét Eva Ásgeirsdóttir	Eva Kuttner	Food Science	Anti-diabetic properties of Fucus vesiculosus and pine bark extracts using the adipocyte cell model 3T3-L1.	M.Sc.	University of Iceland
Páll Arnar Hauksson	Kolbrún Sveinsdóttir, Guðjón Þorkelsson	Food Science	Development of convenience meals enriched with omega-3 fatty acids and seaweed.	M.Sc.	University of Iceland

GRADUATED MATÍS STUDENTS 2016

Student	Supervisor at Matís	Speciality	Title	Degree	University
Paulina E. Wasik	Sigurjón Arason, Magnea G. Karlsdóttir	Food Science	Quality optimisation of frozen mackerel products.	Ph.D.	University of Iceland
Sigríður Sigurðardóttir	Sigurjón Arason	Industrial Engineering	Modelling and Simulation for Fisheries Management	Ph.D.	University of Iceland
Sindri Rafn Sindrason	Sigurjón Arason	Industrial Engineering	Increased efficiency in cooling systems for mackerel.	M.Sc.	University of Iceland
Stefán Þór Eysteinsson	Sigurjón Arason, Guðmundur Stefánsson	Food Science	Marinated and dried blue whiting *(Mcromesistius poutassou).*	M.Sc.	University of Iceland

11 GRADUATED MATÍS STUDENTS 2015

16 GRADUATED MATÍS STUDENTS 2014

9 GRADUATED MATÍS STUDENTS 2013

12 GRADUATED MATÍS STUDENTS 2012

6 GRADUATED MATÍS STUDENTS 2011

13 GRADUATED MATÍS STUDENTS 2010

10 GRADUATED MATÍS STUDENTS 2009

8 GRADUATED MATÍS STUDENTS 2008

GRADUATE DEVELOPMENT PROGRAM – THE OPPORTUNITY IS NOW FOR AN INTERNSHIP

At any given time, several interns are gaining practical experience at Matís. Our Graduate Development Program aims to give young researchers the opportunity to expand their skill set, in collaboration with some of Iceland's top scientists. Not only have we employed interns from all over the world, but our international cooperation has reached new heights. We offer hands-on experience in the fields of food science, biotechnology, microbiology, marine biology and many more. Additionally, there are a number of students who have stayed at Matís for longer periods to work on their Ph.D., M.Sc. or to further their research.

Madeleine Jönsson, Graduate Development Program Intern:
"The internship provided me with good knowledge and experience for my future career. Performing an internship has been good for my CV, when applying for jobs in Sweden as well as abroad. The various methods I performed in my project have given me a more hands-on-experience through lab work. Also, through this program I was able to meet other individuals in the same situation, which was very helpful when living away from home. Also, the accommodation, bus card and breakfast/lunch at the company provided by Matís facilitated the stay in Iceland."

"The internship was a good experience when applying for my current short-time job as quality consultant. At other interviews that I have recently attended, the recruiters have shown interest in the practical knowledge I gained from microbiology work and from the analytical methods I was introduced to at Matís."

Hanna Van Gool, Graduate Development Program Intern:
Hanna has been working on anti-microbial activity of seaweed extracts. She has worked in the Matís biotech lab and now works in the microbiology lab. She has conducted diverse research regarding compounds from seaweed and corresponding analyses. She has much to say about the program:

"I am really enjoying my internship so far! I think this internship might benefit me for the future because I get to experience what it is like to work somewhere else. Here, I get the chance to put the skills I learned at my university in the Netherlands into practice in a different environment. I work for example with other materials and equipment than I am accustomed to working with at Wageningen. Also, I am always focusing on food safety for my study. Here, they also examine other substances like pharmaceuticals, and I think it is interesting to see how they deal with the microbiological examination of those other substances. I am given the opportunity to work independently, but if I need help there is someone to help me here."

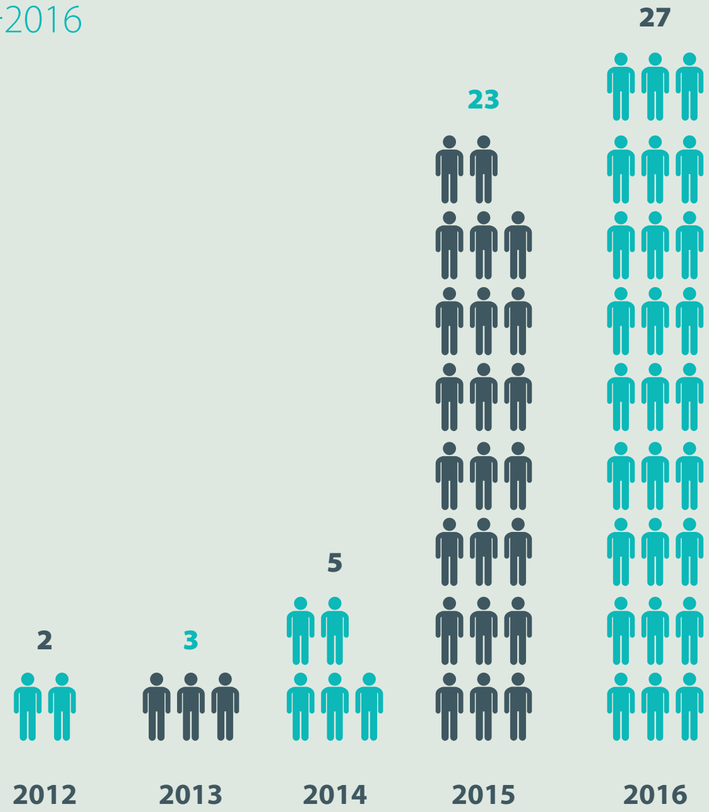
"This is my first time in Iceland, and I think it is an amazing country! During the weekends, I often travel with the other interns and we have already visited a lot of places like the Westfjords, Mývatn, Snæfellsnes and Jökulsárlón. The Northern lights and the landscapes are beautiful, and the people are really friendly."

Björn, Matís Consultant and University of Iceland Lecturer:
"The program has truly reached new heights over the years. Project managers are sitting in on their students´ interviews for internships as there is such excitement and interest in the program now. With an increasing number of interns, we will produce more data, which can then serve to answer industry questions. Greater collaborations amongst institutions, like Matís, and international universities will help progress food science and biotechnology. After completing the program, those that are starting their career are more likely to consider Matís as a collaborator in the future."

"It is truly rewarding to see a diverse, global group of interns experience the lab for the first time or learning new methods, extending their knowledge from the classroom into a "hands-on" environment and giving them experience that they would not have had the opportunity to obtain otherwise. I often hear that Matís has a very different, positive atmosphere from universities they come from or from industry, it is a unique atmosphere – a bridge between academia and industry. We can provide influence into thinking and how academic knowledge really translates into research and industry progress."

Interns at Matís

NUMBER OF INTERNS AT MATÍS 2012-2016



TOTAL NUMBER = 60

ASSOCIATION OF ICELANDIC FOOD SCIENTISTS AND NUTRITIONISTS AWARD

In 2016, Matís and the Food Science and Human Nutrition Department, University of Iceland, were presented the annual award of the Association of Icelandic Food Scientists and Nutritionists, Fjöregg. Matís received first place for the effective collaboration on research and teaching in food. "This is a very unique and exciting award as it is a collarboration between academia and industry and by incorporating students in projects, we train them to be good employees in industry and companies. This is a true success story of reviving the ties between Matís and the University." Guðjón Þorkelsson.

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 student projects. The need for people with this education is obvious, since all graduates have been working in industry in research and for food safety agencies. Students have also been trained in innovation, product development and writing business plans with professional assistance and by using facilities at Matís. This prepares them for industry and entrepreneurship. Most of them have participated in contests to develop new eco-friendly food products, and the winners have participated in the new product development contest, Ecotrophelia Europe. These are excellent examples of how Matís connects academia and industry. "Collaboration with other countries and between different branches of science and art is the key to success. It has resulted in Matís now being among the leading public enterprises in food research in Europe," says Guðjón Þorkelsson.

The true testimony between the University of Iceland and Matís is best said by the students themselves, incuding Telma Kristinsdóttir, BS in Nutrition and MS in Food Science. "The program in food theory was challenging and varied and gave a realistic picture of projects in industry; preparing financial statements, developing new products from scratch to final product form in cooperation with food manufacturers, and installation of a Quality Manual. Good training in laboratory practices and professional and scientific methods are among what the program offers. The program helped me professionally and mentally prepare for the jobs of the official control of foodstuffs and in the food industry… and studies in food are a good springboard for potential quality manager, production manager, and creative entrepreneur positions."

THE NORBIO CONFERENCE – OCTOBER 2016

NordBio is a three-year program under the Icelandic Presidency of the Nordic Council of Ministers, initiated in 2014, and is now about to finish. On that occasion, a conference was held last week in Harpa in Reykjavík, called "Minding the future".

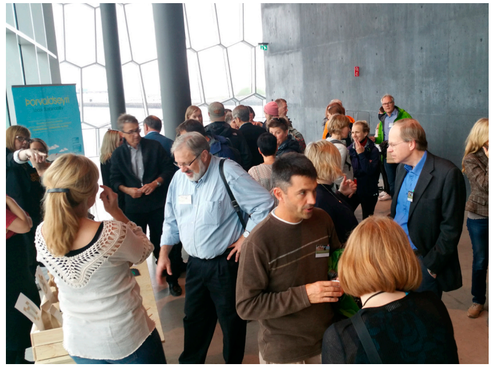
Very exciting lectures took place at the conference and are all available on Youtube at www.nordbio.org. Various projects under the Nordbio programs were on display during the conference: Biophilia, Ermond, Innovation in the Nordic Bioeconomy, Marina and Woodbio. Local food producers from Greenland, the Faroe Islands and Iceland offered tastes of their food production, initiated by the three-year program.

The Icelandic Presidency of the Nordic Council of Ministers 2014 aimed to utilize the enormous potential in building on the bioeconomy in the Nordic Region. NordBio is a program uniting a broad spectrum of sectors in this effort.

It is safe to say that the NordBio conference was a great success and quite large number of people attended the conference and had a taste of food from different production areas in the Nordic region.

Presentations at the NordBio Conference

Iceland's presidency in the Nordic Council of Ministers - The Nordbio Video



CAA 2016 Conference

Iceland Erupts

CIRCUMPOLAR CONFERENCE – NOVEMBER 2016

The 9th Circumpolar Agricultural Conference (CAC) was held in Reykjavík, Iceland October 6-8th, 2016. The overall theme of the conference was the role of agriculture in the circumpolar bioeconomy.

Bioeconomy is the part of the economy that is based on biological resources and it is becoming more and more important in the international policy-making and research programs. People look to the strengthening of the bioeconomy as means to deal with many grand challenges that humanity is facing: food security for the increasing world's population, climate change, the shift from an economy that is based on fossil fuels to an economy that is based on renewable resources, creating jobs and increasing profitability.

Strengthening of agriculture as part of a stronger bioeconomy can create significant opportunities for the arctic and subarctic regions. For the last century, average temperatures in the Arctic have increased at a double rate compared to the world average. It is clear that the Arctic region is facing dynamic times ahead, filled with both challenges and opportunities. Going forward, the focus must be on limiting risk and nurturing of the opportunities with research and development in sustainable practices. One of the key elements in that prosperity is research and advancements in the bioeconomy, with eco-innovation and green growth at its core.

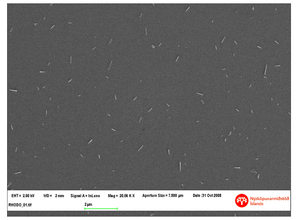
The conference was international with participation from the Nordic countries, Canada, Alaska and Russia. The conference highlighted the role of agriculture in the circumpolar bioeconomy and the importance of knowledge transfer to ensure competitiveness and sustainable value creation in the agricultural and food sectors. Progress, trends and challenges in agriculture in the region with respect to innovation and the development of the bioeconomy were important topics for the conference. A special focus was placed on success stories which can be used to stimulate progress in different arctic regions.

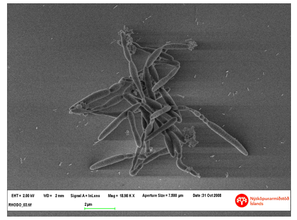
Attendees also participated in a full day tour, a cultural experience to the agricultural regions of South Iceland. Key visits included 1) Efstidalur family farm, specializing in dairy products with a restaurant onsite, the farm Fridheimar with tomato greenhouses, restaurant, and Icelandic horses 3) and the Thorvaldseyri farm, very well known from the Eyjafjallajökull eruption and agriculture exibitions.

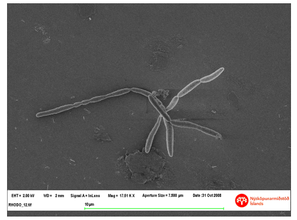
STRAIN COLLECTING AND BIO-BANKING WITH ISCaR

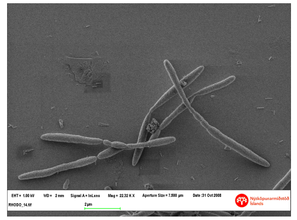
Matís has established a collection of more than 6000 strains and biological samples named ISCaR (Icelandic strain collection and records). The collection hosts a wide diversity of microorganisms from various environmental and food ecosystems in Iceland, including psychrophilic, mesophilic and thermophilic microorganisms presenting great interest for biotechnical application and for fundamental research. These strains originated from past companies including the Matís acquired Prokaria (extremophiles), RF-Icelandic Fisheries Laboratory (fish microbes) and UST-Environmental and Food Agency Laboratory (food pathogens). Matís conserves the original lactic ferments for the famous 'Skyr' produced by the MS Iceland Dairies.

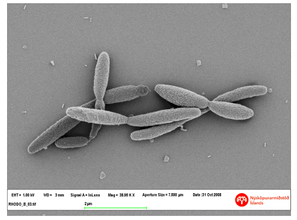
By the end of this year, Matís will open its bio-banking resources to a wider public by developing a web-interface for ISCaR in collaboration with the company SCROL located in France. The website is bound to a highly detailed database allowing scientists to store information regarding the origin of strains and samples as well as the conditions of their collection and storage. It also formally creates a link between biological and genetic resources and overall enables for more productivity and excellence in scientific research.











FISH SUPER CHILLING PROJECT RECEIVES THE "SVIFALDAN" AWARD

The Fish Super Chilling Project is a collaborative effort of 3X Technology, Iceprotein, FISK Seafood, Skaginn, Grieg Seafood in Norway, Hätälä in Finland, Norway Seafood in Denmark and Matís with support from Nordic Innovation and The Icelandic Centre for Research (Rannís). The project's underlying idea was selected as an Outstanding Concept of the Seafood Conference 2016, winning the Svifaldan Prize.

"Svifaldan" is the prize for an Outstanding Concept of the Seafood Conference 2016. This was the seventh time the Svifaldan was awarded. Its goal is to stimulate discussion and motivate new progressive original thinking. TM Insurance awards Svifaldan along with prize money and recognition of those contributing to the three best concepts. Albert Högnason at 3X accepted the prize at the conference. Acceptance of the Svifaldan Prize spotlights the collaborative project and the increasing knowledge about fish chilling.

There has been considerable research on the effect of super-chilling on processing and product quality in the fishing industry and fish farming production. Super-chilling of fish means cooling fish muscle immediately after fish are caught/slaughtered. This freezes 20% of their water content. Ground fish require cooling to -0.7°C. However, salmon is fatter and therefore requires cooling to -1.5°C. as its freezing point is lower. Both cases involve phase transitions at these temperatures. Considerable energy is required to bring the temperature below these points. Extensive research has been done on the super-chilling of fish. Findings suggest that there will be no damage to cells from the formation of ice crystals, provided that chilling is within the defined temperation ranges. The shipping of super-chilled fresh fish (salmon/ground fish) entails numerous opportunities since eliminating ice from the transport chain saves a great deal of cost, particularly with air freight. During transport, about 10% of the weight of traditional products is ice. There are, therefore, both financial and environmental gains with the procedure. Reducing the carbon footprint of the production and transport of fish products is an important future market tool. However, the most important difference is the improved quality fish fillets with the super chilling method, suggesting that this method can increase the quality of fish products.

The ongoing collaboration of 3X Technology, Skaginn, Matís, Iceprotein and FISK Seafood reached the front page of the Icelandic daily newspaper Morgunblaðið in 2014 and superchilling without ice is now an operationation reality aboard trawlers. The machine manufacturess 3X Technology in Ísafjörður and Skaginn in Akranes, in cooperation with the research company Matís and Iceprotein and fish processor, FISK Seafood in Sauðárkrókur, have developed a process to super chill fish on-board fishing vessels without using ice or slush ice.

With this new technology, the seafood is super chilled down to -1°C on the processing deck and stored without ice in the fishing hold at the same temperature. The chilling process is fully computerized using integration of heat exchange, glycol and salt. The seafood is kept at sub 0°C temperatures throughout storage, allowing fishing vessels to extend their trips.

The objective of the design and the development of the processing line is to maximize the quality of the raw material and extend the self-life when seafood is handed over to the primary production ashore. This technology was implemented on the first fresh fish trawler for FISK Seafood and Captain Björn Jónasson of the Málmay vessel stated:

"This new revolutionary processing deck has increased the capacity and eliminated all heavy work for the crew. The Sub-Chilling system exceeds all my expectations."

“MICROLITTER”- MICROPLASTIC EFFECTS ON OUR MARINE FOOD CHAIN

Microlitter Report

International concern over contamination of the marine environment by microplastic has grown rapidly over the past decade, demonstrated in reports from the UN, EU, USA, and leading academic societies. Micro-scale plastic particles (< 1mm) pose a particular threat as a result of a) their physical and chemical properties, which allows them to concentrate chemical pollutants from the surrounding water, and b) the fact that they are consumed by many marine organisms. In combination, these two factors may allow microplastics to act as vectors, transporting pollutants into organisms. These pollutants can accumulate in tissues and enter marine food chains.

Available evidence points to microplastics having a ubiquitous global presence and entering the marine food web at multiple points. Much still remains unknown about microplastic distribution, chemical properties and ecological impacts; particularly in sub-Arctic and Icelandic environments. To address microplastic concerns, Matís participated in research between 2014 and 2015. The research was funded by the Marine Group (HAV) of the Nordic Council of Ministers. The results were published in a report written by Hrönn Jörundsdóttir, Matís Chief Infrastructure Officer, in collaboration with the Swedish Environmental Research Institute, the Finish Environment Institute, and the Aalto University in Finland.

The report, “Microlitter, in sewage treatment systems- A Nordic perspective on waste water treatment plants as pathways for microscopic anthropogenic particles to marine systems,” covered developments in testing protocols and how to best monitor our environment for microplastic. The report has created a great deal of media and regulatory awareness and Hrönn Jörundsdóttir has presented the results to different city councils in the capital area as well as at several scientific and expert conferences and workshops.

“We looked at sewage treatment plants and what we saw, was indeed not surprising. The only purification is performed by coarse filtration at these sites and the microplastic particles are very small, micron size, and we see that the stations are unable to retain these particles. They go through the station and into the environment,“ says Hrönn.

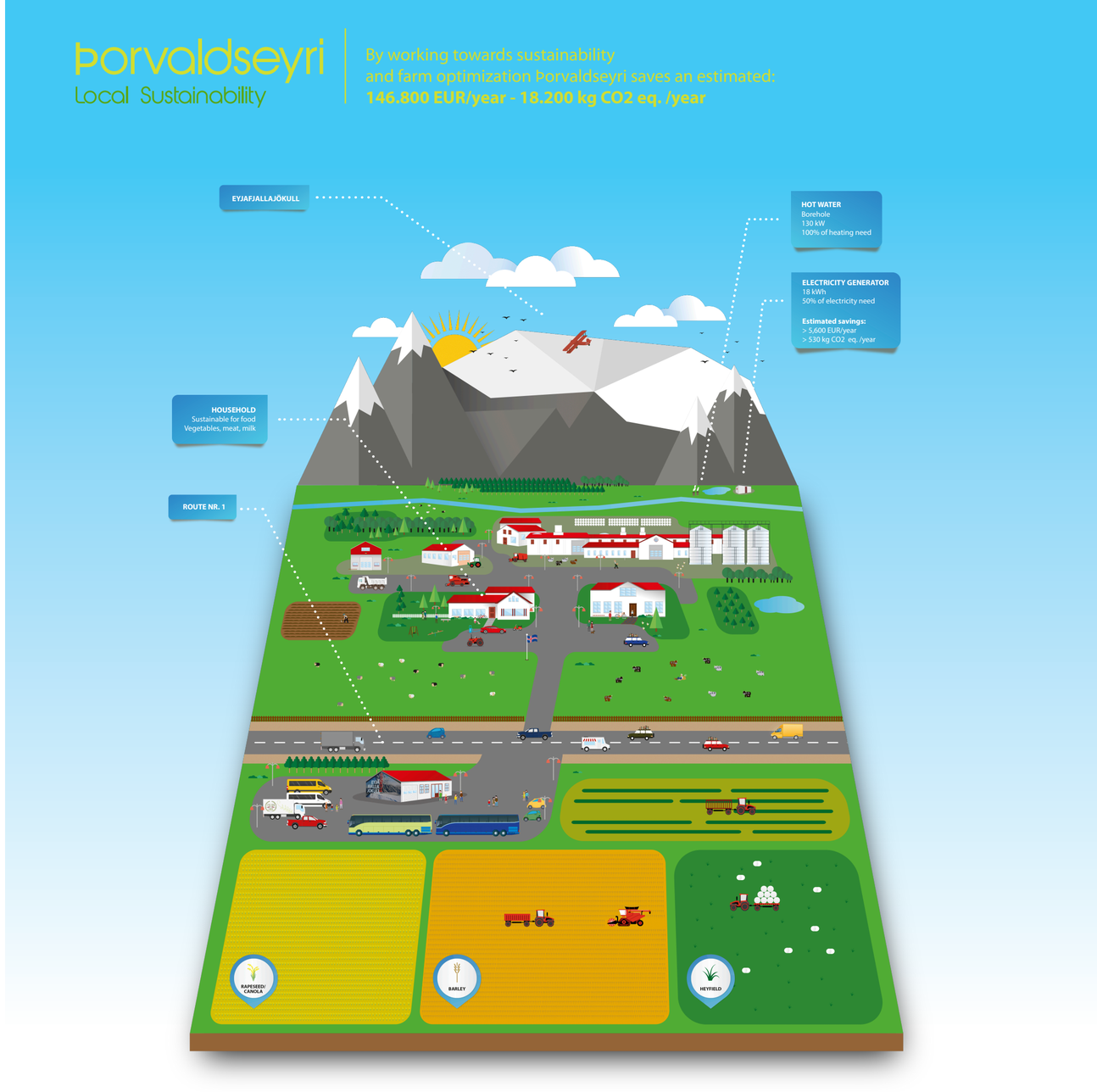
CASE STUDIES – SHARING THE KNOWLEDGE

THE SOUTHERN ICELAND CASE STUDY 2016: CHALLENGES AND OPPORTUNITIES IN SUSTAINABILITY

Food production utilizes the limited resources of the earth and delivers significant amounts of greenhouse gases into the atmosphere. At Matís, various research projects related to this issue are underway. One of these projects is Northern Cereals – New Markets for a Changing Environment, funded by NPA (Northern Periphery and Arctic Programme). The goal of the project is to increase the value of grain products, thereby contributing to increased income of grain farmers and companies. Part of the project relates to the farm Þorvaldseyri, which is located in the south and is one of the most productive cereal farms in Iceland. Þorvaldseyri functions sustainably with a majority of electricity coming from a small power plant on premise, natural geothermal water being pumped from the ground, and feed as well as fertilizer is derived from local grass and rest raw material from cereal. Rapeseed oil is sold to consumers but can also be used as fuel for machinery on the farm. The household can be sustainable. Farm products serve as food and vegetables and fruit is grown for personal consumption. The project described this local sustainability and its implications in environmental and social terms. The Life Cycle Assessment (LCA) methodology was used for calculations based on data from the farm. According to the calculations, the farm could save about 19 million ISK and 18 tons of greenhouse gas emissions per year. An infographic with this information and how the farm sustainably operates was created by Matís and is now displayed in Ólafur Eggertsson´s farm visitor center.

Ólafur discussed the case study, "I believe that this project, and the idea behind the infographic, came exactly at the right time for me, when environmental and sustainability matters are as prominent as they are, they are being discussed so much. I have been busy presenting the infographic where it sits in the visitor center, a lot of people come here and are very curious about this. It is great to be able to expand the discussion about my farm and the farm practices. The collaboration with Matís has been great and helped us tremendously, especially in proving that our products are good, for the customers. And technical projects as well, they have helped us in finding the right way to dry cereals and saved us energy, for example."

Ólafur further stated, "It is important to have access to experts and specialists, you feel that you are not alone thinking about the issues and improvements. I think both Matís as a research entity and Þorvaldseyri benefits from the collaboration. We have to do more of showing something like this. I want to continue this path, do more projects with Matís, and go deeper. I really think that something like this could be done more, even in a broader sense, in agriculture in Iceland in general and other industries."



Anne-Tamara Lorre, Ph.D. Ambassador of Canada to Iceland and Sæmundur Finnbogason, Canada to Iceland Trade Commissioner, learning about the North-Atlantic blue bioeconomy.

Saudarkrokur Biotechnology Centre

Verið Science Park (in Icelandic)

Green Growth in Nordic Regions. Nordic Centre for Spatial Development (NORDREGIO)

Matís' VR Video Channel

Matís' Case Studies

THE NORTHWESTERN CASE STUDY 2016: SKAGAFJÖRÐUR'S TRANSITION TO A KNOWLEDGE-BASED BIOECONOMY

The Skagafjörður case perfectly illustrates the way in which a shared long-term commitment by the private and public sectors can enable sustainable and efficient approaches to a region's technological advancement. The decision to establish Verið Science Park in response to the negative impact anticipated from the reduction in fisheries activities has been a major success. It has led to substantial collaboration across different bio-based industries, inspired new and innovative companies and bio-based products, and created new jobs requiring higher education. The result is a diverse labour market profile in Skagafjörður, a region once dominated by agriculture and fisheries. The education level of the workforce in Skagafjörður has also increased and is notably higher than the education level in the surrounding area (northwest Iceland), which has the highest proportion of the population without a secondary education in the country.

The Verið Science Park began as a limited company, jointly owned by FISK Seafood, the Municipality of Skagafjörður, and Skagafjörður's utility companies. Verið Science Park is home to R&D in biology and biotechnology, including the Faculty of Aquaculture and Fish Biology at Hólar University College, the Matís biotechnology laboratory, and the IceProtein pilot plant. It is partially funded by the Icelandic Government, with the majority of these funds invested in infrastructure intended to increase the competitiveness of the region's bioeconomy through R&D activities. The now advanced capabilities of the Verið Science Park have resulted in a high level of competitiveness for R&D funding at the Icelandic, Nordic, and European levels. Furthermore, the park's unique capabilities have attracted contract research funding from international companies, resulting in significant international contacts, innovations, and collaborations. Dr. Hólmfríður Sveinsdóttir, director of IceProtein and Protis emphasized, "Innovation leads to better quality harvesting and processing, an improved image, more varied market opportunities and increased value."

To further highlight, the Skagafjördur test case and transition to a knowledge-based economy, Virtual Reality (VR) videos were created by Matís. "The videos, particularly with VR glasses, are a successful tool to not only highlight the case in general, but show people what the bioeconomy is about, getting them virtually "into" the bioeconomy. Dr. Hordur Kristinsson, Matís, CSO, 2016 Chair of the Nordic Bioeconomy Panel, of the European Bioeconomy Panel Expert member, 2013-2015.

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A FEW OF OUR PROJECTS 2016

AstroLakes

Subglacial volcanic lakes in Iceland constitute one of the most pristine ecosystem on Earth and are analogues for similar habitats for life on exoplanets and moons such as Mars and Europa. AstroLakes aims at discovering novel bacterial and archaeal lineages in such lakes by combining metagenomic, culture and single-cell approaches. The outcome of the project will be a holistic multidisciplinary description of the functional structure of this particular ecosystem. This will lead to a better understanding of exoplanets' analogue environments and unravel novel enzymes displaying medical or biotechnological interest for academia and industry in Europe.

Subglacial volcanic lakes have long remained unexplored. Advances in drilling technology through thick ice shelves in the beginning of the 21st century enabled sampling of such lakes and led to the discovery of unique communities of microorganisms adapted to extreme conditions. AstroLakes will sequence and analyse metagenomes from one such subglacial lake, Skaftárkatlar, sampled in 2007, 2014 and 2015. The results will support the development of an ecosystem model by estimating the functional contribution of the communities at different depths and locations in the lake.

New isolates and genomes will be obtained through two complementary approaches, cultivation and single-cell sequencing. The cultivation approach will be achieved by designing culture and isolation media adapted to extremophiles with the information acquired from metagenomes. The single-cell approach involves the development of cytometry cell sorting and single-cell sequencing. This will expand the sequencing expertise at the host organisation, Matís. Additionally, the project will impact the career development of the experienced researcher who will gain a wide range of scientific and transferable skills that are relevant to establish a long-term independent leading career in the field of science.

Authent-Net

It is acknowledged that historically anti-food fraud capability within Europe has not been consolidated and lacks the coordination and support structures available to those working in food safety. There are various initiatives underway to redress this balance e.g. DG Santé's Food Fraud network, DG Research's FoodIntegrity project, as well as numerous national programmes and industry initiatives.

One pivotal area that still needs to be addressed is bringing together national research funding bodies to facilitate the development of transnational research programmes.

Authent-Net will address this need by mobilising and coordinating relevant research budget holders in order to facilitate the eventual development of a transnational European funding vehicle that will allow Members States (MS) to jointly fund anti-fraud research. Authent-Net comprises a core group of 19 participants from 10 member states, 1 NGO and the US, who are either National research funding bodies; experts in food authenticity, and/or experts in transnational funding mechanisms.

ClimeFish

The world population is growing, and the demand for food is increasing. Forecasts indicate an overall decline in food production due to climate change. Virtually all aquatic fish and shellfish species are cold blooded and physically supported by water, and they are more efficient feed converters and have higher edible yields than most terrestrial animals

The main goal of the project is to promote sustainable production of seafood where the effects of global warming are taken into account in the management of fisheries and aquaculture. The project will use forecasting models to predict the impact of climate change on the distribution and abundance of important stocks including wild and farmed marine and freshwater species. Possible measures to minimize risk or take advantage of new opportunities due to global warming will be investigated with a view to improving the long-term control over the exploitation of fish stocks. ClimeFish will develop exercise plans for seven specially selected case examples that will make prophecies about the impact of climate change into account, as well as the methodology to prepare such plans will be developed and published as a European standard.

DiscardLess

DiscardLess will help provide the knowledge, tools and technologies as well as the involvement of the stakeholders to achieve the gradual elimination of discarding. These will be integrated into Discard Mitigation Strategies (DMS) proposing cost-effective solutions at all stages of the seafood supply chain.

- The first focus is on preventing the unwanted catches from ever being caught.
- The second focus is on making best use of the unavoidable unwanted catch.

DiscardLess will evaluate the impacts of discarding on the marine environment, on the economy, and across the wider society. We will evaluate these impacts before, during and after the implementation of the landing obligation, allowing comparison between intentions and outcomes.

EuroMix

Every day, we are exposed to a mixture of multiple chemicals via food intake, inhalation and dermal contact. The risk to health that may result from this depends on how the effects of different chemicals in the mixture combine, and whether there is any synergism or antagonism between them. The number of different combinations of chemicals in mixtures is infinite and an efficient test strategy for mixtures is lacking. Furthermore, there is a societal need to reduce animal testing, which is the current practice in safety testing of chemicals.

The EuroMix project will deliver a mixture test strategy and test instruments using novel techniques as recently proposed by the Joint Research Centre (JRC) of the European Commission. The tests will result in data needed for refining future risk assessment of mixtures relevant to national food safety authorities, public health institutes, the European Food Safety Authority (EFSA), the European Chemical Agency (ECHA), industry, regulatory bodies and other stakeholders. Ultimately, this will provide information for future risk management decisions on the safety of chemicals in mixtures to be taken by the European Commission and the Codex Alimentarius.

FUNPRO - Food business from Nordic Plant proteins

There is a global need to increase dietary intake of plant protein, from sustainability but also food security and nutritional perspectives. Searching for new protein crops is one option, but more efficient use of currently available raw materials also offers large potential for increasing the number and volume of high quality plant protein food ingredients. Upgrading feed proteins (eg. rapeseed protein from press cake) to high quality food proteins by use of new technologies offers a range of perspectives for adding value to presently grown crops.

Likewise the aspects of organic food ingredients as well as traceability in production chains are important assets for Nordic food industry with increasing focus on diversity and branding both in European and global markets. For food companies, availability of new protein ingredients offers new business opportunities in terms of development of new high-protein food concepts. The general objective of the FUNPRO project is to utilize existing and potential cereal crops and rapeseed of the NORDIC region to introduce new plant protein based ingredients for new sustainable food products that meet consumer demands both with respect to quality and origin.

MacroCascade

A consortium of European companies and research institutions have obtained funding to advance the blue bioeconomy through innovative scalable seaweed cultivation and novel biorefinery development. The project MACRO CASCADE has received a €4,2 million funding from the Bio-Based Industries Joint Undertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under the grant agreement No 720755.

The main objective of the project is to prove the concept of the cascading marine macroalgal biorefinery. This is a production platform that covers the whole technological value chain for processing sustainable cultivated macroalgae biomass – also known as seaweed - to highly processed value added products such as health promoting feed and food supplements (with documented effect on immune system on both animals and humans), prebiotics, antibiotic agents, anionic polymers, and chemicals for paint, cosmetic and detergent formulations.

Sustainable, large-scale cultivation of seaweed is under-exploited in Europe. Directed efforts in utilising the same biomass for multiple value added streams can lead to products within food, feed, nutraceuticals and pharmaceuticals. The waste streams can be utilised as fertilizer and biofuel products.

MacroFuels

MacroFuels aims to produce advanced biofuels from seaweed or macro-algae. The targeted biofuels are ethanol, butanol, furanics and biogas. The project will achieve a breakthrough in biofuel production from macroalgae by:

- Increasing biomass supply by developing a rotating crop scheme for cultivation of seaweed, using native, highly productive brown, red and green seaweeds, in combination with the use of advanced textile substrates resulting in a year round biomass yield
- Improving the pre-treatment and storage of seaweed and to yield fermentable and convertible sugars at economically relevant concentrations (10-30%)
- Increasing bio-ethanol and bio-butanol production to economically viable concentrations by developing novel fermenting organisms which metabolize all sugars at 90% efficiency
- Increasing biogas yield to convert 90% of the available carbon in residues by adapting the organisms to seaweed
- Developing thermochemical conversion of sugars to fuels from the mg. scale to the kg. scale
- Performing an integral techno-economic, sustainability and risk assessment of the entire seaweed to biofuel chain

MacroFuels will develop technology for the production of fuels which are suitable as liquid fuels or precursor thereof for the heavy transport sector as well as potentially for the aviation sector.

MacroFuels will furthermore expand the biomass available for the production of advanced biofuels. Seaweed does not need fresh water, arable land or fertilizers to grow, which provides environmental benefits, and in addition has a high carbon dioxide reduction potential as well as reduces the demand for natural resources on land. The technology offers many novel opportunities for employment along the entire value chain.

Mar3Bio

The marine biomasses to be used in Mar3Bio are brown algae and crustacean by-products. These abundant but underexploited renewable biomasses have great potential for production of high value biomolecules. The current bottlenecks for a bio-refinery focusing on these raw materials are low yields, high energy consumption and incomplete spectrum of recovered biomolecules. Mar3Bio will tackle this by a multidisciplinary and inter-sectorial R&D approach, and contribute to the development of efficient and sustainable bio-refinery processes for exploitation of the selected biomasses. The main objective is to advance technology beyond state-of-the-art to increase the yield and quality of the products arising from early process streams by optimizing the isolation and fractionation steps performed on the raw materials, and modify selected fractionated biomolecules to high value products.

SAF21

The SAF21 project will focus on EU fisheries, a complex system, to develop effective fisheries management strategies. The research and development will be undertaken by a group of social scientists of the future, managed by the SAF21 consortium, a mix of academic and commercial organisations.

What is unique about the SAF21 project is the way the research and training programme is structured. We offer a practical, collaborative approach to learning, combining research with developing business management skills through placements and training. Through this we aim to improve the commercialisation of R&D results, increase the employability of the researchers, expand the impact of such projects through education, outreach and communication to wider communities as well as enabling more effective fisheries management.

SalGen

SalGen-Evaluating genetic introgression of escapees to wild salmon populations in Iceland. The goal and the motivation of this study is to identify and apply the most recent advances in genetic techniques to document and quantify the introgression of farmed salmon escapees to wild salmon populations in Iceland. Farm escapees can have significant direct and indirect negative impacts on wild populations. Interbreeding can directly impact wild populations by reducing fitness; indirect effects can occur through competition, disease and parasite interactions. The ability to identify farm fish has significant potential to help understand the extent of fish escapes and their impacts on wild populations.

Production of hydrolysed collagen from fishery by-products

To facilitate responsible and sustainable management of marine resources, a market-driven product has been created, which will help to valorise fish skin, an undervalued by-product of the fishing industry. The project will reduce discards using a methodology that enables the refinement of other value-added components from the biomass. Collagen hydrolysate, currently mainly sourced from pig- and calfskin, is becoming increasingly important to the expanding nutraceutical market because of its organoleptic profile, appealing functional properties and strong links to positive health effects. Collagen hydrolysate with very similar characteristics can also be derived from fish skin, which serves as an excellent alternative since it is not connected to diseases or religious restrictions. In the project, new enzymes will be developed that will function at milder conditions than are currently feasible using available commercial enzymes, allowing for the utilization of the spent materials and preserving other bioactive ingredients for later possible mining. Modular production facilities will be built, thereby enabling similar refinements of other by-products. Fish skin will be characterized and storage and handling procedures established for optimal utilization.

SilhouetteOfSeaweed

The project will contribute to consumer's safety by overcoming barriers in estimating toxicity of arsenic species in seaweed. The ocean covers 71% of the planet and for future sustainability the need for looking at using the ocean for food, e.g. seaweed, is increasing. 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). There is a lack of data on AsLps in seaweed products for human consumption. Safety of seaweed must be addressed and more studies and information on AsLps are urgently needed. Currently, only few research groups worldwide work on AsLps, partly due to difficulties associated with the measurements of these compounds.

SilhouetteOfSeaweed will expand this expertise in Europe by establishing necessary facilities at the host Matís to accommodate AsLp measurements. Matís has the capacity to reach this goal together with the experienced researcher and in co-operation with a European partner organisation with expertise in AsLp measurements. SilhouetteOfSeaweed will have two main scientific impacts. Firstly, it will produce AsLp seaweed profiles in 4 different species of brown algae in 3 locations during 3 seasons in Iceland. This information will contribute to the necessary risk assessment needed for algae used for human consumption. Secondly, statistical evaluation and comparison of environmental conditions will make it possible to identify whether the seaweed could be harvested at specific conditions where the amount of toxic arsenic is at its lowest. These data are essential for SMEs entering the European market with their seaweed products. Moreover the project will impact the career development of the experienced researcher who will gain a wide range of scientific and transferable skills that are relevant to establish a long-term independent leading career in the field of science.

TARI - Saccharina latissima

The main objective of the proposed project is to investigate the potential of the brown algal species Saccharina latissima as a food source for human consumption when cultivated in the Faroe Islands, and to develop a finished seaweed product that is produced in compliance with the food safety authorities. Questions to be asked: 1) what is the food quality and food potential of S. latissimi cultivated in the Faroe Islands, with regard to both food safety and culinary uses? 2) How will seasonal changes, nutrient availability and current/wave exposure affect growth and the chemical, microbiological, nutritional and bioactive quality in the cultivated S. latissima? 3) how will different drying processes affect the food quality of the raw material? And 4) how will different culinary processes affect the raw material?

ThermoFactories

Brown algae biomass is a promising and challenging resource for industrial bioconversions, but there is a need to develop efficient cell factories to convert the constituent carbohydrates into high-value added products. Four metabolically different environmental bacteria, inherently suitable to harsh process conditions, will be engineered for production of a number of industrially important platform and specialty chemicals, including 1,2-propanediol, cadaverine, propanol and lycopene. The project will implement and integrate systems biology and metabolic engineering, including rounds of model-driven metabolic optimization. Feedstock development and process engineering are important parts, to optimize fermentability of the algal hydrolysates, and ensure integration with downstream processing and product recovery. At the end of the project, use of all major carbohydrate fractions from brown algae through integrated processing will be demonstrated at small pilot scale.

Virus-X

Biological sequence diversity in nowhere as apparent as in the vast sequence space of viral genomes. The Virus-X project will specifically explore the outer realms of this diversity by targeting the virosphere of selected microbial ecosystems and investigate the encoded functional variety of viral gene products. The project is driven by the expected large innovation value and unique properties of viral proteins, previously demonstrated by the many virally-derived DNA and RNA processing enzymes used in biotechnology. Concomitantly, the project will advance our understanding of important aspects of ecology in terms of viral diversity, ecosystem dynamics and virus-host interplay. Last but not least, due to the inherent challenges in gene annotation, functional assignments and other virus-specific technical obstacles of viral metagenomics, the Virus-X project specifically addresses these challenges using innovative measures in all parts of the discovery and analysis pipeline, from sampling difficult extreme biotopes, through sequencing and innovative bioinformatics to efficient production of enzymes for molecular biotechnology. Virus-X will advance the metagenomic tool-box significantly and our capabilities for future exploitation of viral biological diversity, the largest unexplored genetic reservoir on Earth.

COLLABORATING – MEETINGS AND CONFERENCES HIGHLIGHTS OF 2016

Production of advanced biofuels from macro-algae

The Horizon 2020 funded project MacroFuels was officially launched at a kick-off meeting in January. Matís participates in the project, which aims to produce advanced biofuels from macro-algae. Target biofuels are ethanol, butanol, furanics and biogas. The project aims at achieving breakthroughs in biofuel production from macro-algae. The major tasks of Matís in the MacroFuels project will be in the development of enzymes for degradation of complex, recalcitrant marine polysaccharides, and strain improvement of fermentative biorefinery organisms for production of ethanol from alginate derived mono-uronates.

Too Big to Ignore: UNU-FTP announces guest lecturer

UNU-FTP's distinguished guest lecturer Dr. Ratana Chuenpagdee is Canada Research Chair on Natural Resource Sustainability and Community Development and Professor at Department of Geography at Memorial University in Canada. Her research emphasizes interdisciplinary approaches to coastal fisheries and ocean governance, focusing particularly on small-scale fisheries, protected marine areas, community-based management, and food security. Dr. Chuenpagdee gave the following lectures that were open to the public: Are small-scale fisheries really too big to ignore?; Fisheries governance as a wicked problem; The dos and don'ts in protected marine areas; Assessing ecological impacts of fishing gears using the damage schedule approach.

Deception in seafood trade

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 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. Matís leads a Nordic research project "Authenticate" that brings together experts from marine laboratories to determine the best pathways and targets for developing standardised DNA-testing technologies. A part of the project, was a seminar on how genetic engineering may be used to ensure the integrity of trade in fisheries and aquaculture products. Scientists from Matís gave several seminars: Methods to monitor and verify the contents of feed for aquaculture; Methods to detect undesirable microorganisms in seafood; Genetic methods to identify origin and traceability; Demands of markets and exploitation of genetic information with respect to regulation and economic effects.

Seafood Expo and Processing – North America

The Seafood Expo and Processing Expo – North America took place in March. A number of Icelandic companies were present including Martak, Skaginn/3X, Fjarðarlax, HB Grandi, Sæplast, Marel and Matís, just to name a few. Seafood Expo and Processing – North America is the largest of its kind in the Americas and is an important forum for many Icelandic companies to expand and enhance cooperation. Matís´ employees attended meetings, spoke to attendees at the Promote Iceland booth and distributed materials on Matís' capabilities and on the World Seafood Congress which Matís is hosting in September 2017.

Visit from the French ambassador

The French ambassador in Iceland Phillipe O'Quin and his first advisor Gaëlle Hourriez-Bolâtre visited Matís the 8th December 2016. The aim of their visit was to learn more about Matís and about the ongoing French-Icelandic collaborations. Pauline Vannier from Matís and Philippe Oger from Microbiology, Adaptations and Pathogenicity laboratory (Lyon, France) obtained the PHC Jules Verne Grant: ThermEx for two years (2015-2017).

All catch ashore

In conjunction with the Faroes' Presidency in the Nordic Council of Ministers, the Faroese company Syntesa has been assigned to explore the potential of the Nordic countries in utilization of marine catch. As part of this work Syntesa, together with partners in Norway, Greenland and Iceland, organized workshops with stakeholders and reported various data relating to the utilization of marine catch. This year a workshop was held at Matís. It is expected that the results of the workshop will to some degree shape the Nordic Council of Ministers' policy on utilization of marine catches and on support for research and development in this area in the near future. It is clear that Icelanders are in the forefront with respect to full use of the marine catch, but improvements can still be made. It is therefore important that stakeholders discuss how to improve the technology, adapt the regulatory environment/fisheries management, development of new products and markets in order to increase the value of all catch brought ashore.

What is in the fish feed?

Matís is one of 38 participants in a large pan-European project, Food Integrity, designed to detect fraud in food production and to develop preventive measures. Matís arranged a seminar addressing the food fraud from various sides, including how genetic engineering can be used to promote integrity. Jón Árnason, research scientist at Matís, gave a speech and discussed how to monitor and verify the content of feed in aquaculture. Problems with aquaculture feed are fortunately infrequent, but still there is need to be on guard. Consumers do not only look at the quality and price of food but its origin and what it contains. This makes it even more important for aquaculture companies to be able to trace the origins of all ingredients used for farming.

Food is of great value – New foods and marketing

The Forum of Food Country Iceland is a cooperation forum of The Farmers Association of Iceland, University of Iceland, Matís, The Icelandic Travel Industry Association, The Federation of Icelandic Industries and Minstry of Industry and Innovation. The Forum held a conference where the focus was on the future and ways to increase the value of the food resources in Iceland. The keynote speaker was Birthe Linddal, a Danish expert in future studies, and her talk was: Food trends toward 2025 – from food trends to successful innovation. A number of other talks were given on new ways to increase the value of products, strategy of Icelandic companies and case studies of innovative approaches to reach consumers. Gunnar Bragi Sveinsson, Minister of Fisheries and Agriculture, opened the conference, and Hörður G. Kristinsson Matís Chief Science and Innovation Officer, was conference moderator.

Bioeconomy policy for Iceland introduced

The development of the Bioeconomy policy has been carried out in recent months on behalf of The Minister of Fisheries and Agriculture. In the meeting, a draft of the policy was presented followed by discussions and comments in working groups.

Interesting visit from Colombia

A delegation from Colombia visited Iceland and discussed geothermal energy and fisheries in seminars. These seminars were a unique opportunity to establish and strengthen relations with key players engaged in the administration of harnessing geothermal energy and fisheries at the universities in Colombia, where there is considerable interest in increased cooperation with Iceland.

Final conference of NordBio | The Icelandic Presidency of the Nordic Council of Ministers

NordBio, The Nordic Bioeconomy Initiative, was a three-year program under the Icelandic Presidency of the Nordic Council of Ministers, initiated in 2014. Matís plays a great part in the project. In October 2016 the final NordBio Conference was held in Reykjavik "Minding the future: Bioeconomy in a changing Nordic reality." Very interesting lectures were given at the conference, all available on Youtube and www.nordbio.org. Various projects under the Nordbio programs were on display during the conference; Biophilia, Ermond, Innovation in the Nordic Bioeconomy, Marina and Woodbio. Local food producers from Greenland, Faroe Islands and Iceland offered a taste of some of their food which resulted from the three year program.

Food research in a changing world

Food science and food production face new and demanding challenges related to, among others, limited resources and an increase in global population that make growing demands for food quality and safety. What will we be eating in the future and how will we be able to feed the world in the next decades? One thing is certain: research will play a key role in finding answers to these questions. Ingenious use of resources, healthy food and the environment will be the focus in food development in the coming decades. The Society of Food and Nutrition Scientists held their yearly conference in October where these topics were discussed. Hordur G. Kristinsson and Björn Valur Aðalbjörnsson represented Matís at the conference and talked about technical transformations and chemistry of food.

Marine Biotechnology ERA-NET - stakeholder meeting

The Marine Biotechnology ERA-NET held a stakeholders meeting, coinciding with the launch of the recently completed European Marine Biotechnology Research and Innovation Roadmap in Brussels. The stakeholders' meeting was built on the key elements of the Roadmap and featured a wide range of speakers from international industry and the research community. At the meeting, Hörður G. Kristinsson, Chief Science and Innovation Officer at Matís, gave a presentation: The role of research institutes in supporting marine biotechnology enabled enterprises.

SAFE Event 2016: Safe Food for the Future

SAFE Consortium is a European cooperative research forum in the field of food safety. In 2012, Matís took over the management and operation of the SAFE Consortium. Our food is changing: To protect the European consumer, who assumes that all food found anywhere in Europe is safe to eat, the safety of foods of the future and of emerging bio-based food technologies needing immediate and constant attention. The 8th International SAFE Conference was held in October and at a SAFE Event Oddur M. Gunnarsson, Chief IP Officer at Matís, talked about improving and ensuring food safety in the circular economy.

The 9th Circumpolar Agricultural Conference

http://www.caa2016.com/

The 9th Circumpolar Agricultural Conference (CAC) took place in Reykjavik Iceland, 6th to 8th October 2016. The overall theme of the conference was the role of agriculture in the circumpolar bioeconomy. The conference was an international conference with participation from the Nordic countries, Canada, Alaska and Russia. The aim of the conference was to highlight the role of agriculture in the circumpolar bioeconomy and the importance of knowledge transfer to ensure competitiveness and sustainable value creation in the agricultural and food sectors.

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