

Creating value

Project year 2012



32 examples of useful research



Norwegian Institute of Food, Fishery and Aquaculture



 Nofima

A solid and visible partner

Nofima delivers internationally recognized research that is equal with the best in the world. You are now holding 32 good examples of research that is beneficial to industry, which was carried out by our scientists in 2012.

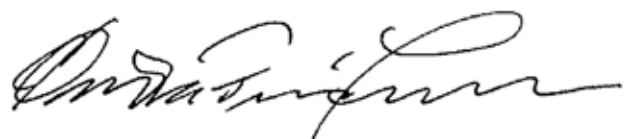
Since its formation one of Nofima's goals has been to be as visible as possible as the industry's research partner. Our culture is that we will deliver what is expected of a solid and strong research institute. We have continual focus on research that benefits industry in line with our vision "Creating value together". This will also continue in the future, but we also want to focus on becoming a more visible partner.

As part of our long-term strategic work, we are closely following the national strategies for research. The new White Paper on research "Long-term perspectives – knowledge provides opportunity", HAV21, the White Paper on seafood, the White Paper on agriculture and food, the action plans from the research funds and the industries' suggestions all form an important part of our strategic decision-making. We are working for research as the basis for value creation in the industries.

Nofima has knowledgeable employees and in all modesty we can mention that 159 of our team of 400 hold doctorate degrees and together with the other research personnel they are focussed on increasing competitiveness. This is achieved through extensive publication, education and dissemination.

Our competent scientists engage in research within the fields of food production, aquaculture and fisheries. Our knowledge in these fields is absolutely world-class and has been developed through many years of industry-oriented research. The results have benefited the industries, but have not always been communicated to the general public. In the years ahead, Nofima will be a clearer, more visible partner.

We hope you find this an enjoyable read and that it provides you with a good insight into how scientists can work to achieve better processes and products that benefit industry and consumers alike. We would like to extend a special thank you to our partners, contractors and funding agencies.

A handwritten signature in black ink, appearing to read "Øyvind Fylling-Jensen".

Øyvind Fylling-Jensen
Managing Director



SENSORY science is the study of the senses and sensory perception, and Nofima has Norway's only professional panel of sensory assessors. The assessors provide an objective description of a product's sensory properties and the results are important in order to create products that the consumers want.

For more information, please contact Research Director Øydis Ueland, tel.: +47 64 97 04 94.

Nofima's mission

Our mission is outstanding research, development and innovation for the food of tomorrow.

This means that

- our research shall be relevant and of high quality and utility value
- we shall be innovative, responsible, committed and inclusive
- we shall think carrying out, competence development and implementation

Our strategy is based on the vision "Creating value together" – and in collaboration with our clients we deliver internationally recognized research and solutions that provide a competitive edge throughout the entire value chain.



32 examples of useful research

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Salmon – a firmer fillet

Thomas Larsson's PhD thesis demonstrates how Norwegian farmed salmon can develop better fillet firmness.



PHOTO: JON-ARE BERG-JACOBSEN © NOFIMA

Thomas Larsson presented his PhD thesis at the Norwegian University of Life Sciences in Ås.

The firmness of salmon fillet is something the consumer perceives as a characteristic of quality and is an important factor for processing by the producer. By making use of new gene technology methods in quality research, Larsson's PhD project points to the fact that a key to a firmer fillet lies in efficient metabolism of nutrients in the cells, and that this is determined by the genes in the fish.

"In order to find the biological difference in salmon with soft and firm fillet, we have used a method called microarray. This is a method used to study if genes are turned on or off in salmon with varying firmness in their musculature," says Larsson.

"Gene analyses tell us what happens in the fish at a molecular level and indicates the cause of undesirable softness in the fillet of farmed salmon. By studying thousands of genes simultaneously, the method functions as an efficient screening tool to point to key factors that influence the firmness."

FAT AS FUEL: Efficient conversion of nutrients occurs in the cellular energy plants, the mitochondria (aerobic metabolism). The gene analyses showed that salmon with firm fillet had more aerobic metabolism, by using fat as fuel, than salmon with softer fillet. Well-functioning mitochondria were a requirement for the formation of firmer salmon fillet.

The knowledge from the gene analyses was used as a basis to design salmon feed that stimulates formation of firmer fillet. A feeding trial involved standard salmon feed or the same feed supplemented. The salmon that received the feed containing extra glutamate had stimulated aerobic metabolism, which resulted in a firmer fillet. Positive health benefits were also observed.

Thomas Larsson presented his PhD thesis at the Norwegian University of Life Sciences in Ås.



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Capsules or enriched food?

A new study shows that you get just as much omega-3 whether you take capsules or eat enriched food. But how much omega-3 do you need?



PHOTO: JON-ARE BERG-JACOBSEN © NOFIMA

“We can see that just as much omega-3 is absorbed into the bloodstream regardless of whether we take in these long-chain marine fatty acids in capsules, enriched fruit juice or enriched fish pâté,” says Senior Research Scientist Bente Kirkhus.

In the study, 159 healthy men and women were randomly divided into four groups. One group ate 34 grams of enriched salmon pâté, another drank 500 ml of enriched fruit juice and a third took three capsules of concentrated fish oil. Over a seven-week period, they all had a daily intake of 1 gram of omega-3, which includes the important long-chain fatty acids EPA and DHA. The fourth group was a control group.

After the seven weeks, the scientists measured the omega-3 level in blood plasma. They found that EPA and DHA levels had increased approximately equally in all three groups. However, in spite of the fact that intake of both was the same, EPA increased by 134 percent on average, but DHA “only” 40 percent.

ALTERNATIVE TO CAPSULES: “Both the group that tested the fruit juice and the group that tested the salmon pâté liked these products, so they can be a good alternative to capsules. Those who don’t like fish or don’t want to take capsules can certainly be advised to drink an omega-3-enriched fruit juice,” says Kirkhus.

The scientists also measured the level of blood cholesterol, inflammatory markers and markers for oxidative stress. These markers can provide indications of the risk of cardiovascular disease. It was found that, for the healthy people taking part in the study, the intake of omega-3 had no effect on the risk markers. The levels were the same as for those in the control group.

The trial was performed at Oslo and Akershus University College of Applied Sciences (HiOA).



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Healthier barley and oats

Lactic acid bacteria increase the content of antioxidants with documented health-promoting and cancer-inhibiting properties.



PHOTO: JON-ARE BERG-JACOBSEN © NOFIMA

Mikkel (18 months) likes to start the day with breakfast cereal.

“The processing method is very significant for the amount of phenolic acids available. The results from fermenting grain with lactic acid bacteria are nothing short of remarkable,” says Research Fellow Anastasia Hole, who presented her PhD thesis at the Norwegian University of Life Sciences (UMB).

Fibre from grain, especially barley and oats, has attracted much attention in recent years. However, the grain has many other healthy components such as antioxidants, particularly phenolic acids.

Hole has analysed various varieties of barley and oats. She has investigated processed and unprocessed grain, as well as grain fermented with lactic acid bacteria. The results are very interesting.

SIGNIFICANT INCREASE: When barley and oats are dehulled, as with oat flakes, the content of both free and bound phenolic acids is reduced. When the dehulled barley and oats are extruded, the free phenolic acid content is considerably increased, by 72 % and 74 % respec-

tively. Only free phenolic acids are absorbed in the small and large intestine. Extruded barley products can be part of muesli or breakfast cereals. Oats contain a different type of starch than barley, wheat and rye. This makes it difficult to produce attractive extruded oats products alone. For this reason, oats are extruded as a mixture with other cereals with the right type of starch so that they can be included in breakfast cereals.

ENORMOUS INCREASE: “In order to achieve an even higher content of free phenolic acids, the solution is to ferment barley and oats with lactic acid bacteria. This gives an increase in free phenolic acids of as much as 2000 percent, which is a higher content than in berries or fruit,» says Hole.

Various drinks and porridges could be developed by fermenting barley and oats with lactic acid bacteria. This could pave the way for new types of products with health-promoting properties in a market that has seen steady growth over recent years.



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Less stress – better quality

Salmon stressed before slaughter has a shorter shelf life due to more bacterial growth and develop undesirable flavours and odours quicker.



PHOTO: KJELL J. MEROK © NOFIMA

Scientists in many different fields at Nofima have come together to work on this study, (from left) Turid Mørkøre, Anlaug Ådland Hansen, Marit Rødbotten and Per Lea.

The negative consequences of stress are greater for raw than for cooked salmon.

“There are a number of issues that influence the fish quality. In this study, we have concentrated on what effect stress just before slaughter has on the quality of the flesh,” says Research Scientist Anlaug Ådland Hansen.

The salmon was divided into three groups subjected to different periods of stress before slaughter. One group was handled as gently as possible before slaughter, and was not crowded in the cage before being taken out of the water. The salmon in the second group were crowded together for 20 minutes before slaughter, while those in the third group were crowded for about 20 hours. Feed, fish size and other factors that can affect quality were constant for all the fish. After slaughtering, the salmon were immediately filleted, cut into portion sizes, packed in a modified atmosphere and stored at 0.3 °C.

NEGATIVE STRESS: Regular quality analyses were made over a 22-day period. It was found that both bacterial

growth and undesirable sensory properties increased most rapidly in the salmon subjected to the longest stress.

“Sensory analysis showed that undesirable odours especially became more obvious as a result of longer stress. We also found that the differences in quality became more marked when the fish was raw,” says Research Scientist Marit Rødbotten.

“Now that we know that stress has greater negative consequences for raw salmon than cooked, more research is needed into what effects different types of aquaculture and fishing have on the end quality of raw fish. This is especially important now that raw fish, as sushi for example, is greatly increasing in popularity,” concludes Ådland Hansen.

The study formed part of the Marinepack 2010 project, which aims to contribute to high competitiveness and profitability and the lowest possible climate and environmental impact for the Norwegian packaging and seafood industries.



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MORE INFO:
 More on the
 publication here



Frozen fish better than fresh

Defrosted fillets in fresh fish counters are now more common at European supermarkets. What does this mean for Norwegian fillet producers?



PHOTO: JON-ARNE BERG-JACOBSEN © NOFIMA

Increased use of defrosted fish fillets in European supermarkets can create major consequences for Norwegian fillet producers, says Scientist Finn-Arne Egeness.

Research shows that increasingly more supermarket chains in Europe prefer to sell previously frozen fish fillets, which are defrosted under controlled conditions, instead of traditional fresh fish.

“It states on the back of the packs that the fish has previously been frozen, but probably not all of the consumers realise this. By using defrosted fish, the supermarket chains secure better access to fish year-round, quicker delivery times and less wastage,” says Egeness.

“At the same time blind tests in Great Britain and France show that consumers don’t notice any difference between fresh and defrosted fish. For the supermarket chains, frozen fish solves many of the challenges they have had with genuine fresh products.”

NEW CHALLENGES: For the Norwegian fishery industry, increased sale of fillet products based on frozen fish

could create major opportunities and challenges. This can cause consequences for the processing industry in Norway as more production of consumer products can be moved overseas.

“The industry needs to have a conscious position in relation to this. However, the Norwegian fishery industry currently lacks knowledge about what the best raw material alternative is, whether it is fresh fish that is filleted before being frozen, fish frozen whole or fish that has been frozen twice,” says Egeness. “If the market prefers fresh fish that is filleted before being frozen, this can open new market opportunities for the producers of frozen fish fillets in Norway. Consequently, it is important that Norwegian companies acquire knowledge about the opportunities and challenges created by this change in the market.”



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Utilize the neighbours

Scientists have studied how to utilize the wild fish around fish farms better.



PHOTO: OLE VEGARD MOSSÉNG

The fish pots utilized near fish farms are extremely large, normally 20 m³.

The studies showed that the amount of wild fish, both saithe and cod, was much higher right beside the sea cages than at a distance of 100 m.

The ban on fishing within 100 m of fish farms was introduced because of the large risk of damage to fish farms and fishing gear. The wild fish attracted to fish farms represent a resource that can and maybe should be utilized. This should primarily benefit the coastal fleet because it is this fleet that would normally have fished in areas where fish farms are located.

The project, a collaboration between Nofima and the Institute of Marine Research, tested several types of fish pots, which will be able to provide a gentle live capture, better raw material quality and economic benefits for the fishermen.

The fish pots that were tested worked relatively well. The size of the fish pots had a clear effect, with the largest fish pots having the best catch. Using fish pots near fish farms offers many advantages. Fish pots

are a relatively safe type of fishing gear with respect to damage to fish farms and other installations. As the fish are captured alive, it creates opportunities for controlled killing, bleeding and handling of the catch in an optimal manner, which provides raw material with whiter flesh and less variation in quality.

GOOD QUALITY: The quality of the fish caught under the fish farm was studied over the course of a year. The scientists studied various quality aspects in relation to a fillet index standard that evaluated quality and shelf life of the fish muscle, as well as sensory analyses of smell and taste. In general the fish was of good quality as a result of the gentle capture and consequently there were no limitations on processing or sale. There is little, if any, effect on the fish from the aquaculture activity and the fish may, therefore, be sold live or as raw material for any type of processing.



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The fish feed revolution

The proportion of fish protein in salmon feed has dropped from 42 % to 17 % from 1990 to 2010. Plant protein has risen by an equivalent amount.



PHOTO: JON-ARE BERG-JACOBSEN © NOFIMA

“Nofima has worked on this revolution of fish feed for several decades and the last ten years also as a participant in the Aquaculture Protein Centre (one of the Research Council of Norway’s Centres of Excellence),” says Director of Research Torbjørn Åsgård.

The fact salmon are eating plants is not more problematic than the fact fishmeal was traditionally used in animal feeds, says Åsgård. The decisive factor is that the fish receive a balanced diet that covers their nutritional needs.

TODAY’S CHALLENGES: “We need to understand the nutritional requirements of the fish in more detail. While 70 trials have been conducted on pigs to determine the need for lysine, one of 10 essential amino acids in protein, only five trials have been done on Atlantic salmon. At Nofima we have worked extensively on the development of a new methodical tool for evaluating amino acid requirements, so it goes more rapidly and precisely than previously.”

“Other work in Nofima addresses the requirements of omega-3 fatty acids. Access to marine oils is limited by the global demand for these fatty acids and thus, information is needed to be able to cover the needs of the fish. Intensive work is also underway in Nofima on alternatives from algae and gene-modified yeast and plants. On a global basis by-products from fishing and aquaculture are a major source of marine protein as an aquacultural feed. But reuse within the same species is currently not permitted owing to the risk of recirculation of disease. We have an emotive barrier against cannibalism, even though this is common in wild fish,” says Åsgård.

Nofima was one of three research institutions behind the Aquaculture Protein Centre (APC). The decade of APC as a CoE ended on January 1, 2013. The research APC has engaged in will now be organised at the centre’s respective partners.



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Preferences vary with occasion

We want celebration food that is as traditional as possible. For everyday food, we are more open to healthier and more convenient options.



PHOTO: JON-ARE BERG-JACOBSEN © NOFIMA

Valérie Lengard Almlí presented her PhD thesis at the Norwegian University of Life Sciences (UMB).

Producers of traditional food are meeting strong competition from other food products and need innovation and renewal. But combining tradition and innovation is not so easy.

Research Fellow Valérie Lengard Almlí has studied the extent to which consumers will accept innovation in traditional food. She has investigated attitudes to traditional food in six European countries, and her conclusion is that consumers have a generally positive image of traditional food throughout Europe. Her clear message to the producers of traditional food is that they make a distinction between everyday traditional food and traditional food for special occasions, because consumers think very differently in these two cases.

CAREFUL, CAREFUL: “The ultimate rule for consumer acceptance is that any change to the recognised sensory properties that characterise traditional food should only be made with great care,” says Almlí.

This is illustrated by consumer tests Almlí carried out with smoked salmon. The consumers had no negative preconceptions about either salt substitutes or salt injection in smoked salmon. But while smoked salmon with salt substitutes tasted the same as the traditional product, the salt-injected fillets suffered changes to appearance, taste and texture. The consumers showed the same acceptance and willingness to pay for smoked salmon with salt substitutes as for the traditional product, but lower sensory acceptance and willingness to pay for the salt-injected product.

“To put it simply, the most acceptable innovations in traditional food are those that give consumers a benefit, but do not damage the traditional image or modify the product’s characteristic sensory properties,” concludes Almlí, who presented her PhD thesis at the Norwegian University of Life Sciences (UMB).



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MORE INFO:
 Check Nofima’s website



Big potential for reindeer meat

There is an increasing demand for fresh reindeer meat and producers see it as a natural choice for a festive meal at Christmas time.



PHOTO: AUDUN IVERSEN © NOFIMA

Growing interest in reindeer meat increases the need for knowledge about what affects the meat quality. Research Scientist Rune Rødbotten is studying how the meat is affected by the method of slaughter and pre-slaughter transport. He is also interested in the many excellent cuts the reindeer carcass offers and how they can give increased value if sold as whole joints.

STRESS INFLUENCES QUALITY: As with all other meat, the quality of reindeer meat deteriorates owing to pre-slaughter stress, and being caught with a lasso increases stress.

“There is a clear connection between how much the reindeer eat and the amount of stress they can tolerate. Those who eat well manage greater stresses and their meat tastes better. This is an important argument for finding a good balance between the number of animals and access to pasture,» says Rødbotten.

He has carried out a review of all recognised scientific literature on reindeer meat. The next step is to study the effect of various pre-slaughter stress factors, including

transport on meat quality. Many reindeer owners believe that the flavour of the meat is ruined if the animals are transported in vehicles. Nofima’s panel of sensory assessors will study if this is true.

HEALTHY AND KEEPS WELL: The reindeer are out in open pastures for most of the year. They eat lichen, heather, herbs and berries, all of which are full of antioxidants. As well as being healthy, this antioxidant-rich diet means that reindeer meat keeps exceptionally well. The endless wandering of the reindeer herds gives them lean muscles, and the little fat that there is in the meat has a good balance between omega-3 and omega-6 fatty acids.

“The results of studies at Nofima show that fresh reindeer meat can be kept in good condition for three weeks provided it is kept at 4°C or lower. As well as the right storage temperature, it is important to use the most suitable packaging,» says Senior Research Scientist Marit Kvalvåg Pettersen.



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Shrimp fishery MSC certified

The Norwegian shrimp fishery in the Barents Sea is now MSC certified as sustainable.



PHOTO: © NORGES SJØMATRÅD

This certification can gain Norwegian shrimps entry into several important markets.

Nofima Scientist Edgar Henriksen has participated in the group that worked on the certification of the shrimp fishery. His task was to study whether the Norwegian management system for the shrimp fishery satisfies the requirements of the Marine Stewardship Council (MSC).

“The conclusion is that the stock of shrimp in cold water is in excellent condition, that the degree of exploitation is moderate to low. The effects of this fishery on other species and the ecosystem in the Barents Sea are limited,” says Henriksen. “The shrimp fishery received three conditions for the certification, including that the catch control rule is improved. In other words, that the authorities ensure there are clear procedures regarding which measures must be implemented if the stock diminishes significantly.”

SUSTAINABILITY AND ENVIRONMENT: DNV (Det Norske Veritas) has undertaken the certification on commission from the Norwegian Seafood Council. MSC is an independent global certification organisation that has developed an environmental standard for sustainable fisheries. The label “guarantees” that the seafood is produced in a sustainable manner and that the fish comes from sustainable stocks.

MSC has to date established itself as the most important market for the fishery industry. The reason for this is that the market has attained social aspects and legitimacy among industrial clients, and several supermarket chains demand that the seafood they buy must be MSC approved, particularly in Germany.

Nofima is carrying out several large research projects to map the significance of such ecolabels, both with respect to the consumers and professional buyers, in for instance supermarkets, and how the customers in the stores react to them.



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Food hazards in the kitchen

Some common hygienic mistakes in the kitchen can be devastating and make you sick, but others are less risky than you might think.



PHOTO: JON-ARE BERG-JACOBSEN © NOFIMA

Scientists at Nofima have a pretty good clue after analysing responses to an online survey involving 2008 participants. All sorts of mistakes are made in Norwegian kitchens and the blunders have not been reduced by modern appliances and busy lives.

“We have new strains of bacteria to tackle along with new types of food. What used to be sound advice has outlived its shelf life and we aren’t necessarily as good as we think at dealing properly with new foods,” says Research Fellow Elin Halbach Røssvoll, who is researching food safety.

NEW CLASSIFICATION OF FOOD HAZARDS: Studies have traditionally classified the consumers’ actions as “right” or “wrong”. But this new study considers the extent of the risk of people becoming sick from the food. “We see that the most common mistake people do is to thaw frozen meat on the kitchen bench, but we know the risk of them becoming sick from this is low. Consequently, this is not the most important area for people to change their habits,” says Røssvoll.

When using the traditional classification, the thawing of food at room temperature would rank at the top of the danger list. But in reality insufficient cooling of large casseroles cooked for many people and the eating of pink hamburgers pose the greatest risks in the Norwegian kitchen.

AVOID CONFUSION: If you give too many messages, none of them get through. It is important to concentrate on a few important messages. To avoid foodborne illness among consumers, it is important to know what people actually do in their kitchen. Then it is important to communicate what poses the greatest risk.

“It’s best to tell people the correct procedures for cooling a homemade casserole for 10 people or why they should grill their hamburgers properly instead of wasting energy on telling them to avoid thawing meat on their kitchen bench,” concludes Røssvoll.



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Equal with the best

New methods and new technology in the trawler fleet will produce raw material that is equal with the very best from the autoline fleet.



PHOTO: TOR H. EVENSEN © NOFIMA

Cod caught by trawling are slightly more exhausted than cod caught by Danish seine.

FROM PINK TO WHITE: Trawl-captured fish is normally subjected to rough handling when the trawl net is pulled onto the boat. This can lead to reduced quality, e.g. the fillet getting a touch of pink. For larger catches, the fish has often been dead for many hours before it is gutted, and large amounts of blood remain in the fillet. If the fish is pumped on board, the handling process will be gentler.

“Provisional findings show that it’s possible to keep trawled fish alive and that the quality is improved significantly by using new and improved production lines, not unlike those we find at salmon processing plants,” says Senior Scientist Kjell Midling. “We have observed that the blood disappears from the fillet if the fish is kept alive and slaughtered after 5-6 hours and the fillet goes from pink to white.”

The scientists are participating in experiments on both research vessels and commercial trawlers.

“In tandem with controlled studies in a new experimental swim tunnel, this project puts us in a position to better understand what influences the quality of the raw material.”

The initial focus has been on the physiological effect the capture process has on cod, haddock and saithe, but the scientists are now planning technology trials involving pumping and modern slaughtering. This project forms part of CRISP.

CRISP (Centre for Research-based Innovation in Sustainable fish capture and Pre-processing technology) is one of 17 centres for research-based innovation established by the Research Council of Norway. Nofima is one of the partners. The Institute of Marine Research (HI) is the host. CRISP was established to develop smarter technologies to meet future challenges for sustainable and economically viable fishing. Its goals include increasing the value creation from wild fish stocks and reducing the strain on the environment during the capture and production processes.



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Research Council of Norway (NFR) and the partners.

MORE INFO:
Check the websites of CRISP and Nofima



Better quality increases value

Cod trawlers can increase the catch value significantly by adopting new methods and new technology.



PHOTO: © NERGÅRD HAVFISKE

Scientists at Nofima, which is one of the partners in CRISP (see opposite page), have mapped the development in the Norwegian cod trawler fleet over recent decades.

The survey points to major variations among cod trawlers regarding catch rate, capacity utilization, fuel consumption and catch value. For instance, the fuel costs vary by almost NOK 2 per kilo caught.

“The added value is directly linked to the improved quality of the end product of the trawlers,” says Nofima Scientist Thomas Andre Larsen. “The autoline fleet, which in the main sells fish frozen at sea, achieved more than NOK 2 more per kilo cod more than the freeze trawlers in 2010. If CRISP can contribute with new technology that improves the quality of the catch, so that the price difference between autoline-caught and trawler-caught cod, saithe and haddock frozen at sea is halved, the catch value for the trawlers could increase by more than NOK 200 million annually.”

STRUCTURAL CHANGES: The survey shows that the structure of the trawler fleet has changed significantly. Over the last decade, two of three cod trawlers have been withdrawn from the fishery and the rights have been moved over to the remaining vessels.

However, many are now approaching the maximum number of quotas per vessel and the investment is now to a larger extent being directed towards renewal of the fleet. However, there is little to indicate that new technology will be implemented to improve this in the trawlers that are already planned. The objective is that the new technology developed through CRISP will gain entry in the next round of new vessels.

The cod trawler fleet represents an important part of the Norwegian seafood industry, with a total catch in 2010 of 255,000 tonnes and a landed value of NOK 2.6 billion.



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Swim tunnel for fish

Nofima has built a swim tunnel to measure how fish react to different types of catch handling.



PHOTO: JON-ARÉ BERG-JACOBSEN © NOFIMA

“The swim tunnel enables us to imitate the conditions the fish experience in the fishing gear, says Project Manager and Nofima Scientist Øyvind Aas-Hansen.

Fish captured using trawls, Danish seines or purse seines then handled on board the fishing boat are exposed to different forms of physical stress, which can lead to a reduction in the quality of the fish and in turn lower prices for the raw material.

During commercial fishing there are limited opportunities to find out what factors have a negative impact on the fish and how to change this. Consequently, Nofima has built a swim tunnel to imitate the conditions the fish experience in the fishing gear, for instance how long and how fast the fish has swum before it is taken on board the boat.

“We can control the conditions in the swim tunnel and study individual factors and in doing so find better ways to catch and handle the fish. If the tests indicate it is necessary, we may be able to develop better fishing

gear and better ways of handling the catch on board the boats,” says Nofima Scientist Øyvind Aas-Hansen.

“Through these tests, we hope to acquire knowledge that will help the industry to become more profitable and for consumers to get fish products of better quality.”

The construction of the swim tunnel has been completed at the Tromsø Aquaculture Research Station. The current, water quality and other variables may be controlled from a laboratory building beside the tank.

The tunnel forms part of the CRISP project, which is hosted by the Institute of Marine Research and in which Nofima is responsible for quality and value creation. The goals of the project are to optimise the fishery industry’s value creation and product quality.



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About the
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Crab success

Nofima technology has made it easier for Norway's largest crab producer to kill and find the crabs with the highest meat content.



PHOTO: JON-ARE BERG-JACOBSEN © NOFIMA

Hitramat is Norway's largest producer of crab and produces a wide selection of different crab products. The company purchases crabs from 250 fishermen who fish waters from Måløy to Bodø. A proportion of the crabs are sold whole. The best crabs with the highest meat content are sorted out for this production.

However, the company had problems sorting out the crabs with the most meat. Through manual sorting, high water content was often assessed as high meat content. As a result, the company risked dissatisfied customers when they opened the crab and found less meat than they expected. Manual sorting also led to a large margin of error.

SCANNING THE CRABS: Nofima Senior Scientist Jens Petter Wold adapted a scanner that had previously been developed for rapid assessment of water content in clipfish. This scanner transilluminates the crab, and based on the light that is absorbed it is possible to calculate the amount of meat in the crab. This technology makes it easier to find the best and meatiest crabs.

"With manual sorting of the crabs to be sold whole, about 20 % were approved after boiling. Now with new technology, around 50 % of the crabs are sold whole," says Kolbjørn Ulvan, factory manager at Hitramat.

MORE PROBLEMS: While the scanner was being tested, a new problem emerged. Crabs placed on the production line to go under the scanner kept moving, making it difficult to get accurate measurements of the content.

The solution was electronic stunning. In this method, the crabs are sent into commercial fish stunner specially adapted for crabs. The crabs are subjected to a series of electronic shocks so they rapidly lose consciousness. They then enter a tank of ice-water that gives them a thermal shock and kills the unconscious shellfish. This production change increases both efficiency and profitability at the company, and also complies with new animal welfare requirements.



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Few words to describe ham

Norwegians use far fewer words than Italians and Spanish to describe the sensory properties of dry cured hams, but we also eat far less.



PHOTO: KJELL J. MEROK © NOFIMA

Figures from 2009 show that the average Norwegian consumer ate 400 grams of dry cured ham a year, while the Spanish ate 3.3 kg and the Italians topped the list with an average consumption of 4.4 kg.

“The main reason why Italian and Spanish consumers’ have a more diverse vocabulary for describing sensory perception of dry cured ham is no doubt that they eat far more ham there. But it’s also to do with the way we eat. The Italians and Spanish are better at communicating about food. Their meals take longer, and when they buy ham in a shop they have it sliced by someone they can talk to,” says Senior Research Scientist Margrethe Hersleth.

Together with scientists at the University of Florence and the research institute IRTA in Spain, she carried out a study involving 90 consumers in Norway, Spain and Italy. The participants tasted six different dry cured hams and were asked to describe the sensory properties – the appearance, smell, flavour and texture.

LIMITED VOCABULARY: On average, the Spanish and Italians used 10 words to describe their perceptions of the different hams, while the Norwegians only used six. The Norwegians were not harmonized in how they used the terms either.

“Norwegians use words like sweet and mature. But we don’t distinguish consistently hams that are sweet or mature from the other hams. We have heard these words, but we have no training in how to use them,” Hersleth points out.

Only three words were used consistently by the Norwegians. The Spanish managed to use 14 words consistently, while the Italians were agreed on 17 properties.

“The Norwegian participants managed to give a correct description of a ham in terms of redness, maturity and saltiness. The Italians are far more precise and detailed. They can describe a ham, for example, as sweet, salty, rancid, mature, melting, marbled and tender. Norwegian ham producers will benefit from training the consumers to put words to the ham’s sensory properties.”



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More about
sensory science



Health benefits of curly kale

Curly kale is full of healthy substances, some of which have an inhibiting effect on the growth of cancer cells.



PHOTO: KJELL J. MEROK © NOFIMA

Research Fellow Helle Olsen has found that there are more healthy nutrients available in raw curly kale than in boiled kale, and more in the green than the red variety.

Research Fellow Helle Olsen is the first to identify a number of polyphenols, a group of health-promoting substances found in curly kale. In her research, Olsen has followed the individual polyphenols via heat treatment and storage and seen whether they have an effect on cell growth and cell mortality in cultures of intestinal cancer cells. The effect on cells grown in the laboratory gives an indication of whether the polyphenols have a corresponding effect in the human body.

“We can see that curly kale extracts inhibits undesirable growth of cancer cells, and we believe this is due to interaction between the polyphenols, and possibly also other substances,” says Olsen.

Olsen has studied both green and red curly kale grown in Ås in Norway over three seasons. She wanted to find out whether there was any difference in the polyphenol content from year to year, but found no difference. However, there was some variation between individual plants.

RAW OR BOILED?: She compared raw curly kale with kale that had been blanched and then heat-treated using ‘boil-in-bag’ technology. The heat-treated curly kale had significantly lower polyphenol content than the raw kale, but still had a very high content of these healthy substances.

The background to this research was that Nofima has established advanced methodology for analyses of phytochemicals in fruits and vegetables, and curly kale proved to be a highly suitable “vegetable model”. It has a high content of complex polyphenols, and the chemical structure of these had not previously been studied in detail.

Olsen clarified the chemical structures by using an analytical technique called mass spectrometry, which provides information about the different constituent parts of a molecule. She discovered new complex polyphenols that had never previously been described.



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More on research about fruit, berries and vegetables



The fussy little helper

New feed from Nofima produces higher productivity in the farming of wrasse.



PHOTO: JON-ARE BERG-JACOBSEN © NOFIMA

Salmon lice pose a major problem for the aquaculture industry and work is underway to develop good methods to combat it. Using wrasse as a biological method of delousing salmon has proven both financially and environmentally successful. Increasingly more fish farmers now use wrasse as their main means of combating the parasite.

As a result, there has been a big strain on wild stocks and a need has developed to start farming wrasse.

FUSSY LICE EATERS: In 2009 Marine Harvest Labrus commenced a project to start large-scale aquaculture of Ballan wrasse, Norway's largest wrasse species. The broodstock was fished for trials and the fish spawned naturally in tanks at Marine Harvest Labrus' facility in Øygarden.

"The commercial feeds that were tested did not produce the desired results because the Ballan wrasse had problems digesting them and did not like the taste. The mortality rate was high and the growth rate was poor," says Project Manager Espen Grøtan at Marine Harvest Labrus. "It's so fussy that in some cases it would rather

die than eat food it doesn't like. Therefore, a special feed needed to be produced."

SHRIMPS AND COD FILLET: Nofima Scientist Katerina Kousoulaki has worked to develop a feed for the Ballan wrasse for use in the transition from live feed to dry feed.

"We produced two different feed types based on earlier recipes developed in a project involving Nofima, HI, NIFES, Marine Harvest Labrus and Villa Organic," says Kousoulaki. "Expensive raw materials such as shrimps and cod fillet were added to the feed, as we knew it was very particular about what it eats."

The fish liked both feed types, but it remains to be seen which one produces the best result.

"The idea is to get the Ballan wrasse accustomed to dry feed by using this special feed. The next step is to produce a feed for feed enhancement that tastes the same but without the expensive raw materials, as the gourmet feed is far too expensive to produce on a regular basis."



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Royal treatment

Nofima has developed written guidelines for king crab fishermen.



PHOTO: STEN SIIKAVUOPIO © NOFIMA

It is important to hold in at least two walking legs to prevent injury to the crab during sorting on board the boat.

Live king crabs must be handled with care in order to achieve optimal quality and survival rate. On commission for the Norwegian Seafood Research Fund (FHF), Nofima has now developed a two-page brochure containing practical guidelines for king crab fishermen.

The guidelines, "How to handle king crabs", describe measures fishermen and transport providers must consider concerning handling and water requirements as well as conditions for the storage of live king crabs.

The king crab fishery is an industry undergoing growth. In recent years, several new companies have established king crab fisheries. The objective of this brochure is to convey systemized knowledge to those new to the industry.

GENTLE TRANSPORTATION: There are several requirements that need to be met during the transportation of

live crabs to the market or to capture-based aquaculture. Useful knowledge from experienced king crab fishermen and new knowledge from research form the basis for this two-page guideline brochure.

"We need to spread knowledge, also to new fishermen and transport providers, about how the king crab shall be an optimal product at an optimal price. That's the thought behind these guidelines," says Nofima Senior Scientist Sten Siikavuopio.

The guidelines are also published on the FHF website and work is in progress to find other channels for disseminating this knowledge.

The report "Capture, capture-based aquaculture, enhancement feeding and transport of live king crabs" may be downloaded from Nofima's website.



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MORE INFO:
 Manual (in
 Norwegian
 only)



From mince to steaks

A lot of Norwegian beef ends up minced. Just 10–15 percent is cut into steaks, which achieve a higher price per kilo than minced.



PHOTO: JON-ARE BERG-JACOBSEN © NOFIMA

Experiments at Nofima demonstrate that various combinations of prime fodder and use of grazing lands yield tender and tasty cuts from more of cattle's muscle tissue than have been commonly found in Norwegian meat markets. In addition, new ways of cutting the carcass can also yield more steaks.

In Norway around 12 percent of the muscle tissue is sliced into various cuts of steaks, while the majority of the muscle is used as minced or ground beef. This is in sharp contrast to USA where the proportion used for steaks is more than twice as high. By cutting the carcasses in a different way in Norway we can increase the added value.

Norwegians and Americans go their separate ways in other aspects of raising cattle. In USA almost 50 percent of beef comes from steers, which generally have more intramuscular fat than bulls. Labour at American meat packing plants and butcher shops is also cheaper. Lower wages make it more profitable for American meat packers to cut out the smaller muscles which in Norway are tossed into the grinders.

MORE STEAK: Nevertheless, Nofima Research Scientist Rune Rødbotten thinks it is possible to increase the share of steak cuts from Norwegian cattle from 12 percent to closer to 20 percent.

He is midway through a four-year project looking into various grazing and feeding regimes that affect tenderness of different muscles and the economic advantages of butchering the meat in new ways.

Some of the lesser known cuts of beef can be just as tasty as sirloin.

"There's a correlation between marbling and tenderness, at least for some of the muscles. We've seen it in our tests, and in USA they've based their quality assessments and pricing on this. In USA they have much more intramuscular fat in their meat than we have here in Norway," says Rødbotten.

Intramuscular fat is the fat that is spread within a given muscle, not the bands surrounding it.



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MORE INFO:

Read the publication here or check forskning.no



First choose your potato

A recently developed measurement technique allows better control of one of the most important quality parameters in potatoes.



PHOTO: KJELL J. MEROK © NOFIMA

Currently, there are often large variations in the constituents of potatoes, which can be a challenge in potato processing.

“It’s now quicker and easier to measure dry matter content, which provides us with new opportunities for understanding how different content levels affect quality,” says Nofima Research Scientist Nils Kristian Afseth. He has been working with Research Fellow Trygve Helgerud on developing the new method, which is based on near-infrared spectroscopy.

NO TWO POTATOES ALIKE: The constituents of a potato and its suitability for industrial processing depend on many different circumstances, such as potential diseases, time of year, growth, weather and storage. There are also natural biological variations.

Dry matter content says a lot about potato quality. The higher the dry matter content, the less water and the higher the price per kilo for the potato producers. The most common method used by the industry to de-

termine dry matter content is called underwater weight. This is found by weighing a sample in air and then immersed in water. This method is cheap, user-friendly and relatively accurate for the sample that is taken. The problem is that it is impossible to characterise an entire batch and only small spot-checks of 5 kg are taken.

“We have been working on a method based on a technology called near-infrared spectroscopy to estimate the dry matter in raw, unpeeled potatoes on the processing line. The aim is to be able to measure the dry matter of every single potato on the line or when sorting beforehand. This means the producers could exclude extreme variation and sort the potatoes better, and in doing so achieve a more uniform product quality,” says Afseth.

As well as measuring dry matter, the scientists are also studying the sugar and starch content. This is especially important in relation to acrylamide and colour in products such as crisps and chips.



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Sea urchins harvested by ROV

Several tests show that a remotely-operated underwater vehicle (ROV) beats divers when it comes to harvesting sea urchins.

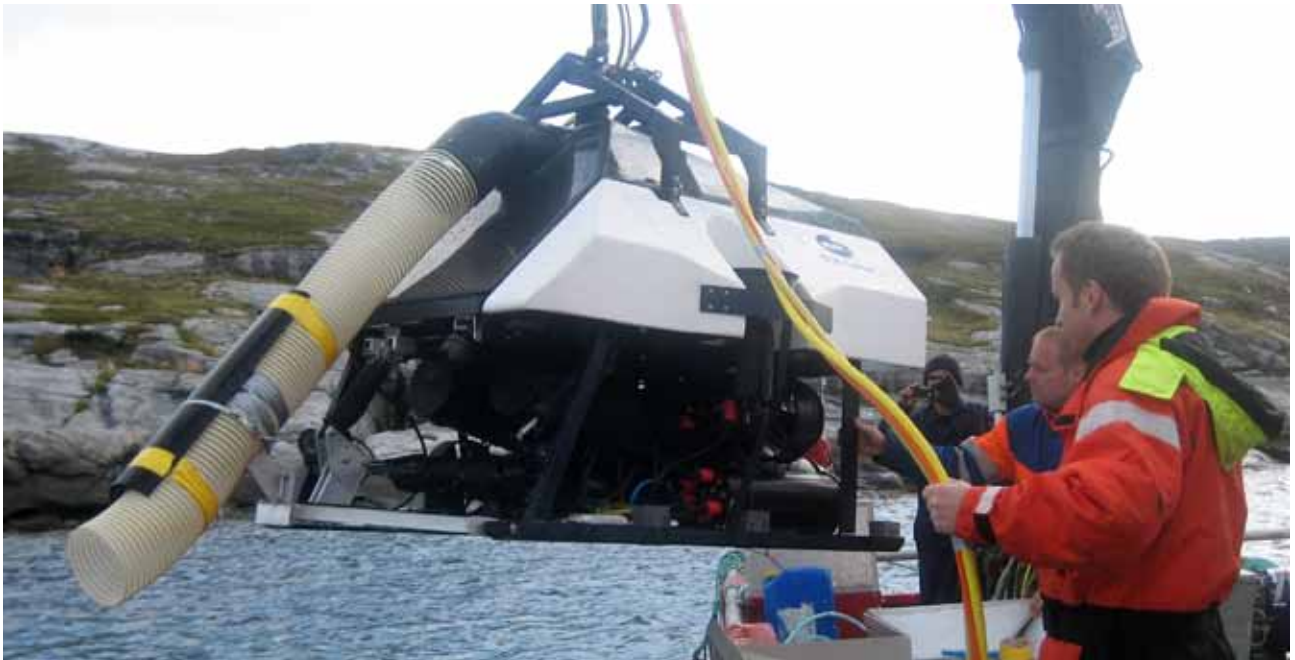


PHOTO: © NOFIMA

Tests show that the remotely-operated underwater vehicle (ROV) works extremely well both summer and winter.

Several companies have attempted to establish commercial harvesting of sea urchins in Norway. Only a couple of companies currently harvest wild sea urchins, but the high kilo price means there is major interest in this product. One of the main bottlenecks for the development of a sustainable sea urchin industry is a reliable and cost efficient harvesting method.

Traditionally sea urchins have been harvested by divers. But the extreme conditions in Northern Norway, with cold temperatures, limited light and strong winds, make it difficult to dive for sea urchins in winter. The market demands regularity of supply and so companies must be able to supply sea urchins all year round.

MINUS 40: The ROV, known as “Seabed Harvester”, has previously been tested in good weather conditions in summer. In winter 2012, it was also tested during the Polar Night, when the weather is at its worst. Strong winds meant that the estimated temperature was as

low as -40 °C. This is too cold for divers, but the ROV could still operate normally.

“This shows that in all likelihood Seabed Harvester is the most efficient harvest method for sea urchins in demanding winter conditions in Northern Norway,” says Scientist Philip James from Nofima. “There are several factors that make it more efficient than the divers. It can be used during winter, in poor weather and at greater depths, and the sea urchins are of the same quality as those harvested by the divers.”

“We have never harvested more sea urchins than we did during the test with the ROV. Diving in Båtsfjord is very unpredictable and 200 days a year the weather is too extreme to use divers,” says Mattis A. Tangeraas, General Manager of Norway Sea Urchin AS. “The ROV will give us an additional 150 harvest days per year. But in order to gain financing for such an ROV, long-term testing needs to be carried out over several months in order to confirm the potential.”



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 Check
 Nofima's
 website



Sea urchin reproduction

Scientists at Nofima have developed a manual that provides a thorough introduction to the reproductive cycle of sea urchins.



PHOTO: © VIDAR MORTENSEN

The goal is to provide sea urchin fishermen and farmers with the opportunity to improve their economic gain.

PRIMITIVE ANIMALS: Sea urchins are primitive animals that lack many of the body parts found in higher animals. They have no specialized respiratory or circulatory systems. No heart, no blood vessels and no oxygen binding molecules in the body fluid and a very simple digestive system. Basically, they consist of a mouth, intestines, the gonad or roe and a primitive nervous system encased in a hard shell.

UNDERSTANDING CREATES VALUE: Within each sea urchin population, it is important to understand the animals' reproductive cycle. The gonads are the only part of the sea urchin of commercial value and the quantity and quality (and subsequently the value) of the gonads

varies considerably throughout the reproductive cycle. Consequently, it is important for both the sea urchin fishing and aquaculture industries to fully understand the animal's reproductive cycle.

Previous research has shown that food availability and the density of sea urchins have a significant impact on the reproductive cycle of sea urchins.

"We have recently studied two sea urchin populations 4 km apart in Kvalsundet, near Tromsø. We found great variation in both size and quality of the gonads, both between seasons and populations, even though they lived very close together," says Scientist Philip James.

The manual is financed by the Norwegian Seafood Research Fund (FHF), and will give sea urchin fishermen and farmers a better understanding of these animals' needs and the opportunity for development and thereby better future economic planning.



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 Read the ma-
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What's in it for me?

Freshly-squeezed juice and a long shelf life seem to contradict each other. What is needed to gain consumer acceptance?



PHOTO: KJELL J. MEROK © NOFIMA

New processing technologies make it possible for juice to have a long shelf life and still retain its natural flavour, but consumers are often sceptical. High-pressure processing (HPP) and pulsed electric field (PEF) processing are two of these new technologies. Scientists at Nofima have studied consumer attitudes towards these technologies.

“To ensure that consumers approach these new technologies with a benevolent attitude, the food producers must think through the possible barriers and what arguments can be used to overcome them,” says Nofima Senior Research Scientist Nina Veflen Olsen, who has been leading this study.

CONSERVATIVE CONSUMERS: One of the causes of consumer scepticism towards new processing technologies is that these methods are unknown. People are uncertain whether food products are safe. While the food

scientists focus on technological innovation and applaud new scientific developments, consumers tend to be more conservative and sceptical.

This phenomenon is known as the “mere-exposure effect”. The more often a product is demonstrated, the better people like it, even though everything else may be exactly the same. This effect can probably be explained in terms of evolution: if you eat something new and survive, you are less afraid of eating it again.

“Precisely because of this effect food producers should be careful about promoting all the new aspects that could lead to uncertainty. If they start to use HPP and PEF, it is better to say how much better the flavour is than that it is processed in a new way,” says Veflen Olsen.

The study is part of the EU project NovelQ. Universities and research institutions in Norway, Denmark, Hungary and the Netherlands have participated.



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EU and the Research
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Learning about high pressure

Several Norwegian food producers are now testing high pressure processing (HPP) technology.



Tone Mari Rode (left) and Maria Befring Hovda use the high pressure equipment at Nofima's trial hall in Stavanger.

The only HPP equipment in Norway is situated in Nofima's trial hall at Måltidets Hus in Stavanger, where several Norwegian food producers carry out their tests.

"We're seeing an increasing interest from the Norwegian food industry and want to provide them with knowledge about this technology," says Nofima Scientist Tone Mari Rode.

In HPP, the packaged food product is placed in a pressure chamber with water and exposed to a pressure of 2000–6000 bars for some minutes. HPP is a gentle method that preserves the nutrients and taste of food products better than, for instance, heat treatment and pasteurisation. The process is ideal for high quality food products.

MAJOR PLAYERS: TINE, Fjordland, Fjordkjøkken, Stabburret, Fellesjuice and Findus are among the food producers currently testing the HPP technology in a project financed by the Research Council of Norway (NFR). Several other companies have tested various products in confidential trials.

Ready-to-eat food, juice, cured meats and cooked meats are product groups highly suited to HPP. Different combinations of pressure and time can provide different effects. This may be utilized, for instance, to achieve a new and improved consistency in a product. Scientists are now studying the impact of extreme high pressure on the properties of food.

In addition to increased food safety, good preservation of vitamins and product quality, HPP may also be used in other fields of interest to the food industry, such as providing increased tenderness in meat. Other suitable applications are rapid freezing and defrosting. This is the subject of an NFR project on technology development in the shrimp industry, which will involve testing if HPP may be used in the defrosting and maturation of frozen shrimps.

An RFF West project is focussing on HPP of Norwegian raspberries, sweet cherries and plums, in which HPP will be used as a method of preservation to give increased raw material utilization and new products.



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MORE INFO:

See film
here



More aquaculture? Yes, but...

If you thought Norwegian coastal municipalities do not want fish farming in their waters, then you had better think again



PHOTO: FRANK GREGERSEN © NOFIMA

Nofima has found that this does not completely correspond with reality.

But it is fair to say that the attitude of the local authorities has changed in recent years. To a higher degree than previously, the benevolence towards the aquaculture industry is conditional, but reluctance is now aimed at the lack of wider economic benefits for the local community.

Through a survey, Nofima found that the local authorities will gladly make preparations for increased aquaculture. As a result of some municipalities experiencing that the development of the industry has not led to as many jobs and wider economic benefits as anticipated, they have become more reserved in their support.

MORE TO THE MUNICIPALITIES:

"They want a greater share of the industry's value creation to go to the host municipalities. In other words, they want compensation for preparing for aquaculture in their coastal zone," says Nofima Scientist John R. Isaksen.

Nofima's analysis shows that the local authorities are

not opposed to growth in the aquaculture industry. On the contrary, the relationship with the aquaculture industry appears to be good and professionally attended to by both parties, and the industry's interests are emphasized in the municipal planning processes.

Today, the local authorities have the possibility of charging a municipal property tax to marine fish farms, which was implemented by 114 of 157 "aquaculture municipalities" by 2010. Nofima's studies and calculations indicate that incomes from this tax are modest.

Parallel with the industry growing in terms of both volume and value, efficiency gains and consolidation have led to concentration of the activity and profitability. Many feel they have not benefitted from the large increase in value creation.

"Several municipalities are now speaking up for the fact that use of area in the coastal zone must be compensated in a way that favours and motivates the municipalities to prepare for aquaculture," says Nofima Scientist Otto Andreassen.



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Ministry of Fisheries and Coastal Affairs,
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Norwegian Seafood Research Fund

MORE INFO:

Report (only in
Norwegian)



Gives best salmon fillet

Gentle handling of salmon when it is pumped from the sea cage to the processing vessel gives the best quality and shelf life of the fillet.



PHOTO: KJELL MIDLING © NOFIMA

Nofima has been research partner for Marine Harvest in Southern Norway during the testing of harvesting methods for farmed salmon. The conclusion is that killing of salmon pumped straight from the sea cage is more economically viable and of better quality than salmon harvested via a holding cage or straight from a well boat.

TAURANGA: The scientists ascertained that salmon harvested on the well boat “Tauranga” straight from the cage had extremely long “pre-rigor” time, sometimes more than 35 hours. The results also showed that the onset of rigor mortis was slower in salmon stored in refrigerated sea water (RSW) in tanks on board than salmon that was stored on ice in containers. This is significant, as salmon that has gone into rigor mortis when it is pumped is at major risk of developing gaping.

“Correct handling of the salmon at the cage gives more time before the salmon needs to be pumped in for further processing. But the vessel should be emptied as rapidly as possible. The longer we wait, the greater the

chances of damage,” says Nofima Senior Scientist Kjell Ø. Midling.

IN OR OUT OF RIGOR MORTIS: Rough handling leads to more rapid onset of rigor mortis. This is also the case if electric stunning is used. Therefore, only percussive stunning may be used during harvesting straight from the cage. It is easy to believe that the whole fish has gone into rigor mortis, but if the salmon is provoked out of rigor mortis, other muscle groups will go into rigor mortis if it is stored on ice.

“We ascertained that salmon were pumped out of rigor mortis and the further they had entered into rigor mortis, the greater the damage to the fillet,” says Midling.

In all likelihood, storage in RSW on board is gentler for the salmon than storage in containers, and salmon that are pumped while in rigor mortis develop gaping.

“It is worth noting that many of the remaining challenges may be related to crowding, rough handling on board and inadequate control of rigor mortis.”



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 Norwegian text
 with English
 summary



Wheat struggles with rain

Norway needs varieties of grain adapted to a humid climate to meet goals for increased production of satisfactory quality.



PHOTO: JON-ARE BERG-JACOBSEN © NOFIMA

Increased knowledge is needed about the impact of the weather on gluten proteins and the role genetic variations play.

Wheat is one of the world's most widely-grown types of grain and is of huge importance for the world's food supplies. Unstable weather has led to little Norwegian wheat in our daily bread some years. While we have problems with wet weather, drought is threatening wheat production in many parts of the world.

Increased amounts of rain during germination and harvest are predicted in the future, which can create major challenges in achieving satisfactory quality. In addition to the sprouting damage, which is a known problem in humid weather, Nofima's wheat researchers have identified a new phenomenon that has major consequences for baking quality.

LOST BAKING PROPERTIES: "The new phenomenon affects gluten proteins and it appears to be due to enzymes that break down proteins. We have found field

samples with acceptable falling number results, but where the proteins have lost their baking properties," says Anette Moldestad, research scientist and project manager of the FutureWheat project.

Through FutureWheat, the scientists have acquired greater knowledge about the structure of gluten proteins and their impact on the baking quality. There are also findings from field samples where the gluten proteins are broken down, which is particularly concerning since this cannot be detected by current quality sorting of wheat. There is an urgent need to study existence of this in practical cultivation and to find the reasons in order to secure good and stable baking quality of Norwegian-grown wheat.

"We have discovered that one variety of autumn wheat largely maintained its quality, while all the other varieties in the areas investigated had a severe loss of quality. This shows that there are genetic variations that can be exploited," says Professor and Research Scientist Anne Kjersti Uhlen.



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MORE INFO:

Read more about the FutureWheat project



Studying deadly bacteria

Scientists at Nofima and collaborating institutes will study what is needed to avoid dangerous Listeria and E. coli bacteria in food.



PHOTO: KJELL J. MEROK © NOFIMA

The Ministry of Food and Agriculture has allocated NOK 25 million over five years to this strategic initiative. The Research Council of Norway is footing the bill.

Europe's first high security processing plant for potentially lethal food is being constructed in Ås. This will enable scientists to study pathogenic bacteria before and during the production process and during packaging and storage. For many foods there are currently no safe methods to prevent Listeria or E. coli during production.

The scientists will study how the bacteria react to various types of stress, such as cold, heat, salt and acid – and whether some bacteria strains tackle stress better than others. When they have learned how the bacteria react, the scientists will study what is needed to avoid or reduce the level of pathogens. An important question in this context is how hygiene and disinfection can contribute to keeping bacteria growth down.

LIMITED OPPORTUNITIES: Until now there have been limited opportunities to study hazardous bacteria in natural food production environments. At the same time, model studies involving cell cultures in test tubes or agar plates tell us little about what actually happens in raw materials containing hazardous bacteria. For instance, when experiments to be rid of Listeria or E. coli are performed in laboratories, the results may be excellent, but when the bacteria are studied in food or production environments the results may be less promising.

With this new pilot plant, it will be possible to contaminate the raw materials and then follow the bacteria through the production process, packaging and storage.



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MORE INFO:

Read more about food safety and quality



Time or technique?

The amount of time before the fish is bled is more important than the choice of bleeding method.



PHOTO: © NOFIMA

The photos show (from left) fish bled immediately versus unbled fish.

This is among the conclusions of the Nofima scientists who carried out experiments involving bleeding methods and the impact of the time interval from capture to bleeding.

Sensory assessment, in which trained sensory assessors assess red discoloration in whole fish and loins, shows that the largest difference occurs between immediate bleeding and bleeding 30 minutes after capture. The analysis showed a pronounced decline in the draining of blood when time elapsed before the fish was bled.

In addition to the sensory assessment, a technical analysis was performed to confirm what could be seen with the naked eye. The analysis does not provide an exact measurement of the blood quantity, but is ideal for ranking various samples according to blood content.

“For loins the blood index increased constantly depending on time from capture to bleeding, and as such confirmed the assessment of the sensory assessors. Naturally enough, the index for this method peaked for raw material that had not been bled,” says Senior Scientist Leif Akse.

DIRECT GUTTING WORST: Direct gutting soon after capture results in poorer bleeding than if the fish is bled in water prior to gutting. This was established in experiments performed by Nofima scientists.

The blood index measurements showed no significant difference between different bleeding methods, as was the case with other reports based on bleeding of farmed salmon. However, the blood index was significantly lower for all bleeding methods than equivalent measurements of fish that were directly gutted and headed immediately after capture.

With a delay of 30 minutes before bleeding starts, direct gutting of headed fish also results in more blood spots in the loins and belly than if the fish was bled before gutting. With longer time intervals before bleeding (1 and 3 hours), there was no significant difference in the blood index between the bleeding methods and direct gutting.



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Quality becoming worse

Nofima has studied the correlation between choice of gear, vessel size, catch size and the quality of raw materials from the coastal fleet.



PHOTO: LEIF AKSE © NOFIMA

The difference between raw material from the coastal fleet that is correctly handled and poorly bled is very clear.

The results of the study indicate that structuring in the coastal fleet has led to catch efficiency gaining greater priority than quality.

SMALL IS GOOD: Hook-caught fish from small vessels gives the best quality and least variation, but nonetheless reduces these landings in the coastal fleet. The perception in the fishing industry is that the raw material quality from large catches from large vessels is the worst. The catch size has increased for all vessel groups.

MUST TAKE STEPS: Today's pricing system gives room for fish buyers to make a deduction for poor quality and to pay more than the minimum price for premium quality. However, this occurs to a low degree. These quality errors transmit to the end products and lead to higher production costs, lower paid products, less flexibility and a poorer reputation.

This leads to losing values in the market. In the Portuguese market alone, the value of the salted cod would have been around NOK 130 million higher if it was of the same standard as that from Iceland.

For fillet production, raw material quality is of decisive importance for the profitability.

Nofima will work to shed light on the mechanisms in the raw material market. No documentation is currently available to show that a general raise in quality of the raw material provides increased added value throughout the value chain. In the study, Nofima points out that the regulatory process may be used to contribute to improving the quality of fresh raw materials.

"However, this should not be done until the potential of increased added value as a result of increased quality may be documented," says the project manager, Scientist Edgar Henriksen.



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 publication
 on Nofima's
 website



Attending to fish welfare

How can fish farmers reduce the incidence and severity of injuries and deformities in their fish?



As part of an EU COST initiative on fish welfare, four Nofima scientists teamed up with collaborators from Canada, the United Kingdom, Australia and Spain to write a review paper on how aquaculturists and capture-based aquaculturists can eliminate or combat factors that lead to injuries and deformities in farmed fish.

The paper provides producers with operational solutions for a range of farmed species through the production cycle.

The paper focuses on external injuries to the mouth, eye, epidermis and fins, and covers topics including feed management, nutrition, handling and live transport. The scientists used the same approach for capture-based aquaculture as for aquaculture.

The paper collates the latest findings and provides producers with state of the art knowledge on the subject, bringing together research from over 175 scientific publications. It was driven by the needs of the fish farming and capture-based aquaculture community and is in a format that is both informative and user friendly.

SEVERAL GOALS: "Fish farmers and capture-based aquaculturists constantly strive to improve their production practices, with the specific aims of improving production efficiency, product quality and fish welfare. These aims are not mutually exclusive," says lead author Chris Noble from Nofima.

Researchers, producers and consumers are increasingly interested in fish welfare, and this has led to numerous industry-led improvements in daily husbandry practices. These production practices not only improve the lives of farmed fish, but also improve the quality of fish further down the value chain. In addition, producers who implement welfare friendly production practices are increasingly rewarded in the market.

A sister paper, focusing on internal injuries is planned for 2013.



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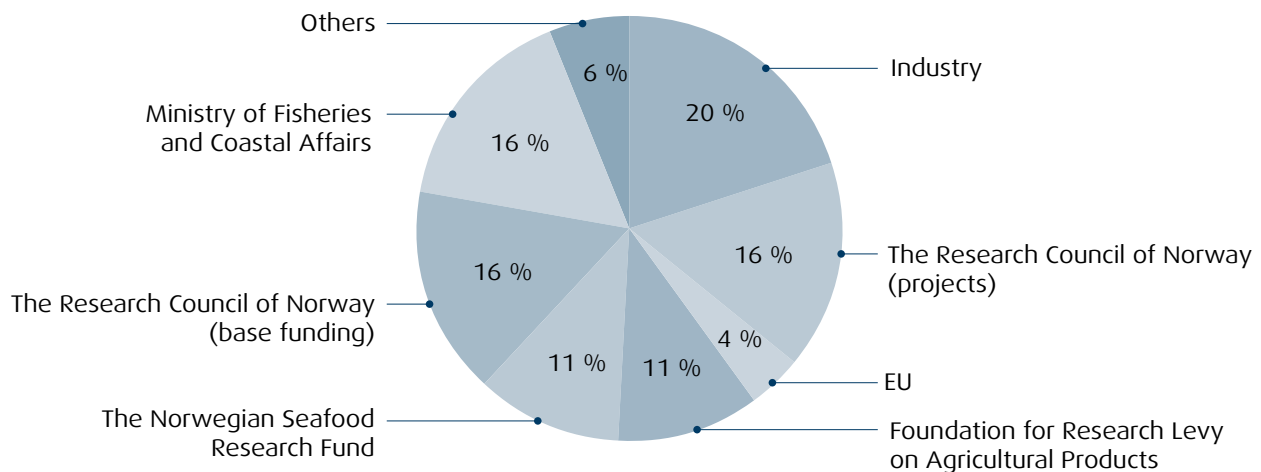
MORE INFO:

Read the publication here



Creating value together

In 2012 Nofima's 400 employees delivered research and services worth NOK 500 million to approx. 240 different clients in Norway and abroad.



The following are our largest funding providers:

RESEARCH COUNCIL OF NORWAY (NFR) is a strategic organ that identifies priority areas and project/programme managers, allocates research funding and evaluates the research that is carried out.

THE MINISTRY OF FISHERIES AND COASTAL AFFAIRS is responsible for the fishery and aquaculture industry, fish health, fish welfare, seafood safety and quality and more.

THE NORWEGIAN SEAFOOD RESEARCH FUND (FHF) shall create added value for the seafood industry through industry-oriented research and development. Financed through a levy on all seafood exports.

THE FOUNDATION FOR RESEARCH LEVY ON AGRICULTURAL PRODUCTS (FFL) shall secure an economic basis for research connected to agricultural products that are utilized to produce food and stimulants, as well as feed grain for animals. Financed through a research levy on agricultural products.

THE INDUSTRY – Nofima's R & D work is oriented primarily towards the aquaculture, fishery and food processing industries.

THE EUROPEAN UNION finances several research projects that Nofima either participates in or has project responsibility for. Nofima has a strong international profile.



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