Aquaculture in Norway

NORGE
SEAFOOD FROM NORWAY

fhl
Norwegian Seafood Federation

Every day, all year round, **38 million meals of Norwegian seafood** are served worldwide. Twelve millions of these come from aquaculture, and eleven million are Norwegian Salmon meals.

The octagonal cages that Ove and Sivert Grøntvedt set out in Laksåvika on Hitra, Norway in 1970 are regarded as being the world's first fish cages.

Norwegian Salmon was the official seafood ingredient used by Geir Skeie when he won the cooking competition Bocuse d'Or Europe in Stavanger in 2008.

62 per cent of the sushi eaten in the United Kingdom is consumed by people under the age of 44. The same group represents 35 per cent of the total seafood consumption. The same pattern can be seen in Norway, where the typical sushi eater is around 30 years old.

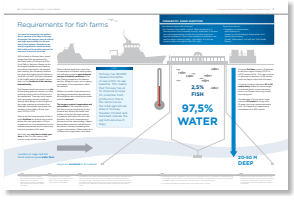
France is the largest export market for Norwegian Salmon and Norwegian Fjord Trout, followed by Russia and Poland.

A report from the Harvard School of Public Health concluded that one portion of fish per week reduces the risk of dying from cardiovascular diseases by 17 per cent. Each additional portion reduces the risk by 3.9 per cent.

Norwegian Salmon is the raw ingredient in a smoked product sold in Switzerland under the name Tsar Nikolaj fillet, at a price of around NOK 2,300 per kg.

Due to its health benefits, Norwegian Salmon has starred on US breakfast television show "Good Morning America".


All of the Norwegian Salmon produced today originates from 41 different strains. One of these stocks is Swedish, while the remainder are Norwegian.
In China, between 80 and 90 per cent of all salmon consumed is eaten raw, in sushi and sashimi.
The Chinese character Nama means, quite simply, ”something no-one has done anything to”. The Japanese use the word to describe the beer before it is bottled, to refer to the day they were born - and when Norwegian Salmon entered the sushi counter they called it *Nama salmon*.
Raffles Hotel is not only responsible for the world-famous cocktail Singapore Sling, chefs at the hotel have also created a dish called “Indian Tandoori Norwegian Salmon”.



An industry responsible for 22,700 Norwegian jobs, and fish delivered to 100 vastly different countries to create 12 million meals a day, gives rise to a host of stories. These are the portraits of brave pioneers, who in the shadow of the first Norwegian oil rigs, developed a second industrial fairy-tale: Norwegian aquaculture. The industry also has a long history at local level as the businesses it embraces form the cornerstone of many Norwegian coastal communities. Last, but not least, aquaculture is one of Norway's most important responses to the challenge faced by the world today: to produce sufficient, healthy food for a rapidly growing population.

Although this brochure can provide little more than an introduction to some of these stories, that is not its true purpose. After reading this short introduction to Norwegian aquaculture you may want to know more about a specific subject, or be left with questions unanswered. In that case, we hope you make use of the tips contained in this brochure to help you find out more. Whether you want to learn more for yourself or intend teaching others, this information will guide you on your way. In addition, we hope you will contact us at the Norwegian Seafood Council or the Norwegian Seafood Federation if you would like further information.

Geir Andreassen
Managing Director
Norwegian Seafood Federation

Terje Martinussen
Managing Director
Norwegian Seafood Council

Published by the Norwegian Seafood Federation and the Norwegian Seafood Council
Text: Apeland Informasjon **Design:** www.tank.no **Printed by:** Gunnarshaug Trykkeri AS, Art. no. NSC: 2469

Photcredits: **Cover:** Johan Wildhagen, Per Eide, Tom Haga, Torgrim Rath Olsen **5:** Aina Hole **6–7:** Johan Wildhagen, Tom Haga **8–9:** Johan Wildhagen, Jean Gaumy, Tom Haga **10–11:** Per Eide **14:** Werner Juvik, Birgit Aarønæs Zanella **15:** Werner Juvik, Frank Gregersen © Nofima, Tom Haga, Astrid Hals **18–19:** Astrid Hals

Lisbeth Berg-Hansen
Minister of Fisheries
and Coastal Affairs

"The aquaculture industry is an important industry for Norway. It is a major export industry, and contributes to activities and jobs throughout the country, especially in the many local communities along the coast. Aquaculture is a growing industry all over the world, and Norwegian expertise in the field is becoming increasingly in demand around the globe. Norway is in the forefront of innovation and development in this area, and we will provide the conditions for this to continue in the future. The government's position is that we must permit further growth within a sustainable framework. Both the authorities and the industry itself must contribute to the realisation of this goal."

The last Viking

The Japanese regard them as new-born infants, they are indispensible for Frenchmen on the move, and they bring good luck to the Chinese. The Norwegian Salmon is Norway's all-time greatest conqueror.

There are three reasons why Norwegian Salmon has become such a worldwide best-seller. First of all, it's versatile and adaptable, whether in the kitchen of parents with small children or the restaurant of a master chef. That is why you are just as likely to find it when time is a premium as in the relaxed atmosphere of a weekend dinner party. Secondly, global health trends have helped. Now that omega-3 are on everyone's lips, salmon has landed on everyone's plates. Thirdly, Norwegian Salmon is value for money compared with many other types of protein, and most of the salmon can be consumed.

The worldwide success of Norwegian Salmon is due to the fact that it is a farmed product. While many other raw materials from both land and sea are inherently seasonal, fresh salmon can be on the menu all year round. With a coastline of 101,000 kilometres, Norway has innumerable cold, clear fjords that provide ideal growing conditions for fish destined to conquer the world. That is why master chefs around the world can be confident that the quality will be consistently high every time a new consignment arrives from Norway.

The Nama character means, quite simply, "something no-one has done anything to". The Japanese use the word to refer to the day they were born, to describe beer before it is bottled – and they started using it when Norwegian Salmon conquered the sushi counter. Today, young Japanese prefer Norwegian Salmon to all other species of fish for sushi and sashimi.

In Paris, sushi bars are flourishing in response to the steadily shrinking French lunch break and consequent demand for fast food. These days, the French prefer to stop at a sushi bar close to their office, unless they have brought what they call a Baguette Nordique: a French bread stick with Norwegian smoked salmon.

The Chinese toss raw salmon in the air to wish for luck and happiness in the New Year. Before Chinese families eat their traditional New Year dinner, they toss the fish with the lucky red colour in the air three times. The first time they ask for happiness in the New Year. The second time they ask for riches. The third and last time they ask for luck.

YEAR	SALMON EXPORT VALUE, NOK 1000
1990	5 100 019
1995	7 036 171
2000	13 245 385
2005	14 819 010
2010	**32 893 988**

It began with a farm built by pioneers at Hitra in 1970. There are now several hundred salmon farms along the Norwegian coast, where the temperature and sea currents provide optimum living conditions for salmon. To begin with, the pioneers learnt by trial and error. Later, excellent collaboration between the industry, the authorities and research communities developed into what we now know as a professional and robust industry.

1959:

- Karsten and Olav Vik, architect and gardener respectively, are among the many pioneers who were inspired by Danish freshwater farms for small rainbow trout. The brothers farmed the rainbow trout in floating wooden crates, and found that the fish could gradually be acclimatised to seawater. In order to achieve the red colour of the flesh, they fed the trout with prawn shells.

FACT

Every day, more than 12 million seafood meals originating from Norwegian aquaculture are served, in around 100 different countries.

1961:

- The first Barbie doll is marketed.
- "Rainbow trout farms, branch of industry or advertising gimmick?" asks newspaper Bergens Tidende. Two years later, newspaper Adresseavisen headlines with: "Rainbow trout - a new domestic animal?".
- The World Wide Fund for Nature (WWF) was established.

Fruits of the sea

Correct nutrition is not just about healthy food, for many people it is just as much about getting enough food. Norwegian aquaculture meets both the need for healthier food in our part of the world, and for more food in other parts of the world.

By 2050, the world population will probably have reached nine billion people, a third more than at the millennium. Because more than one billion people are already undernourished, the world must produce twice as much food in 2050 as in 2010, just to meet their needs.

The potential for growth is to be found in the sea, not on land. Around 70 per cent of the Earth is covered in water, while less than five per cent of world food production takes place in the sea.

Enough food of the right kind

Many people in those parts of the world that have enough food, do not eat the right kind of food. According to the World Health Organisation (WHO), Cardiovascular diseases (CVDs) are the number one cause of death globally. Annually, more people die from CVDs than from any other cause. The Food and Agriculture Organization of the United Nations (FAO) and WHO have recommended a series of steps that Member States should take, to more effectively communicate the benefits of fish consumption with their citizens.

- Acknowledge fish as an important food source of energy, protein and a range of essential nutrients and fish consumption as part of the cultural traditions of many peoples.
- Emphasize the benefits of fish consumption on reducing mortality from coronary heart disease for the general adult population, and the risks of mortality from coronary heart disease associated with not eating fish for the general adult population.
- Emphasize the net neurodevelopmental benefits to offspring of women of childbearing age who consume fish, particularly pregnant women and nursing mothers, and the neurodevelopmental risks to offspring of women of childbearing age who do not consume fish.

Source: Joint FAO/WHO expert consultation on the risks and benefits of fish consumption, published 2011

EFSA and U.S. HHS dietary advice

Among the general adult population, consumption of fish, particularly fatty fish like Salmon, lowers the risk of coronary heart disease mortality. The European Food Safety Authority (EFSA) has concluded that a dietary advice on a daily intake of 250 mg of long-chain omega-3 fatty acids for adults may reduce the risk of heart disease. To this intake 100 to 200 mg of docosahexaenoic acid (DHA) should be added during pregnancy and lactation.

The U.S. Department of Agriculture and the U.S. Department of Health and Human Services (HHS) have released the 2010 Dietary Guidelines for Americans. The U.S. government are advising all Americans, including pregnant and breastfeeding women, to eat seafood at least twice a week for heart and brain benefits. They recommend consumption of about 8 ounces per week of a variety of seafood, which provide an average consumption of 250 milligrams per day of eicosapentaenoic acid (EPA) and DHA, and are associated with reduced cardiac deaths among individuals with and without pre-existing cardiovascular disease.

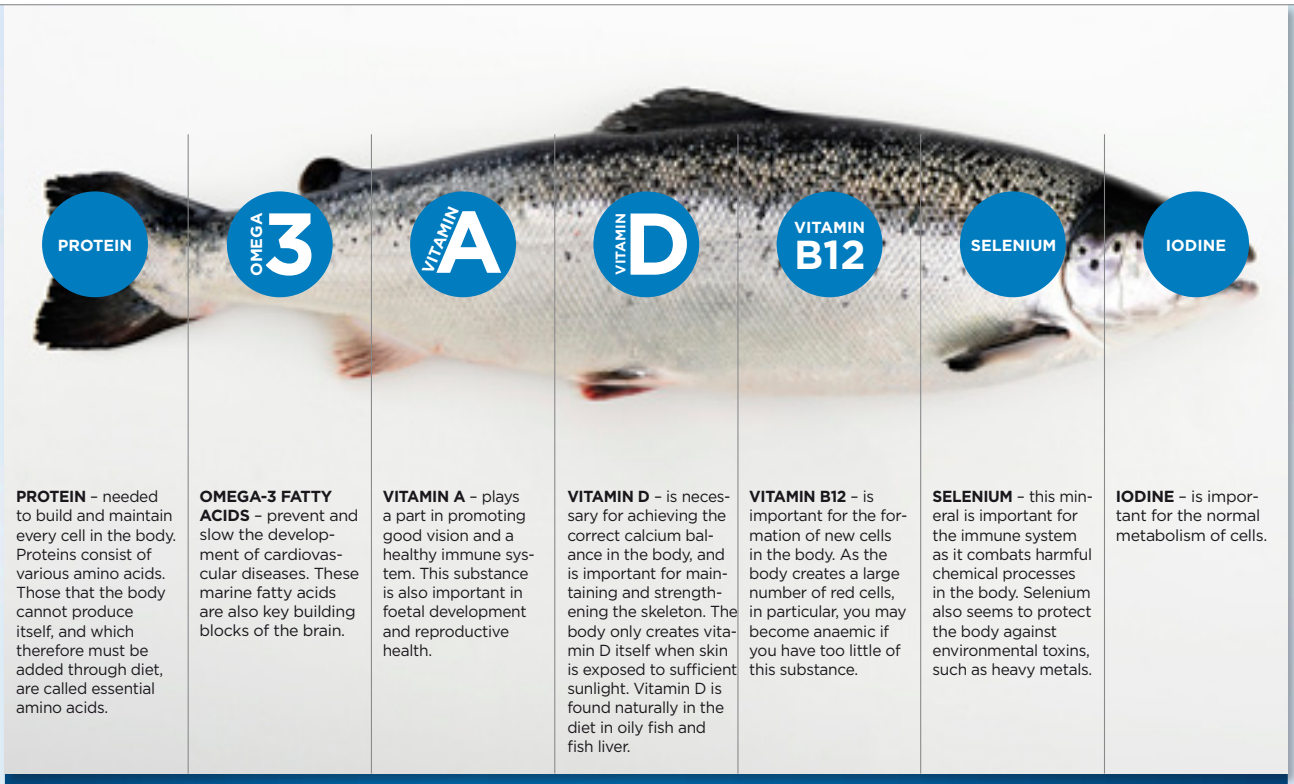
FACT

"We will have food security when everyone has access at all times to enough safe and nutritious food to meet their preferences and nutritional needs for an active and healthy life."

Food and Agriculture Organization of the United Nations, FAO

1962:

- In a restricted fjord arm off Lyngdal, Theis Jakobsen begins to cultivate rainbow trout that he imports alive from Denmark. The same year, Erling Osland leaves his job as a foundry worker in the aluminium plant in Høyanger to work as a full-time fish farmer. He had been farming rainbow trout in netting cages around posts on the beach for many years. At this time, it attracted attention that anyone would want to make aquaculture their main source of income; most people carry it out in addition to other work.
- The earliest ideas for the contemporary Internet, or an "Intergalactic Computer Network" intended to allow general communications among computer users, were formulated by computer scientist J. C. R. Licklider.



PROTEIN – needed to build and maintain every cell in the body. Proteins consist of various amino acids. Those that the body cannot produce itself, and which therefore must be added through diet, are called essential amino acids.

OMEGA-3 FATTY ACIDS – prevent and slow the development of cardiovascular diseases. These marine fatty acids are also key building blocks of the brain.

VITAMIN A – plays a part in promoting good vision and a healthy immune system. This substance is also important in foetal development and reproductive health.

VITAMIN D – is necessary for achieving the correct calcium balance in the body, and is important for maintaining and strengthening the skeleton. The body only creates vitamin D itself when skin is exposed to sufficient sunlight. Vitamin D is found naturally in the diet in oily fish and fish liver.

VITAMIN B12 – is important for the formation of new cells in the body. As the body creates a large number of red cells, in particular, you may become anaemic if you have too little of this substance.

SELENIUM – this mineral is important for the immune system as it combats harmful chemical processes in the body. Selenium also seems to protect the body against environmental toxins, such as heavy metals.

IODINE – is important for the normal metabolism of cells.

FREQUENTLY ASKED QUESTIONS

Who in Norway monitors the content of undesirable substances in salmon and trout?

- The Norwegian Food Safety Authority and NIFES (the National Institute of Nutrition and Seafood Research) take samples and analyse them.

Does farmed salmon contain more heavy metals than wild salmon?

- No. Such undesirable substances as PCBs, dioxins and heavy metals in salmon fillets have been monitored for more than a decade. The content is the same as in mackerel and herring, and far below proscribed limits.

Does farmed salmon contain hazardous pharmaceutical residues?

- No. No residues from illegal drugs or legally used pharmaceuticals above set limits have ever been found. The Norwegian authorities perform thousands of tests every year.

Read more about:

- Benefits of seafood:
  www.who.int
  www.fao.org/fishery/en
  www.efsa.europa.eu (search for: "EFSA sets European dietary reference values for nutrient intakes")
  www.health.gov/dietaryguidelines/
  www.nifes.no/sjomatdata
- UN work on food safety:
  www.fao.org

1968:

- Professor Harald Skjervold at the Norwegian Agricultural University establishes a breeding station for rainbow trout in Romerike County, and collects roe from Norway, Sweden and Denmark. He is also given permission to catch breeding salmon from 41 different rivers and sets up the breeding programme for Norwegian salmon. Skjervold and Professor Trygve Gjedrem share the honours for Norway having the world's oldest and most refined breeding material for salmon and trout.
- The first Big Mac goes on sale in McDonald's costing 49 cents.

Rings in the water

Cod drying on racks in Lofoten, clipfish on the rocks along the Møre coast and crabs on the quays in Trondheim. All tell the same story: over the centuries, rich ocean resources have formed a solid foundation for vigorous local communities along the entire Norwegian coast. Aquaculture is no exception from this tradition, far from it.

When we study the local and regional significance of Norwegian aquaculture, it is not enough to simply consider the large number of people who work directly in the industry by feeding, breeding, processing and selling fish.

Every job in the Norwegian aquaculture industry also creates nearly two jobs in other parts of Norwegian industry, such as the many jobs in manufacturing and maintaining equipment for the farms, transporting goods and personnel and offering food and accommodation. In 2009, the number of jobs created by aquaculture totalled 22,700, and these are jobs that cannot be outsourced abroad.

Services in local communities

Fish farms form the cornerstone businesses in many local communities. In several of these communities, aquaculture has created vital jobs to replace those lost over time through the downsizing of the traditional fishing industry. More jobs are not, however, the only effect of aquaculture industry in small and medium-sized coastal communities. Fish farms create a need, and therefore a market, for companies and services that a small community would not otherwise have had access to, including trades of all kinds.

1969:

- Jam manufacturer Johan Lærum operates a fish farm in a restricted fjord arm at Flogøy outside Bergen.
- Neil Armstrong becomes the first man on the moon.
- The brothers Ove and Sivert Grøntvedt set out 20,000 salmon smolt at Hitra, in what is considered to be the first salmon fish farm in the world. The Grøntvedt brothers make a profit from the first year, and in the early 70s salmon prices are around NOK 80 to 90 per kg, which would be around NOK 600 in current terms.
- The Beatles top the Norwegian charts with "Let it be".

Building roads

In addition to jobs and service production outside the major conurbations, the aquaculture industry creates infrastructure that the rest of the region's inhabitants can enjoy. This applies, not least, to roads, because every 20 minutes, every day, all year round, a fully loaded temperature controlled carriage of goods crosses the border on its way out of Norway. These thermo transport vehicles start their journeys along the Norwegian coast, and the Norwegian transport authorities have picked up on this. In its National Transport Plan, the government presented its goals and strategies for transport policy towards 2020. Among other things, it states *"the government considers that strong increases in investment and maintenance of infrastructure are important if we are to exploit the potential for increased wealth development that exists throughout Norway, and to make it even more attractive to live and work outside the cities."*

Among other things, when discussing the northernmost region of the country, the fishing and aquaculture industries are named specifically: *"Fishing and aquaculture, tourism and petroleum development are the most important areas of industry, in which growth in wealth creation is expected in the years to come. This places demands on a smoothly functioning infrastructure. Based on this perspective, the government's efforts to develop and modernise the transport infrastructure in Northern Norway is balanced against the transport needs of the rest of the country."*

FACT

- Each job in the core activity of the Norwegian aquaculture industry creates 2 jobs in other Norwegian business and industry.

- Each krone created in the core activity of the Norwegian aquaculture industry creates NOK 1.48 in value creation in other areas of Norwegian business and industry.

Source: SINTEF's analysis "The significance of the fishing and aquaculture industries for Norway in 2009 – a national and regional ripple effect analysis."

1972:

- The Lysø Committee, led by formed county governor of Sør-Trøndelag, Nils Lysø, starts its work. Appointed by the government, this professional committee should assess the potential, organisational form, knowledge needs and legislation adjustment for aquaculture. The committee concludes that each farm should be large enough to function as an independent financial unit, not just an add-on business.
- Digital watches are introduced.

Sustainable aquaculture

Norwegian aquaculture operates in the natural environment that we all share, and that imposes obligations on everyone concerned. The authorities, research communities and industry are all working together to enable Norwegian aquaculture to operate within a sustainable framework.

Whether it takes place on land or in the sea, all food production has an environmental impact. This may involve various types of emissions or discharges, damage to biodiversity, consumption of non-renewable resources such as oil, or renewable resources such as the raw ingredients of feed.

In 1987, the UN World Commission for the Environment and Development defined sustainability as *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*. Sustainable development can be further divided into three parts: a social part, a financial part and an environmental part. The history of the Norwegian aquaculture industry has shown that financial sustainability has been challenged on several occasions. Today, the main challenges the industry faces are in the area of environmental sustainability.

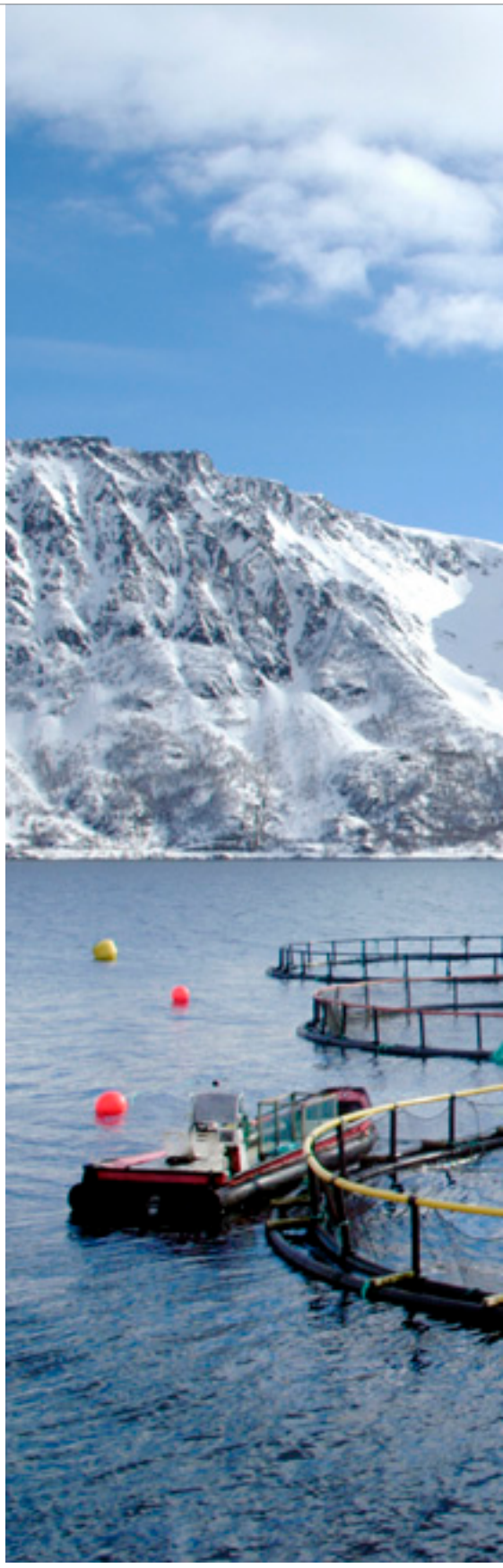
In 2011, companies' members of the Norwegian Seafood Federation committed themselves to several new initiatives to reinforce efforts to combat the two greatest challenges faced by an environmentally sustainable fish farm: Salmon louse and escapees. The initiatives are more stringent than the regulations imposed by the authorities.

Measures against salmon louse:

- **Reduction of infection** by using lice filters in all slaughterhouses and transport boats.
- **Treatment strategy** by counting lice in individual cages every week, and documentation using a common health database for the aquaculture industry.
- **Farming wrasse** in order to avoid overfishing of wild wrasse.
- **More research** by using resources from the Norwegian Seafood Federation Research Fund for this purpose.
- **Professional developments** by ensuring funds for internal projects are earmarked for efficient and environmentally sound methods for lice treatment.

Measures to deal with escape:

- **Prevention** using, among other things, extra risk analyses, Closed-circuit television (CCTV) surveillance and divers when conducting operations that could damage the cage netting or other equipment take place, or new equipment is taken into use.
- **Marking and tracking fish** in order to distinguish between wild salmon and escaped farmed salmon, and to facilitate identifying the facility in question.
- **Enhanced preparedness** to make it easier to catch escaped fish.
- **Make companies responsible** for escapes pay NOK 500 for each escaped salmon caught in a river. The money to be paid to the river ownership association for use in strengthening the population of wild salmon.
- **An environmental fund** of NOK 30 million, the purpose of which will include removing escaped fish from watercourses.



1973:

- The Norwegian parliament passes a law regulating the right of aquaculture companies to use natural resources following proposals from the Lysø Committee. The aim of the legislation is to regulate development of the new industry in such a way that it strengthens Norwegian coastal and fjord communities and does not become dominated by conglomerates. The law also gives the authorities the power to set requirements for quality and health of the farms.
- The first handheld cellular phone call is made by Martin Cooper in New York City.

FREQUENTLY ASKED QUESTIONS

Are the anti-lice measures used hazardous for the environment and crustaceans?

- Fish farms use a range of measures against lice, including wrasse and approved pharmaceuticals. All of the pharmaceuticals used are approved by the Norwegian Medicines Agency following thorough testing. In order to take into account potential environmental impact, and to reduce the use of pharmaceuticals as much as possible, the use of such substances is strictly controlled. There are tight restrictions on the use of pharmaceuticals that could affect crustaceans in fish farming areas during the summer months as this is the main time of the year for crayfish to shed their shells.

Isn't feeding farmed salmon with wild fish a waste of natural resources?

- Farming salmon is one of the most resource-efficient ways of animal farming for food. At the present time, 1.15 kg of feed produces 1 kg of salmon, and this feed comes from 2 to 2.5 kg wild fish. In comparison, a salmon in the wild needs to eat 10 kg of food to grow by 1 kg.

Why can't the wild fish used in salmon feed be used for human consumption instead?

- Not all fish species are suitable or in demand for use directly in human consumption. According to the FAO, the UN food agency, more than 75 per cent of the seafood produced in the world is destined for human consumption. The rest is mainly used in the production of fish meal and fish oil.

Isn't it irresponsible to use food to produce another type of food, such as salmon?

- No, most animal food production, such as meat, milk and eggs, is based on feed containing raw ingredients that could be used for food for human consumption. Most people eat both meat and fish, which is also in line with health authorities' recommendations for a healthy and balanced diet. The WHO thinks that more seafood should be eaten to improve public health. If the seafood requirements for the world population are to be met the FAO says that this can only be achieved through increased production of farmed seafood.

1974:

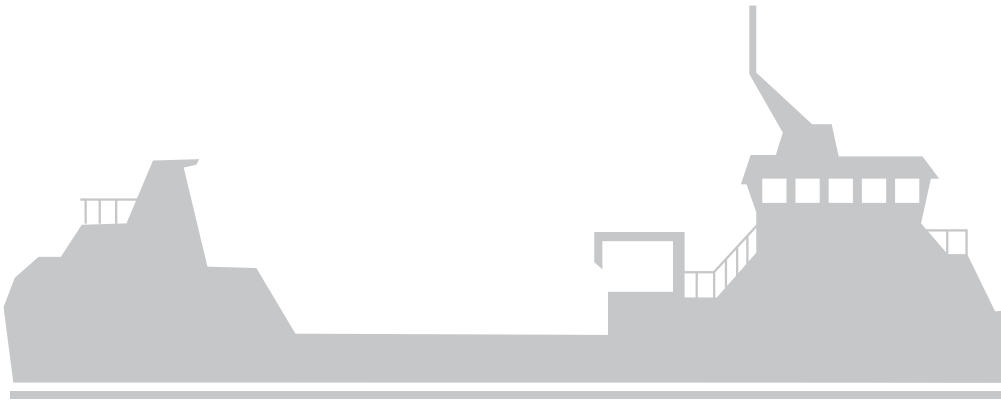
- The aquaculture industry experiences a turnover crisis following rapid increases in production levels. In order to regulate the market, the industry decides to freeze fish instead of undercutting each other.
- Estimate of the world's population reaches 4 billion.
- Worldwide inflation cause dramatic increases in the cost of fuel, food and manufacturing.

1975:

- Between 1972 and 1975, production from Norwegian aquaculture increased by 40 per cent annually.
- Bill Gates uses the Microsoft name for micro-computer software for the first time.

Requirements for fish farms

You must be licensed by the authorities to operate a fish farm in Norway. Norwegian fish farmers have an ethical and legal responsibility for the welfare of their salmon. Operations are strictly regulated for environmental, fish health and food safety reasons for everyone licensed to farm fish.



All fish farms in Norway have operational plans that are assessed by the Directorate of Fisheries and the Food Safety Authority. Based on the Norwegian regulations and farming procedures imposed by the aquaculture industry, the Veterinary Institute has given Norwegian farmed salmon a clean bill of health. We have standards of fish health and a fish health service that is in the **forefront of the industry internationally**.

Fish farmers must have access to a **site** before being granted a licence, in other words the area in which the farm is to be established. There are strict regulations governing current conditions, among other things, as the location of the cages requires good water flow. Although the industry has grown, the number of sites fell by 40 per cent from 2000 to 2010.

After a site has been emptied of fish, it must **lie fallow** for at least two months before the next generation of fish is introduced, out of consideration for the seabed environment and to reduce any infection pressure in the area.

Each site may **only have a single year class** of fish. For this reason, each licence covers at least two sites.

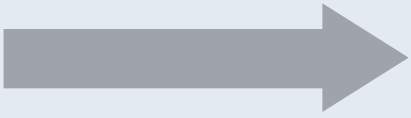
When a farmer applies for new sites, or permission to expand existing sites, the authorities require **environmental surveys of seabed conditions** at the site. During operations, the farmers are also obliged to carry out on-going monitoring of how operations affect the seabed.

Within six months of production at a site being permanently discontinued, all installations above and below water must be **removed**.

The oxygen content, temperature and salt content of the seawater at the fish farm must be monitored closely, because this affects the health and welfare of the fish. Because salmon, in common with other fish, are cold-blooded, their body temperature is the same as their surroundings. Higher temperatures raise the metabolism of the salmon, thereby increasing their oxygen consumption. Warm water also contains less oxygen than cold water.

FACT

Norway has 90,000 square kilometres of sea within its sea baseline. This means that Norway has at its disposal an area for potential food production that is the same size as the total agricultural area of Norway, Sweden, Finland and Denmark (equals the agricultural area of Italy).



Location of cages and fish farms requires good **water flow**.

Cages are **anchored** to the seabed.

1977:

- For the first time, more salmon than rainbow trout are produced. Rainbow trout has initially dominated the industry. Two years later, the first-hand value of salmon has tripled.

1978:

- The attraction of the industry is so strong in the second half of the 1970s, that a temporary ban on new licences is introduced.

1980:

- Production in the industry reaches 8,000 tonnes, compared with 500 tonnes ten years earlier. 70 per cent of the production is in Hordaland, Møre og Romsdal, and Sør-Trøndelag counties. The four licence allocation rounds in the 1980s, however, place priority on the three northernmost counties. After the last round in 1989, the aquaculture industry extends along the entire coast.

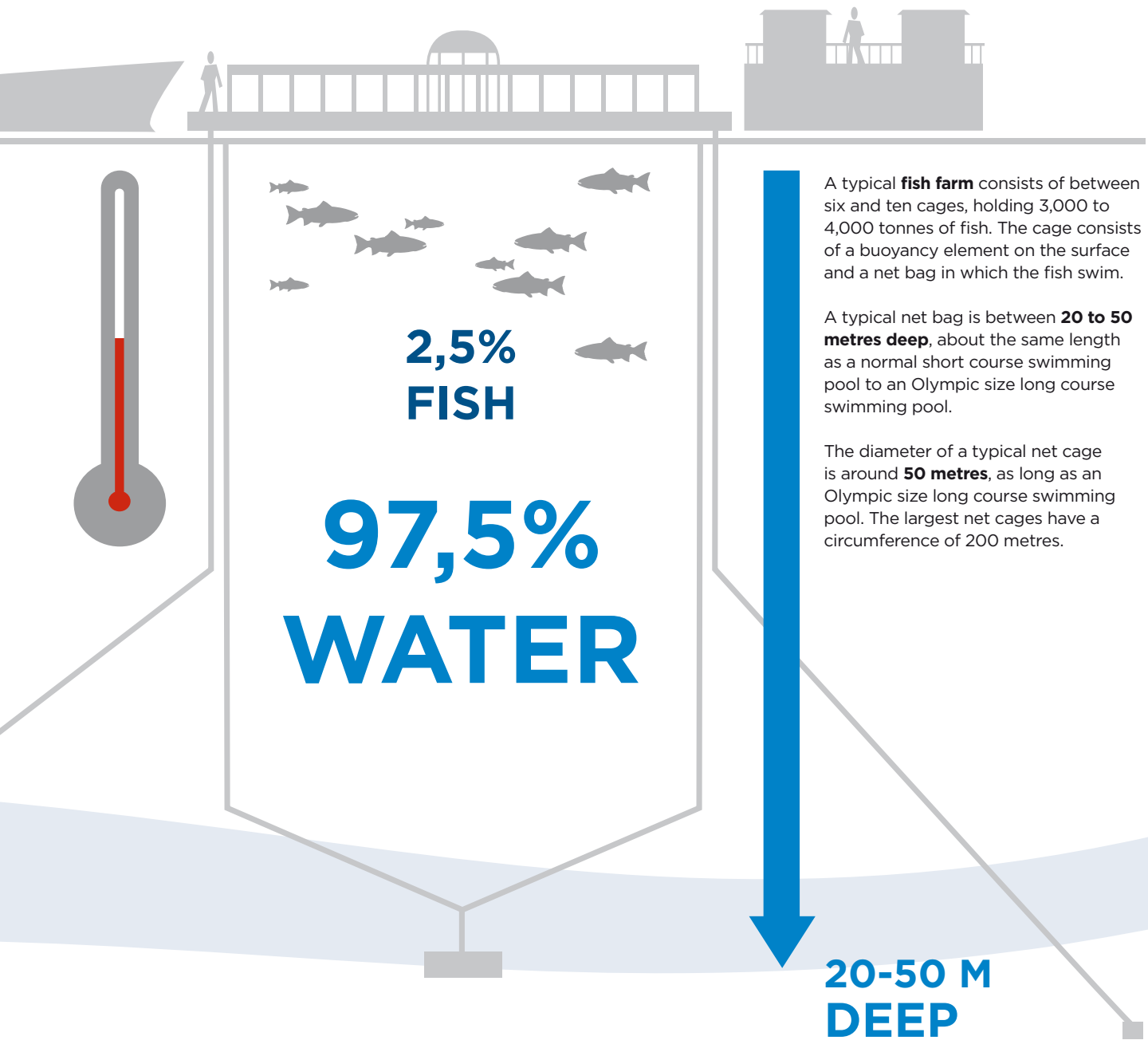
FREQUENTLY ASKED QUESTIONS

Are farmed salmon full of drugs?

- No, because their health is good. While production of farmed salmon has increased strongly, outbreaks of disease have decreased thanks to effective vaccines and strict hygiene regulations. This is why virtually no antibiotics are used in salmon farming today – put simply, the fish are largely healthy throughout their life cycle.

Read more about:

- Regulation of aquaculture:
  www.fisheries.no
  (search for the Norwegian Aquaculture Act)
  www.vetinst.no/eng
  (Under 'Publications' you will find 'Fish Health Report')



A typical **fish farm** consists of between six and ten cages, holding 3,000 to 4,000 tonnes of fish. The cage consists of a buoyancy element on the surface and a net bag in which the fish swim.

A typical net bag is between **20 to 50 metres deep**, about the same length as a normal short course swimming pool to an Olympic size long course swimming pool.

The diameter of a typical net cage is around **50 metres**, as long as an Olympic size long course swimming pool. The largest net cages have a circumference of 200 metres.

1981:

- Aquaculture has been regarded for some time as a potential side-line to agriculture or traditional fishing, but regulation of the industry is now moved from the Ministry of Agriculture to the Ministry of Fisheries and Coastal Affairs. At the same time, Norway adopts a new Aquaculture Act.
- Gro Harlem Brundtland becomes Norway's first female prime minister.

1983:

- Disease in the cages has become such a major problem that the Fish Farmers' sales association initiates the "Healthy Fish" project to support its information work and research into disease prevention.

FROM ROE TO MARKET

1984:

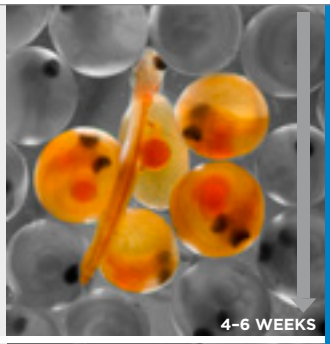
- Infectious Salmon Anaemia (ISA) appears for the first time.
- The first Macintosh was introduced by Apple's then-Chairman Steve Jobs.

1985:

- Norway adopts a new law concerning farming of fish and shellfish. This law does not require hatcheries to be licensed, only registered. The result in subsequent years is over-investment.
- The first .com domain name, symbolics.com, is registered by the Symbolics Corporation.

ROE

The whole salmon farming process begins on shore in an incubator tray, and as for wild salmon, the roe is fertilised in fresh water. The roe hatches after approximately 60 days in water kept at 8 °C.



FRESHWATER

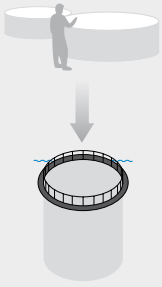
FRY

After hatching, salmon alevins have a yolk sac on their stomach from which they draw nourishment, and they are therefore known as yolk sac fry. Four to six weeks after hatching, the alevins begin to eat feed and can now be moved to larger freshwater tanks.

SMOLT

After 10-16 months in freshwater, the salmon are ready to be moved to net pens in the sea for on-growing and maturation into adult salmon. They still do not weigh more than 60–100 g.

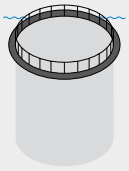
Since hatching, the fish have undergone major changes in a process called smoltification. These changes are necessary if the salmon are to be able to live in seawater. The salmon are now known as smolt.



SALTWATER

FARMED FISH

The salmon are kept in net pens in the sea and fjords for 14-22 months. When the fish weighs 4-6 kg, it is ready for processing.



FINISHED PRODUCT

The salmon are taken by well boat to the fish-processing facility. They are then stunned, gutted, washed, sorted according to size and quality and laid on ice. They are then moved to processing in Norway, to the fishmonger or sent to 100 countries around the world.

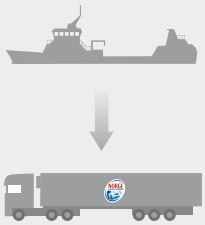


Photo fry and smolt: Werner Juvik
Smolt: Frank Gregersen, Nofima
Farm fish: Tom Haga
Finished product: Astrid Hals

1986:

- Thor Listau's expedition to Japan to investigate the potential for Norwegian seafood export marks the start of "Project Japan", the aim of which is to double Norwegian fish exports to Japan. The result is far better: in the five years between 1986 and 1991 exports increase by 250%. Salmon and trout represent most of this growth by entering the highly significant sushi market.
- Portugal and Spain become members 11 and 12 of the EU.

1989:

- Production growth has led to salmon prices halving in the course of the last five years.

New Species

Species illustrations: Pål Thomas Sundhell

Cod is regarded as one of our best food fishes, and it is eaten virtually around the world. The natural conditions for farming cod in Norway are good, and farmed cod will allow Norway to supply markets with fresh cod all year round. The biological challenges to farming cod are as good as solved, and the long-term prospects for this becoming a significant industry for Norway are promising.

Farming **Mussels** is the part of the shellfish industry that produces the greatest volumes. Mussels are farmed on so-called long lines, and it normally takes around two years before the shells are ready for harvesting. Mussels are not fed, but live on algae found in the sea. Occasionally, these algae contain substances that are toxic for human beings. In such cases, the mussels cannot be harvested until they have eaten themselves clean again. Shell samples are taken continually to check that they are of a good quality. All mussels sold in shops have been tested and are safe to eat.

Excellent future prospects

Norway's long coastline, which includes islands and deep fjords, extends for more than 83,000 kilometres, a distance twice as long as the Earth around the Equator. The conditions in Norwegian waters are excellent for both fishing and aquaculture. Norway is a fishing nation with long traditions of harvesting the fruit of the sea. Aquaculture makes it possible to offer seafood independently of the seasonal variations that limit traditional fisheries. The industry and public authorities are working together to manage these natural conditions, so that aquaculture can be developed within a sustainable framework.

New markets

In the future, new countries will partly supplement, and partly replace, those that are currently the largest markets for Norwegian aquaculture products. Brazil, Russia, India, China and South Africa are known as the BRICS countries, and thought to have the greatest economic potential over the next few decades.

New technology

The future for Norwegian aquaculture does not simply lie in new products for new markets around the globe, but there will also be new ways of cultivating the sea. Norwegian aquaculture is dependent upon continual development within biology and technology. If you employ closed containment fish farm facilities that float in the sea, you may reduce the risk of algae blooms, salmon lice and escapes. Submerged cages, deep under the sea are another alternative being considered by researchers, and this will also protect the equipment from bad weather. The challenge here is that salmon have an air bladder that must have air. By lifting the cages to the surface at regular intervals, submerged cages may also be practicable in the future, but it is essential that production does not affect the health and welfare of the fish and is economically sustainable.

Read more about the new aquaculture technology:
www.sintef.no/home/Fisheries-and-Aquaculture/

Brazil has a population of 198 million, and is the fifth largest population in the world. The country has the world's seventh largest gross domestic product (GDP).

South Africa has a population of 49 million, the world's 25th largest population. The country has the world's twenty-eighth largest GDP.

1990:

- Production in the industry is 170,000 tonnes, compared with 8,000 tonnes in 1980 and 500 tonnes in 1970. In order to regulate the market, The Fish Farmer's Sales Organization starts a freezing scheme.
- The Human Genome Project began.

1991:

- USA accuses Norway of dumping salmon prices and gives Norwegian salmon a punitive import duty of 26 per cent. From 1990 to 1991 exports to the USA fall from 9,300 to 800 tonnes.
- Internet is made available to unrestricted commercial use.

1995:

- A total of 1,220 fish farms are licensed to farm salmon and trout in Norway. Eleven years later there are 50 more. In the same period, the number of farm licenses for other species, including cod and halibut doubles.

FACT

"The aquaculture industry also creates ripple effects for the supplier industry and processing businesses. This revives coastal areas – and stimulates growth both outside and inside urban areas. Seafood is healthy, and researchers recommend we eat more fish. For this reason, the Norwegian government wants the aquaculture industry to develop further. The greatest potential for development is in farming salmon and trout, cod and shellfish. Growth in the aquaculture industry cannot be confined to what the market demands. Growth must also take place within the framework of what the environment can tolerate."

The Norwegian Government's "Strategy for an environmentally sustainable aquaculture industry"

Russia has a population of 140 million, and is the ninth largest population in the world. It has the world's eleventh largest GDP.

China has a population of 1.4 billion, the largest population in the world. It has the world's second largest GDP.

India has a population of 1.2 billion, and is the second largest population in the world. It has the world's tenth largest GDP.

Halibut is the largest of all flatfish and is highly in demand as a fish for human consumption. It has been successfully farmed in Norway but production times are lengthy, so the fish commands a high price in the market. Thanks to the excellent quality of farmed halibut and its steady supply, the fish has secured a premier position among chefs worldwide. No dramatic increase in production of halibut can be envisaged in the foreseeable future, but the goal of farmers is for slow but sure growth of a top quality product.

Char has been farmed for some years but only to a limited extent. As it is much admired by gourmets, the char fishing industry prefers to focus on this segment. Char is farmed mainly in Nordland County, in the fresh water as well as the sea.

Scallops are large shellfish living on sandy beds along the Norwegian coast – and a product that is in high demand. Both the muscle of the scallop and its roe are edible. Experiments are being conducted in the cultivation and harvesting of scallops, which take around 5 years to reach a saleable size of 10-11 centimetres.

Oysters are cultivated in narrow inlets and shallow areas along the Norwegian coast, mainly in southwest Norway. This is the oldest species in Norwegian aquaculture, and oysters were cultivated throughout the twentieth century. The oysters are sold alive and preferably eaten raw.

2000:

- DVD, optical disc storage media format, is announced.
- Norway exports 343,000 tonnes of salmon.
- Vladimir Putin is elected president of Russia.

2004:

- There are around 50 sushi restaurants in Norway.
- Mark Zuckerberg launched "Thefacebook", originally located at thefacebook.com.

2005:

- The Norwegian parliament adopts the new Aquaculture Act, which will *"promote profitability in the aquaculture industry and its competitive edge within the framework of sustainable development, and contribute to creation of wealth along the coast."*

2006:

- This is the first year that fish from Norwegian aquaculture counts for more than half of the export value of Norwegian seafood.
- Google purchases YouTube.

2008:

- Norwegians consume sushi worth more than NOK 271 million. On a global basis, the sushi market grows by around 30 per cent each year at this time. This trend leads to an increase in demand for Norwegian salmon.

Oven-baked **salmon** and **vegetables**

SERVES 4

500 – 600 g de-boned and skinned Norwegian Salmon fillet
2 onions, sectioned
1 red bell pepper, chopped
1 leek, thickly sliced
2 carrots, sliced
1 courgette, sliced
8 baby tomatoes
3 tablespoons olive oil
1 pinch dried thyme
1 pinch dried oregano
1 dl light sour cream
Salt and pepper to taste

METHOD

Cut the salmon into four portions. Preheat the oven to 200 °C. Mix oil, dried herbs and vegetables in a bowl. Transfer the mixture to an oven-proof dish. Drip a couple of tablespoons of water over the vegetables and place the salmon pieces on top. Season with salt and pepper and cover the dish with cooking foil. Place the dish in the oven for around 25 minutes. Garnish with a couple of spoons of sour cream if so desired when serving.

You can vary the vegetables used, and why not try a few spoons of sweet chilli sauce, soy sauce or just squeeze half a lemon? Fresh herbs, such as chives, parsley or dill give the dish an extra lift when added before serving.

2011:

- The member companies of the Norwegian Seafood Federation are committed to a number of new measures to prevent fish escaping from net pens and combat salmon lice. The purpose of the measures is to prevent salmon lice and salmon farm escapee from affecting stocks of wild salmon and sea trout stocks.

History shows us that the Norwegian aquaculture industry has experienced high points, such as technological progress, record production levels and export growth – as well as low points, such as over-production, bankruptcies and disease. Today, the industry is an international role model, determined to continue to develop sustainably, and as optimistic as the early pioneers.

Marit Bjørgen
The world's best female Nordic skier of all time

"Norwegian seafood is an important part of the diet that lets me perform at my very best. After I started eating seafood at least three times a week, I began to perform better, I rested better and I stayed healthier. And salmon is one of my favourite types of fish!"

Arne Hjeltnes
Former host
of male lifestyle
TV programme

"We need to make the value creation occurring around the country more visible. For example, Skjervøy may be a small coastal municipality but it is a modern fishery community with a bright future, due to investments being made here in sushi and the Japanese market. In the far north, the salmon grows more slowly and this, together with a secret feed recipe, helps it turn into a firm red salmon that is perfect for sushi. The result is a business offering 200 jobs and an annual turnover of around NOK 600 million, which creates scores of local jobs and have given little Skjervøy new life and optimism.

In the debate about how the country should make its living when the oil runs out, or even with the oil, it is useful to know what sort of wealth creation we actually have, and the conditions and basis we have for achieving it. And there are many communities like Skjervøy along our coast."

Eva Bratholm
Counsellor at the
Norwegian Embassy
in India

"Norwegian salmon is an excellent ambassador for Norway abroad, and is widely used. This is because it demonstrates some of the best that Norway can offer, and also because international guests almost expect to be served salmon when invited by representatives of Norway. There are also practical reasons for diplomats abroad using salmon so much. Many places are hot, and there is an advantage in serving food that is so easy to prepare."

It's no wonder consumers around the world enjoy eating Norwegian Seafood.

This brochure is published by:

The Norwegian Seafood Federation (FHL)
FHL covers the entire supply chain, from fjord to table, within the fisheries and aquaculture sector in Norway. FHL's member companies range from small, locally-owned family companies to major multinationals. Their common interest is that they work in the seafood sector.

The Norwegian Seafood Council (NSC)
"The best seafood comes from Norway". That is the view of the Norwegian Seafood Council (NSC), and we want people in all four corners of the world to know it. In our quest for Norwegian Seafood to conquer the world, the NSC offers image-building and marketing services on behalf of the Norwegian fisheries and aquaculture industry in all important seafood markets.

For more information about Norwegian Seafood:

Brazil:	www.Bacalhaudanoruega.com.br
China:	www.Seafoodfromnnorway.cn
France:	www.Poissons-de-norvege.com
Germany:	www.Norwegenfisch.de
Hong Kong:	www.Seafoodfromnorway.hk
Italy:	www.Fiordisapori.it
Japan:	www.Seafoodfromnorway.jp
Norway:	www.Seafood.no, www.Fhl.no, www.Godfisk.no, www.Laksefakta.no
Portugal:	www.Mardanoruega.com
Russia:	www.Seafoodfromnorway.ru
Spain:	www.Mardenoruega.es
Sweden:	www.Norskfisk.se
USA:	www.SalmonfromNorway.com

The Norwegian Seafood Federation (FHL)
PO Box 5471 Majorstua
NO-0305 OSLO
NORWAY

Telephone: +47 99 11 00 00
firmapost@fhl.no
www.fhl.no/english

The Norwegian Seafood Council (NSC)
PO Box 6176
NO-9291 Tromsø
Norway

Telephone: +47 77 60 33 33
mail@seafood.no
www.seafood.no

NORGE SEAFOOD FROM NORWAY

fhl Norwegian Seafood Federation

Published by the Norwegian Seafood Federation (FHL) and the Norwegian Seafood Council (NSC), November 2011

Art. no: 2469 | Photo: © Norwegian Seafood Council | Text: Apeland Informasjon | Design: ww.wtank.no | Print: Gunnarshaug Trykkeri AS