

Learning from experience

Four years ago, Faroe fish farming was all but obliterated by ISA. After a remarkable turnaround, today there is hardly any sign of disease and mortality in the net pens at all.

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Editorial : Fish health first



Since the foundation of Europharma in 1996, our aim has been to become the fish farming industry's package supplier of fish health products. This means more than just selling our products. We would also like to share knowledge on the field of fish health with the industry, and this is the idea behind Europharma Fokus. Our ambition is to give you something more than a traditional customer magazine where the editor praises the company's own products and brilliance. We wish to contribute something a bit more substantial.

We are very pleased that skilled researchers and scientists have been willing to contribute to our magazine with articles on their respective fields of expertise. In addition we will present our own articles on current challenges for the industry. In this way we will try to present both expert and general knowledge, both essential to an industry where established truths have a surprisingly brief half-life.

20 years ago, few people believed that one single vaccine could protect the fish against seven different diseases, but research and experience has made this possible. Obviously, we will have to keep in mind that the fish farming industry is still very young. Being a biological industry the sector has a constant need of technical updates and developments, seeing as there are still a lot of teething problems.

In this first issue of Europharma Fokus, we take you to the Faroe Islands. In the 11-page cover article we tell the story of ISA in the archipelago, how the disease totally wiped out the industry at the start of the millennium, and how the fish farmers and the authorities together seem to have solved the problem through a combination of strong regulations, screening and vaccination.

Both the Norwegian Food Safety Authority and the fish farming industry in Norway could probably learn a lot from the Faroe experience. In fact, it is remarkable how little we learn from each other. The fish farmers who lived through the crisis on the Faroe Islands are probably not surprised at the disastrous development we now can see in Chile. Elementary precautions taken a long time ago in other fish farming nations are only now about to be implemented in Chile.

The recurring cardinal sin of the fish farming industry - the tendency to regard profit as more important than fish health and common sense - is hitting Chile hard. The consolation is that it is possible to start all over again - and succeed.

Enjoy the read!

Jim Roger Nordly,
Europharma

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Publisher:

Europharma AS
Lufthavnveien 11, 8370 Leknes
Ph: 76 06 09 30

Editing:

Information Advisor Øystein Bie Pettersen
Ph: 76 06 09 38
Mob: 913 85 465
obp@nordly.no

Print and design:

Forretningstrykk AS



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About the publisher Europharma:

Europharma AS is Norway's leading wholesaler and package supplier of vaccines and fish health products to the fish farming industry. Its main office is located in Lofoten, with warehouse and distribution facilities in Bærum, close to Oslo. For years Europharma has been running the same kind of business in Chile and recently established new branches in USA, Canada and Scotland.

The company is part of the Nordly Group and thus is part of a broad network of expertise. Europharma has sister companies in areas such as research and development, feed production and logistics.



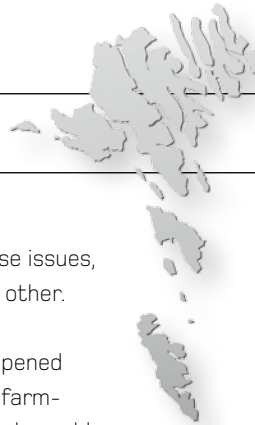
The great turnaround

After ISA had all but eradicated Faroe fish farming at the start of the new century, the industry has now resurfaced with the strictest regulations in the world, and results so sensational that the Faroe Islands deserve to be called world champions of fish farming.





Øystein Bie Pettersen
Text/Photo



The Faroe Islands. 18 islands consisting of 1400 square kilometres of weather-beaten mountains halfway between Iceland and Scotland. There are 48,000 inhabitants, and a dependency on fisheries and aquaculture that is in no way balanced by the 70.000 sheep that make sure there is not a single wild growing bush between Enniberg in the north and Akraberg in the south. When the fisheries fail in the Faroe Islands, there is a nationwide crisis. Introducing fish farming was meant to decrease the island nation's dependency on nature's whims. Fish farming was supposed to provide stability, where traditional fisheries depended more on unpredictable variations in stock and influx. In the spirit of social democracy, licenses were handed out left, right and centre. Everyone was to participate in the bonanza. In the

beginning of the 90s, there were close to 70 plants with as many owners, scattered over the 25 fjords suitable for fish farming in the Faroe Islands. Laws and regulations were virtually non-existent.

In hindsight, it is evident that this was a recipe for disaster. And disaster came. First in 1992, when not only the fish farming industry, but more or less the entire Faroe state went bankrupt. The situation was quite similar to what we see in Iceland today, but in the Faroe Islands it was due to a combination of carelessness with government guarantees along with a crisis in traditional fisheries and failing salmon prices. People lost their homes, and a large part of the population left to try their luck in mainland Europe. The small fish farming companies with limited capital, who were

already struggling with disease issues, went bankrupt one after the other.

This probably would have happened anyway, at that time the fish farming industry in the Faroe Islands could hardly be called sustainable. In just one fjord there could be three different plants with up to three generations in each. Thus, there could be as much as nine fish groups in one fjord. Fallowing was virtually non-existent, says Atli Gregersen. He is one of the true veterans of the Faroe industry, and has escaped both great downturns unscathed. Today he owns three licences through the company Luna.

Gregersen is also vice-chairman of the Faroe Fish Farming Association that – despite a dwindling member-



Excellent conditions: The Faroe fish farming fjords are relatively short and open. This means that in some locations the weather is a bit rough, but the Faroe Islands are located in the middle of the Atlantic, and the flow of water is very good. In addition to this, water temperatures are favourable and stable.



Veteran: Atli Gregersen got through both of the crises in Faroe fish farming unscathed and is today the owner of Luna, one of six remaining fish farming companies in the Faroe Islands.

ship – has played and still plays a vital part in shaping the terms of today's industry. Contrary to the tendency in Norway, where new regulations from the Norwegian Food Safety Authority are often met by protests and "trench tactics", the Faroe fish farmers have actually themselves pushed for some of the strictest regulations that they must now live by. After the annus horribilis of 1992, there was a general agreement on the need to do something about the proximity of adjacent plants. The guidelines that were laid down were as follows: One fjord, one plant, one owner. And if 1992 was hell, it did not take long before disaster again loomed in the Faroe fish farming fjords. Some fish farmers recovered already the year after, and benefited from stable and high salmon prices. The industry recovered and prospered in no time. But there were dark skies on the horizon.

The disease issues were increasingly difficult to deal with. Cold Water Vibriosis disappeared almost immediately due to a vaccine, while Bacterial Kidney Disease (BKD) and a growing sea lice problem continued to cause concern.

A feeling of uneasiness spread in the Faroe Fish Farming Association. – Sea lice are in my opinion often a preliminary warning that something is seriously wrong. We knew that there was ISA in Norway, and that, based on experience; the Faroe Islands normally get the same diseases as Norway a few years later. We were not prepared for such a challenge, and our veterinary legislation was completely inadequate. This is why the Fish Farming Association as early as in 1998 took the initiative to

do something about this, explains Atli Gregersen.

The fish farmers met with the authorities and asked for stricter regulations, and also provided concrete suggestions for the regulations. For different reasons the new regulations were not in place until Christmas 2003. By then the entire Faroe archipelago was infected with ISA.

Fuglafjörður march 2000. ISA is discovered for the first time. No doubt bad news for the industry, but at this point no one in their wildest dreams imagined that it would turn out as disastrous as it did. The following year five new plants were infected, in 2002 five more, in 2003 ten plants all over the archipelago, and in 2004 ISA was detected in 11 locations. The disaster was complete. Bankruptcies flourished and this year only a small amount of fish was transferred to sea in a couple of locations.

– In the beginning ISA did not cause a lot of concern. A lot of people thought we would be fine. All we had to do was to produce large smolt and reduce the number of days at sea. Perhaps we



Extensive: The spread of ISA from 2000 to 2005.



Vulnerable: The capital Tórshavn is, like the rest of the archipelago, constructed with money from fisheries and aquaculture. An economy that one-sided is vulnerable to fluctuations.

could have reduced the negative development if we had implemented measures sooner. Three years passed from the first outbreak until we got the new regulations in place, and they came only after a considerable pressure from the



Better safe than sorry: Fish veterinarian Peter Østergård thinks it would be sensible to continue the vaccination programme against ISA, even though so far there is no conclusive evidence that it has been effective.

industry, says Atli Gregersen.

He thinks that the authorities failed because they did not allocate enough resources to get the job done. In the late 90s, only one man, the state veterinarian, was responsible for fish health in the Faroes. On top of that, during this period he fell seriously ill. Initially, the plan was to more or less translate and adopt the Norwegian regulations, but this gradually changed. In 2000 Veso was asked to make a report and to suggest regulations based on Faroe conditions. And this came only in 2003. Two years earlier the fish veterinarian, Peter Østergård, was employed by the office of the state veterinarian, and later assigned to the Heilsufrøðiliga starvstovan, the Faroe Food Safety Authority.

Østergård was to be responsible for inspection and laboratory operations, but, due to the limited resources, became a kind of factotum whose responsibilities

also included a substantial management component. Østergård thinks that the limited resources in the fisheries management was a serious problem and a factor that contributed to a delayed response to the ISA-outbreak. There was a lot to do. The lack of separation of different generations was a big problem. Some fjords had not been fallowed in 18 years, trailers carrying freshly slaughtered fish and dripping with blood water passed the water supply of smolt installations that even contained brood stock. Well boats entered and exited the fjords with open valves, and even though slaughter facilities were good, they were, according to Østergård, not good enough. Initially management was not rigorous enough, he admits today. - We could have managed to introduce separation of generations earlier. In some instances we showed too much consideration for the fish farmers. The new regulations that were introduced in 2003 tightened things up a bit, but still

small ISA-fish could remain in the sea for up to six months. This would never happen today.

In 2005 stricter ISA rules were introduced, which made the regulations as a whole the strictest in the world. After an ISA outbreak has been clinically diagnosed, the fish must be removed within two weeks and with subclinical diagnosis (no mortality) within one month. In addition to this, the Faroe fish farming industry has a set of rules that definitely take prevention and transmission seriously.

Some examples:

- All in – all out. As is the case in Norway, a site must always remain fallow for two months prior to re-stocking fish into the site. In the Faroe Islands the distance between the plants is greater than the case is in parts of Norway. The minimum distance is five kilometres, and plants are never located in the same fjord. The Atlantic Ocean ensures a substantial flow of sea water between the sites, and thus decreases the chance of transmission.
- The net pens must be cleaned and disinfected between each stocking. In the Faroes a central laundry facility has been established to this end.
- The land sites shall be fenced in and designed for preventing transmission.
- Any kind of handling and movement of fish must happen in closed installations that ensure containment and disinfection of blood water.
- Well boats must never have open valves.
- Each plant must be an independent unit with its own staff and boats, to prevent, as much as possible, movement between fjords.

- Dead fish should be ground up and ensiled by the net pen before it is transferred to tanks on land.

Not that there is that much fish to grind up in the Faroe Islands any more. When the industry rid itself of ISA and introduced the new, more rigorous regulations, they also got rid of BKD and other problems. There is now hardly any disease issues in the Faroe fjords and lice are rare. Mortality from sea transfer to harvesting is between two and five per cent, and all six remaining aquaculture companies share these excellent results. The industry as a whole has an average feed factor of 1.1.

– Previously branding of Norwegian salmon caused a lower price for salmon from the Faroe Islands, but those days are over. We strongly emphasise quality, and our aim is that Faroe salmon shall be the preferred choice in the market, states the General Manager of Vestlax, Frimund Hansen. He admits that at first he was concerned about the costs of



Convinced: General Manager of Vestlax, Frimund Hansen, admits that initially he was sceptical of the costs involved in introducing the strict regulations. No he has no doubt that it was worth it.

the new Faroe regulations.

– I was one of the sceptics, thinking this would become very expensive, but today no one thinks like that. While we struggled with BKD and other diseases in the

Ownership in Faroe fish farming

Massive changes have taken place in the ownership of Faroe fish farming. In 1990 there were 63 companies operating in the Faroe fjords. Most of them disappeared after the crisis in 1992, and in 1995 there were 26 operative companies left in the archipelago. After several acquisitions the number had been reduced to 12 when ISA was discovered in 2000, and after this crisis there were 6 companies left. This is the situation today, but there are signs that indicate that the process is still not complete. Vestlax was one of the companies that was brought to its knees during the ISA disaster, and was taken over by the bank. Recently the company was sold to two of the

owners of Faroe Salmon. At the moment it is, however, not legal for one company to control more than 25 per cent of the fish farming licences, and the two companies will, for the time being, be run as two separate entities. A change in the rules that will increase this limit to 50 per cent is being discussed, and this would open for a merger. – It is on the cards that we will now work towards a larger company that later on will be listed on the stock exchange, states General Manager of Vestlax, Frimund Hansen. He predicts that the consolidation of ownership will continue until there are 3-4 fish farming companies left in the Faroe Islands.





Innovation: Luna's mobile slaughter unit has made the well boat redundant.

90s, mortality could be up to 25-30 per cent. Now there is hardly any loss at all. The profit is excellent. All in all I think we have profited from the strict regulations, he says.

Atli Gregersen of Luna agrees:

- We operate in a way that is more expensive when it comes to salaries and boats, and we may produce a slightly smaller quantum. What we gain is less mortality, better growth and lower feed factor, and that more than makes up for the extra cost. It actually gives us a better economy. Feeding fish that you later have to dispose of is expensive. There are probably a few business people in the industry who are very preoccupied with number of boats and net pens and salaries, but his has only a limited value if you stretch the biological limits too far, he states.

In the Faroe Islands there are now fewer plants, and also fewer net pens and fewer fish in the net pens. While in Norway the general maximum limit is 25 kilos per cubic metre, this is valid only

for fish of less than three kilos in the Faroe Islands. 10 kilos per cubic metre is the maximum limit for fish up to one kilo, 15 kilos per cubic metre for fish of one to two kilos and 20 kilos per cubic metre for fish of two to three kilos.

- I consider the amounts stated in the

regulations a minimum requirement, and do not try to get as close as possible to the regulation limits. We have achieved good results by not exceeding a density of 17 kilos per cubic metre, states Atli Gregersen of Luna. He sees good opportunities for an increase in production

A unique ISA variant

The authorities in the Faroe Islands have performed lab tests on the Faroe ISA variant and compared it to Norwegian and Scottish findings. They indicate that the Faroe outbreaks cannot be attributed to neither Norwegian nor Scottish isolates. Fish veterinarian Peter Østergård affirms that the virus found during the outbreaks on the Faroe Islands appears to be a unique variant, different from both Norwegian and Scottish isolates. This is

based on sequencing of the entire virus genome. By sequencing just the HPO part, a slightly larger variation was observed, and isolates were found that resembled the Scottish variant. Particularly the HPR-0 variant. It has so far not been possible to make a complete comparison of the Faroe and the Scottish isolates, as the entire sequence of the Scottish isolate has not been made public.





The beginning: In Fuglafjörður the first outbreak of ISA happened in 2000. The next outbreaks took place in the neighbouring fjords Öyndafjörður and Funningsfjörður, which is interpreted as evidence that ISA spreads through horizontal transmission.

in the Faroe Islands without increasing density in the net pens, particularly through establishing a more efficient production cycle, where you make sure new smolt is ready for introduction to sea as soon as the two-month long fallow period is over.

Luna has also entirely ceased to use well boats. When net pens are due to be emptied, they are towed quietly to shore, where a mobile slaughter unit is ready. The fish is pumped directly from the net pens and swim forward against the current until it receives an automatic blow on the head and is bled. The blood is gathered in one tank, and the fish in another, which is then transported by road to the slaughterhouse. When the smolt is to be transferred to the net pen, it is transported to the site by car and then through pipes to the net pen.

- It is my opinion that, as a rule, well boats should not be used for smolt transport at all, and if they are used, at least the valves must be closed. It is also difficult to rinse a well boat properly, and you can not place smolt in a well boat that has transported slaughtered fish the same day. Even though it is very difficult to prove, it was evident that there were incidents involving well boats during the ISA-period. This kind of incidents made entire companies go bankrupt, explains Gregersen.

The fish farming veteran cannot, however, imagine that it is possible for the Norwegian industry to rely as much on road transport as they do in the Faroe Islands, where distances are so much shorter. Well boats must be utilised, but according to Gregersen in a different manner, and a decentralized harvesting system would facilitate this.

- With your experience from the ISA disaster in the Faroe Islands, what is your opinion of the present situation in Chile?

- I recently visited Chile for the first

Registering “everything”

Reporting requirements are extensive for Faroe fish farmers, and the wealth of information that is accumulated in the central database of the supervisory body can become valuable.

Like their Norwegian colleagues, the Faroe fish farmers make monthly reports describing the day-to-day situation in their net pens. The accumulation of information is even more extensive than in Norway, and include reports on mortality, medication, feed, temperature, oxygen content, growth, bio mass and net pen density.

- These figures will be more and more interesting the longer we keep collecting them. We can link the information to information on e.g. weather and currents, and make important discoveries. This system also gives us the opportunity to monitor closely the state of things in the industry and quickly apply the appropriate measures if we see negative tendencies, explains Andrias Petersen of Heilsufrøðiliga starvstovan, the Faroe Food Safety Authority. The system features a benchmark function that makes it

possible for the individual fish farmer to check his performance compared to the industry as a whole. This contributes to a certain level of internal competition.

Currently an expansion of the data collection is on the line, and hatcheries will be subject to similar reporting requirements, which will make it possible to trace a fish all the way back to roe stage. Another planned change is introducing automatic web-based processing of fish movement applications. All movement of fish is subject to application, and by linking a search function to a register of individually approved means of transport, they hope to save both time and paper work.



Gathering all the threads: Andrias Petersen of the Faroe Food Safety Authority believes that reporting and collecting information will be an important factor in meeting future challenges related to fish disease.

time, and my impression is that Chile has a long road ahead. The Chileans must first do what we did in 1992. Then they must go through the process that we did during the ISA outbreak. I have seen that some people think Chile will have recovered within a year. I do not think so. In my opinion this will take years, states Gregersen.

At present a lot is going well in the Faroe Islands, but knowledge of how

effective the different measures have been in preventing a new outbreak of both ISA and other diseases is inadequate. The ISA vaccine is of course a central issue, and to this day one does not know whether it has been effective or not.

The vaccination project in the Faroe Islands was initiated in 2005, and implied that ISA vaccination was carried out at all plants, while separate non-vaccinated



Thoroughness: The net pens should be cleaned and disinfected between each stocking. In the Faroes a central laundry facility has been established to this end.

control groups were also cultured. The project was to be carried out through three production cycles, and today the project has passed the half-way



In charge of the food: Odd Eliassen heads the feed division of Havsbrun, who supplies practically all feed used in the Faroe Islands.

mark. Simultaneously, the Faroe Food Safety Authority has been searching systematically for ISA, taking monthly samples of the fish. Every month, 80 salmon samples are collected from each plant, but although the results are quite interesting, they give little information about a possible effect of the vaccine. ISA is still found in all fish cultured in the Faroe fjords, although this is the short-chain, harmless 0-variant of the virus. The virus appears 6-7 months after sea transfer, but 5 months later it is no longer possible to detect ISA in the fish. The same thing happens both with vaccinated and non-vaccinated fish. The question is whether this has always been the case, also before the mutated and dangerous strand of the ISA-virus appeared. We will probably never find out. But the fish farmers knowing that there is still ISA in the fjords, even if it is the harmless kind, keeps them alert.

- When we know that it is out there, we pay more attention to the risks. Now

we check everything all the time, says Frimund Hansen of Vestlax.

In Norway there is not yet enough data to claim that there are cyclic outbreaks of the ISA variant HPR-0. It will not be possible to confirm this unless a test programme taking regular samples is carried out in Norway as well. The theory that ISA mainly spreads by vertical transmission is not popular in the Faroe Islands – for several reasons. First ISA was detected in Fuglafjørður; the next outbreak came in the adjacent fjord Oyndafjørður and the third in Funningsfjørður, a neighbouring fjord. It was, in other words, possible to trace ISA from fjord to fjord, which is interpreted as a clear indication of horizontal transmission. Also, when ISA was detected in 2000, roe had not been imported to the islands in 13 years.

– I am not going to totally reject the notion that ISA may spread by vertical transmission, but all the evidence



Rough weather: In The Faroe Islands nature likes to show its power.

indicate that in most cases it happens horizontally. We have tested the hatcheries for years, and have never been able to detect ISA. The virus does, however, always appear in the fish a while after it has been transferred to sea. We can predict quite accurately when we will get the first positive test results. It looks like somewhere in the sea there is a carrier of the virus, says fish veterinarian Østergård.

In the Faroe Islands there will be a discussion around whether or not to continue the ISA vaccination programme after the initial project period. There is probably disagreement on the subject, as the vaccine costs money and it is still not clear how effective it is. A very turbulent past constitutes a different kind of vaccine for the fish farming industry, a vaccine against taking chances when it comes to fish health.

– At the moment I see no reason to give up the vaccine. Whether it has been effective we don't know, but it is a fact that we have not had an ISA outbreak since the start of the project. As long

as we do not see any negative effects of the vaccine, I think it would be wise to continue, Østergård states.

In the great puzzle that constitutes the foundation for good results in fish farming, feed is always an important piece. Today the supplier of most of the feed used in the Faroe Islands is Havsbrun in Fuglafjørður. Havsbrun produces feed with a high marine content based on its own production of fish meal and fish oil.

– It is evident that the feed is important when you look at parameters such as mortality, growth rate and feed factor, and impressive results are currently presented in the Faroes. The results, however, are a combination of excellent regulations, good structure, feed, improved smolt quality and above all good cooperation between the six remaining owners, all skilled people with a good understanding of the field, concludes Odd Eliassen, manager of Havsbrun's feed division.

He is not the only one who emphasises industry cooperation as a decisive factor in the industry's remarkable recovery after the ISA disaster.

– There is no doubt that it is the fish farming industry itself that has been the primus motor in implementing the most important changes. It was the fish farmers who lobbied to make the Faroe Islands a test area for the ISA vaccine, and to establish a strategy to combat the disease that implied strict rules for the running of their companies, explains Marita Rasmussen of Vinnu-husid, the Faroe Employers' Association.

– Fish farmers have a good dialogue, and no one is hiding anything from each other. This has clearly been a key factor, states Frimund Hansen of Vestlax. Despite several companies collapsing following the ISA outbreak in the Faroes, the Fish Farming Association never demanded an economic rescue package. – Everyone knew that some colleagues would have to give up, and that the outcome of the crisis probably would be a maximum of seven remaining companies in the industry. Our priority was creating a sustainable industry in the Faroe Islands, says Atli Gregersen.

It seems they have finally succeeded. ■

- Limited control with transport

Martin Binde of the Norwegian Food Safety Authority has doubts about using well boats for long distance transport, but does not envision that the model used in the Faroe Islands can be easily introduced in Norway.

All well boat transport on the Faroe Islands is carried out with closed valves, while some fish farmers have replaced the use of well boats with slaughter units on land and transport by road. It is, however, difficult to introduce this practice in Norway.

- It is hard to imagine, not with the long distances to slaughter facilities and smolt installations. An interesting alternative is exsanguination at sea. Mobile slaughter units may some day solve part of the problem, but that scenario is years away, at best, Binde states.

He feels that it is a paradox that new EU regulations remove restrictions on moving fish already put to sea, and that the authorities now permit unrestricted moving of fish, with the potential danger of spreading disease that this involves. Binde has no doubt that transport is one of the areas in which the Norwegian aquaculture industry needs to improve.

- Transport is one of the least controlled areas. This has perhaps been most evident in the case of cod francisellooses, and many also feel that part of the initial problems related to PD were connected to transmission through moving fish already put to sea. We have also seen the spread of ISA through human activity. Well boats used on and off for transporting smolt are probably a high risk factor, although we do not have too much hard facts to back this up, Binde affirms.



The Norwegian Food Safety Authority is now moving towards the Faroe model by opening for vaccination, but transport of smolt and slaughtered fish will still be a weak link in the Norwegian fish farming system, says Martin Binde of the Norwegian Food Safety Authority.

The centralized slaughter structure in Norway, as well as a lack of smolt in Finnmark and Troms, make many of the long-distance transports difficult to avoid without making profound structural changes in the industry.

Binde thinks that the Norwegian Food Safety Authority has much to learn from the Faroe experience. He particularly finds the results of the systematic screening interesting.

- There is probably a great deal of HPR-0 in Norway too, but they probably have a better overview than we do. It is also interesting that they almost exclusively find HPR-0 in the sea, he states, and adds that the Norwegian Food Safety Authority now is moving towards the Faroe model by opening for vaccination. Whether systematic screening will be introduced by the Norwegian Food Safety Authority is, according to Binde, a question of cost.

Cod sensation on the Faroe Islands:

As fast growing as the salmon



Øystein Bie Pettersen
Text

Fiskaaling
Model/Photo

The results of the first major experimental cod farming project on the Faroe Islands are sensational, and far exceeds what the Norwegian industry has accomplished after several years of development.

- This may be a once in a lifetime experience, and without doubt the most exciting thing I have ever been part of. The results show very exciting prospects for

cod farming, says Arne Kolbeinshavn.



Project Manager
Arne Kolbeinshavn,
Fiskaaling.

He has worked with the development of alternative species for aquaculture since 1980. That means quite a few disappointments and not quite as many positive experiences. At present he is

the project manager of PF Fiskaaling's experimental cod farming project on the Faroe Islands, a project that is likely to be extended beyond the initial three-year project period.

- With mediocre results the idea of farming cod on the Faroe Islands might have been abandoned after the initial project period, but now we just have to keep working. The Faroe Islands have every chance of becoming a world leader in cod farming, states Kolbeinshavn.

Even though, prior to the start of the project, he was familiar with the environmental advantages of the Faroe Islands, such as stable sea tempera-

ture of 6 to 10 degrees, and access to broodstock from the Faroe Bank, home to the cod stock with the fastest individual growth rate in the world, he was taken by surprise as the project progressed. His astonishment increased as he saw the massive growth taking place in the illuminated net pens, where the cod in 20 months reached a weight of 4-5 kilos with hardly any sign of maturation at all.

Large scale experiments

PF Fiskaaling is a publicly financed research- and development company whose main interest, until the start of this project in 2006, mainly had been salmon and salmon breeding. In order to carry out the cod project a provisional start feeding plant and an on growing plant were set up in order to produce large amounts of cod fry that later on would be transferred to large scale experiments in net pens at sea. Fiskaaling's limited resources made it necessary to find commercial partners, and 100,000 cod fry were sold to Faroe Salmon in Árnafjørður. The fry, at this point weighing 60 grams, were placed in three net pens, two illuminated and the third with natural light only. Fiskaaling took regular samples of the fish up until it reached a weight of 4 kilos. The aim was to monitor growth rate and maturation.

Early maturation is one of the greatest challenges in cod farming. Maturation leads to weight loss, poor feed utility and thus longer production time. One of the great surprises in the production on the Faroe Islands was the fact that the

fish in net pens with controlled illumination did not mature at all and maintained a good growth rate throughout the period. The fish in net pens with natural light only matured at approximately 2 kilos, experienced some weight loss, but then recovered and reached a weight of 4 kilos approximately 3 months after the illuminated group, after 23 months.

- I would not have thought that maturation would be this easy to control only with a bit of light. We also used less light than what is usual in Norway, relates Arne Kolbeinshavn.

Special cod stock

He is convinced that two natural factors have been crucial to the astonishing results. One is sea temperature and the other the special Faroe Bank cod stock.

This type of cod has light-coloured skin and flesh, as well as a very fast growth rate. How much the genes of the stock have to say for growth is difficult to determine, but that the stable sea temperature at the Faroe Bank is an important factor is unquestionable. This is the same temperature that we find in the Faroe fish farming fjords.

- The fact that the farmed fish enjoys the same environment that it has adapted to through hundreds of years, is a great advantage. These conditions you will not find elsewhere, Kolbeinshavn affirms.

More breeding

The results of the experimental project



Follow-up: By regularly collecting samples of the development of the cod, Fiskaaling has documented the astonishing results achieved on the Faroe Islands. Here fish is taken out for samples in august 2008.

on the Faroe Islands is no less impressive when one takes into account the fact that the fish is not a result of systematic breeding. This is a first-generation farmed cod with a growth-rate that equals that of salmon which is the result of decades of breeding. Now the largest fish from the group with controlled illumination will be used in so-called phenotypical breeding, as will the small amount of cod that did not mature even though it was in the net pen with natural light only.

- Experience shows that you often get very good results from breeding during the first 2-3 generations, and I am convinced that will be the case also here, at least with the largest fish from the light-controlled group. Perhaps we can lower the production time to 17-18 months to produce cod the same size that we now used 20 months to produce, Kolbeinshavn envisions.

The cod has been fed marine feed produced by the Faroe company Havsbrun. How this has influenced results is another question that one cannot yet answer.

- The feed is probably excellent, and may have influenced results somewhat, but to what extent and in what way we still do not know. There are a thousand things to figure out, says Kolbeinshavn.

Norwegian-Faroe cod?

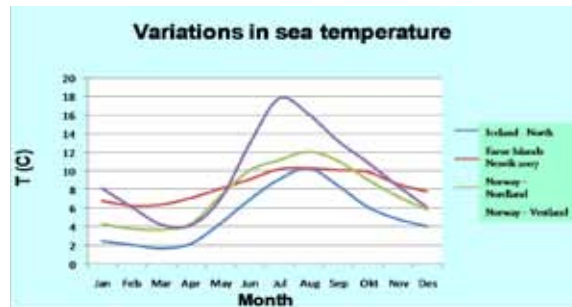
A vital question is of course whether introducing fast-growing Faroe cod in the Norwegian fish farming industry will be a success. It will not necessarily be. The question is whether the Faroe cod will be able to adapt to Norwegian conditions, where the sea temperature varies a great deal more than in the Faroe Islands. It is also unknown to what

extent the temperature causes the unusual growth-rate, or whether most of the explanation can be found in the genes.

- There are of course many people who ask themselves whether this could be the solution for cod farming in Norway. I am not so sure, but it will of course be interesting to look into it. I hope that these results can at least be a boost for cod farming in Norway, an industry that has had its share of difficulties.

A tight fit

Despite the excellent natural conditions, the Faroe Islands may not become a cod bonanza, at least not yet. Most locations are already occupied by a salmon industry that at the moment is thriving. The net pens used in the experimental project are located right next to a salmon installation in Árnafjørður, but this was only made possible through a dispensation from regulations that are normally strictly adhered to on the Faroe Islands.



Stable temperature: The stable sea temperature on the Faroe Islands is probably important for the results.



Full speed: This model shows the growth rate. The fish in net pens exposed to natural light only experienced weight loss during maturation, while the fish in the other two net pens, exposed to controlled illumination, did not experience maturation and had a stable growth curve.

One thing is certain – cod is coming. I am convinced that cod is the next big species in fish farming, says Kolbeinshavn.

He thinks that Nordland, and particularly the area surrounding the Lofoten Islands, is most similar to the Faroe Islands when it comes to sea temperature, but even there the temperature variations are substantially larger than in the fish farming fjords of the Faroe Islands.

Andrias Petersen of the Faroe Food Safety Authority, however, indicates that allowing parallel farming of both cod and salmon in several fjords is definitely a possibility.

Another option is to simply move production to recirculation installations on land, and this option is currently being explored. Limited access to fresh water has made the Faroe Islands a leader in the field of recirculation technology for smolt production, and this expertise is now taken one step further. Faroe Cod has built the world's first recirculation installation for production of cod for consumption in Hvalba on the Faroe Islands, and the plant purchased 40,000 cod fry from Fiskaaling as part of the larger cod project. The results from this plant are still not available.

If one were to succeed in producing cod from fry to harvestable cod in recirculation installations on land, it would open up enormous potential for further development on the Faroe Islands. The successful process would also be more easily exported to the aquaculture industry of other countries. As all the cod from the experimental project still has not been harvested, there is still no overview of loss.

Spinal deformation in commercially cultured salmon

Norwegian salmon industry has experienced an enormous growth during its relatively brief history. This can also be said about the growth rate of cultured salmon, and this may have consequences for its skeleton.

In 2002, the IMR research station at Matre showed that fast growing autumn smolt had a weaker spine and more spinal deformations than spring smolt and wild salmon. We presumed the reason was that we had exceeded the biological limits for how fast bones could mineralise, or that the feed used was not designed for fast growing salmon.

To shed some light on this we carried out a test together with NIFES, Marine Harvest and Skretting. Autumn smolt, early transferred to sea on the 17th of August, was fed either normal feed or a special feed with extra minerals (calcium and phosphorus). The groups received different feed from sea transfer till Christmas. After Christmas they all received normal feed. Regular x-rays were taken of the fish from sea transfer until slaughter the next fall when the weight had reached 4 kilos.

Big differences

The first eight weeks in sea water proved critical. The group given normal feed suffered a significantly weakened spine during this period, with subsequent high extent of deformations from Christmas till slaughter. The deformations were compressed vertebrae in the tail region, which gave the fish a higher condition. Picture B shows an example of compressed vertebrae. This deformation was much more common within the group that received normal feed compared to the group fed with extra minerals. Picture C shows fused vertebrae. The frequency of this kind of deformation did not show the same pattern of variation between the groups.

The fish had a high growth rate during the first eight weeks in sea water, which may be related to the high temperature in this period. Because of this we produced a second group the following year to find out to what extent different temperature during the smoltification process and the first six weeks in sea water influenced the frequency of spinal deformations in salmon fed with normal feed. It showed that the temperature during the early sea water phase is critical to have a normal development of the spine. Fish exposed to a temperature of 16° C during this period had a high rate of deformations. The deformations were again compressed vertebrae in the tail region.


Increased growth rate due to breeding

It is also possible that increased growth rate due to breeding can give a higher frequency of deformations. This has proved to be the case in chickens. To do research on how breeding has influenced the spine of the salmon we did tests with wild salmon (Lærdal), cultured salmon (Mowi) and a hybrid between the two. We produced both autumn smolt and spring smolt from the three groups. Cultured salmon grew much faster than wild salmon and autumn smolt grew faster than spring smolt. However, there were no differences between the groups as they all developed normally and had a low frequency of spinal

deformations at slaughter. This may indicate that cultured salmon are not genetically disposed to develop spinal deformations, and that this is probably related to nutrition and/or production factors.

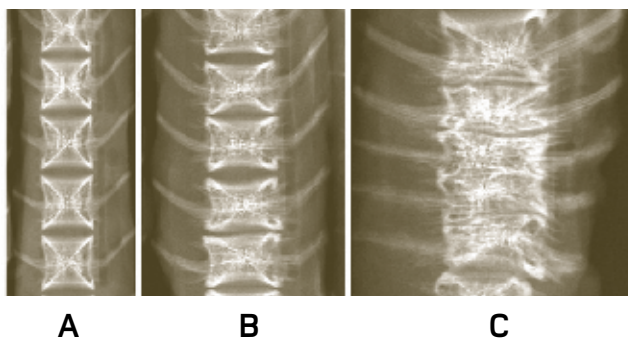
Consequences for the fish

Spinal deformations do not necessarily influence the growth rate negatively. Fish with small deformations grow just as fast as fish without deformations, while fish with many deformed vertebrae experience a lower growth rate. This can be due to discomfort or to these fish losing the fight for the feed. Another possibility is that they spend more energy on moving around than normal fish, and therefore has less available energy for growth.



Per Gunnar Fjellidal
Institute of Marine Research

The author is an employee with the Institute of Marine Research (IMR) and has a PhD on growth and mineralisation in the spine of commercially cultured salmon. Fjellidal's results indicate that the growth rate, the temperature and the feed influence the occurrence of spinal deformation. In this article he gives a summary of the research done in this field.



X-ray of the spine (tail region) of a 4-kilo salmon. (A) Normal vertebrae. (B) Compressed vertebrae. There was a much higher frequency of this deformation in salmon fed with normal feed than in salmon fed with a special feed with extra minerals. (C) Fused vertebrae. The frequency of this kind of deformation did not show the same pattern of variation between the groups.

The importance of stress in smolt production (Part 1)

Stress is an important indicator of fish welfare. In connection with transport of salmon smolt, stress can cause an increased mortality rate after the fish has transferred to sea.

Stress plays a vital role in discussions of animal welfare, and fish is no exception. Animals suffering stress is often defined as a consequence of an unfortunate production routine or environment. The common conception is that stress has a negative influence on welfare, which is why quantifying stress as a direct measure of animal welfare is an objective.

What is stress?

A common conception amongst experts and laymen is that stress, as an isolated factor, is lethal to the fish or the animal. This is not always so. Stress involves different stress responses which are important coordinating physiological responses in fish. This maintains the internal physiological balance and increases the individual's chance of survival. The short time effect of stress therefore is positive when it comes to survival, as it mobilises all available resources to survive the moment (imagine a zebra being hunted by lions). But stress is costly and if it lasts for a longer period of time, it will have consequences for the animal's ability to function normally. For fish in the wild it is possible to swim away from threats or stressors. A farmed fish has limited opportunity to escape because of the physical barriers (tank, net pen etc.). Does this mean that the fish is exposed to more or less constant chronic stress? Like other animals, fish can survive unacceptable conditions for a limited amount of time by using valuable energy to maintain physiological balance. If the stress lasts for a long time (turns chronic), its situation will change from adaptive to maladaptive, which will reduce the fish's ability to grow and to survive.

How do we measure stress?

The increase of the stress hormone plasma cortisol gives us the opportunity to categorise how the fish reacts to different stimuli (stressors). Cortisol is produced in the interrenal gland of the fish, and the activity of this gland is regulated in the brain through the so-called HPI axis. Any change in the environment, regarded as uncomfortable or threatening, will, through the HPI axis, provoke the excretion of plasma cortisol, and as a consequence it can be an indicator of the fish's welfare. With this physiological measuring system it is possible to make some reflections about fish welfare. The Biological Research Group at the Faculty of Biosciences and Aquaculture (FBA) at Bodø University College has for years cooperated with smolt producers to map stress and its influence on production up until one month after sea transfer. Based on the

results of this survey, smolt producers have changed both equipment and routines with the purpose of reducing stress. This has proved to be very efficient and has had a positive effect on mortality rate and appetite after sea transfer.

Stress in smolt production

To achieve maximum well being, growth and survival, animals should not be subject to long term stress in its breeding environment. The notion that modern intensive fish farming causes a certain degree of strain which makes the fish chronically stressed seems to be generally accepted. Reasons include high density of fish, poor smolt quality, frequent handling, inferior water quality etc. The results from tests carried out in smolt installations where we regularly took blood tests early in the morning, indicates that this perception is wrong. An example from this survey is illustrated in figure 1, with measurement of plasma cortisol (stress hormones) in one of the installations during smolt production from January until sea transfer in spring 2008.

The test showed that the fish in the different installations had low levels of cortisol, which indicates no stress and therefore high well-being and animal welfare up until the fish was touched or disturbed. We could not find any proof that substantiates the idea that salmon lives under chronic


stress during normal production. That myth is hereby pretty much killed off.

Plasma cortisol as a forewarning

Can measuring cortisol tell us something about the well-being of the fish? Figure 2 shows all of the measurements made over a period of four months, merging the data from each of the hatcheries that participated in the survey. All of the installations, with one exception, had generally low cortisol values. The last installation had higher values and more variation between the tanks. In this installation, problems such as higher mortality rate and outbreak of atypical furunculosis appeared.

Stress and Mortality

To gain more knowledge on the connection between plasma cortisol and mortality, we carried out controlled experiments where smolt was transferred from freshwater to seawater after a two hour transport by car. One of the groups was mildly sedated by AQUI-S© (a stress reducing substance), while the control group was subject to no stress reducing factors. Figure 3 shows that the group given AQUI-S© had a lower level of plasma cortisol in its blood plasma than fish in the control group.



Martin Haugmo Iversen

The author is a senior scientist with the Applied Biology and Extension Group at the Faculty of Biosciences and Aquaculture at the University College of Bodø. In this article he presents results from research on stress in the production of salmon smolt. This is a field that scientists in Bodø have worked with for several years, and it has led to a change in routines and improved results for many smolt producers. This is the first part of the article; the second part will be presented in the next issue of Europharma Fokus.

This positive effect on the cortisol level gave the same effect on mortality. The group sedated with stress releasers (AQUI-S®) had a mortality rate of 2.5 %, while the mortality rate of the other group was as high as 11.3 % after 16 days in the sea. We carried out the same test using clove oil (closely related to eugenol, the active ingredient in AQUI-S®) and had the same results. Low stress levels during handling and transport at sea transfer gave a lower mortality rate and improved animal welfare. We also received indications suggesting why the fish apparently died of stress. It seemed the osmoregulatory capacity of the fish was significantly reduced due to stress. Transport related stress increased the level of so-called divalent ions like magnesium and calcium, which indicates a reduced regulatory capacity in the kidneys. In both of the tests this had fatal consequences for 10 – 12 % of the fish.

Summary

- Plasma cortisol seems to be a very good tool for measuring stress and welfare of salmon smolt during different phases of the commercial production.
- The welfare of the smolt in the installations is generally good, and nothing in our tests indicates that the salmon suffer constant chronic stress.
- Smolt is subject to increased stress for short periods of time, for instance while handling the fish during vaccination, sorting and transport.
- Repeated stress situations and unfavourable production routines can give reduced animal welfare and increased mortality rate, causing economic and reputational loss.

To be continued

In the second part of this article we will go through different parts of the production which can cause considerable strain and damage to the smolt. We will show that the number of stress episodes, duration and choosing the right technology can influence stress related injuries to the smolt. We will also present possible measures to minimise the negative effects.

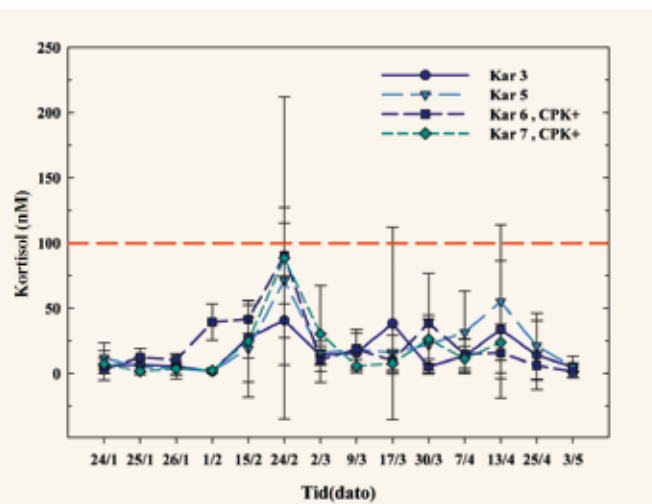
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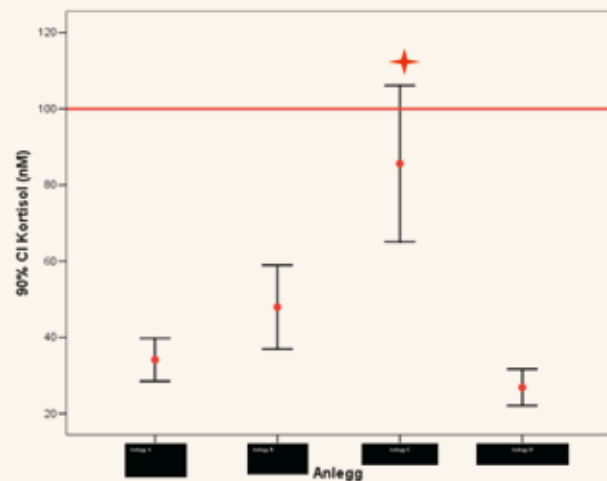
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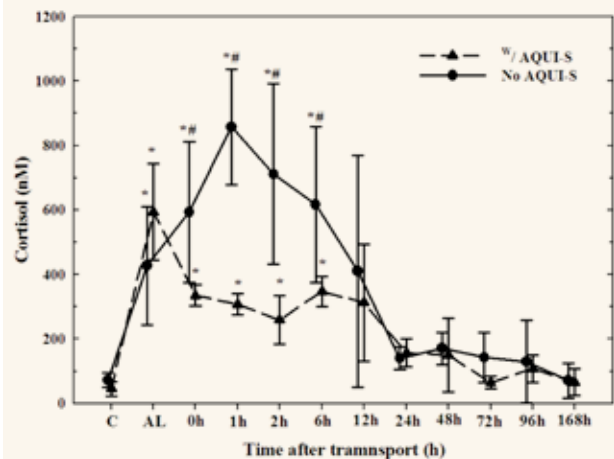
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Figur 1. Average level of plasma cortisol in non-stressed fish throughout a smolt season.



Figur 2. Average stress level in 4 different installations during the production cycle of 2005-06.



Figur 3. Average stress level after transport and sea transfer with or without stress reducing factors (with or without AQUI-S®).

Consumer challenges for the fish farming industry

The fish farming industry has grown at such a fast rate that nearly all attention has been centred on production. The demand for fish that combines representing a positive food tradition and being a healthy meal and on top of that is experiencing a substantial drop in price has been so massive that the industry has been able to focus, as is only natural, on increasing production of the standardised product that the consumer prefers.

But what will happen when at some point there is sharper competition? When consumers actively prefer a certain variety? Could consumers develop distaste for farmed fish? Greater competition lower prices, would it be possible to tempt consumers with a specialized product that would not be subject to price competition, where loyal customers will accept a stable, somewhat higher price?

The commodity-trap

Political theorists, from James Mill, his son John Stuart Mill, most definitely the young Karl Marx in his works on alienation, and later on a great number of other philosophers of different political convictions (e.g. Sigmund Freud, Max Weber, André Bjerke), were concerned about a particular effect of modern industrial mass production: standardising and especially its long-term cultural consequences.

It was no longer the craftsman who made the products. Industrial organisation, world trade and complex production processes make workers anonymous wheels in a great machine that they cannot quite grasp and the products deteriorate. After a while, the product's only characteristics are technical qualities and price. Where they were manufactured, by whom and what kind of culture and identity they embody, these factors are all gone. A nail, a PC, a car, a sweater or a fish all have a production history that we do not know, they have become "commodities" and this process is called "commodification".

Two different aspects meet here: the logic of the market when the products are standardised; and the reactions of the consumers when society is filled with deteriorated products.

There are a few very simple factors regarding the market that can be deduced from Marx' theories on competition. Every time a new product is developed and passes through a phase of innovation and pluralism on its way towards large scale, industrialisation and standardising, a classical foe lurks in the shadows: the murderous price competition. When production capacity has developed and the product is standardised, there is often only one factor driving competition. The price.

Both economic theory and many real-life examples from fish farming industry indicate that this description resembles reality; overproduction and low prices endanger the entire industry. Through their expertise in production, price and quality, the producers are laying a trap for themselves; the commodity-trap. These mechanisms can be controlled through public regulation, but they are also weakened and modified if products succeed in developing or retaining an identity, for example by becoming branded products. This is the most interesting scenario for us, as it is closely linked to the consumer's unease with standardising. In fish farming industry it is probably this same

commodity-trap that the Norwegian ecological salmon producer, Villa, refers to when they say: We disagree that the only way to be a winner is low cost.

The consumers' reaction

There is stronger and stronger emphasis on the fact that as human beings we long for the authentic, shaping ourselves and our surroundings, belonging to a family, an environment, a group. Both to belong and to shape oneself as something unique are important parts of modern man. In our Northern European safe, inexpensive and wealthy countries this is a tendency that has become increasingly visible during the last couple of decades. It is often referred to as "individualism", but to us it means that consumers increasingly are interested in and drawn to what they see as authentic, special, genuine in the products. Simultaneously society often also offers more standardised and anonymous ("fake") products. Norwegian consumers have not turned against mass produced

products, but there is a definite tendency towards preferring the authentic.

A fast-growing and very particular consumer organisation focusing on food is Slow Food. Their main agenda is to preserve and protect traditional alimentary products, with character and tradition from a particular geographical location, well-known qualities and low degree of industrialised processing, and enjoyment and culture in preparation and use. Their activities are tied to documentation, support and preservation of local food specialties of particular value (Norway has six, two of them fish). They now have a membership of more than 100.000 from 135 countries; they are a central factor in the shaping of the European Union's food policy and its last big event in October 2008 probably had approximately 200.000 visitors. Its aim has been widened, and Slow Food now also includes global justice (cooperation with Fair Trade), often prefers ecological alternatives, is committed to the climate etc. It was founded in Italy, where the link between identity and food is quite strong. Since the beginning in 1989 it has been clear



Thor Øivind Jensen

Associate professor
University of Bergen

The author is an associate professor with the Department of Administration and Organization Theory at the University of Bergen. Jensen includes the consumer perspective as one of his professional fields of interest and has worked a great deal with the food market as an arena for interests, regulations and values. The summer of 2008 he was a speaker at the Europharma aquaculture seminary for the fish farming industry, where he took a closer look at the industry from this perspective.

This article is based on the lecture.

that this is a movement whose priority is to fight against the modification of food.

In Norway there is a distinct tendency towards preferring the authentic, especially when it comes to food. This has something to do with a very marked standardising of food under a classical agricultural policy (Gilde, Tine), where all red meat was branded simply "beef", where milk and cheese had no origin, and potatoes were called "1st class". Increased travelling, increased knowledge, lack of trust in large food companies and especially the personal character of food and meals contribute to make food an important arena for the search for authenticity. Historically as well as internationally food production is an area where critique towards industrialisation has been strong. The heavy critique towards the meat industry in the USA after the turn of last century had massive political repercussions and in 2000 there was a new round of critique focusing on hygiene, conditions for workers and not least the standardising of the products.

Already we can sense one of my conclusions: The fish farming industry and the consumers have good reason for cooperation when it comes to stronger diversification, more clearly defined branded products and not least brands and diversification that marks pluralism and personal-ality and a credible authenticity in the products.

The new concerns of the consumer

In 1986 a book was published that pinpointed the key to understanding what many say is the more or less irrational anxiety of modern consumers. This book was Ulrich Beck's "Risk Society". In this book he looks at modern consumers' fear and distrust of industrial society. To put it simple, the massive optimism and trust in all technological and industrial advances that characterised previous decades has been replaced by anxiety and distrust. This has especially been the case in areas where technology was unsafe, invisible and not easily controlled. Radiation, chemical pollution, genetic modification and environmental hazards are good examples. Parallel to this, terms like "natural", "traditional" and "hand-made" became more positive to consumers. Often the industry will, perhaps to some degree rightfully, discard this anxiety as "irrational" because ordinary consumers do not have the necessary knowledge. Here there are, however, two serious misconceptions. First, the consumers are the customers, irrational or not. Second, in many instances this kind of anxiety has been wise and sometimes ahead of its time. This was the case with mad cow disease and in some issues concerning climate and the environment. In general fish is considered safer than meat in this context, but the industry has also, rightfully, been associated with anxiety factors such as chemicals, pharmaceuticals, environmental toxins etc. Feelings can go both ways, and being regarded as "natural" and "safe" definitely gives a competitive edge.

One of the least complicated factors in the food industry is people's enormous interest in the connection between food and health. Whether it is a scandalous headline about new hazards or sensational headlines on new health opportunities in food, the interest is massive and this is one of the best selling themes in the media. Fish, and especially fatty fish (salmon and trout), seem increasingly healthy to people as new research is being published. Heart related disease, blood pressure, joint-related disease and brain functions are buzzwords both for research and media headlines that cover both very common causes of death, bothersome ailments, and important bodily functions, problems that can probably be prevented or affected posi-

tively by seafood and most effectively by fatty fish. More exotic is its possible effect on aggressive behaviour.

The other factor is the much discussed and criticised use of environmental toxins. We are talking about very small amounts of toxins, whose possible negative effects are part of the new anxiety mentioned above. There are possibly very long-term and undocumented effects on reproduction, hormones, genes, possibly cancer, and a couple of undocumented effects related to a gradual accumulation of these substances in the body. Some health authorities issue warnings, some do not. Norwegian authorities at the moment have an odd double argument, where they do not deny the problem, but state that the health benefits outweigh the problems. This is pretty much the same as saying "apples with pesticides are overall a healthy thing". This kind of logic will do until apples without pesticides are available. Our point is that the anxiety of the consumer is easily awakened, and can easily change attitudes, and that there are competitive opportunities in dealing with this issue (through the feed).

New values, new brands

Gradually the consumers' vague anxiety related to health, environment and climate have become something more defined and is today a common part of the political landscape. AND a part of the market. More and more producers offer products that not only have a label and a declaration of content (even this is not very highly developed in the fish farming industry), but that are also certified by an independent entity. This independent control mostly documents guaranteed origin, environment, fair treatment of workers and climate impact. In 12 bars of slightly advanced chocolate I found, for example, 20 different certifications demonstrating fair trade, general ethics, ecology, origin, and environmental impact. With anxious consumers and products of unclear or unknown origin where trust cannot be the same as with a well-known product, this kind of independent labelling is a logical solution. A fair trade label states that the entire process has been controlled with emphasis on the workers' conditions, ecological means that all ingredients comply with ecological standards. A label on guaranteed origin says far more than the more and more common toll free number to an answering service that is supposed to be able to inform the consumer (test show that they not always can), and is far more trustworthy than the variety of odd statements like "made in", "made by", "designed by" etc. Now also organisations, groups, factories, investments etc. can be certified and there is an ISO certification for ethics and social responsibility (ISO 8001).

Gradually the fish farming industry has joined this trend. One of the largest groups, Marine Harvest, has become certified in the highest rank as an ethical investment object. The first ecologically certified products have been established (Villa). On ecology, the Washington Post 16/6-08 writes that in the USA there is a wave of demand for environmental products from the fish farming industry. General systems for certification of moderate environmental impact have been developed. This is not only for the end customers, but also for the chains that use it in their marketing of the products. At the same time more and more high-quality brands appear (Selma, Blue Silver), and the first chains have made traceability freely available information that also gives the customers a guarantee of authenticity. But these are examples that demonstrate that change is possible. The general situation in the industry is still characterised by farmed fish being an anonymous standard commodity with a clear potential for provoking consumers' anxieties and values in a negative way. The link to health and taste is, however, solid.

The strategic advantage of the fish farming industry

If we put aside the current situation in Norway and rather focus on some basic characteristics in fish farming, we find something interesting. The nature of fish farming implies that we assume control of the fish's environment and growth. It should be possible to utilize this control to solve several of the consumer issues, especially where there is a vague anxiety that can be seen as a need for knowledge and precision. If consumers are concerned about what ordinary fishing can do to fish stocks and nature's plenty, through fish farming we should be able to supply fish that do not harm or affect endangered species at all. Our glorious traditional cod-fishing in Lofoten is, for example, a substantial depletion of the stock of spawning cod. Wild fish in Norway, as well as crustaceans, are often unpredictable and/or downright problematic when it comes to level of environmental toxins, while fish farming, in principle, easily can control this. Climate impact is probably more problematic, but also in this case traditional fishing techniques and fish farming can be measured against each other, and fish farming will offer better opportunities when it comes to controlling the different factors. Probably climate (CO₂ imprint) will play a major role in the next couple of years. Local environment and the concrete fish farming process may today seem problematic in terms of the environment, but again there are good possibilities when it comes to controlling and documentation, and concrete comparison with other food production are often both instructive and surprisingly positive for fish farming.

But can fish farming become "authentic" in the sense that it reflects a basis in local traditions and with a production that gives a genuine and unique product? It is easy to discard this thought as impossible and it is not easy today to imagine Norwegian farmed fish as a specialty approved by Slow Food. On the other hand, culture and identity is something that is built up gradually, some components being trust and emotions. Agricultural products, Slow Food's ideal, definitely include aquaculture, and oyster farming is already among the specialties. Blue mussel farming is today considered quite beneficial to the environment. Much can probably be achieved by creating good lines of production, tying together labels, production site, fish stocks, quality and documentation. Particularly the vast research resources in the Norwegian industry should be utilized to this end.

Which way will it go?

Food is about trust, and in this article it has been implied that there may exist conflicting emotions regarding fish farming. An interesting thought is how the average consumer will react when she realizes that the cod is from a fish farm. With a feeling of relief and trust because she associates this with quality, the product has a good history and origin, and factors such as environmental impact, pollutants and natural diversity have been taken into account? Or with scepticism and expectations of a considerably lower price due to a perceived lower quality, suspected negative environmental impact and with unknown origin or originating from a group resembling McDonalds?

Wild fish, on the other hand, is considered ecological. But only farmed fish can be labelled ecological, and on the fish farm there can be complete control with the feed and the fish's health.

Consumers' health concerns can easily be turned into scepticism towards the industrially produced fish, with the associations that exist today between nature and health. On the other hand farmed fish can be actively designed according to our knowledge of nutrition and then be perceived in some instances and by many groups as the healthier alternative.

Food, health and good associations to what is familiar and safe is a huge contrast to diseased fish and scandals. And diseased fish is to this industry a curse that it has so far not been able to rid itself of. To food, image is a particularly important factor, and media is quite central when it comes to shaping people's attitudes. Both good stories about farmed fish and health and stories of dioxins and disease have a considerable impact. Perhaps we can say that farmed fish is a somewhat "nervous" product image wise, the final result can turn out to be very good or very bad.

To summarize, we can say that consumers' attitude towards the fish farming industry is positive, but anxious. The positive emotions are more evident when it comes to food with a well-known quality and origin. The anxiety is more evident when it comes to the industrial aspect and particularly strong when it comes to factors such as health,

environment and climate. The situation for the industry is unstable, with clear dangers and opportunities. The strong growth may continue, but that depends on both luck and skill when it comes to quality and image. In addition to these factors there are now new values that consumers increasingly will expect to be included: Ethics, environment, climate, health, and authentic origin are key concepts. So far the challenges have been kept on an industry level. For the individual producer it can seem more concrete, and it is about brand-

ing, authentic quality, documentation, quality assurance as well as documentation of ethics, environmental and climate.

Overall there is cause for optimism; in the brief period during which this article has been written, new food products have appeared on the market in Norway, new brands, new origin labelling, increased demand for ecological food and a fish farming industry that actively pursues these trends. On the other hand: At Slow Food's grand Salon de Gusto in October 2008, where 200,000 visitors sampled quality food from around the world, Norwegian food was represented, as was some farmed fish, but no Norwegian farmed fish.

A few tips for those who wish to read more about the modern consumer:

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Forbrukerne blir ansvarlige borgere.

I: Amilien/Krogh (eds) *Matkultur*. Cappelen Akademiske.



Cultured salmon may be tasty, healthy and visually appealing, but that is no use if the consumer does not trust the product.

ABC : Vaccine handling

This is how you achieve safety, complete traceability and documentation of correct vaccine handling.

Some pharmaceuticals, and particularly vaccines, require proper storage temperature in order to maintain durability and potency. Still a substantial part of transport of this type of products currently relies on postal service or other services without temperature control. Valuable vaccines are subject to potentially harmful conditions such as too high temperatures during summer and too low during winter. As a customer it is extremely difficult to find out whether you have in fact paid for a vaccine that has been compromised.

In order to achieve a higher level of quality assurance, Europharma in Norway has created a countrywide network of specially equipped vehicles that ensure an unbroken cold chain is maintained all the way to the end user. The vehicles are equipped with two separate storage units with individual temperature control, and both the temperatures and the positions of the cars are monitored from the company's main office. As a customer you achieve full traceability of the vaccine handling through our temperature log, from Europharma's cold storage facilities via specialized distribution vehicles and finally to your own cold storage facility.

The storage- and distribution system this way ensures that the vaccines and other pharmaceuticals are handled in a way consistent with the products' storage specifications. This gives a guarantee of delivery that no other company in the Norwegian market can offer.

Checklist:

- Make sure you order your vaccines well in advance. That way you are sure that Europharma will be able to deliver the vaccine by means of temperature-controlled transport.
- Place the vaccine in a refrigerator/cold storage room immediately on delivery.
- Vaccines should be stored at a temperature between 2 and 8°C. Prepare the vaccine for use by placing it in room temperature over night.
- Don't be tempted to make concessions when it comes to the quality of your cold storage facility. Preferably use a specialized refrigerator for storage of temperature sensitive pharmaceuticals.
- If you are using an old refrigerator, never place the vaccine containers close to the rear wall of the refrigerator, as this can cause frost damage. Also note that the temperature at the top and bottom of the refrigerator may vary quite a bit.
- Introduce constant monitoring of the temperature in the storage facility. This is easy and inexpensive and safeguards the quality of the product. It also facilitates important tracing and documentation.
- If you have any questions regarding the handling of vaccines or regarding temperature and cold storage facilities, don't hesitate to contact Europharma. Phone: +47 76 06 09 30.



SuperSmolt expanding the smolt window

This year the SuperSmolt method has been the solution for several norwegian fish farmers who have not had time to transfer the fish to sea at the right time.

One of the most important features of the SuperSmolt programme is the option of keeping the fish in the smolt window for a longer period of time. This way you are more likely to avoid desmoltification in situations where you cannot transfer the fish to sea at the appropriate time. Europharma's sister company, ACD Pharmaceuticals, who has represented SuperSmolt in Norway over the last couple of years, has seen an increased demand from fish farmers who need to keep the spring fish in the smolt window.

- Current issues

- A common problem is that the smoltification happens at an unexpectedly early stage. This can put the fish farmer in an awkward position if he is unable to deliver

the fish. Delay in production with subsequent later access to fallowed locations can give the same kind of problems. We have also had clients who, pending the approval of new locations by a slow moving bureaucracy, have used the SuperSmolt method to avoid the fish desmoltifying before sea transfer. Another classic scenario is installations waiting for a well boat that does not arrive when the fish is ready, explains Arthur Lyngøy of ACD Pharmaceuticals.

So far in Norway one has successfully kept the fish in the smolt window for five weeks. In Canada and Chile one has seen examples of 7-10 weeks where the fish is perfectly fine after sea transfer. Exactly for how long it is possible to extend the smolt window is still not known.

Homogenous smolt status

More and more people see the use in synchronizing the smolt status in a group

of fish. If you have a prolonged stay in fresh water or if the size of the fish vary, you run the risk that part of the group will desmoltify before delivery. If the purpose of running the program is keeping the ATPase at a functional level, you can start at a lower temperature than 6°C and combine it with rising temperature throughout the program period.

For the autumn fish the smolt window is often narrow due to high fresh water temperatures. With use of light control only, a delay in transfer can become critical for the entire group, or for part of it. In such situations, SuperSmolt can help to avoid desmoltification.

- The good news for our clients is that using the SuperSmolt method to keep the fish in the smolt window is less costly than using it for smoltification, says Arthur Lyngøy of ACD.



Gives flexibility: The SuperSmolt method has proved a very efficient tool in situations where fish are in danger of desmoltifying due to delayed sea transfer.

Fresh start after the fire

Europharma quickly was up and running in new offices after a fire struck the main office on the 28th of September last year.

The premises of both Europharma, several of its sister companies and the parent company, Nordly Holding, were uninhabitable after the fire. However, important computer equipment was rescued from the building as the fire was being put out, and this made it possible to have the company fully operative as early as the next day. During the first couple of weeks after the fire the employees were working in dif-

ferent locations around town, but now all of the companies are reunited under the same roof in Lufthavnveien 11 in Leknes. In other words it is business as usual for client consultant Siv Bentsen (photo) and the rest of the Group's employees.

Europharma wishes to express its profound gratitude to companies and individuals who offered their assistance and support after the fire. A special thanks to Lofoten Sjøprodukter who provided our sister company, Polarfeed, with a new main office during the first weeks.



Conquering the salmon world

Europharma's ambitions in Scotland and Northern America are in no way inferior to its activities in Norway and Chile.

During the first quarter of 2009, Europharma will become operative as a supplier of vaccines and fish health products both on the eastern and western coasts of Canada and in Scotland. At this, the company will have reached its objective to offer its services in every market where salmon is produced. This expansion has been a priority to Europharma for quite some time, not least since many of the company's customers are active in several countries.

Europharma is already represented in Canada/USA and Scotland through the purchase of the

global patent rights of SuperSmolt last summer. Those employees of MariCal who had been involved in the development of SuperSmolt came along, ensuring that the change of ownership had no repercussions for clients in these regions.

Europharma strives towards offering its clients the same level of service as in Norway. In other words, Europharma will have the same role as package supplier of vaccines, pharmaceuticals, disinfectants and equipment for the fish farming industry in Scotland and Canada.

In Canada/USA, the Regional Manager is Aaron Craig, and in Scotland Sunil Kadri.

Regional Manager Aaron Craig joined the Europharma-team when the company acquired the SuperSmolt patent. He now heads the development of Europharma in Northern America.



The logo for Europharma features a black, thin, curved line that starts on the left and curves upwards and then downwards to the right, resembling a stylized 'C' or a partial circle. To the right of this line, the word "europharma" is written in a bold, sans-serif font. The letters "euro" are in red, and "pharma" is in black.

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