



Environmentally sustainable aquaculture

The Directorate of Fisheries' objective is to facilitate sustainable and profitable fisheries and aquaculture industry within the current political framework and guidelines. During the spring of this year, the government submitted its strategy for an environmentally sustainable aquaculture. It lists five main challenges:

- Escapes and the influence on genes
- Access to sites
- Pollution from fish farms
- Access to marine feed resources
- Diseases and parasites

In this booklet you can read more about our objectives and directions for an environmentally sustainable aquaculture industry. In 2009 and going forward, the Directorate of Fisheries will pay special attention to the sustainability strategy's objectives concerning escapes, access to sites, pollution and access to marine feed resources, while the Norwegian Food Safety Authority will be responsible for the monitoring of diseases and parasites. In order to reach these objectives, it is imperative for the industry and authorities to collaborate actively.

We currently have a well established level of collaboration between the industry and the authorities, both in terms of proposals for specific regulations and in terms of the practical monitoring in circumstances such as escapes. Without solid cooperation it will prove difficult to reach the objectives set by the government in the strategy for an environmentally sustainable aquaculture industry.



Liv Holmefjord
Director General of Fisheries

Use of sites

Efficient use of sites in the aquaculture industry implies a usage which facilitates the greatest possible production within a limited geographical area and without an unacceptable negative impact on the environment. The structure of the industry is based on an approval of new farms on a first-come-first-serve basis, without any higher-level planning.

The current location structure and site usage may well be contributing factors in the fish health problems experienced in the aquaculture industry in recent years. In Western Norway in particular, where the concentration of aquaculture facilities is most dense, pancreas disease (PD) has been a problem.

The authorities have obtained important tools to help counteract poor structures, for instance the statutory authority to force aquaculture facilities to move due to social or environmental considerations.

The continued growth in our aquaculture industry may consequently depend on changes being implemented to the current structure, to ensure that the allocated site can be utilised in a more efficient manner. This will help equip the industry to better cope with current and future challenges, such as lack of space, pollution and the spread of diseases. Aquaculture facilities must be set up in accordance with plans adhering to the Norwegian Planning and Building Act.

The Directorate of Fisheries' regional offices are responsible for evaluating, in individual cases, the need for an impact study in reference to environment, natural resources or society.

Objectives

- The aquaculture industry maintains a location structure and site usage that reduces the impact on the environment and risk of infection.
- New sites must be located in accordance with a management plan for site usage in the industry, and in areas assigned to aquaculture in the municipal site use plan.
- Each site that is used and cleared must be considered suitable in reference to environment, fish health and fish welfare.

New initiatives

- Formulation of improved criteria for sites.
- Amendments to the Norwegian Aquaculture Act give authorities the option to impose aquaculture facilities to move due to environmental or industry considerations.
- Work towards an updated coastal zoning plan for all coastal municipalities.
- The government will consider guidelines for the implementation of the impact study in accordance with the Planning and Building Act.
- Establish a committee to evaluate more effective possibilities for use of sites in the aquaculture industry.





Escapes from aquaculture facilities and the genetic impact on wild fish stock

Escaped farmed fish are genetically less equipped to survive in nature in comparison with wild fish. A so-called gene flow between escaped farmed fish and wild fish may cause deterioration in the genetic material of the wild fish, and consequently contribute to a weakening of the wild fish populations.

We currently do not have adequate knowledge of how the escaped farmed fish influence the wild fish populations and the environment. However, a number of scientific studies indicate that there is reason for concern and that we should adopt a principle of 'better safe than sorry'. This means that the authorities should work to prevent all escapes – irrespective of fish species.

In most cases escapes are caused by breakdowns and inadequate technical standards

in the facility, human error, collisions or lack of expertise on behalf of the farmer.

The reported figures for salmon escapes went down considerably in 2007 and 2008. Cod escapes have been increasing in recent years, and the 2008 figures for escaped cod were reported to be 228,000. As of May 2009, there have been reports of around 52,000 escaped farmed cod from Norwegian facilities.

In the event of an escape, the fish farmer is obliged to attempt to re-catch the fish in the local area. With salmon, river based recapture is probably the most successful method. Only a small number of escaped salmon will reach the spawning grounds. As a result recapture in the river can prove to be very effective. There is currently no national system in place to ensure that this will happen. Other

solutions to reduce environmental damages, such as using sterile fish in fishfarms, is also being examined.

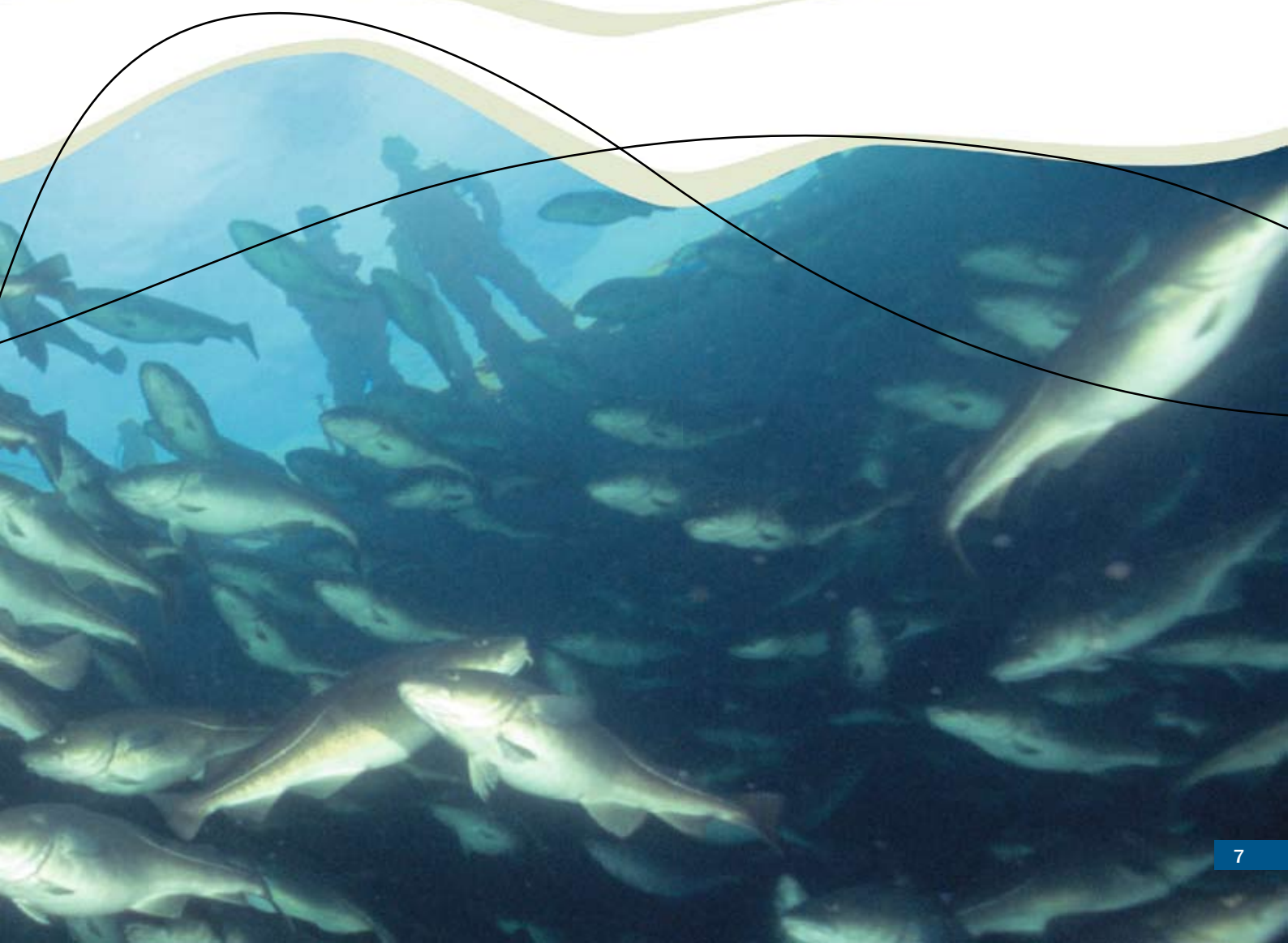
Objectives

- Aquaculture shall not result in permanent changes to the genetic make-up of wild fish stocks.
- The objective of our "Vision - No Escapes" will be maintained. One escaped farm fish is one too many.

New initiatives

- Improve supervision of aquaculture facilities to ensure adherence to the environmental stipulations in prevailing regulations.
- The government will recommend that the regulations for technical standards and requirements are made more stringent.

- Facilitate the development of new technical solutions to prevent escapes.
- Prioritise the gathering and transfer of knowledge as to the risk and behaviour related to escapes.
- Prioritise the monitoring programme in national salmon waterways and fjords and increase our knowledge around DNA profiles and gene stability in important salmon stocks.
- Continue our efforts to increase our knowledge about the impact of escaped farmed fish on the wild fish populations.
- Evaluate whether fish farmers should pay for damage compensation measures implemented by the government following escapes.
- Evaluate further whether there should be a maximum limit to the size of sea cages and the number of fish per cage, taking into consideration the consequences of escapes.





Pollution and emissions from aquaculture facilities

In general, the emission of nutrient salts and organic materials can be considered a minor environmental problem in Norway. There can, however, be negative effects on the local and regional environment:

- The decomposition of organic material (feed spills and faecal matter) may lead to a reduction in oxygen and change the biodiversity in the bottom sediment.
- Emission of nutritional salts can increase the growth of algae and the production of biomass in the water as a result of the fertilisation effect (eutrophication).
- Emission of chemicals and preservatives containing copper have a negative impact on the environment. The substances become concentrated in the bottom sediment and in the food chain and will result in damage to sensitive species such as molluscs.

Systems have been developed to monitor the influence on the seabed/riverbed and the animals that live in, below and near fish farms. These so-called MOM studies (fish farms – monitoring– modelling) are defined in Norwegian Standard 9410, and describe amongst other things, investigations of the impact on the seabed/riverbed conditions.

Efforts have been initiated to develop MOLO (environmental monitoring and localising) as a total system for regulating environmental impact and site adaptations.

In 2005, a new system was introduced for production restrictions with maximum permitted biomass (MTB) and environmental monitoring. The MTB system combined with the introduction of environmental studies at time of approval and environmental monitoring during operation, safeguards considerations for an environmentally appropriate production process, as well for the health and welfare of fish.

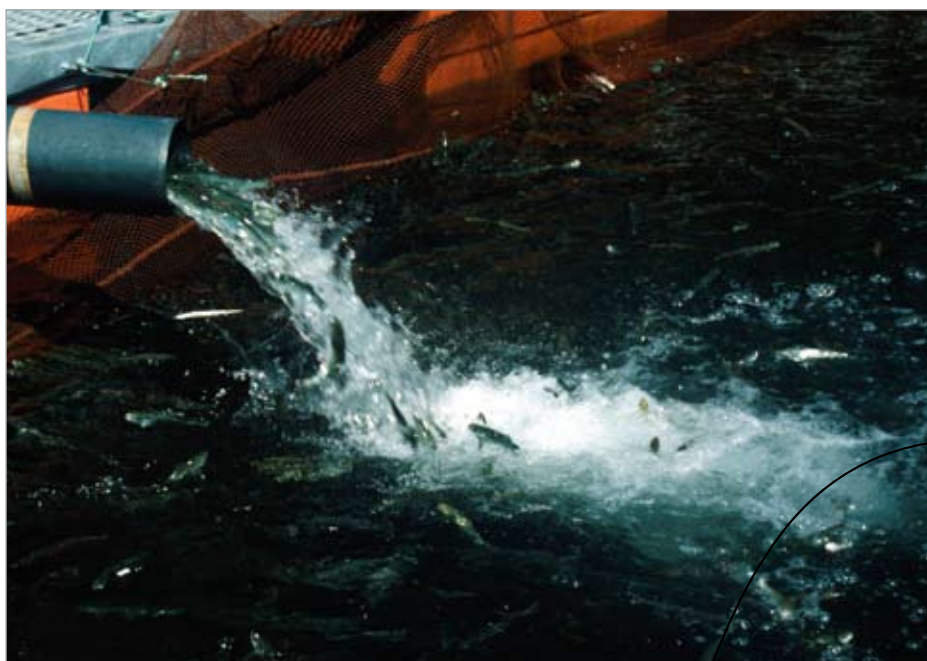
Objectives

- All operational aquaculture facilities must comply with reasonable environmental standards and shall not have emissions of nutrient salts and organic material that are greater than the recipient can manage.
- Site approvals must be based on proper assessments and criteria.
- The utilisation factor on the site in relation to carrying capacity must be within defined and measurable limits.

- In areas with many facilities and large production, the combined influences must, in total, not result in reduced environmental quality further out in the recipient.
- It is important to have a management system which can ensure that the production at each site does not exceed what that site can sustain, which sees individual sites in the context of a larger geographical area, for instance the Hardangerfjord area.

New initiatives

- Prioritisation of management-oriented research in environmental data, water quality, fjord and coastal ecology, and the environmental impact of aquaculture in general.
- Developing criteria for selecting sites in view of environmental sustainability.
- The government will propose the introduction of compulsory C-investigations (extended investigations of seabed conditions near aquaculture facilities from Norwegian Standard 9410) upon approval and during operation.
- Promote the development of MOLO as a future total system for regulating environmental impact and site adaptations.



Diseases and parasites

Diseases and parasites continue to represent a significant loss factor in the Norwegian aquaculture industry. However, health conditions have improved considerably in the past 20 years, mainly due to vaccinations and other initiatives. Reported figures for loss (including mortality, escape, predators and disposal) show that approximately 90 percent (or 36 million fish) of loss in 2007 was caused by mortality. This is considered to be a low percentage.

The use of antibiotics has been greatly reduced during the past 20 years. In 2008, a total of 905 kilos of antibiotics were used in the aquaculture industry as a whole. For new farmed species, however, there are some unsolved problems with bacterial diseases. For example, Francisellosis is a growing problem for cod farming.

The largest disease-related losses in Norwegian salmon farming can be attributed to viral diseases such as pancreas disease (PD), heart and skeletal muscle inflammation (HSMI), infectious salmon anaemia (ISA) and infectious pancreatic necrosis (IPN).

Salmon lice have been discovered at most sites, which in the long-term may cause damage to the wild fish populations. As a result changes have been implemented in the regulations to combat salmon lice, including measures to reduce the danger of developing resistance.

The Hardangerfjord represents exceptional and complex challenges. The critical condition of the wild salmon and sea trout populations, and the level of diseases and salmon lice, give cause for serious concern. More research is required to determine if changes are really

taking place in the ecosystem of the Hardangerfjord and what the possible reasons for these changes are.

Objectives

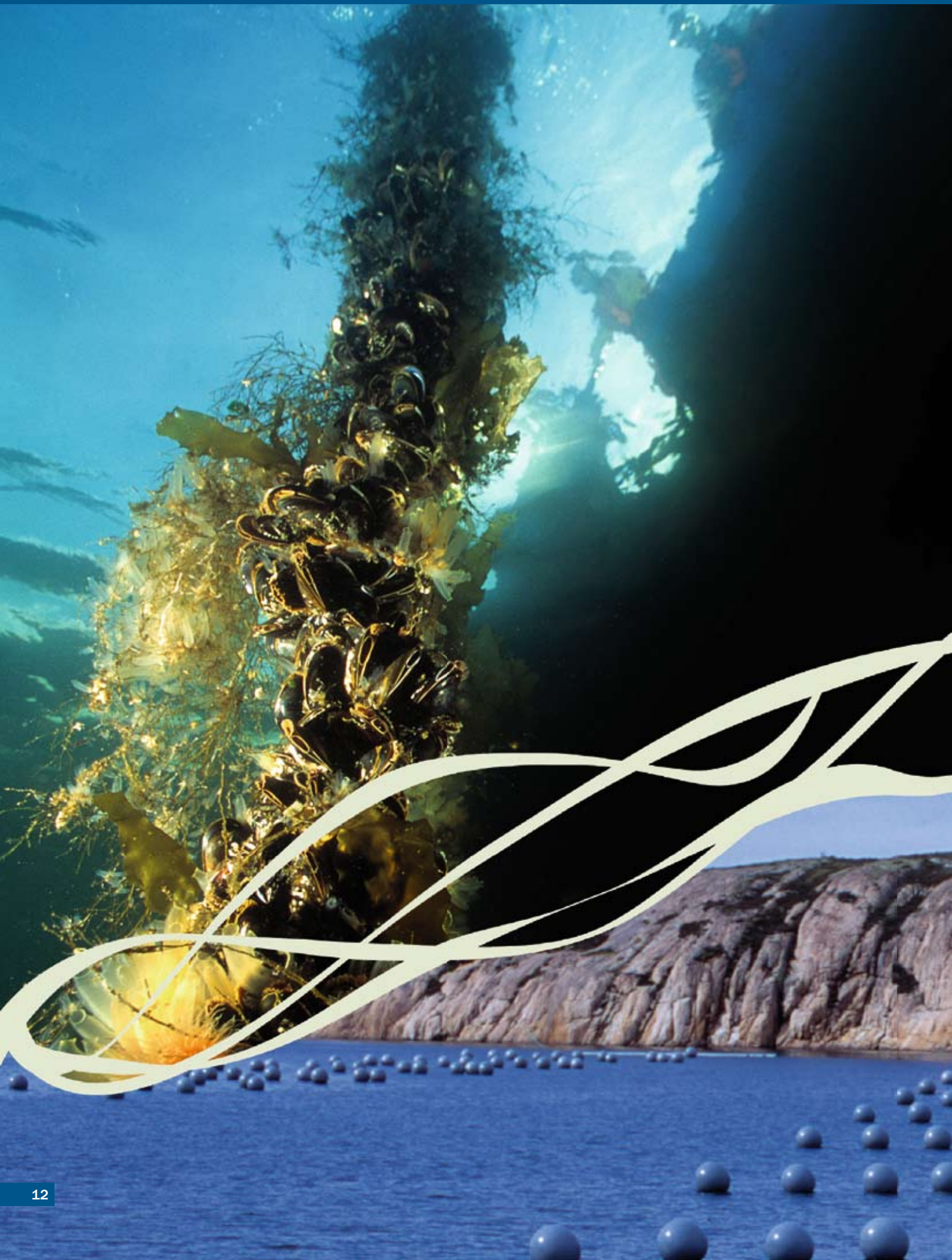
- Disease in aquaculture facilities should not have an effect on the levels of wild fish stocks, and as many farmed fish as possible should move through their life cycle with a minimum use of medication.
- It is important to attain a level of knowledge, an industry structure and operational procedures that will minimise future losses in the aquaculture industry.
- Aquaculture activities should not be carried out in a way that causes wild fish stocks to suffer unacceptable negative consequences from disease.



New initiatives

- Stricter regulations for the control of salmon lice.
- Propose levels of lice present in wild populations as an indicator for when action should be taken at fishfarms.
- Consider a reduction of biomass in a specific geographical area, in cases where other methods have failed to give the desired results in the lice levels of wild fish.
- Consider implementing a ceiling on the physical size of the production units, and/or on the number of fish per sea cage.
- Propose stricter requirements for well-boats and transport.
- Urge the industry to create manuals for best practice (Code of Good Practice).
- Consider measures in collaboration with the industry to create improved operational structures that will have a positive impact on salmon lice infections and other diseases.
- Implement a separate regional management regime for the Hardangerfjord.





Major challenges for the mussel industry

The Directorate of Fisheries has during the past two years completed a full inspection and mapping directed at the Norwegian mussel industry. The purpose of the initiative was to map relevant characteristics among enterprises that are licensed to grow mussels.

The report from the mussel initiative was published in May 2009. The main findings in the report were: many breaches of regulations, poor equipment, several problem facilities and a shortage of professional players.

Too many problem facilities

The inspections showed that there are 51 problem facilities located in the Norwegian coastal zone. These are facilities or remains of facilities that are ownerless, or where previous or current owners are unable to clean up. During the mussel initiative, 25 new problem facilities were discovered which had previously been unknown to the authorities. And there were an additional 19 new problem facilities due to bankruptcy or liquidation.

During the same period, 26 problem facilities were cleaned at the initiative of the

Directorate of Fisheries. Such initiatives are extremely time consuming for the administration and the owner, but they cannot be avoided when conditions have deteriorated too far.

More than half lack proper equipment

More than half of the users who responded to the survey lacked the equipment required to operate an efficient production. Many of the growers did not have boats and other harvesting equipment with adequate crane capacity. Many were also far from a receiving facility.

Uncertain forecasts and low productivity

The growers had forecast a harvest of 5185 tons of mussels in 2008, but total was only around 1900 tons. The growers did not have any precise estimate of how many mussels they could harvest or when it would happen.

In 2007, 166kg were harvested per licensed decaire, while each of the 69 reported full-time equivalents harvested 39 tons at a value of almost NOK 285,000 each. As a comparison, each full-time equivalent in the farmed salmon industry produced 464 tons of salmon at a value of NOK 9.6 million.

Many breaches of regulations

In the 519 sites that were inspected, 374 breaches of regulations were observed in relation to aquaculture regulations. Furthermore, a lack of upkeep or operation was observed at 152 licensed sites.

A total of 179 licenses were withdrawn in the period. In addition, 163 cases were referred to the Norwegian Coastal Administration.

Fewer licenses

Only one new license was awarded in 2008. This is because the authorities since April 2007 require a financial guarantee from the grower that the site will be cleaned up when operation ends. With as many as 750 licenses awarded, 2003 was a peak year for mussel growing. By 2007 the number had sunk to 531 and at the end of March this year there were 378 licenses.

NOK 500,000 allocated

In reaction to the report concerning the conditions of mussel industry, the Norwegian Fisheries and Coastal Minister Helga Pedersen allocated NOK 0.5 million to the efforts of cleaning up deserted and ownerless mussel installations along the coast.



Feed and feed resources in the aquaculture industry

Fishmeal and fish oil have traditionally constituted the most important ingredients in fish feed. To a large extent, the use of so-called industrial fish (small and bony fish species not suitable for human consumption) are common in the production of fishmeal and fish oil. These industrial fish also constitute an important food source for fish species living in the wild. The challenge is to find a way to produce fish feed without endangering the industrial fish populations.

Norwegian aquaculture has experienced substantial growth in production for a number of years now and consequently also a growth in feed consumption. In 2008 there was a turnover of 1.2 million tons of fish feed. Of these, 1.182 million tons were produced in Norway while 18 000 tons were imported.

On a global level, around 33 million tons of fish are used to produce fishmeal and fish oil each year. This yields around 6.3 million tons of fishmeal and 1 million tons of fish oil.

Norway annually produces approximately 200 000 tons of fish meal and imports an equivalent amount. Norway annually produces approximately 55 000 tons of fish oil and

imports approximately 170 000 tons. The largest suppliers of fishmeal and fish oil to Norwegian feed production are Peru, Iceland and Denmark.

Norway participates on an international level to reduce illegal fishing, which is one of the main threats to the sustainable management of fisheries. Norway also prohibits fish dumping, which means that all fish caught in the sea must be brought to shore, and works internationally to encourage other countries to do the same.

Objectives

To ensure that all further growth in the aquaculture industry is sustainable on all levels, the objective is that all feed used in the production of Norwegian farmed fish should have complete environmental traceability.

The utilisation of offal and marine by-products in feed production should be increased. For instance, single cell proteins based on natural gas should be considered in this context. Efforts must also continue in the development of alternative marine ingredients for use in feed production.

New initiatives

- International effort to reduce the level of IUU-fishing (illegal, unreported and unregulated fishing) and limit dumping to a minimum.
- International effort to ensure countries exploiting industrial fish do so sustainably.
- Promote increased utilisation of marine by-products as ingredients for feed, and prioritise research in alternative marine sources.
- The government will consider policy instruments related to the production, import and labelling of feed and feed ingredients to ensure that fish feed used in Norwegian farms only contains fishmeal and fish oil produced from sustainably managed stocks.
- Promote the development of feed and feeding technologies that will increase growth and reduce the environmental impact near the facilities.





New (re)forms of aquaculture management

From 1 January 2010 the management reform comes into force (white paper nr. 10 (2008-2009) Concerning laws to reform the public administration legislation, etc. (implementation of management reforms)). The reform, which was also known as the regional reform, is a follow-up of Report No. 12 to the white paper (2006-2007).

Core issues and objectives

The core objective of the reform is to transfer responsibilities from the state to the county authorities in order to strengthen the representative government, the local democracy and value creation based on local values. The reform should facilitate a more coordinated and efficient management and improve value creation and employment based on local priorities.

Results and consequences

The county authorities will take over the majority of tasks associated with processing aquaculture applications, which will result in an organisational division between the management and control functions. The county authorities will grant licenses and the Directorate of Fisheries will inspect and supervise the process.

For people involved in the industry, it means that applications for aquaculture licenses and site locations that are currently submitted to the regional office of the Directorate of Fisheries should be sent to the county authorities from next year.

Responsibilities in aquaculture management

The county authorities will receive a number of responsibilities, such as health, transport, education and research.

With effect from 1 January 2010, the county authorities will also be responsible for aquaculture management including the processing and granting of licences and sites for:

- edible fish of salmon, trout and rainbow trout in seawater (separate allocation processes)
- sea ranching (separate allocation process)
- production of hatchery fish from salmon, trout and rainbow trout
- production of other fish species (sea and fresh water), all life cycles
- production of molluscs, crustaceans and echinoderms, all life cycles

- slaughter cages
- catch-based aquaculture (marine species)
- put and take in the sea (marine species)
- recreation in fresh water (fresh water species and anadromous species)

The case work that takes place centrally in the Directorate of Fisheries, in Bergen, will continue as before (this will mainly be the processing of appeals, disposition applications and special permissions).

Read more

You can find the complete Odelsting Proposition (white paper no. 10) online on the pages of the Ministry of Local Government and Regional Development (www.regjeringen.no). There you will also find Report No. 12 to the white paper (St.meld. nr 12 (2006-2007)) Regional priorities – regional future.

More information will appear on the Directorate of Fisheries' own website. (www.fiskeridir.no)



New system for the location of aquaculture sites (STAK)

The Directorate of Fisheries is working on a project called Location of Aquaculture (STAK) which is designed to improve the quality and precision of positioning aquaculture.

STAK has been divided into the following project areas:

- A. Implement a system for the location of aquaculture sites at sea in the form of areas.
 - for existing locations
 - for new locations
- B. Implement location as a natural part of aquaculture control in reference to the positioning of sea facilities.
- C. Organise A and B in a mapping tool to be used for case management especially when follow-up is required in the event

of discrepancies between allocated sites and actual positioning.

All aquaculture licenses at sea must be localised as areas. The outer perimeters of the licenced area will be registered in the aquaculture registry and visualised on a map as an area on internal and external map solutions (<http://kart.fiskeridir.no>). STAK will deliver an accurate picture of the allocated areas for the whole aquaculture industry during 2009.

All aquaculture licenses, including land-based, must as before be registered as the central point. The coordinates must be checked and adjusted if necessary to improve accuracy.

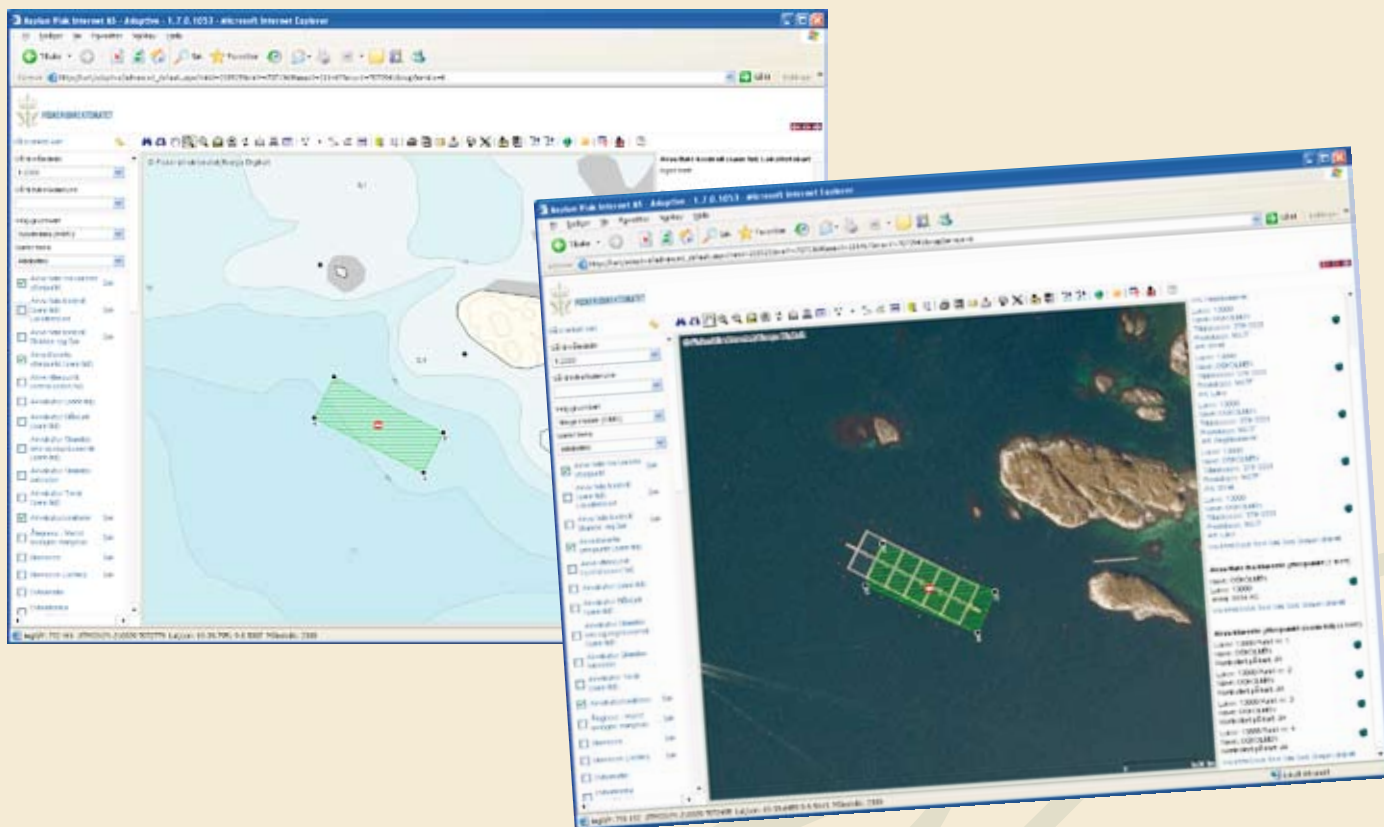
When the Directorate of Fisheries is on a site inspection visit, the outer perimeters (=main floats) of the facility will be measured by

GPS to verify that its actual position is within the perimeter stipulated by the license.

The objective of the new system for the location of aquaculture sites (STAK) is that the Directorate of Fisheries and the administration in general will improve the quality and efficiency of case management related to site usage in the coastal zone.

Additional impacts

- Increased adherence to regulations
- Aquaculture database with improved reliability
- Safer for boat traffic
- Reduced risk of escapes caused by boat collisions







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