IP(10)13

Aquaculture, Introductions and Transfers and Transgenics Focus Area Report

Norway

Content

1. Introduction

Norway has a coastline of 21.000 km. Along this coast there are about 450 rivers that sustain or once sustained self-reproducing Atlantic salmon stocks. At present 407 of these sustain self-reproducing stocks. The total return of salmon to Norway was estimated to approximately 490 000 individuals in 2008 (fig 1). However, historic catch data from Norway show fluctuations, and trends vary in different regions over time. The wild salmon has historically been, and still is, important to Norwegian and Sami culture. The most important risk factors involving aquaculture is currently escapees and salmon lice.

Figure 1: Estimated number of pre-fishery abundance for wild salmon to Norway 1983 – 2008. Mean values (black) and 95% confidence limits from simulations (red). Source:

Norway's overall objectives concerning preservation of the wild salmon is laid down in St.prp. no. 32 (2006-2007). An English summary of this document is to be found in Annex 1.

1.1 Activities within the Party or Jurisdiction related to aquaculture, introductions and transfers and transgenics

Aquaculture

In Norway there has been a very rapid development of the aquaculture production, and the last decades farming of Atlantic salmon has grown to be a major industry. Figure 2 show the increase in tons and value from 1980 until last year.

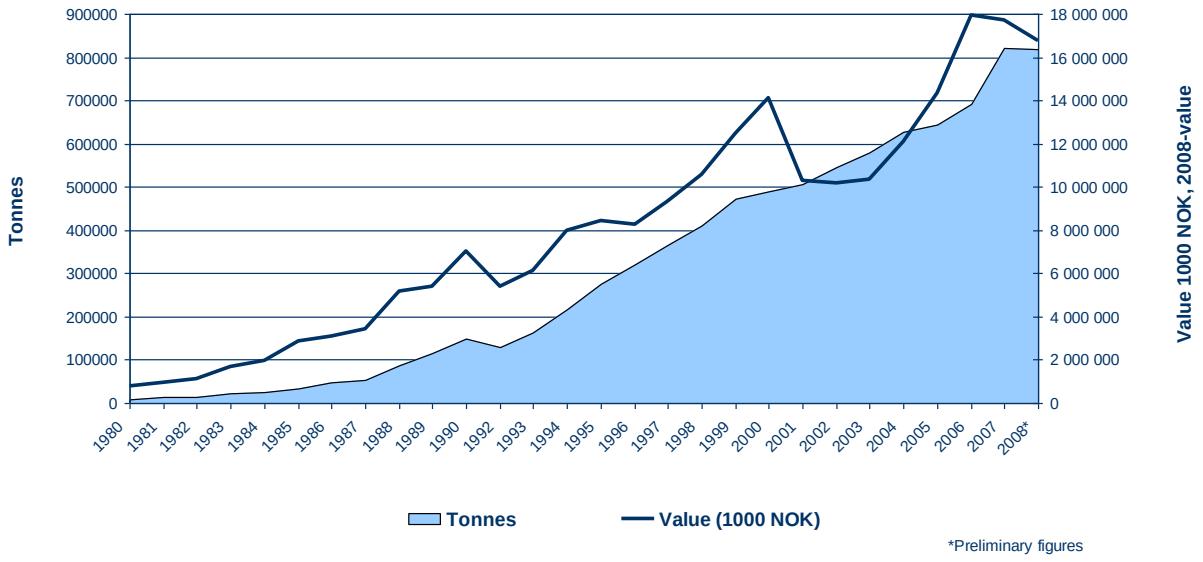


Figure 2: Production of Atlantic salmon and Rainbow trout 1980 – 2008. Tons and value. Source: The Directorate of Fisheries

The number of licenses for production of Atlantic salmon has been relative stable (fig. 2). In 2008 the Norwegian government decided to grant 65 new licenses (normally 780 tonnes per license). In 2009, the Government decided to allow a 5% increase in the production capacity of each license. Around 20% of the coast was excluded from taking part in this increase, due to environmental concerns. However, because of increased problems with salmon-lice in the autumn, the Government decided to await the entering into force of this decision, pending the development in the salmon-lice situation.

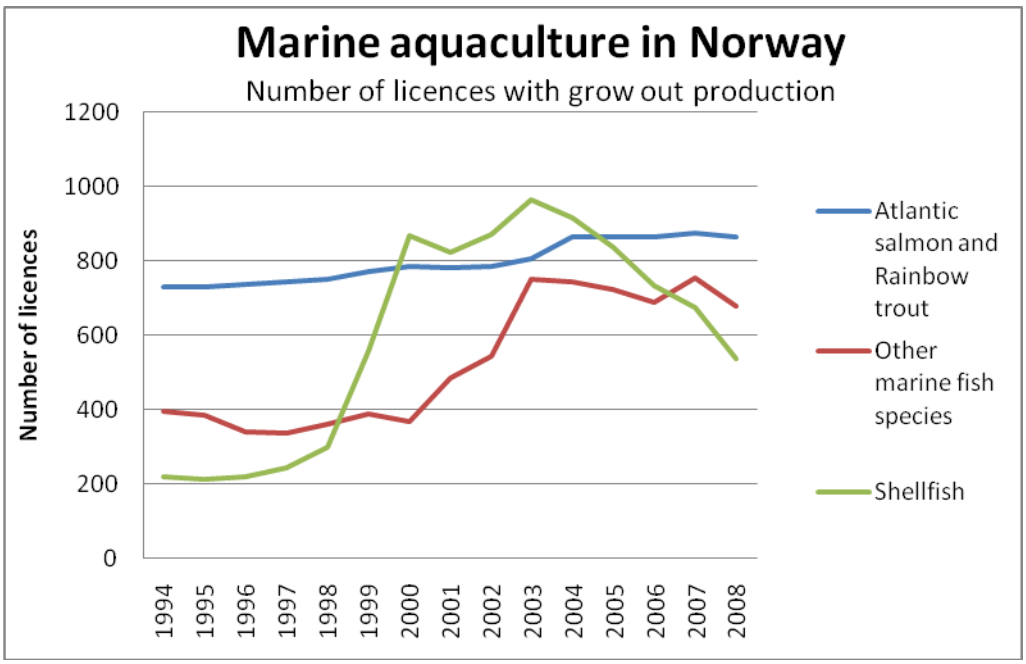


Figure 2: Number of licenses with grow out production 1994 – 2008. Source: The Directorate of Fisheries

Figure 3 shows the regional distribution of licenses issued for production of Atlantic salmon and rainbow trout in Norway.

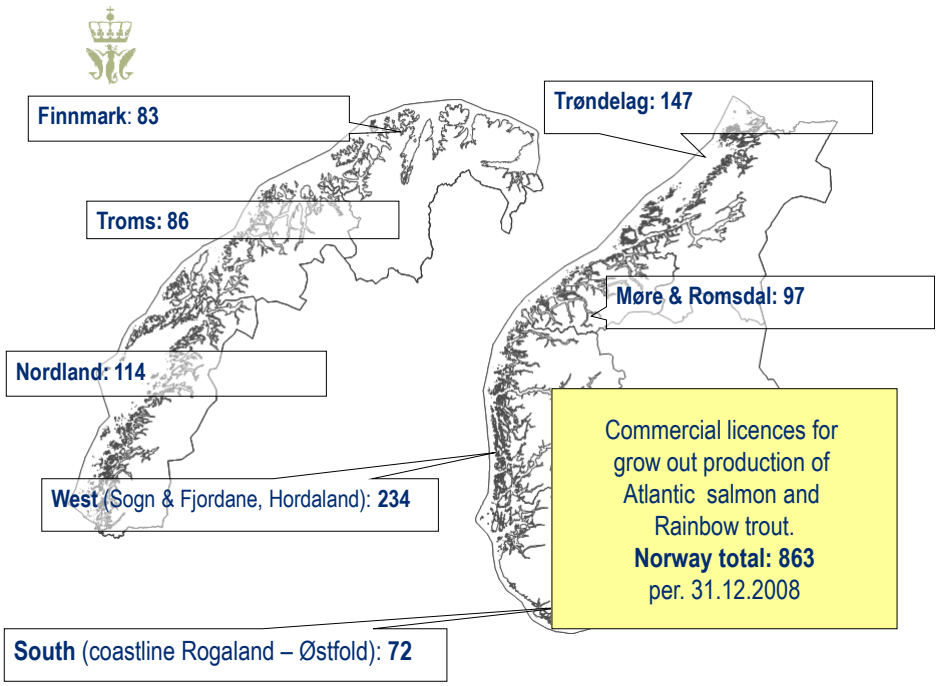


Figure 3: Licences for grow out production of Atlantic salmon and rainbow trout in Norway per 30.06.09. Source: The Directorate of Fisheries

In January 2009 there were 1.038 sites approved for salmon and rainbow trout farming in Norway. Due to routine fallowing of sites, the number of sites with fish is at any time between 600 and 700.

Stock enhancement activities

Cultivation licences are issued for 168 wild fish hatcheries in Norway. The majority of these are restricted to non-anadromous fish production.

Approximately 4.5 million salmon smolt, parr, fry and eggs are produced annually for enhancement purposes in various rivers around the country. Stock enhancement activities are conducted for various reasons such as to compensate for losses in natural production due to hydroelectric power development, other habitat deterioration, or to reintroduce salmon stocks. Specific stocking programmes are developed after i.e. rotenone treatment against *Gyrodactylus salaris*. Stocking in salmon rivers is based on local stocks.

1.2 Policy and management structure as it relates to aquaculture, introductions and transfers, and transgenics

Norway's policy regarding conservation of wild salmon and the impact of aquaculture is established in a whitepaper to the Parliament (St prp no 32 (2006-2007)) and the Governments Strategy for an environmental sustainable Norwegian Aquaculture industry (Appendix 2) from 2009. A summary of the whitepaper is attached (Appendix 1).

The overall objectives for wild salmon management are: *To conserve and restore spawning stocks at levels of abundance and with a composition, that ensures genetic diversity and the full utilisation of the natural productive capacity of salmon habitats. Salmon habitats shall be managed to preserve diversity of nature and its productive capacity, and threats and adverse impacts shall be identified and eliminated. Wherever this is not possible, adverse impacts on the production, abundance and composition of salmon stocks shall be counteracted or neutralized. Impacts threatening the genetic diversity of salmon shall be reduced to not-harmful levels by 2010.*

The internationally acknowledged Precautionary Approach shall be applied as a basic principle for all sectors involved. According to the Act relating to the management of biological, geological and landscape diversity of 19.06.2009 (Nature Diversity Act), those responsible for adverse impacts on the salmon resource shall also be responsible for restoration and compensation measures.

Within this framework the salmon resource shall be managed to the greatest possible benefits to society, fishing right holders and recreational fishermen.

Figure 4 illustrates the management structure concerning aquaculture and conservation of wild Atlantic salmon.

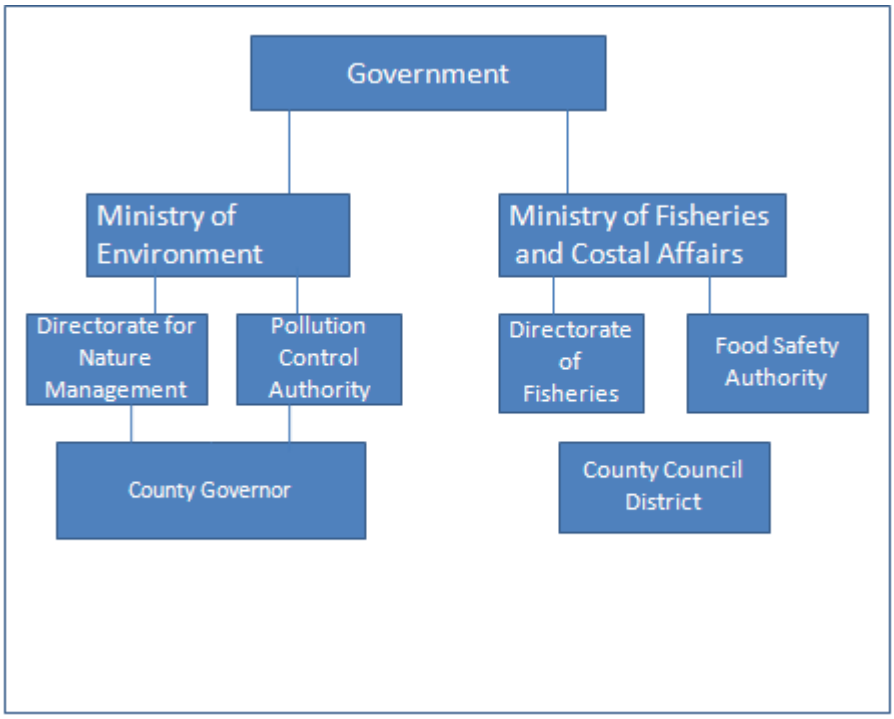


Figure 4 Management structure.

The Ministry of Fisheries and Coastal Affairs.

The Ministry of Fisheries and Coastal Affairs is responsible for the fisheries and aquaculture industries, seafood safety and fish health and welfare for both wild and farmed fish.

The overall aim is to ensure that the aquaculture industry is conducted without unacceptable negative impacts on the environment or wild fish populations.

The strategy for an environmentally sustainable Norwegian aquaculture industry focuses on the environmental aspects of sustainable farming, based on five main areas in which the industry impacts the environment (the impact model).

These are:
- genetic interaction and escapes
- pollution and discharges
- disease, including parasites
- use of coastal area
- feed and feed resources

The strategy discusses details of challenges, status, measures initiated, future goals and the Government's proposals for new measures for each of these five areas. The strategy identifies problems, sets goals and explains what needs to be done to achieve them. It does not include specific effect-indicators for acceptable influence. The Directorate of Fisheries and the Norwegian Food Safety Authority will play a central role in implementing the drive for sustainability, and the ongoing process will require more research or investigation.

The Directorate of Fisheries

The Directorate of Fisheries' main goal is to promote profitable economic activity through sustainable and user-oriented management of marine resources and the marine environment.

The Directorate is responsible for management of the Aquaculture Act, as well as an executive responsibility for following up political objectives related to aquaculture. The Directorate is also responsible for co-ordinating other public authorities in this area.

It is a major goal to reduce negative impact of aquaculture on wild species to an acceptable level, and therefore an action plan "New vision - no escapees 2008-2009" has been adopted. (Described later in this document).

The last 25 years the directorate and its regional offices have issued licenses for fish farming. From 2010 this task is delegated to the county council district. The responsibility for inspections and withdrawal of licences will remain in the Directorate of Fisheries

To get a license according to the Aquaculture Act, it is necessary to have a specific license according to other Acts, see figure 9 which illustrates the present "application-system". The system has been developed over many years in co-operation with other ministries (see chapter. 2.2).

The Norwegian Food Safety Authority

The Norwegian Food Safety Authority is responsible for controlling the compliance with national fish health and welfare regulations with respect to both cultured and wild fish. It is governed by the Ministry of Fisheries and Coastal Affairs. The legal framework is the Food Act of 12.19.2003, EU Directive 2006/88/EC and the Animal Welfare Act, respectively. EU's Fish Health Directive was implemented in Norway 08.01.2008. The current Animal Welfare Act came into effect on 01.01.2010. National regulations are proposed by the Norwegian Food Safety Authority and decided by the Ministry of Fisheries and Coastal Affairs. The Norwegian Food Safety Authority may propose and effectuate specific fish health regulations that pertain to limited geographical areas (zone specific regulations) for disease control purposes.

A separate regulation that covers establishment of seacage production facilities falls under the combined jurisdiction of the Norwegian Food Safety Authority and the Directorate of Fisheries. The Norwegian Food Safety Authority's responsibility includes inspections and control of aquaculture facilities to ascertain that fish health and welfare regulations are being abided. This responsibility covers all of the country's commercial aquaculture facilities and enhancement facilities for wild salmonid stocks. Transfer of live fish with respect to risk of spreading disease within, and into Norway, falls under the jurisdiction of the Norwegian Food Safety Authority in accordance with the EU Fish Health Directive.

The Ministry of the Environment

The Ministry of the Environment has a particular responsibility for developing and carrying out the environmental policies of the Government. In addition to initiating, developing and carrying out its own measures through its own instruments, the Ministry of the Environment has an important role in coordinating activities within the responsibility of other ministries in order to achieve environmental policy objectives of the Government, and ensuring follow-up and monitoring results of environmental policies.

The Ministry of Environment is also responsible for managing wild salmon stocks.

The Directorate for Nature Management and the Norwegian Pollution Control Authority

The Directorate for Nature Management and the Norwegian Pollution Control Authority are advisory and executive bodies under the Norwegian Ministry of Environment (fig. 4).

The main areas of responsibility to the Directorate for Nature Management lie within the conservation of biological diversity and the sustainable use of Norway's natural resources, including the management of wild salmon stocks. The directorate for Nature Management is the main authority of the Act Related to Salmonid and Fresh-Water Fish etc. No. 47 of May 1992 and the Nature Diversity Act.

Provisions and guidelines in order to regulate stock enhancement activities are developed under the Act Relating to Salmonids and Fresh-Water Fish. According to this act all introduction and transfers of non native freshwater organisms is prohibited unless derogation is given. The objective of the regulations and guidelines is to ensure that natural stocks of anadromous salmonids and their habitats are managed in such a way as to maintain natural diversity and productivity. Within this framework, the regulations and guidelines provide a basis for improvement of the stocks.

Furthermore the Directorate for Nature Management is in cooperation with the Norwegian Food Safety Authority also responsible for the Gyrodactylus salaris eradication program.

The Norwegian Pollution Control Authority implements governmental pollution policy. The Pollution Control Act forms the legal basis for its work in freshwater and marine environment.

2. Implementation of the Willamsburg Resolution

2.1 The parties shall cooperate in order to minimize adverse effects to the wild salmon stocks from aquaculture, introductions and transfers and transgenics.

Escaped farmed Salmon

Figure 5 illustrate the numbers of escaped salmon reported by fish farmers compared to livestock. Related to the livestock of salmon in fish farms, the proportion of reported escaped salmon has decreased the last years; and in 2008 less than 4 of 10.000 salmons in sea-cages escaped.

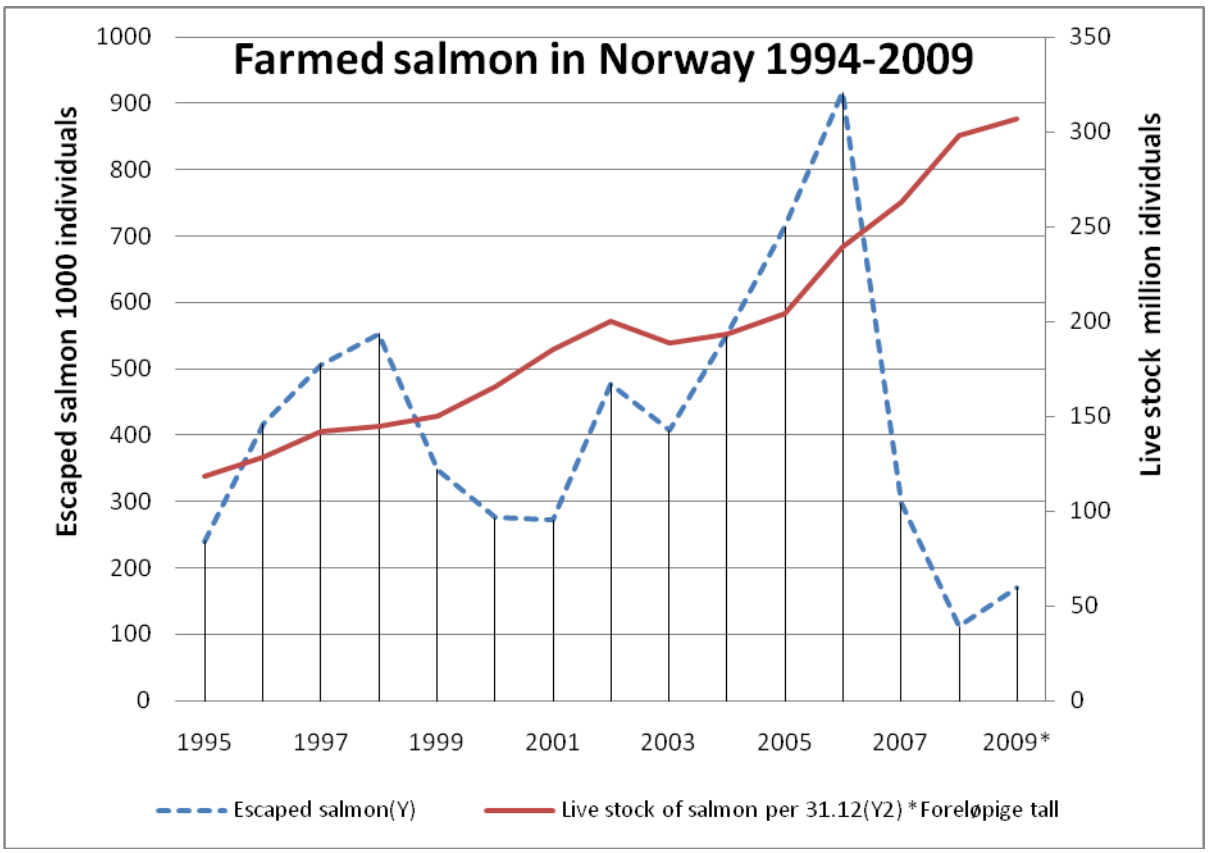


Figure 5:Livestock and reported escaped salmon. Source: The Directorate of Fisheries

Monitoring of spawning populations in 39 salmon rivers indicates that proportions of escaped farmed salmon are consistently high (figure 6). It will be necessary to define limits which indicate what effects are unacceptable. The different salmon stocks may however have different tolerance levels and robustness, and suitable parameters/indicators are needed to measure the effects. The Strategy for an Environmentally Sustainable Norwegian Aquaculture Industry has declared that aquaculture shall not contribute to long-term changes in the genetic characteristics of wild fish stocks.

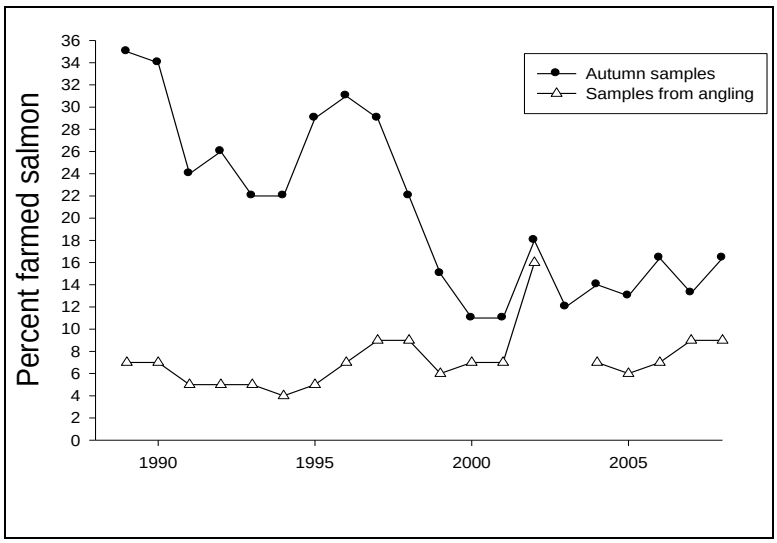


Figure 6: Estimated percentage of escaped salmon in autumn samples (spawning population) and in samples from angling. ***Source: NINA***

Sea lice

At present, the salmon louse *(Lepeophtheirus salmonis)* is by the Norwegian Food Safety Authority and the national scientific community deemed to be a serious threat to the wild Atlantic salmon stocks in Norway.

Recently, resistance against emamectin benzoate and pyrethroids has been discovered in salmon louse along the Norwegian coastline. Preventive measures against resistant lice are laid down in the regulation for combating lice in aquaculture sites. The sea lice infestation levels in the industry have been found to be three times higher in September 2009 compared to the same period in 2008 (fig. 7). However, since then, the salmon louse level has been reduced. During the winter 2010, compulsory synchronised de-lousing in enforced at a threshold of 0,5 adult females in January, and a threshold of 0,1 all stages in March/April. This, in order to ensure a lowest possible level of salmon louse when smolts leave the rivers in the spring.

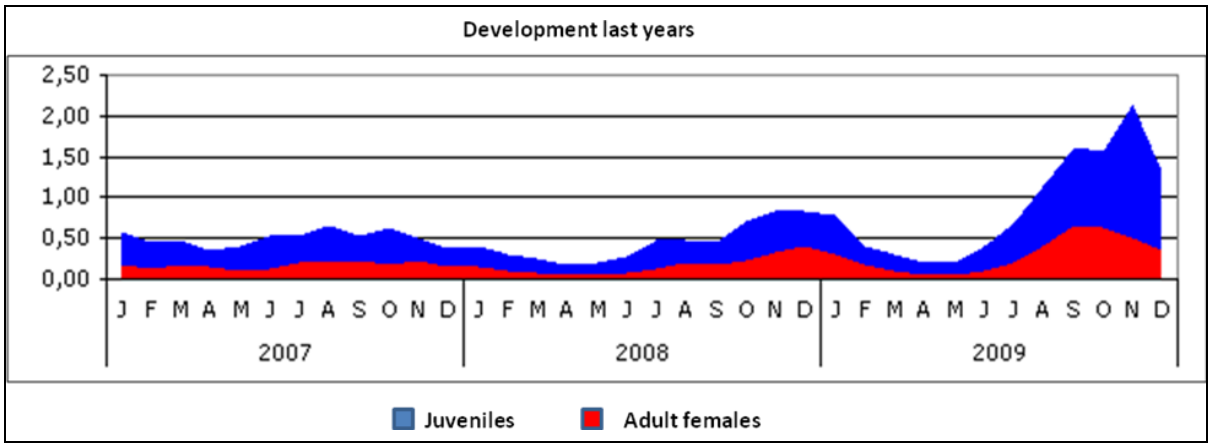


Figure 7: Development of sea lice in salmon farms last years. ***Source: www.lusedata.no***

Gyrodactylus salaris

The primary goal for the Norwegian authorities is to exterminate the *G. salaris* from every infected river in Norway. An action plan is developed for this purpose. If measures are not implemented to combat this parasite it will contaminate new watercourses. The worst-case scenario is that the parasite contaminates all salmon rivers. Based on current experiences and knowledge about this parasite and its impact on salmon, such a development will have grave consequences for Norwegian salmon and salmon fishing.

Infected rivers are treated with rotenone to remove the parasite. Rotenone treatment has so far been conducted in a total of 35 rivers in Norway. In 21 of the treated rivers, the parasite has been successfully eradicated (fig. 8). At present a total or five rivers are being monitored after treatments to ascertain documentation for the success, or failure, of the treatments. Today a total of nine river treatments have been deemed unsuccessful based on the parasite still present post treatment. Considerable efforts continue to be put into improving the eradication method used. These improvements are expected increase the probability of successfully eradicating the parasite in future treatments.

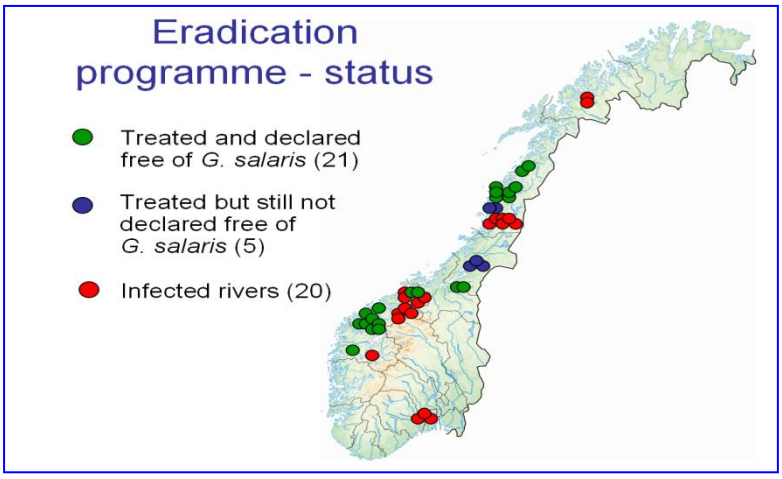


Fig. 8 Status eradication of G. salaris

2.2 Each Party should require the proponent of an activity covered by the Williamsburg Resolution to provide all information necessary to demonstrate that the proposed activity will not have a significant adverse impact on wild salmon stocks or lead to irreversible change.

Before a license for fish farming is issued, the application has to be published by notice in local newspapers and be evaluated by different public authorities. In the end there will be a decision where the concern for wild salmon is one of the considerations taken, see fig. 9.

In Norway a special regulation forbids new commercial salmonid aquaculture facilities within the country's National Salmon Fjords (see 2.9)

Application for an expansion of an existing fish farm, or for a new fish farm, is a demanding and a lengthy process governed to a large extent by the Aquaculture Act. On January 1 2010, the responsibility for coordinating the review process for such applications was transferred from The Directorate of Fisheries to the county council authorities. Several different authorities are required to review such applications using different guidelines and regulations. For such applications to be granted, all the implicated authorities must issue their approval as briefly described below. The local municipality announces the application to the general public, clarifies land and sea area use according to the Planning and Building Act. The County Governor decides whether the application pursuant to the Pollution Control Act, and subsequently issues a statement with respect to nature conservation, recreational fishing and expected implications for the free living salmonid fish in the area.

The Norwegian Food Safety Authority evaluates each application with respect to a regulation for production expansion of existing aquaculture sites and establishment of new sites. The Norwegian Food Safety Authority and the Directorate of Fisheries govern the different decisions laid forth in this regulation. The review process entails evaluation of compliance with distance to other aquaculture facilities and rivers. The evaluation also includes the maximum standing biomass being sought relative to disease risk and control, the applicant's ability to perform responsible delousing treatments and whether an adequate contingency plan accompanies the application for handling high mortality and serious diseases. Further considerations include the general disease situation of the area surrounding the site location being applied for and whether there are any risk factors that can compromise the welfare of the fish at the location being applied for. Risk for spread of disease to wild fish stocks is also considered.

The Norwegian Costal Administration decides on the application pursuant to the Harbour Act. In addition the Norwegian Water Resources and Energy Directorate (Regional Offices) will be involved in cases that involve the extraction of fresh water. After receiving the written decision from all of the above sector authorities, the county council authority either issues the license, or declines the application. If any of the above sector authorities decline the application, the applicant has the right to appeal the decision to the relevant sector authority via the county council authority.

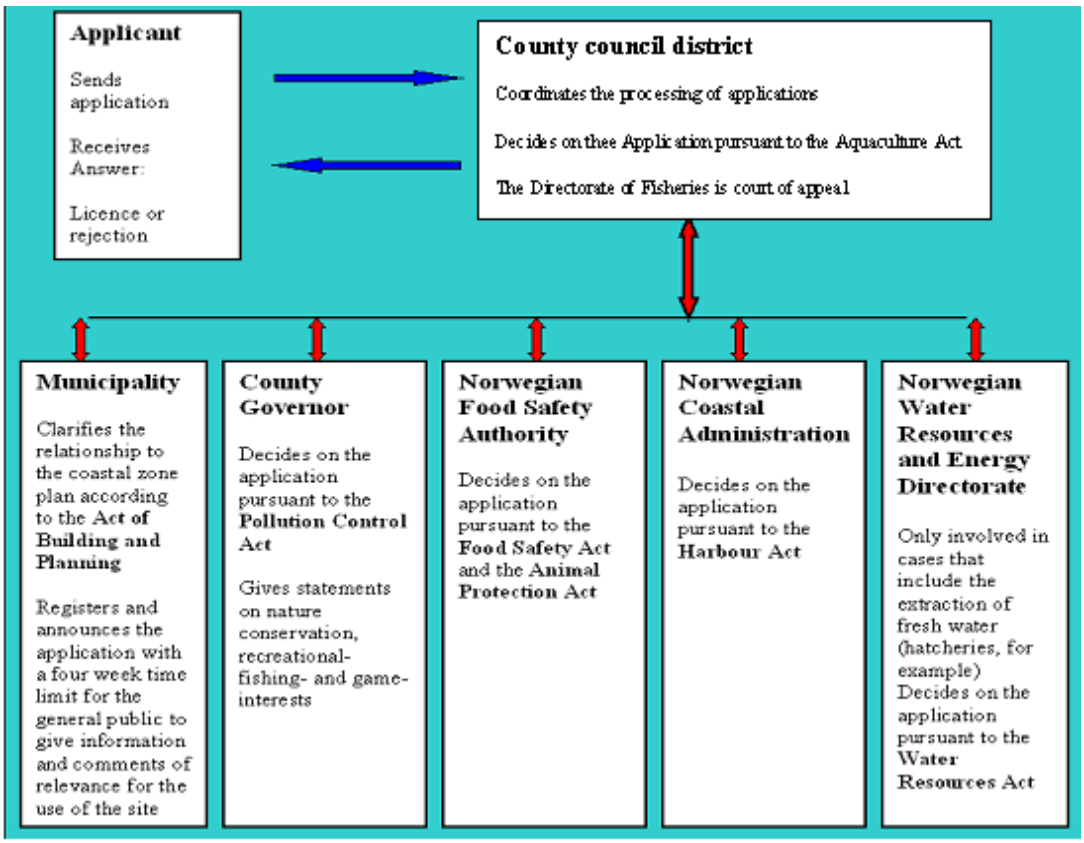


Figure 9: Application system

Containment is a central part of the strategy, and measures to meet the ambitions of "Vision zero escapes" are focused.

- *Technical standards for floating aquaculture installations*

  NS 9415 is a Norwegian standard that provides technical specifications for fish farms and enables producers of fish farms to cope with forces from waves, winds and currents (Annex 4). The standard has recently been revised. In 2009 government initiated a process to develop a new standard for landbased aquaculture installations, including commercial hatcheries.

- *Codes of Containment including operating protocols*

  Regulations are designed to secure maximum containment. Fish farmers must operate their sites according to their own quality systems, which are regularly audited by public inspectors.

- *Verification of compliance*

  In 2008 the inspectors from the Directorate of Fisheries completed over 200 ordinary audits and inspections at aquaculture establishments. In addition they performed investigations into all significant escape episodes. In 2010, the Directorate of Fisheries got increased budget allocations from the Ministry of Fisheries and Coastal Affairs, in order to increase their number and efficacy of audits and inspections. The increased funding came from levy paid by the aquaculture industry.

- *Mandatory reporting of escapes and investigation of causes of loss*

  According to Norwegian law it is illegal to withhold information about escaped fish. Heavy fines have been issued to those who have resisted to report. The Ministry of Fisheries and Coastal Affairs has established a special Escape Commission for Aquaculture. The Commission analyses all escape episodes and gives advice to prevent further escapes. The obtained knowledge has been used to strengthen the new technical standard, and has also been implemented in new regulations of fish farming (Annex4).

- *Adaptive management in response to monitoring results to meet the goal*

We refer to the paragraph above and section 2.10.

2.3 The Parties should develop and apply appropriate risk assessment methodologies in considering the measures to be taken in accordance with the Williamsburg Resolution.

Aside from the ban against commercial salmonid aquaculture production in 14 National Salmon Fjords and Rivers, the biological risk assessment of aquaculture activities is for the most part evaluated in connection with the aquaculture application process described in Chapter 2.2. In September 2009, an expert committee for effective and environmentally sustainable use of the coastline for aquaculture was established. The committee will suggest a new geographical structure for aquaculture to ensure effective use of area and minimize negative impacts on the environment. This work will be important for future development of the aquaculture industry.

- *Risk-based site selection*

  Before issuing a license for fish farming, regional authorities evaluate the risk of pollution and whether the site is sufficiently sheltered from ocean waves and other forces.

  When licenses become active, compliance with legislative requirements are controlled by The Directorate of Fisheries and the Norwegian Food Safety Authority. The inspection program is risk based, i.e. companies and sites are selected based on assessment of risk of non-compliance. In 2009, all marine aquaculture sites were categorized in three groups (low, medium and high risk). The control focus has been on the high-risk group.

Risk assessment frameworks

The Directorate of Fisheries has introduced risk-based control in the aquaculture industry (AkvaRisk). The purpose of the introduction of risk assessment as a working tool has been to carry out control in a more efficient manner. This means that one selects the proper objects for control and in this way reveals violations of the regulations with a good utilization of allocated resources.

The Ministry of Fisheries and Coastal Affairs provides guidelines for the main areas that should be given attention by the control. Among other things, all farms in the National Salmon Fjords are controlled every year. The Directorate of Fisheries design more detailed guidelines for the control from the operations and

activities and on the basis of risk of violation of the provisions. On this basis, the Directorate of Fisheries regional offices select the individual establishments that will be checked.

The Directorate of Fisheries has started a project to establish a common understanding of the minimum acceptable level associated with escape of fish (AquaBest). More research is needed to increase the knowledge on local and regional impacts on wild stocks Also, current regulations require fish farming operations to be run "properly", by using adequate technology and best practice procedures.

Specification of the “proper operation” will provide a better understanding of the requirements for internal control and critical inspection points. This work may contribute to reduced numbers of escapes.

Reporting & Tracking

Norwegian authorities have established routines to ensure that:

- Reported escape episodes are registered, classified and analyzed
- An overview showing the number and life-stage of reported escaped salmon is available.
- The amount of escaped salmon is regularly monitored in 39 rivers during the spawning season.
- Escaped farmed fish in salmon fisheries are also monitored.
- A method for genetic tracing of escaped farmed fish has been developed (see 2.11 Tagging and marking).

Methods for DNA identification of escapees have been developed, and is currently in use for investigation and prosecution of farmers.

2.4 Each Party shall take measures in accordance with Annexes 2, 3 and 4 of the Williamsburg Resolution

2.4.1 Minimize escapes of farmed salmon to a level that is as close as practicable to zero through the development and implementation of action plans as envisaged under the Guidelines on Containment of Farm Salmon

In 2006 The Directorate of Fisheries developed an Action Plan to minimize the number of escapees (“Vision Zero Escapes”). The action plan was a result of a dialog between the aquaculture industry, governmental agencies and environmental NGO’s (Annex 5). The ambition was to fulfil within 2 years. Even though much was fulfilled during this period, the action plan was revised and extended for another two years. A further prolongation beyond 2009 is currently being discussed.

The action plan is incorporating a number of measures to reduce escapees. Among the most important of these measures are strict technical requirements for the equipment used in fish farms, a permanent

commission of inquiry which investigates every escape incident, and heavy punishment for violation of the environmental regulations.

The authorities want to **Motivate (01)** the producers and urge them to keep the fish inside the pens by positive means of desirable conduct. To achieve that goal it is important to obtain a positive focus and incitement for desirable action and attitude. To stimulate good behaviour the Directorate of Fisheries handed out an environmental prize to the best candidate for 2009 during the Aqua Nor conference.

In addition it is necessary to make **Demands (02)** to the industry. Therefore, considerable efforts have been made to develop and amend regulations to secure that the best technical equipment is used. In 2004 the first standard worldwide for floating fish pens was made in Norway, and in 2009 it has been revised.

To protect the wild salmon in the most important salmon rivers in Norway, the Norwegian Parliament (acting on a proposal from the Government) decided to establish a special regime including 52 National Salmon Rivers and 29 National Salmon Fjords (figure 11a, b) . Within these areas the salmon industry faces a stricter legislation. In 2009 new regulations implementing additional requirements on fish farming operations in National Salmon Fjords were established. In the 14 salmon fjords of highest importance, salmon farming is banned as from 01.03.2011.

The authorities **Measure (03)** and monitor escaped fish and their harmful effects. In this connection it is important to follow up the commitment set in the monitoring program concerning NLF/NLV.

The Directorate of Fisheries regional offices **Investigate (4)** escape episodes and collect information in close collaboration with the Escape Commission for Aquaculture.

The fishery authorities **Follow up (5)** the demands for technical standards in the aquaculture industry, and ensure that the provisions for technical demands in the regulations are respected by the industry. Audits, inspections and investigations of scenes are conducted when escapes occur.

The Directorate of Fisheries also focus on **amendments (6)** and **standardisation (7)** for continuous improvement of available tools. It is also important to implement dialogue and **communication (8)**.

Good assessments and experience with risk operations are being **shared (9)**. It is essential to communicate practical knowledge to staff members, producers and contractors, in order to reduce the risk of accidents and escape situations.

The Directorate of Fisheries intend to contribute to strengthen the **competence (10)** requirements for own employees and aquaculture industry workers.

It is also important to implement **evaluation (11)** of Vision Zero ESCAPEES and report to the Ministry of Fisheries and Coastal Affairs.

2.4.2 Minimize impacts of ranched salmon by utilizing local stocks and developing and applying appropriate release and harvest strategies

There are no ranching activities in Norway.

2.4.3 Minimize the adverse genetic and other biological interactions from salmon enhancement activities, including introductions and transfers

The objective of the Act Relating to Salmonids and Fresh-Water Fish is, inter alia, to ensure that natural stocks of anadromous salmonids are managed in such a way as to maintain natural diversity and productivity. It is prohibited both to import anadromous salmonids and release any kind of anadromous salmonids in watercourses, fjords and the sea without a distinct permission. Release of both imported and local stocks of fish for enhancement activities is regulated by the act.

As regards stock enhancement programmes, Norway has established cultivation zones to avoid transfer of non indigenous stocks. It is not allowed to transfer eggs or fish between these zones. If salmon is to be reintroduced or enhanced in one zone, the stocking material has to come from the local stock reared at a hatchery in the same watershed or river-basin. Exemption may only be granted for disinfected eggs from the national gene bank program. All these activities are regulated by provisions and guidelines given by Directorate of Nature Management.

Ordinary salmon stocking programs, in order to enhance local populations are kept at a minimum level and gradually replaced by

1) Habitat protection and restoration
2) Rebuilding strategies based on conservation and restoration programs reflecting the Norwegian gene bank model.

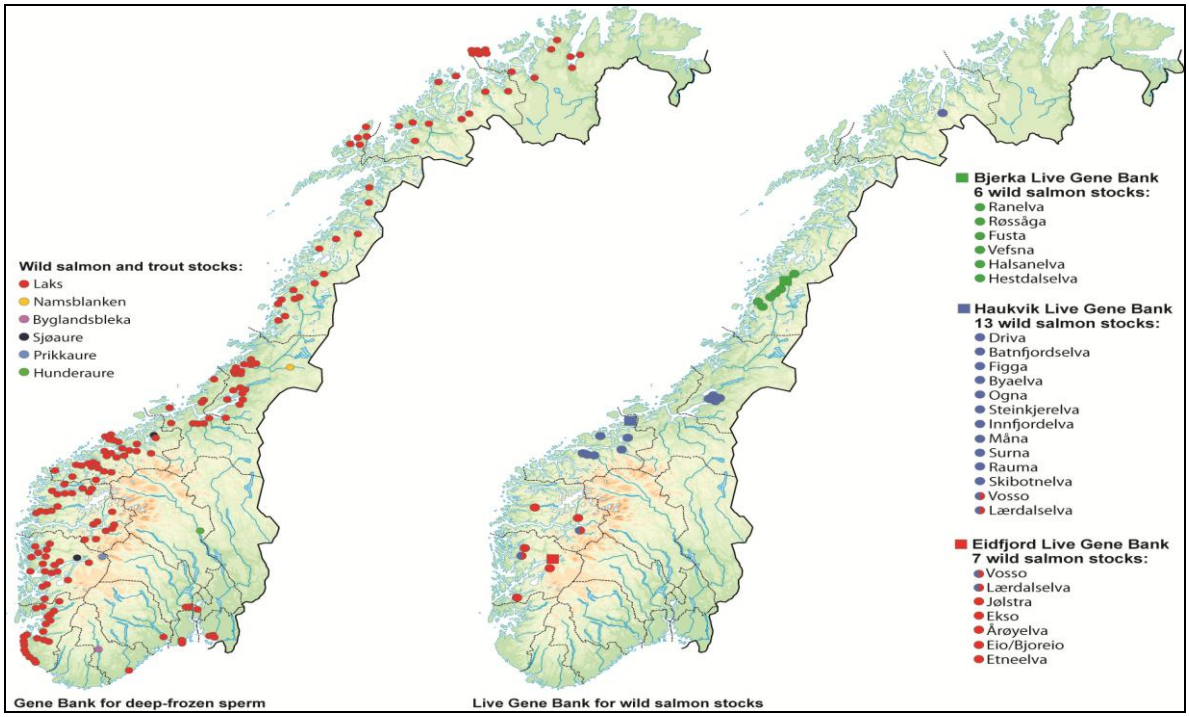


Figure 10: ***Live gene bank***

In 1986 The Directorate for Nature Management started a work to secure threatened salmon stocks. A "Gene Bank" was established to keep genetic resources in storage (figure 10). So far acid rain, the parasite *Gyrodactylus salaris* and hydroelectric power production have been the main reasons for the development

of live gene banks. As envisioned in the wild salmon whitepaper (St prp no 32 (2006-2007), the conservation of stocks may depend on an extension of the gene bank program in the future.

The preservation of live fish is a measure that is used only for salmon stocks which are threatened by extinction. These stocks are saved in Live Gene Banks (LGB). The LGBs supply eggs to local hatcheries which produce fish for release, or if suitable eyed eggs are placed directly in the spawning habitat. There are three LGBs for Atlantic salmon. The LGBs are situated in Eidfjord (South-Western Norway), Haukvik (Central Norway) and Bjerka (Northern Norway).

Cryopreservation of salmon milt

Deep freezing of sperm enables the preservation of genes for a virtually unlimited period. Two millilitres of sperm are taken from each fish, enough to fertilise about 1000 eggs.

Emphasis is put on collecting sperm from salmon stocks from different parts of the country as well as different kinds of environment. Stocks that are threatened by extinction, of special scientific value, or valuable for fisheries are given priority. The gene bank for deep-frozen sperm now contains material from 6520 individuals from 169 salmon stocks, and from four trout stocks. The aim is to collect sperm from at least 50 individuals from each stock. Collecting takes place over several years to reduce the chance of great overrepresentation of a single year-class.

The fish, both in live gene banks and the milt bank, are tested by DNA analysis. All information about the stocks is handled by a national gene bank database.

2.4.4 Minimize the risk of disease and parasite transmission between all aquaculture activities, introduction and transfers, and wild salmon stocks.

Sea Lice

Sea lice levels have been regulated nationwide for a number of years at very low levels, primarily to minimize the infestation rates to wild Atlantic salmon stocks. This entails that each sea cage site has to count lice at least twice per month in accordance with specific instructions and report the findings to the Norwegian Food Safety Authority. If the lice counts at a cage site exceed a maximum allowed limit, the owner is obliged to perform a delousing treatment within 14 days.

During the winter and spring of 2010, all sea cage farmers rearing salmonid fish, with the exception of farms in Troms and Finnmark counties are required by law to participate in a synchronized delousing treatment program. Such integrated pest management strategy (IPM) was first initiated in the Hardangerfjord basin in 2004, and has since 2007 been made mandatory every winter along the Norwegian West Coast. The primary objective of this IPM strategy is to minimize the sea lice infestation levels on Atlantic salmon during the smolt migratory window in the spring and early summer. The synchronized treatments against sea lice have been deemed successful in reducing the sea lice infestation levels at aquaculture sea cage facilities during spring and early summer. With the exception of the outer Hardangerfjord basin, the infestation rates of out-migrating Atlantic salmon smolts and sea trout have similarly been reduced along the West Coast as measured by the sea lice surveillance program described in

Chapter 2.11. The Norwegian aquaculture industry is dependent upon having access to highly efficacious drugs against sea lice if an IPM-strategy as here described is to minimise the impact from sea lice on the out-migrating Atlantic salmon smolt.

During the last decade, the Norwegian aquaculture industry has relied mainly on emamectin benzoate (delivered orally) and pyrethroids (delivered by bath) for treating the cage reared salmonid fish against sea lice. Both these compounds are highly efficacious in treating sea lice under normal circumstances. However, sea lice along the Norwegian coastline have been found to develop resistance against these two compounds. This development is forcing the industry to apply less efficacious compounds to keep sea lice levels below the maximum allowed levels. Besides increasing resistance, this negative trend can in part be explained by the inability of the aquaculture industry to treat the fish in the large cages by use of closed tarpaulins. The use of closed tarpaulins during sea lice treatments will be mandatory from January 2011. In the mean time, no new treatment drugs against sea lice are believed to be in licensing pipeline from the pharmaceutical companies.

The consequence of this resistance development is illustrated in fig. 7 showing approximately three times higher sea lice levels on cage reared salmonids in early autumn of 2009. This has resulted in an increased interest in use of different species of wrasses as biological delousing agent.

A few species of wrasse have been used as biological delousing agents for many years in Norway. During the last decade, the use of these fish species has declined significantly, largely due to the highly effective sea lice drugs that have been available. The aquaculture industry has a strong focus on reintroducing wrasse on a large scale for the control of sea lice as seen by steep increase in the use of these fish during summer and autumn of 2009. Wrasse is by many considered as the only long-term solution if the aquaculture industry is to remain environmentally sustainable. Based on current know-how, this method is probably not sufficient to protect the wild salmon stocks.
Wrasse have historically been captured in the wild and introduced into the cages together with the salmonid fish. However, and according to the Institute of Marine Research, the wild stocks of these fish will not sustain the amount of live harvests that the aquaculture industry needs. Recent developments in experimental culture of wrasse have shown promising results. Subsequently, a few Atlantic cod hatcheries have newly shifted their focus to rearing wrasse. The aim is to provide the industry with sufficient quantities of goldsinny wrasse (*Ctenolabrus rupestris*) and ballan wrasse (*Labrus bergylta*), the most promising species of sea lice "cleaner fish" for smaller fish (<2 kg) and larger fish, respectively. It is, however, estimated that these hatcheries will not be in a position to supply the salmon farming industry any significant quantities of wrasse until 2013.

One important criterion for authorizing the establishment of a new seacage production facility is the minimum ocean tracked distance that is allowed between such facilities. The inherent biology of the sea lice allows it to have the largest spreading area of all known fish pathogens. The current aquaculture industry's sea site structure is consequently not well suited to minimize spreading of sea lice between cage farms and subsequently to wild salmonid stocks. These are among the issues that are being considered in the expert committee for effective and environmentally sustainable use of the coastline for aquaculture (see 2.3.).

A very thorough and comprehensive document ("Lakselusveilederen" – Guidelines for sealice treatment) was officially launched in December 2009 on the Internet by the Norwegian Seafood Federation. The document (http://www.fhl.no/helse-og-kvalitet/abc-for-lusebekjempelsen-article3507-23.html) details the

aquaculture industry's best management practice guidelines in its efforts to maintain sea lice infestations below the maximum allowed levels. The objective of these guidelines includes measures how to minimise impact of sea lice to wild Atlantic salmon stocks throughout the country. This document is actively supported and recommended by the aquaculture industry organisations. The National Veterinary Institute, the industry, the scientific community and the fish health services contributed in developing the guidelines. These guidelines will periodically be reviewed and updated as needed by the Norwegian Seafood Federation.

Gyrodactylus salaris

In 2009, the Directorate for Nature Management and the Norwegian Food Safety Authority produced an updated national action plan to combat *G. salaris*. The plan includes surveillance to ensure early detection, prevention of the spread of the parasite to uninfected rivers, and measures to eradicate the parasite through chemical treatment and migration barriers.

Eradication measures consist of fish migration barriers and chemical treatment of infected rivers. The principle behind migration barriers is to prevent the further spread of the parasite and/or to drain the river above the barrier from hosts, and thereby from the parasite, in order to reduce the area and the complexity of treatment regimes. This approach increases the probability of successful treatments and simultaneously reduces environmental conflicts. Fish barriers are also used to split up the treatment area of complicated tributaries, thus simplifying treatment of large and complicated river systems.

The National Veterinary Institute is responsible for carrying out the national *G. salaris* surveillance and control program on behalf of the Norwegian Food Safety Authority. The objective of the program is to maintain the country's *G. salaris* free status areas and to report to the Norwegian Food Safety Authority of any new *G. salaris* findings. Fish are sampled from rivers and all of the country's freshwater aquaculture facilities and analysed for the presence of *G. salaris every 24. month*. Confirmation of the parasites' presence results in a swift eradication of all fish from such facilities followed by a comprehensive disinfection procedures. When a previously unaffected watercourse is confirmed to be infected with *G. salaris,* the Norwegian Food Safety Authority instantly instates a zone regulation defining the entire watercourse as infected. Such regulations include a complete ban on all fish transfers into and out of the water shed. Mandatory disinfection stations for fishing gear and rafting boats together with warning posters in several languages are included in such regulations to reduce the risk of spreading the disease. The Norwegian Science Council considers *G. salaris* infected fish migrating into neighbouring rivers as the greatest risk factor for spreading the parasite.

2.5 Movements into a Commission area of reproductively viable Atlantic salmon or their gametes that have originated from outside that Commission area should not be permitted.

The regulations in the Act relating to Salmonids and Fresh-Water Fish prohibit imports of all freshwater organisms, due to ecological considerations. However, it is a possibility to apply for derogation.

The EU Fish Health Directive has been implemented in Norway. Subsequently, import of aquaculture animals and products from aquaculture animals from countries outside the EEA is only allowed if such products originate from previously approved states or areas within those states. Within the EEA, import is only allowed from a zone or segment having an equal or better disease status. Furthermore, for such imports to be allowed requires a health certificate to be issued by the exporting country's authorities which meet the criteria specified in the EU Fish Health Directive. The authorities of such third countries are also required to apply for an import authorisation to the Ministry of Environment. To date, Atlantic salmon or their gametes have never been imported to Norway from countries outside the Commission area.

In order to import reproductively viable Atlantic salmon and its gametes permission under both legal frameworks is needed.

2.6 Introductions into a Commission area of reproductively viable non-indigenous anadromous salmonids or their gametes should not be permitted.

According to the Act Relating to Salmonids and Fresh-Water Fishes it's prohibited to import and to release anadrome fresh-water fish, eggs and fry in watercourses.

Pink Salmon (*Oncorhynchus gorbusha*) was introduced by the Soviet Union to salmon rivers at the Kola Peninsula during the period of 1958-1989. Today Pink Salmons are regularly observed in Norwegian rivers, especially in the most northern part of the country. In 2007 spawning of Pink Salmon was recorded in the river Grense Jakobselv, and fry was found in the following spring.

North-American rainbow trout (*Oncorhynchus mykiss*) is common in Norwegian aquaculture. Escaped rainbow trout are regularly observed in rivers, especially along the western coast. . There is an element of uncertainty as to whether the rainbow trout has established stocks, and the risk related to potential genetic effects is therefore not well understood.

2.7 No non-indigenous fish should be introduced into a river containing Atlantic salmon without a thorough evaluation of the potential adverse impacts on the Atlantic salmon population(s) which indicates that there is no unacceptable risk of adverse ecological interactions.

Stocking and stock enhancement is prohibited without permission. When permission is given only material from the local stocks can be used, and as a rule a plan is made in each case in order to minimize possible adverse genetic and other biological effects.

2.8 The Parties should apply the Guidelines for Action on Transgenic Salmon (Annex 5 of the Williamsburg Resolution – CNL(04)41) , to protect against potential impacts from transgenic salmon on wild stocks.

In agreement with all livestock organizations and the Norwegian Seafood Federation, the current policy in Norway is not to develop transgenic livestock and farmed fish.

2.9 Parties should, as appropriate, develop and apply river classification and zoning systems in accordance with Annex 6 of the Williamsburg Resolution for the purposes of developing management measures concerning aquaculture, and introductions and transfers.

A classification system of rivers based on the condition of the salmon stock in relation to adverse human impacts has been developed. Only rivers which have or have had natural self reproducing populations are included.

The classifications are as follows;

- lost stocks
- threatened stocks
- vulnerable stocks – near threatened
- vulnerable stocks – maintained by mitigative actions
- reduced stocks – reduced young fish production
- reduced stocks – reduced number of adults only
- moderate or lightly affected stocks – requiring special concern
- moderate or lightly affected stocks – not requiring special concern

Cultivation zones have been established to avoid transfer of diseases or not indigenous stocks. It is not allowed to transfer eggs or fish between these zones. If salmon is to be reintroduced or enhanced in one zone the fish has to come from the local stock reared at a hatchery in the same watershed or river-basin. Exceptions may only be given for disinfected eggs from the national gene bank program.

Norway has established 52 National Salmon Rivers and 29 National Salmon Fjords (figure 11a, b). The salmon stocks in National Salmon Rivers and Fjords shall be given a special protection against human activities that can harm the wild salmon stocks. A regulation on special requirements for aquaculture-related activities in National Salmon Rivers and Fjords came into force 22 June 2009.

In order to protect wild Atlantic salmon, it is prohibited to establish new aquaculture facilities for the production of fish and brood stock of anadromous fish within the National Salmon Fjords and Rivers. Furthermore, it is neither allowed to increase production capacity at already established locations within the zone, nor to transfer capacity from licenses outside and into a National Salmon Fjord. Aquaculture sites with production of anadromous or marine fish in the sea must be located at least 5 km from the National Salmon Rivers.

In a National Salmon Fjord it is not permitted to establish new salmon slaughterhouses or manufacturing plants for anadromous fish. The authorities may also set upper limits for the slaughterhouse capacity for existing facilities in the zones. By August 2011 established aquaculture facilities for production of fish and brood stock of anadromous fish and eels are required to move out of 14 named National Salmon Fjords.

Salmon that are transferred to a location in a National Salmon Fjord should not be moved, except for slaughtering. The purpose of this is to reduce disease risk and the risk of escapes. In addition, the Directorate of Fisheries has established a strict control regime and is checking all sites in the fjords at least once a year. There are also more stringent requirements for disease control and measures against sea lice.

The Ministry of Fisheries and Coastal Affairs and the Ministry of the Environment have established a perennial national monitoring and evaluation program aiming to measure the effects of the scheme.

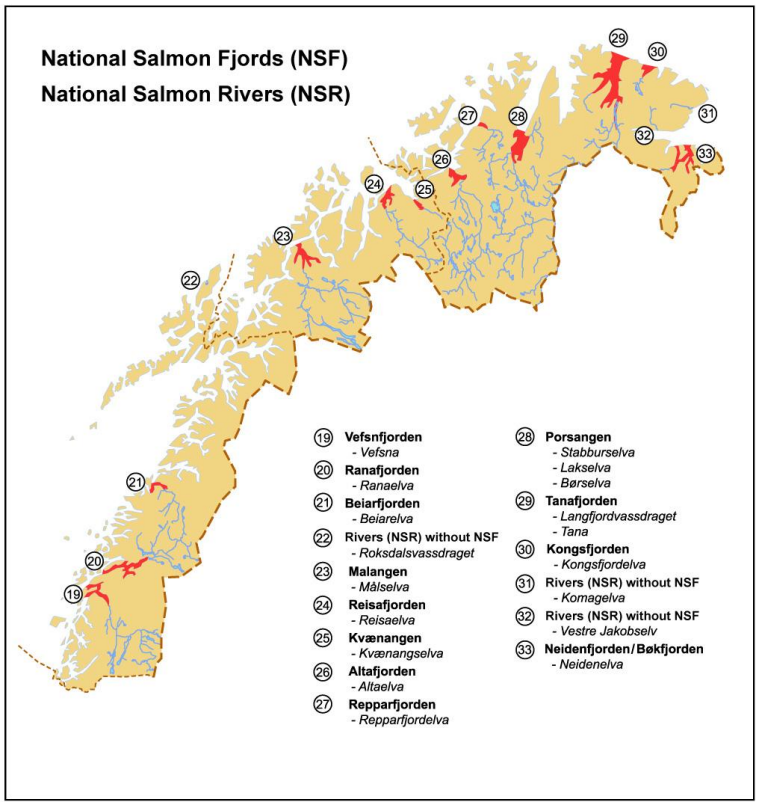


Fig. 11a National salmon fiords and National Salmon Rivers in Northern Norway. Source:The Directorate for nature management

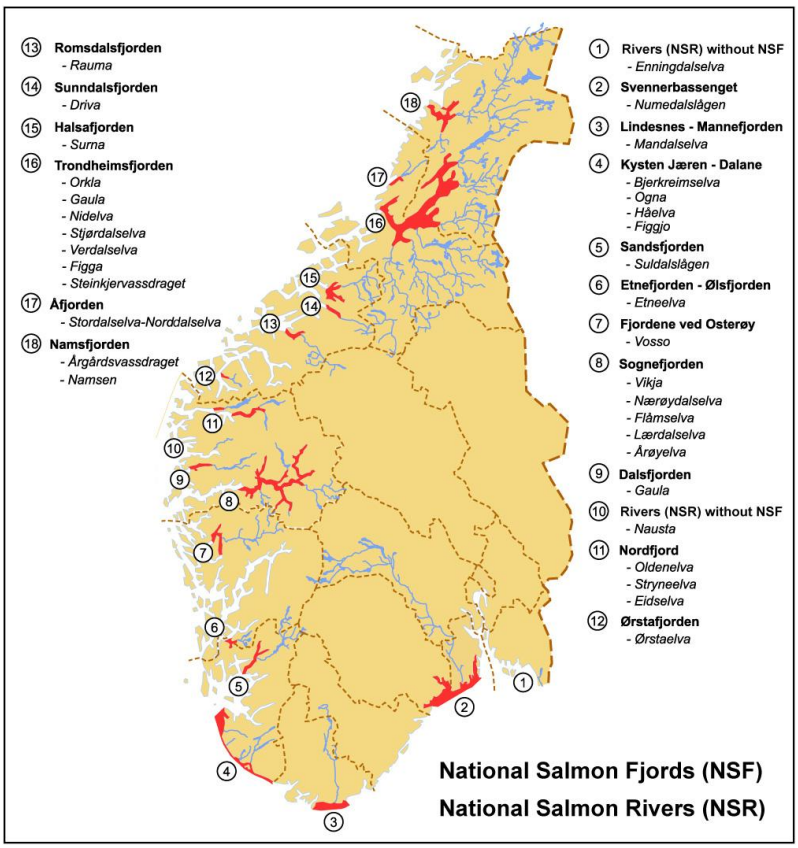


Fig. 11b National Salmon Fiords and National Salmon rivers in Southern Norway. Source:The Directorate for nature management

2.10 The Parties should initiate corrective measures without delay where significant adverse impacts on wild salmon stocks are identified.

Containment

After some years with high numbers of escapees, the Norwegian Parliament defined a more strict policy regarding fish farming. It was emphasized that the industry had to be environmentally sustainable; otherwise part of the activity should be reduced. Most of the industry reacted proactively and made significant investments (more than 1 billion NOK) to improve their existing farms.

The Norwegian Seafood Federation also supported new measures, such as establishment of the Escape Commission. In recent years, the organization has provided “escape-preventing” courses for the staff that operate the fish farms.

Escape

The fish farmers are required to immediately notify the Directorate of Fisheries' regional office in knowledge about any escape of fish, or when escape is suspected, regardless of whether the fish have escaped from their own or others' production or aquaculture facilities.

Escape from known site

After receiving notification of escapes – or possible escapes – from the fish farmer, the regional office will conduct an inspection of the facility as soon as practicable. The local police are immediately notified if the event seems to be serious. It is important that the police are quickly on the spot to secure evidence or conduct police questioning.

If irregularities are discovered at the facility which involves a risk of new escapes, the regional office will immediately issue orders to necessary improvements. In addition, the fish farmers must have a stand-by arrangement and must try to recapture escaped fish up to 500 meters from the actual site.

The regional office may, together with the environmental authorities, expand recapture in time and geographical extent, if opportunities for recapturing of escaped fish are present. Extended recapture fisheries are considered against the amount of fish that have escaped, the size of the fish, and time of the year. It is important to avoid disturbance of migratory wild fish in connection with the recapture fishery.

The regional office writes a status report that is assessed by the Escape Commission (Annex 3). The report shall be submitted to the Directorate of Fisheries together with a cover letter clarifying whether the incident is reported to the police.

Escapes or suspected escapes from unknown source /site.

The Directorate of Fisheries' regional office are informed about unreported catches of farmed fish in an area, without connection to relevant reports of escapes or suspected escapes.

Fish farmers in the relevant geographic area are contacted and asked to perform control, including diving, to find holes in the cages. All farmers who have been contacted should immediately give written feedback. If holes or other potential escape causes are discovered, the farmer must also send a written report of escape (or notification of suspect escapes).

If no farmers report back about missing fish or other irregularities, the Directorate of Fisheries' regional office determines whether the tracing procedure (Akvaspor) for identification of the source for the escaped farmed fish should be undertaken. This procedure has been developed in cooperation with the Institute of Marine Research.

Sea lice

The Norwegian Food Safety Authority has a high focus on combating sea lice. Sea-lice has for years been subject to special regulatory measures. A new national sea lice regulation came into effect in August 2009. The most important new elements in this regulation include:

- mandatory reporting of all suspected or confirmed cases of reduced sensitivity or resistance of sea lice to any of the available treatment drugs.
- powers for the Norwegian Food Safety Authority to demand prompt reduction in biomass at any give cage site and, if necessary, slaughtering of all the fish on a given sea cage farm were the farmers are not found capable of maintaining the sea lice levels under the maximum allowed levels.
- powers for the Norwegian Food Safety Authority to propose and implement zone regulation in limited geographical areas that can include mandatory extension periods for fallowing of specific

areas, ban against new smolt entries into an area and ban against use of a specific sea lice compounds where resistance has been documented.

In a separate aquaculture regulation, the Norwegian Food Safety Authority may, if necessary, withdraw sea cage production licenses. To date, this has not been deemed necessary.

Mandatory and synchronized sea lice treatments will be performed during winter and spring of 2010 from the counties of Rogaland in the south, to Nordland in the north. This effort represents the most extensive IPM strategy against any aquatic parasite in history. Again, the primary objective of this strategy is to minimise the sea lice impact on out-migrating Atlantic salmon smolts during spring and early summer of 2010. A new national sea lice resistance surveillance program is planned to be launched in January2010. The program is administered by the National Veterinary Institute on behalf of the Norwegian Food Safety Authority. The program's objective is to collect information and data on all reported cases of reduced sensitivity or resistance of sea lice. The National Veterinary Institute will analyse all the incoming data, publish and update the results on a specifically designed website, which will be available to the general public. The area status of the sea lice sensitivity and resistance profiles are planned to be illustrated on a map. The website is expected to provide information of great importance to the aquaculture industry, the aqua-veterinary services, the NGO's and the scientific community. This website will furthermore provide an important regulatory tool for both governmental bodies.

The combined effect of the corrective measures described above is expected to significantly slow down the rate of resistance development.

Gyrodactylus salaris

Contingency plans to minimise the impact of the parasite if introduced are critical. The surveillance program, which aims to detect and trace any spread of *Gyrodactylus salaris* to new rivers systems or fish farms, is essential for any contingency plan. Any findings of *G. salaris* will lead to a number of measures being implemented, depending on the nature of the watercourse. If infection has been discovered in a fish farming facility, it will be sanitized. The fish farm will be emptied of fish, disinfected and not used for a period of time before new fish can be brought in.

2.11 Each Party should encourage research and data collection (as detailed in Annex 7 of the Williamsburg Resolution) in support of the Williamsburg Resolution and should take steps to improve the effectiveness of the Williamsburg Resolution.

Interactions and biological impacts

Effects by escaped farmed salmon on wild Atlantic salmon populations have been documented in controlled experiments and in the wild. Research and monitoring programmes during two decades have shown that these effects include transfer of diseases, competition and other ecological interactions, and genetic changes caused by interbreeding between escaped farm salmon and wild salmon. The biological significance of these effects is still not fully understood.

Information on these effects is accumulated by a large number of studies using a variety of methods from monitoring and field experiments, to laboratory studies and computer simulations. Several studies on these issues are ongoing at institutions such as Norwegian Institute for Nature Research, Institute of Marine Research, National Veterinary Institute, Nofima Marine and several Universities, which carry out projects financed from the Research Council of Norway and/or commissioned by government departments.

Norwegian management authorities have established a system to monitor and protect important salmon rivers. The proportion of escaped farmed salmon in the spawning population is registered in 39 rivers. Based on the estimates of the proportion of escaped farmed salmon in the spawning populations of wild salmon, experimental data on the fitness of farm salmon and their offspring in the wild, and a computer model presented at the 2005 NASCO/ICES meeting on interactions between salmon aquaculture and wild salmon, the Norwegian Institute for Nature Research (NINA) has developed a map showing how the proportion of wild salmon in the rivers changes over time in different regions of Norway (fig. 12).

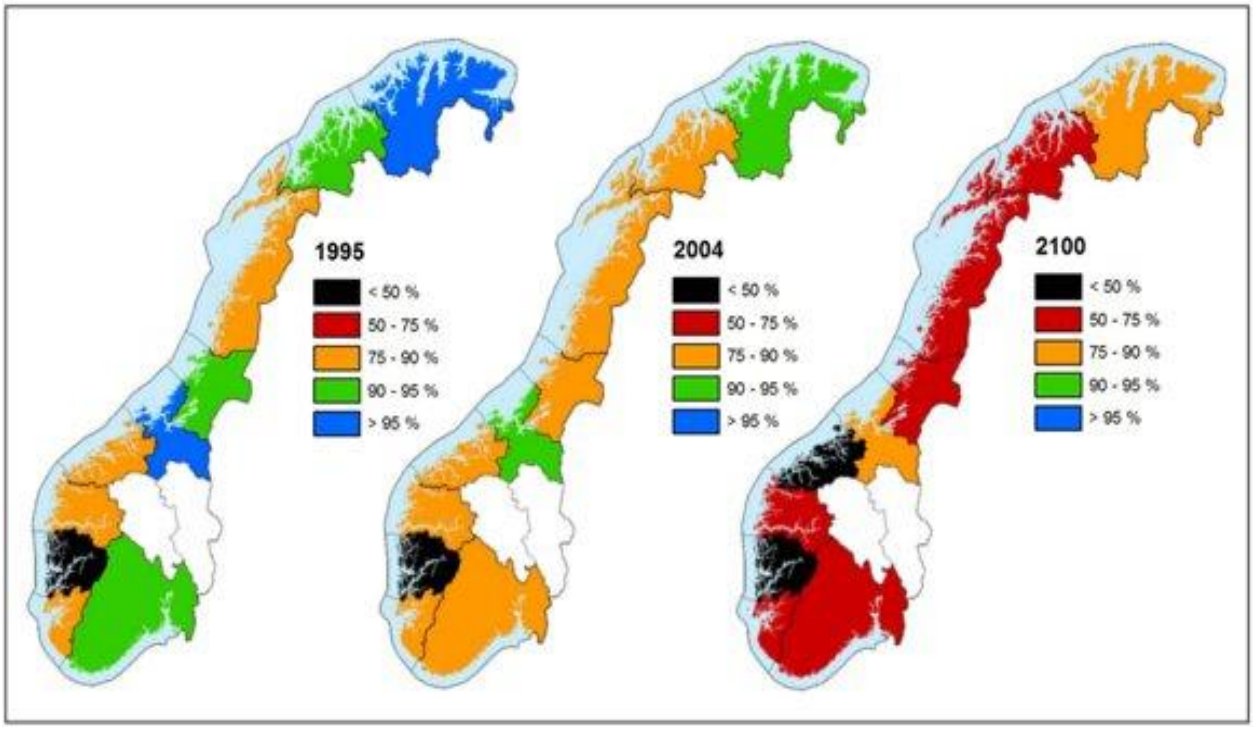


Figure 12: Estimated percentage of wild salmon in the rivers after spawning. *Source: NINA, in preparation.*

The figure illustrates how the composition of the spawning run (shown as the percentage of spawners of wild origin returning to the river, and excluding farmed escapes) had changed by the years 1995, 2004, as well as predicted changes for 2100. Among the salmon that hatched after spawning in 1995, an estimated 75 % or more came from wild parents in all regions, except in the most aquaculture-intensive region. A century later, the model predicts that < 75 % comes from wild parents in all but two regions.

Genetic and ecological consequences of escaped fish and sea lice are issues of special concern for Norwegian management authorities. A program is set up to monitor gene flow from farmed salmon to wild salmon populations. It is prioritized to investigate by using genetic markers how much the genetic composition in wild salmon populations is altered due to escaped farmed fish. In addition, research is going on to see if new genetic markers can distinguish between wild salmon and farmed salmon on a generic basis.

Genetics

The mapping of a genetic baseline for Norwegian wild Atlantic salmon populations has been significantly extended during the last year. By October 2009, approximately 90 rivers had been sampled. Also, the regional coverage has been greatly improved for most regions. The limiting factor is access to samples, as the opportunities to obtain samples has not been equal for all regions. The efforts to obtain further samples from rivers not represented in the baseline continue. At present, around 75 rivers have been analysed for the suite of microsatellites agreed under the SALSEA program, and the data from these analyses are being submitted for entry into a database

Sterile fish

Although considerable technological advances have been made in the design of cages, no system can provide 100% safety of escapees. Natural disasters, human error or mechanical breakdown could occur. Use of sterile farmed salmon could be an effective measure to prevent genetic dilution of wild salmon stocks if other measures do not provide sufficient power.

Fish may be sterilised by a variety of alternative methods, which differ in efficiency and undesired side-effects. The Ministry of Fisheries and Coastal Affairs is funding projects to imporove the methods, and to assess possible negative impacts on fish welfare.

Tagging and marking

The Directorate of Fisheries has adopted a method based on DNA profiles to identify sources of unreported, escaped farmed fish from aquaculture facilities. Analyses performed by the Institute of Marine Research have confirmed the source of fish on site and even cage levels, with a level of accuracy that held in a court-case.

A range of identification methods, including physical tagging of all farmed fish, have been evaluated by the Norwegian Tagging Committee, appointed by the Fishery Director in 2004. The Government recommended in St prp no 32 (2006-2007) not to pursue this method, due to high cost and fish-welfare issues. The stand-by (i.e., post-escapement) method of identification was outlined as the most feasible, and various methods were evaluated in the project TRACES (2006-2007) funded by the Norwegian Research Council and the fish farmers organization.

In order to develop a tool to assist the Directorate of Fisheries, a DNA based forensic identification method has been established by researchers at the Institute of Marine Research. This method enables the identification of farm of origin for unreported escapees, and has been successfully implemented in several cases in collaboration with the police. This method is currently being applied in identification of salmon, rainbow trout and cod escapees.

Through the project TRACES, a DNA based, stand-by method for the identification of Atlantic salmon was established, and successfully implemented in a real-life escapement episode in 2006. This resulted in a fine for the company imposed by the Norwegian police for investigation of economic and environmental crime, and, represents the first time a DNA method has been used to identify the source of fish-farm escapees globally.

In short, the method uses a procedure called genetic assignment to match and exclude the genetic profile of individual escaped fish with fish sampled on all farms operating within the region where the escapees were observed and recaptured. The method requires no prior knowledge of the farmed fish, and there is no need for physical tagging of the fish. It rests purely on naturally occurring DNA variation in the fish.

The DNA method also works for the identification of rainbow trout and cod escapees. The method is now established as a routine service for the Directorate of Fisheries during investigation of unreported escapement events for the three major farmed species. Analysis protocols are continuously being advanced with new statistical methods and genetic markers.

Aquaculture broodstock

Commercial companies are doing research to create a faster growing and more robust salmon for farming purposes.

Regarding health care, commercial broodstock sites are more frequently and thoroughly examined than ordinary fish farms.

Diseases and parasites

The National Veterinary Institute and the Institute of Marine Research are financed by the Norwegian Ministry of Fisheries and Coastal Affairs for providing scientific advice on fish health and welfare issues as requested by the Norwegian Food Safety Authority. The National Veterinary Institute is furthermore responsible for providing the Norwegian Food Safety Authority with diagnoses during disease outbreaks in fish.

The Norwegian Food Safety Authority is responsible for two disease surveillance monitoring programs that pertain to wild Atlantic salmon, one for sea lice and the other for *Gyrodactylus salaris*. The sea lice surveillance program includes sampling and counting of sea lice on Atlantic salmon smolts migrating through Norway's coastal areas in and around the National Salmon Fjords. An infestation rate of 10 lice per smolt during out-migration has been considered to be a lethal dose. The sea lice surveillance program demonstrates every year a significantly less number of sea lice on the migrating smolts in the aquaculture free areas compared to areas with salmonid aquaculture present.

No additional disease surveillance programs covering wild stocks of Atlantic salmon are expected to be initiated during 2010. The Norwegian Food Safety Authority has requested that the National Veterinary Institute to initiate a preliminary surveillance program to examine the prevalence and severity of the

microsporidian parasite *Paranucleospora teridion* in wild Atlantic salmon. However, further research and development is necessary to improve the diagnostic tools for this parasite.

A new national sea lice resistance surveillance program is to be launched in January 2010. This program, coupled with the new sea lice regulation (see Chapter 2.10) is expected to provide valuable data on the resistance status and resistance development of sea lice against the commonly used treatment drugs along the Norwegian coast line. The mandatory and routine counting and reporting of sea lice levels at sea cage farms will further help the Norwegian Food Safety Authority to keep control over the environmental sea lice status at any given time.

***Gyrodactylus salaris* – research and monitoring**

Research on impact:

The invasive salmon parasite *Gyrodactylus salaris* is among the worst threats to Atlantic salmon today. The salmon parr abundance has been reduced on an average of 86 % and the catch of salmon are reduced on an average of 87 % in infected rivers. A research program is still going on to detect any changes.

An indirect effect of *G. salaris* is the negative effect upon the freshwater pearl mussel *Margaritifera margaritifera* caused by reductions in salmon parr populations. This may cause reductions in the population of the freshwater pearl mussel because the larvae (glochidiae) of the pearl mussel are dependent on Atlantic salmon parr in a certain stage of their life. Studies have revealed that freshwater pearl mussel larvae in many water courses have an obligatory period in the gills of salmon.

Extremely high proportions of hybrids between Atlantic salmon and brown trout have recently been detected in Rivers Vefsna and River Driva. The salmon populations in both rivers have been infected by *G. salaris* since the 1970's. Reasons for the remarkable hybridization rates are probably the dramatically reduced wild salmon stocks and a high frequency of non-native (escaped farmed) salmon. Increased hybridization may cause vulnerable populations to become even less viable and may increase the likelihood of rare events such as backcrosses and introgression of genes from one species to another. Triploid backcrosses have been identified in both rivers.

Monitoring:

G. salaris is a notifiable disease in Norway. It is listed as "Other significant disease" in the World Organisation for Animal Health (OIE). Surveillance of *G. salaris* has been performed in Norwegian salmon rivers since late 1970s. The Norwegian Food Safety Authority is responsible for sampling rivers and fish farms although County Governors and other institutions are commissioned to do the actual sampling. The National Veterinary Institute is responsible for the examination of samples and taxonomical studies if *Gyrodactylus* is detected. The surveillance program aims to detect and trace any spread of *G. salaris* to new river systems or fish farms. The surveillance includes a program for maintaining a free status for this parasite in the unaffected areas and an eradication program where the parasite is present. The eradication program entails implementing measures to prevent *G. salaris* from spreading from infected rivers. Once a river has been treated for the eradication of *G. salaris*, a separate surveillance program is immediately initiated to monitor the success, or the failure, of the treatment. The aim of this post-treatment surveillance program is to document the complete absence of the parasite for approximately 5 years before the river can be reinstated as free of *G. salaris*.

Methods improvement:

Rotenone treatments have proven to be quite effective in eradicating *G. salaris* from small and middle-size rivers. Such treatments have also been found effective in the Rana river, a large river in the county of Nordland in northern Norway which was recently declared free of the parasite. Over the last 5 years, considerable efforts have been made to improve the methods used. Improvements include increased rotenone concentrations, multiple treatments, revised planning routines, new equipment and methods of application. These improvements will where suitable be combined with the use of artificial migration obstacles.

The use of rotenone needs authorisation according to the EU Biocide Directive 98/8/EC. An application was sent from Norway to EU within deadline. A complete dossier is now in the review programme, and we are waiting for a decision. For the Norwegian authorities the use of rotenone is essential for combating the parasite *G. salaris* in the future.

Several years of research has demonstrated that acidified aluminium (AlS-method) is lethal to *G. salaris*. The advantage using this method for river treatments is that only the parasite is killed and not the fish. However, applying this method on a full scale in rivers has thus far not been successful with the parasite "reappearing" at different times after treatment. Research will continue to focus on improving the AlS-method using the Lærdalselvi in the county of Sogn and Fjordane as the trial river. Only when this method has been shown to work successfully in Lærdalselvi will other rivers harbouring the parasite be treated using the AlS-method.

2.12 Educational materials should be developed and distributed to increase awareness of the risks that introductions and transfers of aquatic species may pose to wild salmon stocks and the need for measures to control these activities.

Several projects from all relevant research institutes produce educational fact sheets and internet homepages where results are being presented regularly. Together with information from the respective directorates, journalists and the public in general have the opportunity to be informed.

On application the Directorate for Nature Management grants financial support to NGOs with the aim to produce educational material for different groups of the public (i.e. children, students, the press, politicians and other decision makers).

The aquaculture industry´s best management practice guidelines in its effort to control sea lice was launched on the Internet in December 2009. These guidelines provide a wide variety of scientific and practical advices how to keep sea lice infestations under the maximum allowed levels and how the different IPM strategies help minimize impact of sea lice to wild Atlantic salmon.

Each year, the Norwegian Food Safety Authority produces a large number of posters in several languages warning about the risk of spreading G. salaris with fishing gear and rafting boats. These posters are strategically placed in large numbers in all the typical access areas to rivers infected with G. salaris. All fish gear and rafting boats are required to be disinfected before visitors depart from G. salaris infected rivers.

ANNEX

Annex 1

Main features of Norwegian policy for the preservation of wild salmon

1. Introduction and background

In February 2003 the Storting (parliament) designated 37 national salmon watercourses and 21 national salmon fjords while establishing ground rules for this management scheme and guidelines for follow-up, on the basis that additional river systems and fjord areas would be included in due course.

In its proposal St.prp. no. 32 (2006-2007), the Ministry of Environment has set out the Government's policy for the preservation and strengthening of Norway's salmon stocks and recommendations for the establishment of 15 new national salmon watercourses (river systems) and 8 new salmon fjords. The proposal is based on established criteria for selecting salmon stocks for the management scheme, a comprehensive technical report, comments on the report following consultations, recommendations from the Directorate for Nature Management, and a balanced assessment of other relevant sectors.

The Storting endorsed this proposal on May 15th, and the scheme now comprises 52 national salmon river systems and 29 national salmon fjords.

2 Summary of St.prp. nr. 32 (2006-2007)

2.1 Preservation and strengthening of the wild salmon stocks

The Government aims to protect and regenerate salmon stocks to a level and composition that will maintain diversity within the species while exploiting its productive potential. As the responsibility for achieving this objective is divided between several sectors, cooperation in salmon management will be improved.

National salmon rivers and salmon fjords comprises an essential measure aimed at protecting wild salmon. However, action is equally necessary in other areas involving for example fish farming, salmon river management, combating *Gyrodactylus salaris*, liming, operation of gene banks, research and development, monitoring, and salmon fishery management.

Measures involving aquaculture

Escapees from salmon aquaculture (farmed salmon which have escaped or been released into the natural environment) are one of the most serious threats to wild salmon. Efforts to limit escapes will be intensified on the basis of the fisheries authorities' action plan "Visjon nullflukt" ("Vision 'No Escapees'"). Work on potentially useful new technologies and production methods, the use of sterile fish and the development of systems for tracing fish will also be intensified.

Infestations with salmon lice is also a serous threat to wild salmon. Efforts to reduce the infection pressure on outgoing smolt will therefore be intensified through a national action plan to combat this parasite. Regulations will be strengthened, as will efforts to develop vaccines and schemes for coordinated delousing.

Gyrodactylus salaris

Next to aquaculture escapees, the greatest threat to wild salmon is the parasite *Gyrodactylus salaris*. Combating this parasite will be a high priority, with the aim to eradicate the parasite where possible and minimize the risk of transmission to new areas. Measures will be based on the best available technology and systematic follow-up.

Watercourses

Protection of salmon habitats in the rivers will be strengthened. Habitats in good condition will be safeguarded, and those which are not optimal for production of wild salmon will be restored. The interests of the wild salmon itself, other stakeholders in the watercourses and cost-efficiency combined calls for scrupulous and systematic implementation. Restoration work will therefore be based on a comprehensive national plan for the preservation and renewal of salmons habitats.

New encroachments in connection with the production of hydroelectric power shall not cause significant damage to salmon production. In new hydropower projects affecting salmon river systems, emphasis will be put on avoiding harmful effects to wild salmon through adaptation and/or compensation measures.

In relation to hydroelectric power, the situation for wild salmon can be improved mainly through revision and renewal processes for hydropower licences. These instruments will therefore be used to improve conditions for wild salmon in affected river systems.

Regulations in salmon fisheries

Substantial restrictions in salmon fisheries will be necessary in the on-coming regulations for the period 2008-2012. The regulations will be based on international scientific advice and criteria which presuppose mainly that mixed stocks fisheries must be curtailed. In practice, this can only be achieved by reducing fishing pressure in the sea water fisheries and probably also phasing out this type of fishing in certain areas. In addition, regulations will be introduced with the aim of meeting spawning stock targets and reducing the relative abundance of escapees from aquaculture.

The new regulations in salmon fisheries will be developed with contributions from the various interest groups, in particular the owners of fishing rights in rivers and fjords, the Sami (Laplanders), recreational fishers, and local enterprises that may be indirectly affected. The aim is a new regulatory regime well adjusted to the situation of the wild salmon, where the over all consequences for the interested parties are acceptable.

Liming, releasing fish and gene banks

Liming is currently carried out in 22 salmon rivers; these liming projects will continue. Over time, liming projects may be extended to additional salmon rivers.

Release of salmon is currently carried out as a compensatory measure in hydroelectric power projects. In many cases such releases are not particularly effective, and quality control and assessment will therefore be strengthened.

Material from 169 salmon stocks are maintained in frozen gene banks, and 22 stocks are preserved in living gene banks. To date, the salmon stocks included in the gene banks are at risk from either *Gyrodactylus salaris* or acid rain. As a result of the additional need to protect stocks that are threatened by escaped salmon from aquaculture, an expansion of the gene bank programme is in preparation.

Research and monitoring

Salmon management requires a good basis in scientific information, i.a. on stock development and biological and environmental conditions for salmon production. Research and monitoring will therefore be priorities in the future.

2.2 National salmon river systems and salmon fjords

The aim of national salmon river systems and salmon fjords is to offer special protection to 52 of the most important salmon stocks in Norway. These salmon stocks will be protected from encroachment and activities in the watercourses and in the nearby fjords and coastal areas.

In the national salmon rivers no permission will be given to new enterprises or activities that might harm the wild salmon. In the salmon fjords no additional salmon aquaculture plants will be established. Existing installations will be subject to more stringent standards for preventing escapes and controlling sea lice and other deseases. The stocks included will also be prioritized for other measures aimed at strengthening the wild salmon.

The national salmon rivers and salmon fjords will encompass about three-quarters of the Norwegian wild salmon resource. The scheme will include large and abundant stocks with high productivity or with a potential for high productivity as well as stocks of "storlaks" ("big salmon", weighing 7 kg or more) and stocks with special genetic characteristics. The selection of stocks will have a good geographic distribution.

The management system involving national salmon rivers and salmon fjords has been designated by the Storting in plenary session. This system will later be legally based in the Act relating to salmonids and freshwater fish and in regulations under other relevant legislation. Necessary legislative changes are to be proposed to the Storting once the scheme has been adopted.

The regulations concerning national salmon rivers and salmon fjords are administered according to the prevailing division of responsibility in central government. Local authorities and owners of fishing rights will also be involved in the administration of this scheme.

The national salmon rivers and salmon fjords will be a permanent scheme. However, new information, new technologies and new general framework conditions might require regulatory changes in the management of watercourses and fjord areas over time. The scheme will therefore be evaluated ten years after implementation at the latest.

The stocks involved in the scheme will have priority in general activities aimed at strengthening wild salmon stocks. This will involve i.a. measures to combat *Gyrodactylus salaris*, habitat restoration, revision of licenses and compensatory measures in regulated watercourses, liming, and monitoring of stocks. In addition, other measures for protection of wild salmon will include reduction of escapees from aquaculture, minimizing sea lice and improved regulations in salmon fisheries.

Changes in the protection regime for salmon fjords

As a consequence of changes in aquaculture regulations since the salmon fjords were established, the Storting endorsed an updating of the existing protection regime for national salmon fjords. In addition, all salmon aquaculture will be terminated in the established salmon fjord Tanafjorden outside the Tana river, which is one of the World`s richest salmon rivers. Apart from that, the new scheme does not include any relocation of aquaculture plants. However, voluntary agreements to move aquaculture installations out of national salmon fjords is a relevant option.

The protection regime sets out guidelines for aquaculture operations in the salmon fjords and also allows for flexibility in the event of future developments.

Annex 2

Strategy for an environment-friendly, sustainable aquaculture industry

Foreword

The Soria Moria declaration's points on aquaculture were addressed in the government's *Strategy for a Competitive Norwegian Aquaculture Industry*, presented in August 2007. On the subject of protecting the environment, we wrote that the government "will ensure that the Norwegian aquaculture industry is run on a sustainable basis." Strategy for an Environment-friendly Aquaculture Industry" is a follow-up and extension to the competition strategy, concerning sustainability.

Aquaculture is a vital industry in Norway. It creates jobs and value. Know-how is acquired which can be used to develop and improve aquaculture production in this country, and to help Norwegian companies break into other markets than those traditional to Norway. Aquaculture also creates spin-off effects for the subcontract industries, and distribution companies. It brings life to the coast and growth to rural districts and towns. Seafood is healthy, and scientists recommend that we eat more fish, which is why the government wants to develop the industry further. The greatest potential for growth is the farming of salmon, cod and shellfish. The growth in the aquaculture industry cannot be limited to market demand, it must grow within what the environment can tolerate. This entails that a ceiling has to be set for how big the industry can become and ensuring that production remains within what the environment can cope with is vital factor. Environmental-friendly, sustainable production is therefore a condition of long-term development and growth.

A sustainable aquaculture industry is one which is run with consideration for the environment, and adapted to the marine environment and biological reproduction. As a food producer, the aquaculture industry depends on good environmental conditions and water quality, which means that in order to protect their own interests, fish farmers have an obvious interest in maintaining good water quality and avoiding any negative impact on their surroundings. It is important to ensure a clean maritime environment and good production locations for aquaculture, with minimum impact from long-distance transport emissions and pollution from local sources. Similarly, the authorities and industry must cooperate to ensure that aquaculture is run to the benefit of its surroundings, and not to their detriment.

Those involved in the aquaculture industry are invited to collaborate in order to fulfil the goals of this strategy, which is to ensure that the Norwegian aquaculture industry is run in the most sustainable manner possible.

1. **Introduction**

1.1 About the process

During the process of devising the strategy, the Ministry of Fisheries and Coastal Affairs has received input from a wide variety of sources. The Directorate of Fisheries, Norwegian Food Safety Authority, Institute of Marine Research and the Institute of Veterinary Science have helped considerably with identification of the problems, and with quality assurance. The Ministry of the Environment has contributed specialist skills for environmental aspects and a wide range of related organisations have taken part in hearings, sharing their views on what should comprise an environment-friendly aquaculture industry in the future. These include: The Norwegian Seafood Federation, the Norwegian Seafood Association, Bellona, Greenpeace, WWF Norway, Norwegian Salmon Rivers, The Norwegian Association of Hunters and Anglers, the Norwegian Fishermen's Association and the Norwegian Farmer's Association.

The strategy identifies problems, sets goals and what needs to be done to achieve them. It does not include specific effect-indicators for acceptable influence. Further work is therefore necessary on implementing the concept of sustainability in an appropriate manner, which will require further research or investigation. Many of the measures proposed will have to be implemented either by specific regulations, or by changes to existing rules. Such regulations will be subject to hearings and the economic and administrative consequences will be assessed in the usual manner.

1.2. Background

Over the last 40 years, aquaculture has developed into a major industry in Norway, with over 800,000 tons of farmed fish produced in 2007, equivalent to around NOK 17.5 billion in turnover. Farmed fish represent more than half of total Norwegian seafood exports, and have contributed to Norway becoming the world's second biggest exporter of seafood. Around 4,500 people are directly employed in the industry, but a very high number of others work for suppliers, processing- and transport companies.

The Norwegian aquaculture industry faces a range of environmental challenges and scientists and environmental organisations have helped identify some of the major problems. The industry and the authorities have already implemented a range of measures, but there is a lot more work yet to be done. Therefore, a major element of aquaculture policy will be the identification of what elements go to making environment-friendly sustainable production.

The government's policy for conservation of wild salmon is stated in Report to Storting no. 32 (2006-2007*) On Conservation of Wild Salmon and Completion of National Salmon Watercourses and Salmon Fjords, and the strategy here will contribute to achieving the goals for wild salmon.* This should also be implemented into the strategies of the farmers themselves.

This strategy focuses on the environmental aspects of sustainable farming, based on five main areas in which the industry impacts the environment (the impact model). These are:

- genetic impact and escapes
- pollution and emissions
- disease, including parasites
- area utilisation
- feed resources

The strategy document states details of challenges, status, measures initiated, future goals and the government's proposals for new measures for each of these five areas. The strategy will identify problems, set goals and what needs to be done to achieve them. It does not include specific effect-indicators for acceptable influence. The Directorate of Fisheries and the Norwegian Food Safety Authority will play a central role in implementing the drive for sustainability, and the ongoing process will require more research or investigation. All organisations with an interest in the process will be invited to join the dialogue.

1.3 Horizontal concern for the environment, and use of the precautionary principle

The Aquaculture Act has a special environmental clause which states that aquaculture must be established, run and wound down in an environmental-friendly manner. When evaluating the concept of environmental-friendly, the precautionary principal comes into play, which entails that where there is a risk of serious or irreversible damage to nature, ignorance may not be used as an excuse for delaying or avoiding the initiation of proportional and cost-effective measures. This entails in turn, that any possible impact must not be assessed in isolation, but against a background of the environmental damage already caused through other forms of impact.

The principal of collective damage is also relevant when the environmental impact of aquaculture is being assessed. The principal implies that the impact of an ecosystem must be assessed based on the collective impact it will be or is exposed to. This has particular relevance if environmental impact is at a critical level, at which only a small increase will have a major effect on the ecosystem. These principals form the basis of the government's proposal for the Natural Diversity Act, and lay down guidelines for implementation of aquaculture legislation.

1.4 Climate, tracing and environmental marking

Aquaculture has an impact on the climate, and is influenced by the climate. For example, changes in weather and temperature affect disease levels in fish, and test the tolerance of the farm facilities. Production and the sale of seafood also affect the climate through emissions.

The Ministry has commissioned a report on carbon emissions from seafood trading to establish the levels of emissions from various types of transport and packaging. This will contribute to broader understanding to be

able to evaluate the impact various forms of seafood products have on the environment in a lifetime perspective, and to identify areas where such impact can be minimised.

Consumer demand for marking and documentation related to the climate and environment has grown. Such marking is currently based on various initiatives, and with various levels of official involvement. For example, mandatory marking such that the future marking requirements on marking of production method, type and catch area will be involved. Important private marking schemes applicable to fishery are KRAV, Friend of the Sea, Marine Stewardship Council (MSC). Relevant schemes for aquaculture include Krav, Friend of the Sea, Global GAP, and organic marks such as Debio, Naturland and Soil Association. The WWF has taken the initiative for the Aquaculture Stewardship Council (ASC), a parallel to the MSC, but for aquaculture. The UN's Food and Agriculture Organisation (FAO) is developing guidelines for certification of sustainable aquaculture.

Clear criteria and chain-traceability are important for climate and environment marking, such that the information is credible and provides guidelines, and is not misleading for the consumer. The Norwegian authorities are working via international forums to establish common guidelines for environment marking of farmed seafood. The authorities have also launched a project which will introduce a common electronic infrastructure for exchanging information on food by 2010, including farmed fish, throughout the entire value chain.

The climate issue is relevant to the aquaculture industry, but the problems are more complex and general than the five main areas focused on in this strategy. Please refer to Report to Storting no. 34 (2006-2007) on Norwegian Climate Policy.

2. Genetic interaction and escape

2.1 Status and challenges

2.1.1 Salmon

World stocks of wild Atlantic salmon have been significantly reduced over the last 30 years. Around 1/3rd of the Atlantic salmon have their spawning grounds in Norway and through international agreements, Norway has committed to take special administrative responsibility for wild Atlantic salmon. Salmon have disappeared from around 45 watercourses in Norway, and around 100 of the remaining 400 Norwegian populations are vulnerable. However, historic catch data from Norway shows fluctuations and trends differ in different regions over time. There are many reasons for the decline in wild salmon stocks over the last 30 years, which have been examined in more detail in the NOU 1999:9 "*Towards salmon without fences?* The reasons for the decline in Norwegian wild salmon stocks and suggestions for strategies and measures to improve the situation." Amongst the main reasons described in the NOU are natural fluctuations in food availability and water temperature in the Norwegian Sea, pollution, acid rain, watercourse diversion, *Gyrodactylus salaris*, overtaxation, the effects of aquaculture etc.

The government's policy for wild salmon conservation is laid out in Report to Storting no. 32 (2006-2007) *On conservation of wild salmon and the designation of salmon watercourses and salmon fjords.* In addition to national salmon watercourses and fjords, the proposition suggests effective measures are needed with regard to aquaculture, salmon watercourses, combating the salmon parasite *Gyrodactylus salaris,* calcification, gene banks, R&D, salmon monitoring and regulating salmon fishing.

There is a large degree of agreement in research environments that high levels and sustained crossing of escaped and migrating salmon is negative for wild salmon.

The causes of most escapes in recent years have been vandalism, poor maintenance, human error, predators and predator attacks through nets, collision, poor inspection and working procedures, lack of control systems and competence amongst farmers.

Escape figures reported for salmon reduced significantly in 2007 and 2008 compared with previous years. Over the last five-year period from 2004 to 2008, reported escape figures were 553,000, 715,000, 920,000, 290,000 and 100,000 individual fish respectively. This positive trend shows that efforts made by the authorities and the industry are paying off. However, significant amounts of unreported escapes can be expected.

Farmed salmon in Norway differ from most other farmed stocks in the world, in that they do not have any genetic material from stocks outside of the country. Farmed salmon differ from wild salmon in terms of growth, behaviour and numbers of inheritable variations, properties which heavily influence their adaptability to the living conditions of rivers and the sea, and thereby their survival in nature. The properties of farmed salmon are a result of highly focused breeding over around eight salmon generations, with the aim of improving important production characteristics for aquaculture.

Scientific comparison of wild and farmed salmon, and cross-breeding between them, has shown that the gene-transfer from farmed to wild salmon can reduce the ability to survive for wild salmon. That is why such gene-transfer is one of the main problems with escapes. Registration of escaped farmed salmon in a number of Norwegian watercourses since the end of the 80s proves that the number of escapes has been very high in some of them. Genetic changes can already be seen in some salmon stocks. We have little knowledge of to what extent cross-breeding can take place without the natural genes of wild salmon being degraded permanently. Nevertheless, it is known that even relatively low numbers of escaped farmed salmon in the rivers can damage wild stocks. Many of the breeding characteristics of farmed salmon will be diluted and out-competed by the genes of wild salmon if the number of escaped fish in rivers - particularly during the spawning season - is held at a sufficiently low level. Escapes are also known to disturb and confuse spawning grounds, in addition to providing competition for food and space.

2.1.2. The rainbow trout

Rainbow trout is an introduced species, which is undesirable in the Norwegian fauna. Escaped rainbow trout

can migrate up the rivers and spawning has been recorded in several instances. There is an element of uncertainty on whether the rainbow trout has established stocks, and the risk related to potential genetic effects are therefore unknown. In addition, escaped rainbow trout could transfer disease and parasites, in particular *Gyrodactylus salaris* and salmon lice, to wild salmon and sea trout.

Reported escape figures for rainbow trout show a lot of variation over the last five years from 2004 to 2008, of 10,000, 8,000, 15,000, 315,000 and 600 individual fish respectively.

2.1.3. Cod

Farmed cod have proven to be more adept at escaping than salmon and rainbow trout, and relatively more cod escape than the other two species. This is due amongst other things to cod having different behaviour patterns in the cages, looking for holes, and they have even been observed chewing their way through nets. This is something which is supported by very high - and partly inexplicable - loss during production.

Farmed cod which spawn in the cages represent a challenge to the genetic uniqueness of wild cod, due to the release of fertilised eggs. ***Coastal cod have spawning and growth areas in the same areas where the farms are located, and escapes and spawning in cages will therefore have a negative effect on wild stocks. Even though studies have proved major spread of eggs from cages, nothing is known of the spread of eggs from cod farming facilities. The effect of escaped fish and eggs has therefore not been documented on wild cod stocks, but negative effects cannot be ruled out.***

Reported escape figures for cod have been relatively high in recent years. For the five year period 2004 to 2008, reported figures were 20,000, 213,000, 85,000, 290,000 and 228,000 individual fish respectively.

2.2 Measures implemented

The industry itself bears a major responsibility for preventing escapes, and puts a lot of effort into preventive measures. The fishery authorities also take the escape problem seriously, and have developed a control system, rules, technical requirements, operational requirements and inspections to ensure farming runs on environmentally-responsible lines. Many of the measures are however recent, and it must therefore be expected that some time passes before they make any clear impact, and produce results.

Norway was the first country in the world to introduce a scheme laying down requirements and a technical standard for aquaculture in 2004 (NYTEK).

The Ministry appointed a permanent escape commission for farmed fish in 2006 to examine the causes for escapes, systematically work to reduce risk and to propose changes to standards, rules etc. The commission's term has just been extended to 31.12.2010.

The Directorate of Fisheries launched a special plan in 2006/2007 called "Vision: Zero Escapes" to bring down the number of escapes. The plan has now been extended and contains a number of measures to prevent escaped farmed fish. Collaboration between Økokrim (the National Authority for Investigation and Prosecution of economic and Environmental Crime), the Prosecution Service and the Directorate of Fisheries has become closer, allowing Prosecution Service and Økokrim to prioritise breaches of the law within the aquaculture industry.

The final resolution on national salmon watercourses and fjords was taken in Stortinget on 15 May 2007 and entails the setting up of a total of 52 national salmon watercourses and 29 national salmon fjords, where stricter regimes for aquaculture will be applied for the sake of the environment.

A series of administrative measures have been introduced to reduce the likelihood of escape, including a requirement for internal control of the facilities, new requirements for mesh width in nets, requirements for double protection on hatchery facility outlets, new marking rules for reducing the likelihood of collisions with the facilities, and tougher reactions in the event of a breach of the rules which causes an escape.

Furthermore, methods for marking fish are under development, to be able to track them back to their origin. DNA identification is now in use to identify where escaped fish come from, and these methods have shown to be suitable, and escape episodes have been resolved.

Work is being done to develop sterile fish for aquaculture, something which could help reduce the genetic impact escapes have on wild fish. Current techniques of sterilising fish have negative effects on fish welfare and production results. A lot of work still remains therefore before such techniques can be used in practical terms in a commercial situation.

2.3 Future goals

Aquaculture does not contribute to long-term changes in the genetic characteristics of wild fish stocks.

The goal of "Vision: Zero Escapes" must be upheld. One escaped farmed fish is one too many, but to adapt the measures to the risk, it will be necessary to define limits which indicate what effects are unacceptable. The different salmon stocks can however have different tolerance levels and robustness, and suitable parameters/indicators are needed to measure the effects.

The number of reported escaped fish is not an optimum target figure for escapes and since escaped farmed fish do not have identical behavioural patterns, and escape figures are probably inaccurate, it will be relevant in the future to use the number of farmed fish found in salmon watercourses as a more realistic indication of potential harmful effect.

Even if we develop techniques for production of sterile farm fish which satisfy the requirements for production results and fish welfare, they will not fully replace the goals for escapes above, as sterile fish will also affect spawning grounds for wild fish, physically and ecologically.

2.4. New measures

The Directorate of Fisheries will expand its *"Vision: Zero Escapes"* plan. This will involve creating a better escape register, new escape instructions and new experience databases, which can provide the knowledge of practices which reduce the likelihood of escape.

The technical requirements for farming equipment are of major significance to prevent escapes, and more emphasis is needed on preventive technology. Experience gained by the Escape Commission shows that a technical standard such as NYTEK, which will apply to land-based farming facilities (hatcheries), should be developed.

Understanding of the genetic stability of wild salmon stocks needs to be increased. Whether DNA profiles are more stable in salmon stocks within national salmon fjords than others needs to be studied, and whether DNA profiles in wild salmon are more stable in areas with few escaped farmed salmon than in areas with many. The occurrence and penetration of escaped fish in the spawning population in the autumn in national salmon watercourses and in reference watercourses needs to be established. The same applies to the extent of hybridising and gene-crossing in national salmon watercourses and reference watercourses. The aim is to increase understanding of the tolerance limits of salmon stocks when it comes to the penetration of escapees in spawning populations.

To be able to improve the strategies for more effective recapture of escaped fish, better understanding of a number of biological conditions is needed, including the behaviour of newly-escaped fish. To fish-out escaped fish in rivers incurs costs for the authorities, and in accordance with the principal in Norwegian environmental policy of the polluter footing the bill, it has to be considered whether such costs should be charged to the aquaculture industry.

In the event of an accident or destruction of large cages, large amounts of fish will escape compared with smaller units, and the consequences of damage increase. Given that the trend is towards larger units, the setting of an upper limit for an acceptable amount of fish in one cage should be considered.

The Government will:

- improve inspection of aquaculture facilities, along with prosecution of infringements, to ensure that the environmental terms in the rules are observed
- propose tightening up the rules on technical requirements and standards
- encourage the development of new technological solutions to prevent escape
- prioritise understanding of escape-related behaviour and escape risk
- prioritise the monitoring program for national salmon watercourses and fjords, and increase understanding of DNA profiles and genetic stability in major salmon populations.
- continue to work towards increasing understanding of the effects escaped farmed fish have on wild populations
- investigate whether farmers should pay for damage-limitation measures launched by the authorities after an escape
- investigate whether an upper limit on the size of cages and/or the number of fish in a cage ought to be introduced, with regard to the consequences of an escape

2.5 Cod in particular.

The Ministry for Fisheries and Coastal Affairs presented the government's proposals for a sustainable and future-oriented aquaculture industry on 12 February 2009. We want controlled growth, in parallel with the development of technology which ensures environmental sustainability.

We need better understanding in several fields, and will therefore launch investigations to:

- identify environmental risk factors, including on genetic impact and the risk of infection of wild fish
- obtain an overview of areas with vulnerable coastal populations and spawning grounds
- assess whether 'cod fjords' will be a suitable administrative measure to protect particularly vulnerable cod populations.

Based on professional understanding and balancing the desired effects of measures in place and their commercial consequences, new administrative measures will be considered within five years. As part of this work, a proposal on amending the Aquaculture Act has been debated. The proposal entails us being able to stop allocating new concessions if necessary, whilst we await the results of the investigations to be made.

In addition to setting requirements, the authorities will invest major resources in research and development measures. This is important to be able to solve the disease problems within cod farming, and thus help reduce production costs. The Ministry spent around NOK 100 through the Research Council and direct grants to research institutes in 2008 for research into cod farming.

Effective breeding is essential to combat disease and cod farming of the future is dependent on solving the problem of disease. Even though farming will change farmed cod in relation to wild fish, national farming programmes are being carried out.

Meanwhile, the escape of eggs and spawn must be prevented. Consequently, researchers and industry will be invited to collaborate to develop the necessary technological solutions. Such solutions will be a vital step to ensure sustainable growth in the cod farming industry. The government's ambition is to introduce

requirements for zero release of eggs and spawn by 2015.

In the short-term, the following requirements pertaining to operation will be tightened up:

- tougher regulations for current administrative practice to ban cod farming in wild cod spawning grounds
- requirements for cod farmers to be subject to the same rules as salmon farmers for approved operation plans
- requirement for net checks - and to consider whether double nets should be made a requirement
- requirement for monitoring fish to be able to quickly spot escapes, to thus be able to limit the extent of the escape.

3. pollution and emissions

3.1 Status and challenges

In general, emissions of nutrient salts and organic materials from farming is a minor environmental problem in Norway. The long coastline and extensive use of farming locations with high levels of water circulation and good water quality are contributory factors. Farming takes place in many regions in relatively deep fjords and inlets with good recipient conditions, where the ability to support and self-purification properties are relatively good. Production takes place in composite ecosystems, with high biodiversity and tolerance levels.

The emission of nutrient salts and organic materials from farming can however have negative local effects, depending on the location. In some farming areas, regional effects can also count. The decomposition of organic materials (spilt feed and faeces) can cause a reduction in the amount of oxygen and number of species. Emissions of nutrient salts can also cause increased algae growth, and increased biomass production in bodies of water with a fertilisation effect (eutrophication).

Methods for monitoring the effects on the bottom and bottom-habitat life under and near farming facilities have been developed. These methods, Matfiskanlegg – Overvåkning – Modellering (MOM) (edible fish breeding facilities - monitoring - modelling) are defined in a standard, NS9410, and mandatory by regulation. The methods describe how effects on the sea bed are to be monitored, and which limit values (environmental standards) are to be applied to assess whether such effects are acceptable.

The B-check described in NS 9410 monitors trends in bottom conditions under and near farming facilities in use. The check frequency is increased in line with emission levels from the facility. It must also be used before starting operations at a new location to benchmark environmental conditions. The C-check from NS 9410 also defines bottom conditions from the facility and into the recipient, measuring environment impact in a much larger geographical area than the B-check.

The emission of chemicals and copper-content impregnation agents have undesirable effects on the environment. They concentrate in the bottom sediment and nutrition chain, and are harmful to sensitive species, such as molluscs. The use of such substances must therefore be reduced, and the authorities must stimulate the use of alternative and more environment-friendly methods.

3.2 Measures implemented

A new system for production limits with maximum permitted biomass (MPB) and environment monitoring was implemented in 2005. The MPB system combined with the introduction of environment checks upon allocation and environment monitoring during operation, ensure environmentally suitable production and fish health and welfare.

In the event of applications for new or expansion of existing facilities, environmental checks of bottom conditions at the location are mandatory before startup, along with hydrographical and topographic surveys. During operation, farmers have to perform regular environmental monitoring of bottom conditions at the site.

Work on integration of the area into the MOM system into a cohesive management system - MOLO (MOm–LOkalisering) (environmental monitoring - location) has been initiated. Localisation will be a central feature of the new system for area and environment adaptation, as we want to know where farming facilities ought to be sited, how big they can be and how they should be run.

A special regulation was introduced in 2005 to prevent emissions of environmentally-harmful chemicals from cleaning, washing and impregnation of farming nets. The regulation applies initially to net laundries which are required to purify their waste water.

3.3 Future goals

All farming locations in use keep within an acceptable environmental conditions, and do not have higher emissions of nutrient salts and organic materials than the recipient can tolerate.

Conditions related to operation, biomass, location of farming facilities or facility integrity can have negative effects and lead to eutrophication and overload. It is therefore important to have accurate assessment and criteria as the basis for location scaling. The degree of utilisation of the location in relation to its capacity must be within defined, measurable limits.

In areas with many facilities and high production, the sum of the effect must not cause reduced environment quality in the recipient.

Emissions of organic materials can in some instances affect the bottom near the facilities, or cause over-fertilisation and lack of oxygen. Furthermore, organic material (particularly spilt food) can be eaten by wild fish. It is therefore important to have a management system which ensures that production in each location is geared to capacity, and which views individual locations in relation to a larger geographical area, such as the Hardanger fjord area.

3.4 New measures

Environmental adaptation is a precondition for long-term growth and development in the aquaculture industry. Better understanding of the ecosystem in coastal waters is needed in general, and of fjord ecology in particular, including Hardanger fjord.

The fishery and environmental authorities will collaborate on developing a common, upgraded environmental monitoring system to provide the best means of assessing location scalings. Development of such a system will also help simplify monitoring and checks performed by the authorities, and give better grounds for initiating measures in areas where tolerance limits have been exceeded.

Emissions from farming facilities have to be seen in an area-perspective, and not just measuring emission levels under and near individual facilities. The C-checks from NS 9410 help measure levels at greater distances from the facility. Overall, the C-checks from several farming facilities - for example in a fjord pool - will give a better picture of total emission levels from the aquaculture industry in the area.

MOLO needs to be developed into a cohesive system for regulating environmental effects and area adaptation for aquaculture. Part of this will involve a review of the guidelines for using consequence analyses according to the Planning and Building Act.

The Government will:

- prioritise research into environmental data, water quality and fjord and coast ecology, and into the environmental effects of aquaculture
- develop location criteria to protect environmental sustainability.
- propose the introduction of mandatory C-checks from NS 9410, at the time of allocation and during operation
- stimulate development of MOLO as a future cohesive system for the regulation of environmental effects and area adaptation.

4. Disease

4.1 Status and challenges

4.1.1 Disease in general

Disease, including parasites, continues to be a major loss factor in Norwegian aquaculture. The health situation has however been much improved over the last 20 years, thanks to vaccines and other measures launched against the most common diseases towards the end of the 1980s. Reported figures to the Directorate of Fisheries on losses (fatalities, escapes, predators and rejects) show that around 90% (or 36 million fish) of losses in 2007 were due to fatalities. The loss percentage over the last 10 years has been stable, between 8 and 10%.

Use of antibiotics can be an indicator of the health standards within aquaculture within bacterial disease. Total consumption has been reduced significantly from its peak at the end of the 1980s and early 1990s. 905 kilos of antibiotics were used in total within aquaculture in 2008. Of these, 342 kilos were used for farming salmon and rainbow trout, whilst the rest, 563 kilos, were used for farming marine species, mainly cod. Tougher requirements for operating procedures, new and better drugs, including vaccines, made a major contribution to reduced problems with bacterial disease in salmon. New farmed species still have some unsolved problems with bacterial diseases. For example, Francisella is a growing problem within cod farming. The bacteria is also found in wild cod, although its effect on the wild population is unknown. An increase in the scope of marine species farming can also lead to new disease and parasite problems.

The biggest losses to disease within Norwegian aquaculture are due to viral diseases such as pancreas disease (PD), heart and musculoskeletal inflammation (HSMB), infectious salmon anaemia (ILA), and infectious pancreas necrosis (IPN). The relationship between these diseases and fatality amongst wild fish in Norway has not yet been established.

Diseases and parasites can represent a serious threat to wild populations, whilst the disease in farming which has the most serious impact on wild fish is primarily salmon lice. Even though salmon lice also occurs in wild salmon and sea trout, it is an example of a parasite disease which has grown due to so many hosts in aquaculture facilities. In addition to infecting fish, it can also be spread over long distances by currents.

Lice are to be found in most locations, and according to the *"regulation on combating lice in aquaculture facilities"* an average of 0.5 adult female lice is permitted per fish. This is well under the level which can harm farmed fish, but where large-scale farming production increases the number of hosts, wild salmon can be exposed to lice, causing damage particularly to young fish.

Salmon lice on wild fish are much more difficult to tackle than in farmed fish. Even though the tolerance limits for lice infection have not yet been determined, there is a general consensus that the wild salmon stocks cannot tolerate high levels of lice. Even though there is a downward trend in lice on farmed fish, data from the Institute of Marine Research, the Norwegian Institute for Nature Research and others shows that in some areas there are high levels of lice on wild fish. For example, figures from the extremities of Hardanger fjord show that some caught wild salmon and sea trout had 3-5 times more lice than what is considered to be a "fatal dose". In the worst case, this will lead to migrating salmon with such high levels of lice dying.

4.1.2 Cage size and its significance to disease control

The size of the production units (cages) has increased from a standard cage of 80 metres circumference to 160 metres, whilst the largest units can house over half a million fish, and have a circumference of 240 metres. The physical size of the cages gives rise to problems in the execution of routine operations such as daily inspection, lice counts, anti-lice treatment and the recovery of dead fish. The problem of performing good delousing gives rise to particular concern as suboptimal conditions will lead to poor delousing, and are a major factor in the development of resistance in salmon lice.

A large number of individuals in the cages also means problems with recovering dead fish in the event of mass deaths and sanitary culls. This can lead to an increase in the spread of infection and delay date of slaughter.

4.1.3 Infection risk when moving fish

All relocation of fish entails a risk of the spread of disease and the loading and unloading process involves a risk of escape. It is forbidden to move sick fish (except for slaughter) and fish from facilities where there is infectious disease is suspected.

Smolt can be transported from hatcheries to edible fish facilities. The supply of young fish in the vicinity of edible fish locations determines the number and length of transports. If the availability of smolt is evenly spread in relation to the edible fish locations, fewer and shorter trips are needed. The current industry structure means there is a shortage of smolt in several regions with high levels of production. Groups with integrated operations use their own young fish regardless of distance between the smolt facility and edible fish facility, which contributes to increased transport.

Edible fish which have already been released are moved for operational reasons. Some locations are better suited to smolt release or for large fish than others. Fish can also be moved to ensure that the ceiling for maximum permitted biomass at that site is not exceeded.

The trend is towards fewer and larger slaughterhouses where fish are slaughtered all year round, and often using several shifts. There are also concerns about this aspect of the production chain with edible fish locations spread over large geographic areas, who want to use their own slaughterhouses - which increases the need for transport.

4.1.4. Hardanger fjord

Hardanger fjord has separate and multiple problems, in particular the critical condition of wild stocks of salmon and sea trout, and the disease and salmon lice situation. There is also uncertainty related to the general environmental condition of the fjord, including water quality and increased algae growth. Closer investigation is needed to find out if there are any real changes occurring in the fjord's ecosystem, which could be the reason for such changes and whether they are man-made or natural.

4.2 Measures implemented

The Norwegian Food Safety Authority has the operative responsibility for implementing official measures against fish diseases, including salmon lice, and was granted fresh funds in 2009 for increased inspections within the field of fish health.

Winter and spring delousings are now performed in Western Norway, and a similar campaign is being planned for implementation at Troms in the autumn. In these campaigns, the Authority prioritises inspection with processing and definition of resistance status. It is vitally important that delousing is performed in accordance with therapy recommendations.

Changes have been proposed in the rules for combating salmon lice, including measures which will reduce the danger of the development of resistance. Amongst the measures are a duty to report suspicion of resistance, a requirement for following-up on treatments against lice, a requirement for treatment methodology and that the Authority can set up zones for combating resistant salmon lice in the same way as for infectious diseases.

The Ministry of Fisheries and Coastal Affairs has asked the Marine Research Institute and the Norwegian Research Council to prioritise salmon lice research over the next few years.

It is important to ensure that the environment and fjord ecology in Hardanger fjord are protected as the industry continues to develop. That is why the situation in the fjord was frozen on 8 April 2008, in expectation of the setting up of the area's own administrative regime. A draft regulation for the regime will be sent for debate in the spring of 2009, with the aim of becoming effective from 1 January 2010.

4.3 Future goals

Disease in fish farming will not have a regulating effect on stocks of wild fish, and as many farmed fish will grow to slaughter age with minimal use of medicines.

Even though current losses as a result of fatalities are relatively low in percentage terms, the figure of 36 million fish in 2007 is unacceptably high. What is therefore needed is a level of understanding, an industry structure and operating practices which minimise future losses in aquaculture.

Neither should aquaculture activities be run in such a way that can lead to unacceptable sickness levels in wild stocks. The industry must therefore have a structure which reduces the danger of disease in farming

having a regulatory effect on wild fish stocks. Synchronised withdrawal from service of facilities in a large area is one example of a form of operation which would be highly beneficial in reducing salmon lice on wild fish.

Within current rules, the level of lice in farming facilities is not a problem for the farmed fish. However, salmon lice are a serious problem in some areas for wild stocks of salmon. In addition to an acceptable lice level in farming facilities which can satisfactorily protect farmed fish, we must work towards a lice level on wild salmon which does not lead to unacceptable effects.

It will take time to develop new delousing agents, and particularly a vaccine. The existing salmon lice agents will have to be used for many years yet which is why it is essential that delousing is properly performed, and experience indicates use of closed treatment centres gives the best effect. Biological delousing of wrasse appears to be the most environment-friendly alternative which can be successfully used more in Norwegian aquaculture.

4.4 New measures

The Norwegian Food Authority will revise its "Action Plan Against Salmon Lice" to include measures against resistance development. A separate plan will also be devised against the development of resistance to salmon lice agents.

Limits have been introduced on salmon lice in fish farms although experience shows that this does not necessarily give the desired effect against lice in wild salmon stocks. Therefore, the lice figures for wild salmon must be included when implementing new measures for aquaculture. If delousing in fish farming fails to yield the desired effect on lice figures for wild fish, it may be necessary to consider a reduction in the biomass of the farming facilities (reduce the number of hosts) in the worst-affected areas.

The industry and the authorities ought to collaborate on measures to achieve a better operating structure which can reduce salmon lice infection and other diseases. There are many positive elements in the industry's own "General Plan for PD" which ought to form the basis for such measures, including safe smolt transport, avoiding released fish being moved other than for slaughter, better utilisation of good locations (fewer but bigger), and coordinated operation/withdrawal from service. The industry ought to take the initiative to develop a code of best practices which incorporates such elements, including well boats, which can also go further than official minimum requirements.

Increased use of larger cages will make treating salmon lice harder and suboptimal delousing will accelerate resistance development. Current rules permit larger cages, providing the farmer can treat the fish satisfactorily. Such requirements need to be applied much better by the Authority, and if necessary, the rules on cage size need to be revised.

Moving fish involves the risk of the spread of infection and increases the likelihood of escape. A review of current requirements for well boats and transport will therefore be performed and new requirements can range from stricter requirements for boat design, to dedicated boats for smolt transport, and transport of fish for slaughter.

The Government will:

- introduce stricter rules for controlling salmon lice in farming
- propose that lice figures from wild stocks should also be used for measures in farming facilities
- consider reduction of biomass in a given geographical area if no other options give the desired effect on the levels of lice on wild fish
- consider introducing a ceiling on the physical size of production units and/or the number of fish in one cage
- propose stricter requirements for well boats and transport,
- encourage the industry to develop a code of best practice
- consult with the industry to devise measures to achieve better operating structure, with a positive effect on salmon lice infection and other diseases
- initiate a separate administrative regime in Hardanger fjord.

5. Area utilisation

5.1 Status and challenges

Effective area utilisation facilitates maximum production within a limited geographical area and without unacceptable impact on the environment. To ensure this, we are dependent on good area structure and the suitability of the location. The latter is relevant to infection spread, pollution, biological diversity etc. and for the growth, welfare and health of farmed fish. The location structure will also be relevant to migrating salmon being able to reach their spawning grounds safely.

Current area structure is influenced strongly by the massive growth of the industry for many years. This is particularly true of traditional salmon farming, but also for new species such as cod and blue mussels. The industry structure is built up around new locations being built in the order in which their applications have been granted, with no overall plan.

There are grounds to believe that the current location structure is a contributory factor to the fish health problems the industry has experienced in recent years, particularly concerning pancreas disease (PD) in Western Norway, where the density of farming facilities is greatest. The shortage of new, suitable locations also makes it difficult to relocate for better production conditions. Consequently, production continues in less-suitable locations. Neither do salmon and trout farmers have the opportunity to relocate permits between

the Directorate of Fisheries' regions, and the chance of dispensation is low. Consequently for example, farmers in Western Norway are prevented from relocating production further north.

Ongoing growth in the aquaculture industry can therefore mean that the current structure needs to be changed, such that allocated areas can be used more effectively. This is particularly true in Western Norway, but also in other parts of the country. This could make the industry better equipped to face its existing and future problems such as lack of space, pollution and the spread of disease.

The options the authorities have to change the existing structure are limited. A location permit can be withdrawn if the location is no longer deemed to be environmentally appropriate, in accordance with section 9 of the Aquaculture Act, e.g. where a subsequent survey of biological diversity shows that vital natural values have been adversely affected by farming facilities. The statute is a form of safety valve to ensure that the environmental norm in section 10 of the Act is observed, and checked at location level. However, the statute is not suitable as a tool to change the area structure.

The Norwegian Food Authority can change or withdraw permits for establishment under certain circumstances, and the Directorate of Fisheries can also withdraw a sector permit according to the Aquaculture Act. This can be done if it transpires that disease levels or awareness of poor disease or welfare conditions have changed significantly since the permit was granted. The Authority cannot however enforce relocation unilaterally. Neither can it perform an overall assessment of what will be an appropriate area structure in a larger area, apart from assessing infection risk between individual farming facilities.

The authorities lack essential tools to avoid inappropriate structures, including legislative authority to enforce relocation of facilities when necessary on environmental or social welfare grounds.

On its own initiative, the industry has formed a steering group to tackle PD, which has drafted a "General plan for PD". This proposes extensive structural changes linked to area utilisation by the industry. The proposal entails organising aquaculture into geographically-separate areas to limit infection, separated by fire doors to prevent or reduce the risk of infection between neighbouring zones, closure of "poor" locations and structural transport of fish in well boats. There must be "useable, synchronised production plans" within the infection-limitation zones which will be dependent everyone within the area implementing and supporting the plan, but individual operators, this can be difficult. Small farmers in particular can have special problems related to the change process. The industry has developed and implemented a model in Møre and Romsdal which goes a long way to matching the PD steering group's proposal.

Setting up a fish farm must comply with plans according to the Planning and Building Act, possibly with the consent of the relevant planning authority. When establishing a major facility or hatchery with more than 5 million fry, the Directorate of Fisheries must decide whether it is necessary to run a consequence analysis (CA) according to the Planning and Building Act. A CA must be performed if the Directorate finds that

establishment can have a major impact on the environment, natural resources or a local community after assessing the criteria. A CA must include documentation for the facility's consequences for the environment, natural resources or local community and form the basis of more in-depth and specific processing and setting of conditions for the application.

5.2 Measures implemented

The Aquaculture Act came into force on 1 January 2006. The reason for maintaining a requirement for a permit to run a fish farm is that the administration needs to safeguard certain social aspects, which can be difficult for individual farmers. Regard for the environment and optimised use of the coastal zone are aspects which have to be taken into account for the establishment, running and closing down of fish farms. Prior approval of the facility with regard to environment and area are therefore central issues behind the requirement for a permit.

During 2009, 65 new permits will be issued for farming salmon. The new permits can only be issued to applicants planning to establish them in local authorities which have a coastal zone plan, in accordance with the Planning and Building Act. The aim is to stimulate the local authorities to draft and update local development plans. Within the PD zones, a prioritisation criterion will apply in addition to other criteria, for using the allocation of new permits for salmon to change the location structure to make combating PD easier. The local authorities were given powers to levy property tax on farming facilities in seawater in 2009, something which will stimulate them to plan for fish farming.

The Ministry of Fisheries and Coastal Affairs issued new regulations on the establishment of aquaculture facilities, zoo shops etc in 2008. The regulation implemented the EU's new Fish Health Directive and the European Commission's recommendation on keeping farm fish. The new provisions tighten requirements for new locations.

Approving new locations often happens without full awareness of the environmental consequences, as understanding of life underwater is often incomplete. A program for a national survey of maritime biological diversity has been launched, which covers spawning and growth areas in coastal zones. The survey will influence where fish farming ought to be established.

5.3 Future goals

The aquaculture industry will have a location structure and area utilisation which reduces impact on the environment and the risk of infection.

New locations must be placed according to a general plan for the area utilisation of the industry, and in areas designated for aquaculture by the local authorities. Each locality used and permitted must be well suited with regard to the environment, fish health and welfare.

5.4 New measures

The Ministry of Fisheries and Coastal Affairs and the Ministry of the Environment will collaborate on cohesive guidelines and location criteria before the next concession round, to support sustainability and protect wild salmon.

It is important that areas of special value for marine resources are protected, such as spawning grounds, important breeding grounds for wild fish, coral reefs and major kelp forests. A means to be used by the authorities for this purpose is to grant such areas special protection according the Sector Acts, in this instance, the Aquaculture Act. This has to be seen in relation to the need for studying the need for cod fjords, according to the model for national salmon fjords, as a suitable means of protecting particularly important coastal cod stocks.

During the spring of 2009, the government will submit a proposal for an amendment to the Aquaculture Act which will include a new statute giving the authorities the opportunity to enforce relocation of aqua cultural facilities based on general regard to community and industrial needs.

The new Planning and Building Act comes into force on 1 July 2009, providing wider powers for local authorities to enable the planning of areas for farming specific species or groups of species. However, this will require good understanding of local conditions and suitability.

Local authority development plans are a vital tool for planning the use of coastal zones as a good plan will avoid conflict between various users, such as aquaculture and fishing, and balance their interests against major community needs, such as outdoor pursuits, marine and conservation. Such plans will therefore be a vital part of an overall plan for the placing of aquaculture locations. The act also facilitates planning across local authority boundaries through new provisions on regional planning and inter-authority joint planning.

According to the Aquaculture Act, the industry must always act responsibly towards the environment, and at no time cause significant impact on the environment. Where the permit-issuing authorities believe there is a risk of such impact, sufficient investigations must be made to establish whether permission can be granted on environmental grounds. Such investigations can include consequence analysis in pursuance of the Planning and Building Act, although such analyses are rarely required for fish farm establishment. The Ministry of Fisheries and Coastal Affairs will review the guidelines for consequence analyses in close collaboration with the Ministry of the Environment, and if need be will adjust them to encourage increased use of consequence analyses.

In its "*Strategy for a Competitive Norwegian Aquaculture Industry" the Ministry proposed setting up a committee to examine options for more efficient area utilisation in the industry* which will now be given a much wider mandate. The committee will examine options for more efficient area utilisation, including how the surrounding environment and fish health and welfare can be protected better than at this time. Its work should result in a general plan for the industry's area utilisation, including the use of a clause in the Aquaculture Act to relocate farm facilities and ecosystem-based location criteria.

The Government will:

- initial the process of defining better location criteria
- consider introducing specially-protected areas for aquaculture administration
- propose changes to the Act to give the authorities options to enforce relocation of farming facilities on general environmental and commercial grounds
- encourage all coastal local authorities to have updated coastal zone plans
- consider guidelines for initiating consequence analysis according to the Planning and Building Act
- set up a commission to examine options for more efficient area utilisation in the aquaculture industry.

6. Feed and feed resources

6.1 Status and challenges

The Norwegian aquaculture industry has undergone enormous production growth for some years, which naturally includes growth in feed consumption. However, the growth in feed consumption has not kept pace with the growth in production over the last 30 years. 1.2 million tons of feed were sold in 2008 of which 1.182 million tons were produced in Norway, whilst 18,000 tons were imported. Traditionally, fishmeal and fish oil have been the main components in fish feed, but in recent years, the proportion of vegetable oils has grown.

On a global basis, the average production of fishmeal and fish oil is generated from around 33 millions tons of fish annually. Of this figure, around 5.5 million tons are by-products from fish caught for human consumption, whilst the rest are industrial fish. This gives around 6.3 million tons of fishmeal and 1 million tons of fish oil, and about 50% of global fishmeal production goes to 50 aquaculture. The rest of the fishmeal is used for agricultural feed production, particularly pigs, chickens and pets. Of total global production of fish oil 85% goes to aquaculture production, 10% to human food and the rest for technical use.

Norway produces around 200,000 tons of fishmeal, and imports about the same amount annually. The major suppliers of fishmeal for Norwegian feed production are Peru, Iceland and Denmark. When it comes to fish oil, Norway produces around 55,000 tons annually and imports around 170,000 tons. Denmark is the largest supplier of fish oil, followed by Peru and Iceland. The countries which export fishmeal and oil to Norway have active fishing management, including regulation of fishing for industrial fish. Management of the actual fish species in these countries follows the same principals as in Norway.

Approximately 20% of the fishmeal used for farmed fish feed is used for the production of salmon feed and

the rest is used for marine prawns (23%), marine fish (20%) and carp (15%) and other species. The salmon feed industry uses around half of the fish oil produced in the production of fish feed.

The term 'industrial fish' is used as a collective description of the species which are small, bony and have a short generation cycle, and which are used for production of fishmeal and fish oil, such as anchovies, blue whiting, sand eels, Norway pout and horse mackerel. Industrial fish play a vital role in the sea's ecosystem, as food for other sea creatures and birds. Harvesting industrial fish therefore contributes to reducing food resources for other wild species, including commercially important species such as cod and tuna. Seabirds are also dependent on prey fish of the right size, which means proper management of industrial fish is important, and has to be taken into account when calculating quotas.

The cornerstone of Norwegian fishery is sustainable management and harvesting. The former is based on best available understanding and scientific advice from the ICES (International Council for the Exploration of the Sea) and our own Marine Research Institute.

Norway has also committed to international agreements on sustainable management for all fish stocks under its management. We will do this using a precautionary principal approach, entailing defined levels of taxation and minimum limit for spawning stocks which must not be exceeded.

All fish (with a few exceptions) are nutritionally suitable as human food. The market, and willingness to pay in the various markets, decide what can be sold as food and what goes for fishmeal for feed production. In the current situation with an increase in wealth in many major markets, the demand for meat and fish of better quality than that which can be fulfilled by industrial fish is growing. For industrial fish to end up on the dining table, demand has got to grow to the extent that it is not worth sending to feed production. One result of this is that there are times when a lot of mackerel, herring and capelin are ground up when prices are higher on the meal and oil market than on the consumer market, and in some instances the fish are landed in countries which do not have the facilities to process them into human food. In the large seasonal fisheries which fish for anchovies off the coast of South America, the production of meal and oil help conserve the catch and spread earnings over a longer period, giving the fishermen better prices.

The overall by-product volume from fish and shellfish in Norway was estimated at 650,000 in 2007. Of this, 75% (485,000 tons) was used, mainly for meal and silage production. An increase in the value-creation of by-products from fisheries and aquaculture is a target, to contribute to a sustainable industry. Part of the campaign to this end is the establishment of the Resirkulering og Utnyttelse av organiske Bioprodukter i Norge (RUBIN) (recirculation and utilisation of organic bioproducts in Norway).

How much raw material (fish) is used to produce one kilo of Norwegian farmed salmon has been one of the themes in the sustainability debate on Norwegian aquaculture. The proportion of vegetable raw materials in feed has grown considerably in recent years, and it is not unusual that up to 1/3rd of the oil content in salmon

feed is vegetable oil and 2/3rds fish oil. Given current feed composition and factors, an average of around 2.6 kg fish raw material is used to produce the fish feed needed to produce 1 kg of salmon.

6.2 Measures implemented

The Norwegian management of current fish stocks is deemed to be sustainable. Management of stocks we share with neighbouring countries is regulated by negotiations and international agreements. These are also deemed to be sustainable. In an international context, Norway is one of the driving forces for sustainable fisheries management, which is also reflected in the new Sea Resources Act.

Norway is working internationally to reduce illegal fishing, which is one of the greatest threats to sustainable fisheries management. Effective coastal management, better harbour controls and tougher requirements for shipping flag states are key to this process. Market-oriented measures, such as tougher requirements for traceability, have been introduced against illegal fish. The Sea Resources Act gives the Ministry of Fisheries and Coastal Affairs a statute to require traceability for fish and fish products, with the intention of preventing illegally-caught fish coming onto the market.

Norway has a rejection ban which means that fish taken from the sea have to be landed, and is working internationally to influence other countries to do the same.

6.3 Future goals

The aquaculture industry's needs for raw materials for feed will be met without over-taxation of wild marine resources.

To maintain sustainable production of farmed fish, it is vital that fishmeal and fish oil used in the production of fish feed come from sustainably-managed stocks. In time, other sources of marine fats and proteins should also be utilised, and the utilisation of by-products for fish feed production should also be increased significantly.

In expectation of the development of alternative sources, it is important that the management of fish stocks is prioritised, and that all fish caught are utilised in the best possible way. Combating illegal fishing, reducing rejections and ensuring better utilisation of by-products are also vital to sustainable management of the sea's resources.

The feed industry must continue to work to replace marine ingredients with other sources. For example, single cell protein based on natural gas could be considered in this context. The use of non-marine

ingredients must however be balanced against fish health and welfare, product quality and the reputation of the industry.

It is also necessary to optimise utilisation of fish feed in terms of feed technology, to ensure that as much of the feed as possible spread in the cages is eaten by the farmed fish or collected again, and in terms of digestion of feed to ensure that as much of the energy absorbed goes to growth as possible.

6.4 New measures

To ensure that further growth of the farming industry is sustainable at all levels, all the feed used in production of Norwegian farmed fish must have full environmental traceability for all its raw materials, and documentation must be publicly available. This will provide consumers with the information they need to make environment-friendly choices when buying sustainably-produced foods.

The use of offal and marine by-products in feed production must be increased. Given current demand for feeds, it ought to be commercially viable to invest in know-how and technology to enable the use of more by-products from fishery to be used in the production of fish feed.

More work needs to also be done on the development of other marine raw materials for feed production. This can be both harvesting of lower levels of the marine food pyramid, and development of new sources of marine feed ingredients.

It is also important that farmed fish, cages, feed and feed technology are adapted to optimise utilisation of feed resources.

The Government will:

- work internationally to reduce the scope of IUU fish, and reduce rejections to a minimum,
- work internationally to ensure countries exploiting industrial fish have sustainable fisheries
- stimulate increased use of marine by-products for feed
- prioritise research into alternative marine sources
- consider means for production, import and marking feed and feed ingredients to ensure that fish feed used in Norwegian fish farming only contains fish meal and fish oil produced from sustainably-managed stocks
- stimulate the development of feed technology and feed which boost growth and reduce environmental impact around the facilities.

7. Summary of goals and measures

Chapter 2 Genetic interaction/escape

Aquaculture does not contribute to long-term changes in the genetic characteristics of wild fish stocks.

The Government will:

- improve inspection of aquaculture facilities, along with prosecution of infringements, to ensure that the environmental terms in the rules are observed
- propose tightening up the rules on technical requirements and standards
- encourage the development of new technological solutions to prevent escape
- prioritise understanding of escape-related behaviour and escape risk
- prioritise the monitoring program for national salmon watercourses and fjords, and increase understanding of DNA profiles and genetic stability in major salmon populations.
- continue to work towards increasing understanding of the effects escaped farmed fish have on wild populations
- investigate whether farmers should pay for damage-limitation measures launched by the authorities after an escape
- investigate whether an upper limit on the size of cages and/or the number of fish in a cage ought to be introduced, with regard to the consequences of an escape

Chapter 3 Pollution and emissions

All farming locations in use keep within an acceptable environmental conditions, and do not have higher emissions of nutrient salts and organic materials than the recipient can tolerate.

The Government will:

- prioritise research into environmental data, water quality and fjord and coast ecology, and into the environmental effects of aquaculture
- develop location criteria to protect environmental sustainability.
- propose the introduction of mandatory C-checks from NS 9410, at the time of allocation and during operation
- stimulate development of MOLO as a future cohesive system for the regulation of environmental effects and area adaptation.

Chapter 4 Disease

Disease in fish farming will not have a regulating effect on stocks of wild fish, and as many farmed fish will grow to slaughter age with minimal use of medicines.

The Government will:

- introduce stricter rules for controlling salmon lice in farming
- propose that lice figures from wild stocks should also be used for measures in farming facilities
- consider reduction of biomass in a given geographical area if no other options give the desired effect on the levels of lice on wild fish
- consider introducing a ceiling on the physical size of production units and/or the number of fish in one cage
- propose stricter requirements for well boats and transport,
- encourage the industry to develop a code of best practice
- consult with the industry to devise measures to achieve better operating structure, with a positive effect on salmon lice infection and other diseases
- initiate a separate administrative regime in Hardanger fjord.

Chapter 5 Area use

The aquaculture industry will have a location structure and area utilisation which reduces impact on the environment and the risk of infection.

The Government will:

- initial the process of defining better location criteria
- consider introducing specially-protected areas for aquaculture administration
- propose changes to the Act to give the authorities options to enforce relocation of farming facilities on general environmental and commercial grounds
- encourage all coastal local authorities to have updated coastal zone plans
- consider guidelines for initiating consequence analysis according to the Planning and Building Act
- set up a commission to examine options for more efficient area utilisation in the aquaculture industry.

Chapter 6 Feed and feed resources

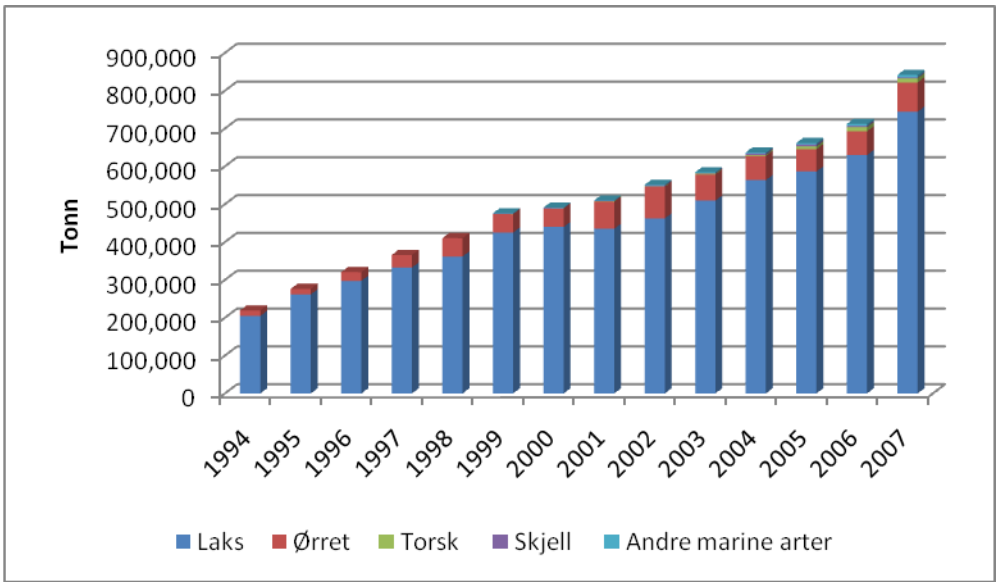
The aquaculture industry's needs for raw materials for feed will be met without over-taxation of wild marine resources.

The Government will:

- work internationally to reduce the scope of IUU fish, and reduce rejections to a minimum,

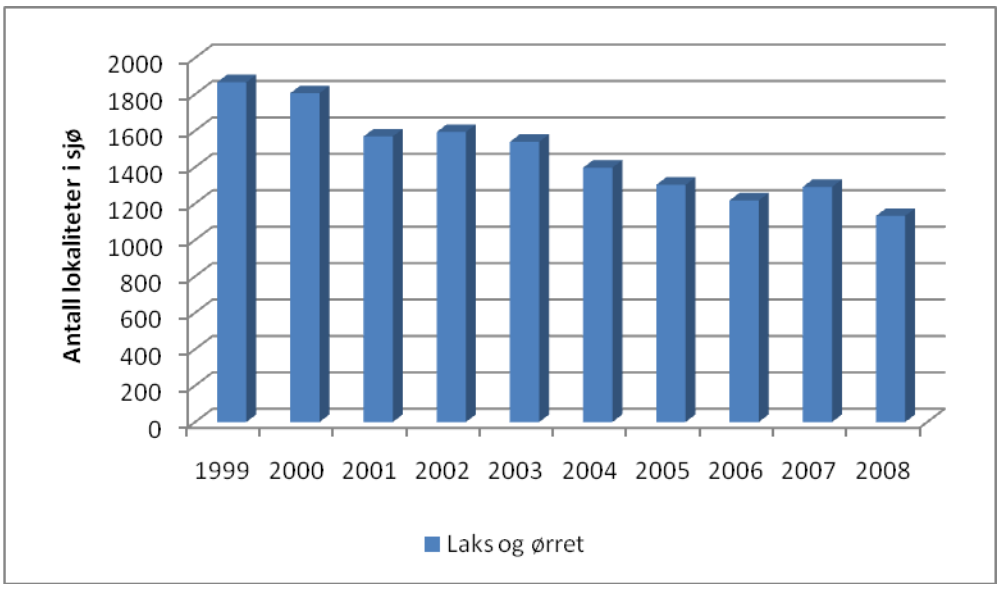
- work internationally to ensure countries exploiting industrial fish have sustainable fisheries
- stimulate increased use of marine by-products for feed
- prioritise research into alternative marine sources
- consider means for production, import and marking feed and feed ingredients to ensure that fish feed used in Norwegian fish farming only contains fish meal and fish oil produced from sustainably-managed stocks
- stimulate the development of feed technology and feed which boost growth and reduce environmental impact around the facilities.

1. Production



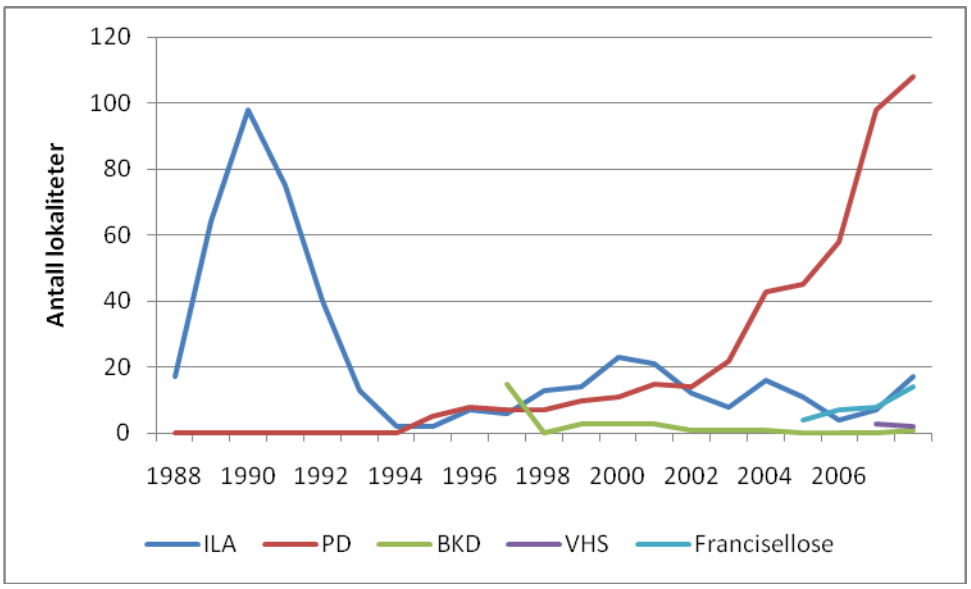
Aquaculture production in Norway 1994 – 2007. Source: The Norwegian Directorate of Fisheries.

2. Total number of locations in seawater



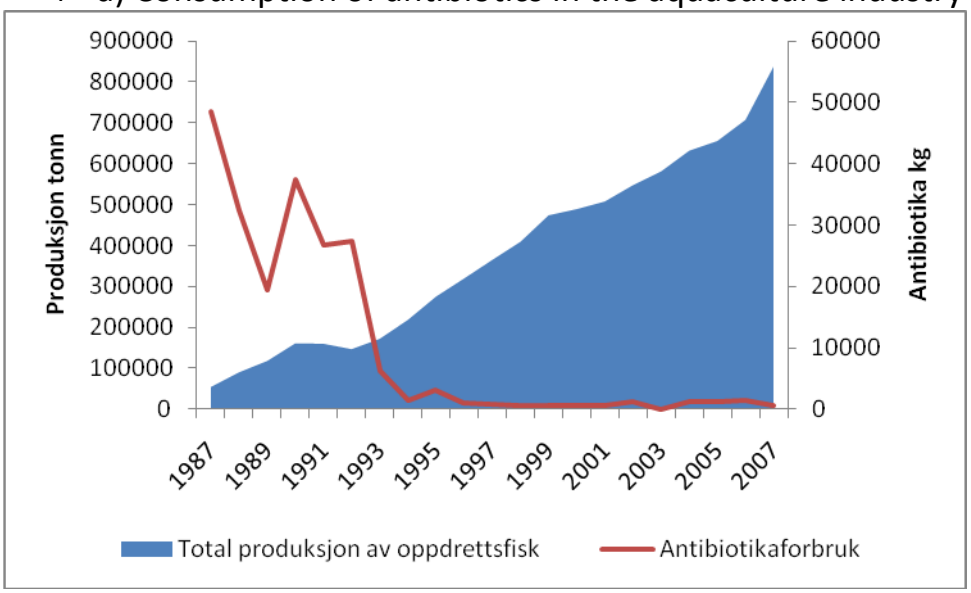
Total number of locations in seawater for salmon and trout 1999 – 2008. Surveys were performed at different times of the year. Source: The Norwegian Directorate of Fisheries.

3. Disease



Total number of locations 1988 – 2008 with infectious salmon anaemia (ILA), pancreas disease (PD), bacterial kidney disease (BKD), viral haemorrhagic septicaemia (VHS) and francisella. Source: National Veterinary Institute.

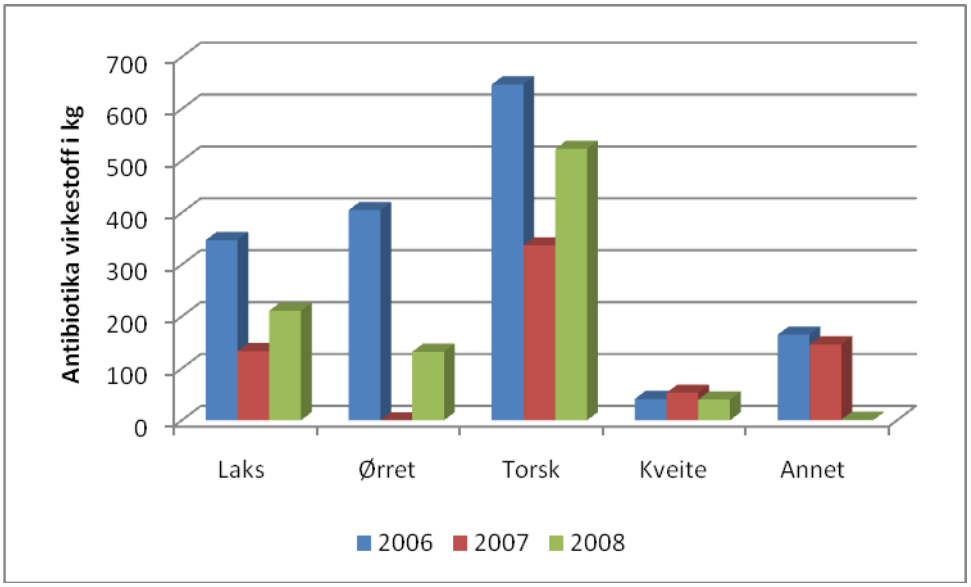
4 a) Consumption of antibiotics in the aquaculture industry



Use of antibiotics in the Norwegian aquaculture industry in relation to total

production of farmed fish. Source: The Norwegian Directorate of Fisheries and the National Health Institute.

4 b) Antibiotics consumption per species

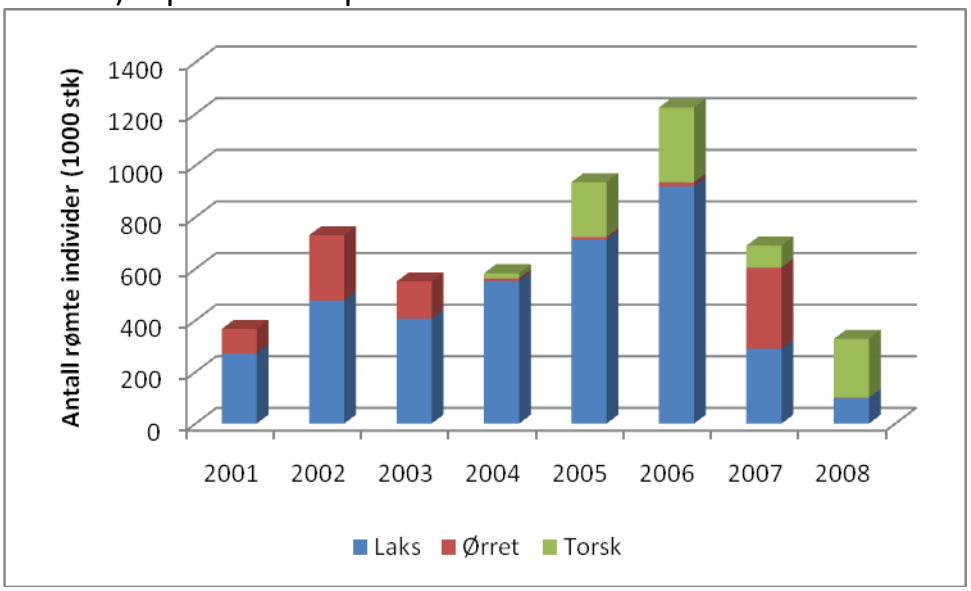


Amounts of antibiotics ordered per species 2006 - 2008. Data taken from

the Norwegian Food Authority's prescription database, based on prescriptions reported by the requester and

supplier, and registered nationally by the Norwegian Food Authority. Source: Norwegian Food Authority.

5 a) reported escapes

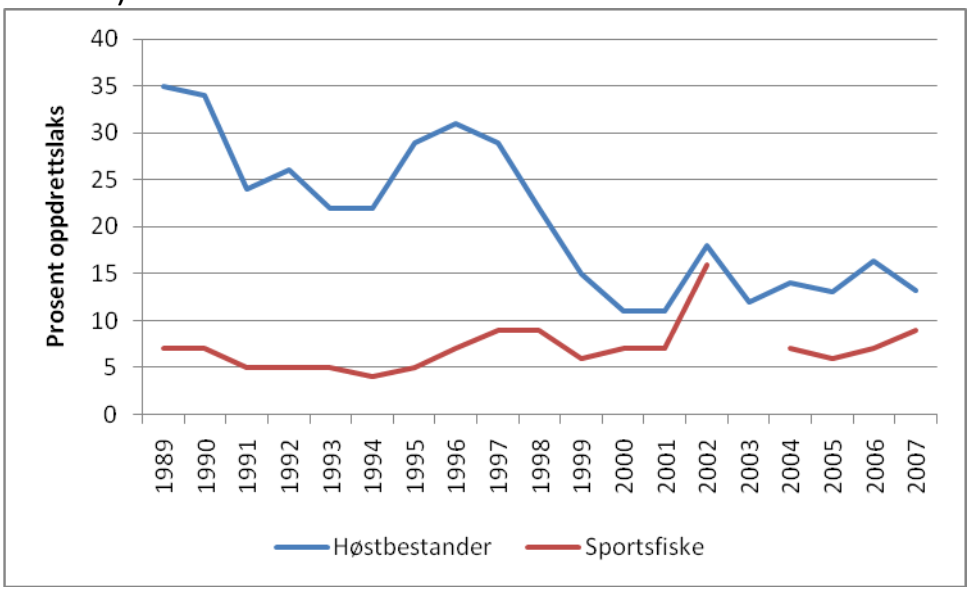


Total escaped individuals (x 1000). Figures are based on reports from

fish farmers. Collection of data on escaped farmed fish started in 2004.

Source: The Norwegian Directorate of Fisheries.

5 b) Infiltration of farmed fish in rivers



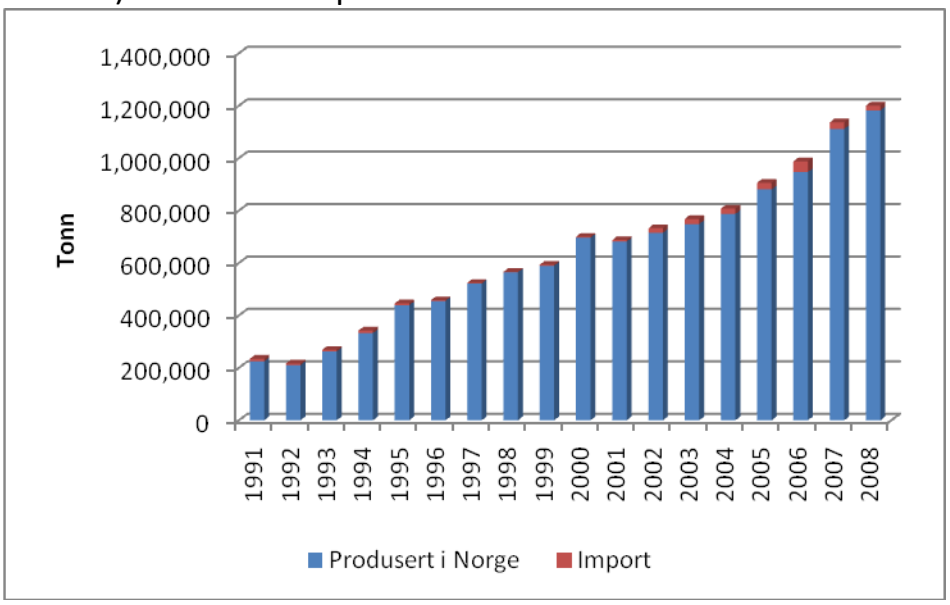
Calculated percentage of infiltration of escaped farmed salmon in sports fish,

sample fish/brood stock fish just before spawning between 1989-2007.

The proportion of escaped farmed salmon in sports fish was not calculated in 2003.

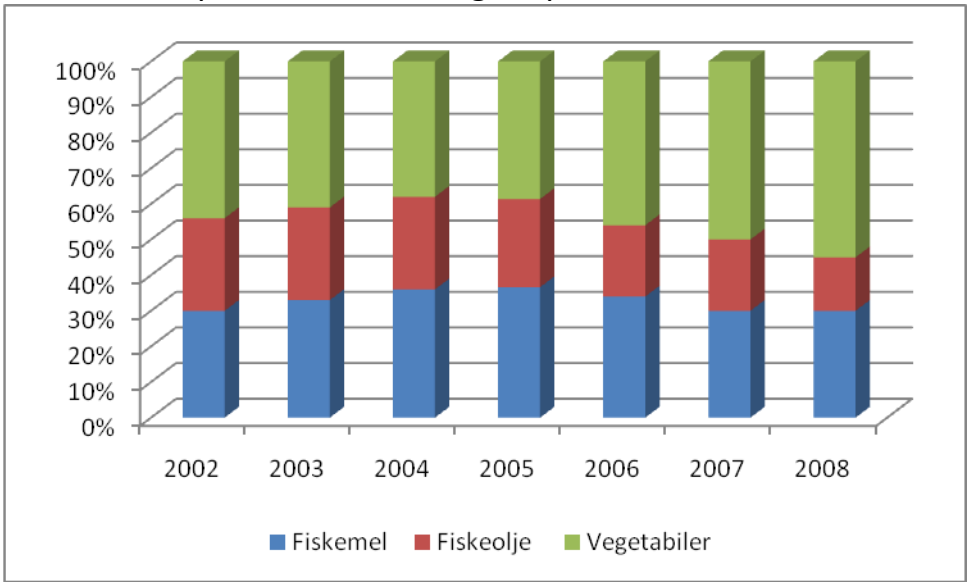
Source: Directorate for Nature Management.

6 a) Feed consumption



Sales of dry fish feed in Norway 1991 – 2008. Source: FHL.

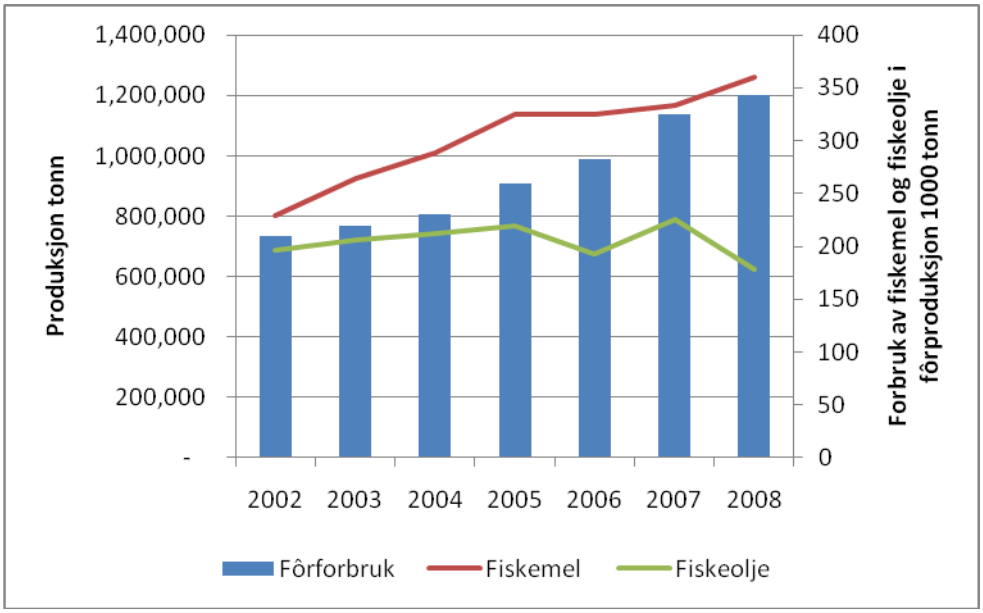
6 b) Composition of Norwegian-produced fish feed.



The composition of Norwegian-produced fish feed, 2002 – 2008.

Figures are based on reports from Norwegian manufacturers. Source: FHL.

6 c) Consumption of marine ingredients in Norwegian feed production



Consumption of fish feed and fish oil in Norwegian feed production in relation to total feed production. Source: FHL.

Annex 3

The Aquaculture Escape Commission

- The Aquaculture Escape Commission is a government-appointed committee set up by the Ministry of Fisheries and Coastal Affairs in the summer of 2006.
- The Commission systematically collects information and carries out investigations in order to discover sequences of events and reasons for escapes. The aim is to ensure that there is a better understanding of escapes and to help identify measures that can prevent them from occurring.
- The Commission gives advices to the Directorate of Fisheries in order to improve the regulations and surveillance.

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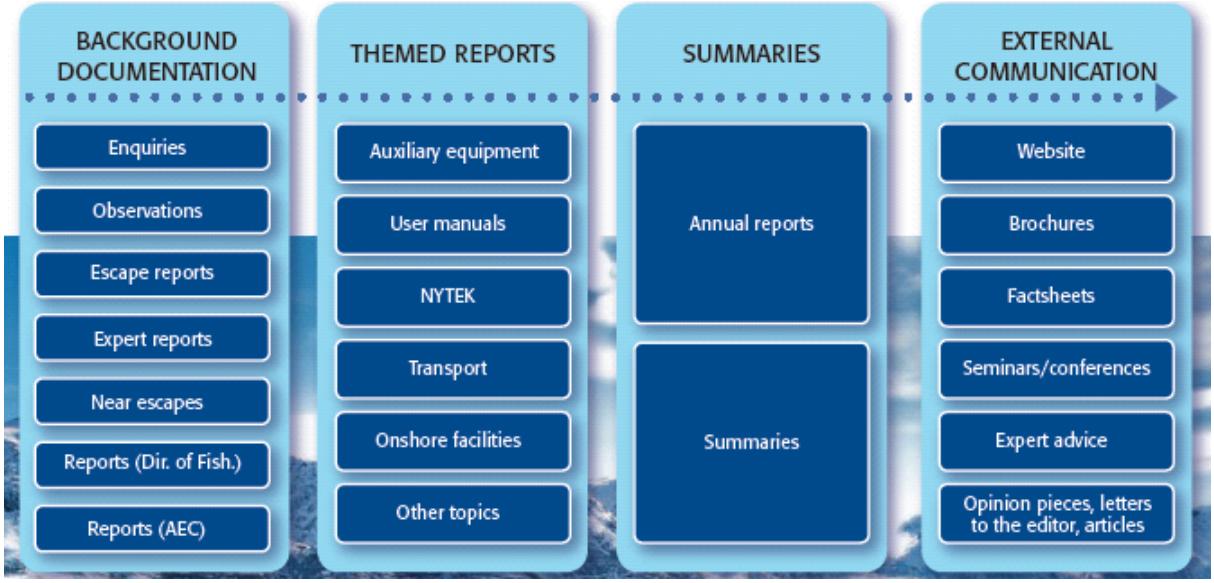

BACKGROUND DOCUMENTATION
Enquiries
Observations
Escape reports
Expert reports
Near escapes
Reports (Dir. of Fish.)
Reports (AEC)
THEMED REPORTS
Auxiliary equipment
User manuals
NYTEK
Transport
Onshore facilities
Other topics
SUMMARIES
Annual reports
Summaries
EXTERNAL COMMUNICATION
Website
Brochures
Factsheets
Seminars/conferences
Expert advice
Opinion pieces, letters to the editor, articles

Most of the input for the work is provided by inspectors from the Directorate of Fisheries. The commission also co-operates close with scientific institutions.

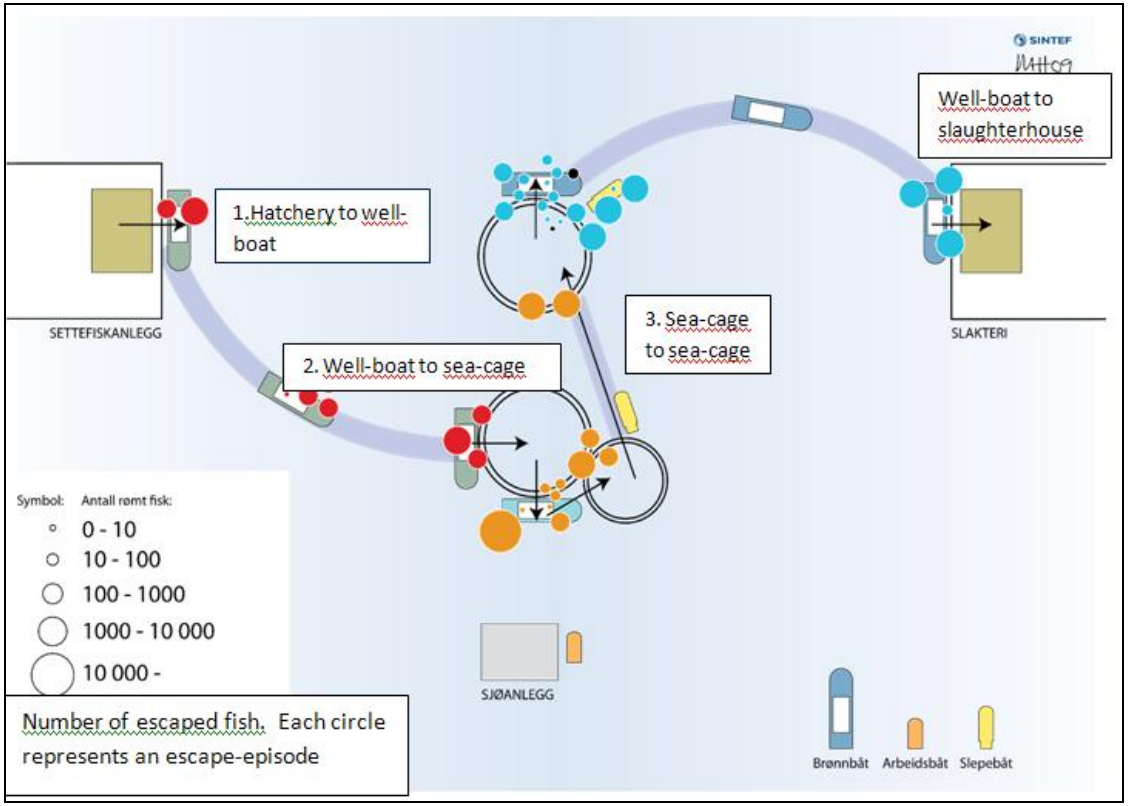

SINTEF
Well-boat to slaughterhouse
1.Hatchery to well-boat
SETTEFISKANLEGG
2. Well-boat to sea-cage
3. Sea-cage to sea-cage
SLAKTERI
Symbol: Antall rømt fisk:
0 - 10
10 - 100
100 - 1000
1000 - 10 000
10 000 -
Number of escaped fish. Each circle represents an escape-episode
SJØANLEGG
Brønnbåt
Arbeidsbåt
Slepebåt

Figure An example from one of the reports ordered by the Aquaculture Escape Commission showing how escape episodes occur during transportation.

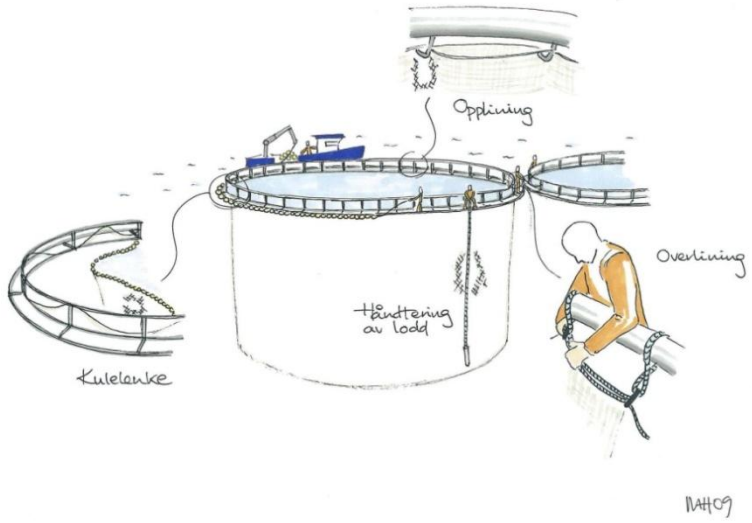


Figure showing critical operations that can lead to holes in net etc.

The Escape Commission focuses on the reasons why fish escapes. See the next figures.

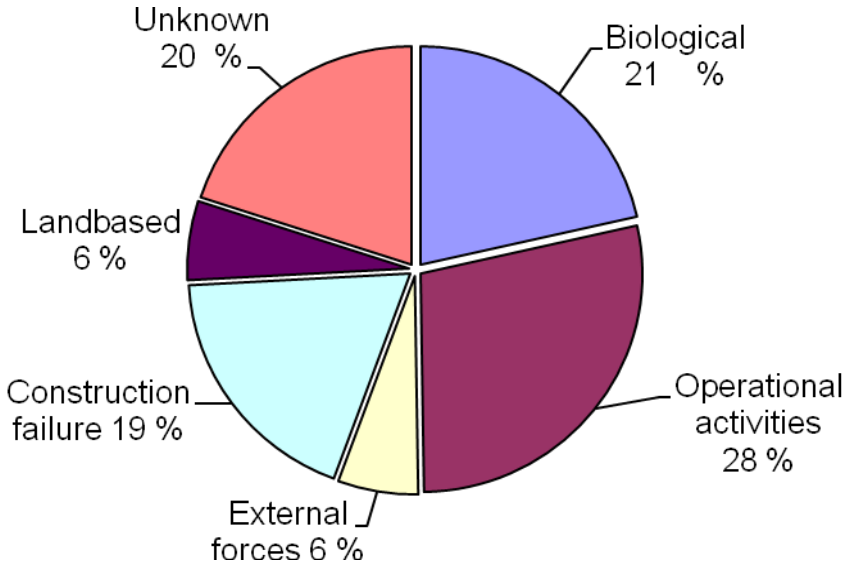


Fig. **Reasons why fish escapes - related to numbers of incidences from 2006-2009.**

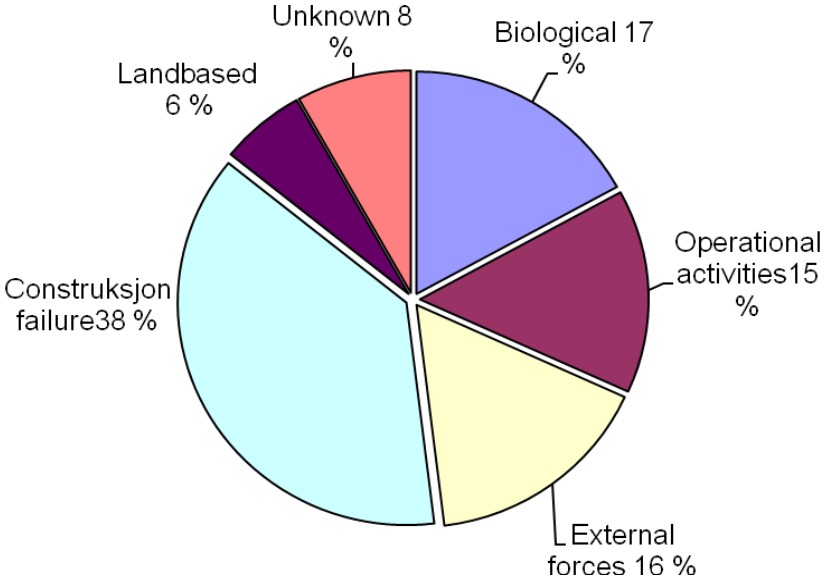

Unknown 8 %
Biological 17 %
Landbased 6 %
Operational activities15 %
Construksjon failure38 %
External forces 16 %

Fig. Reasons why fish escapes - related to numbers of fish that have escaped.(2006-2009).

Remarks.

Biological causes include predators and biting by fish.

Land based refers to producers of smolt/juveniles.

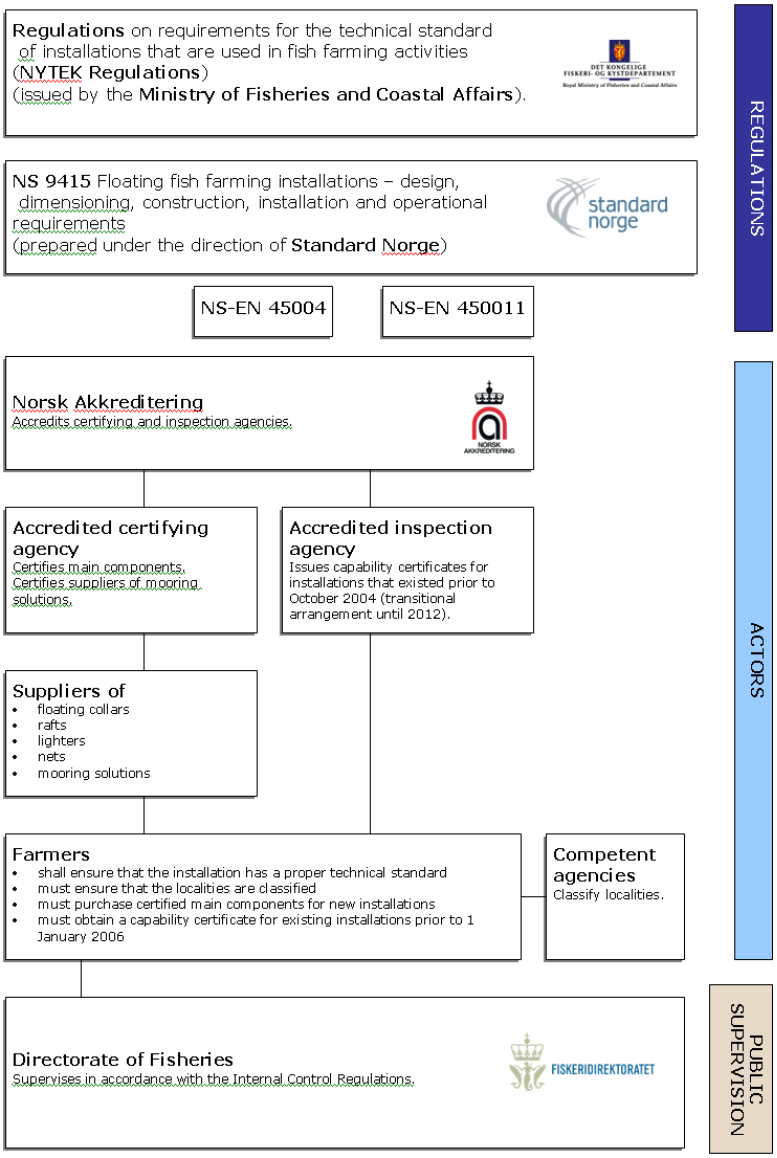
External forces include sabotage, drifting material, trawling to close … etc.

Considering the reasons why salmons escape we present some modified diagrams made by the research institution SINTEF. The diagrams are based upon information from 205 incidences reported between October 2006 to October 2009. The figures also include episodes where fish escapes from farms producing rainbow trout and cod. The category "Biological" is a little biased, since cod bites holes in net pens and salmon does not. When we look at salmon exclusively, other causes will count more.

Annex 4

Technical requirements to floating fish farm, NYTEK

A report from The Norwegian Ministry of Fisheries and Coastal Affairs.(2005)



One of the greatest environmental challenges that the fish farming industry has faced and faces is the escape of farmed fish. There are many causes of escape – ranging from poor operating routines, boat collisions and attacks by predators to technical installation failures.

The authorities and the industry have worked on determining what technical requirements should be placed on floating fish farming installations to prevent escape and how this should be regulated since the mid-1980s. This work was difficult, especially because floating fish farming installations are one of the most complicated marine constructions in existence.

The solution to this problem was the development of a Norwegian standard that places technical requirements on the dimensioning, design, installation and operation of floating fish farming installations – NS 9415:2003.

This standard, which is the first of its kind internationally, was developed by Standard Norge in cooperation with representatives from the industry, research institutions and authorities. Standard Norge is currently working on internationalization of the standard through ISO.

Photo: Per Eide,
Norwegian Seafood Export Council

NS 9415 Floating fish farming installations – design, dimensioning, construction, installation and operational requirements

This standard contains requirements for the physical design of the installation and the associated documentation. This includes calculation and design rules, as well installation, operating and

maintenance requirements.

There are, for example, requirements for the physical design of all the main components in an installation, functionality after assembly, and how the installation shall be operated to prevent escape.

The standard stipulates what parameters shall be used to determine the natural conditions at a given locality and the procedure for classification of localities.

To ensure that the standard is observed by the farmers, the Ministry of Fisheries and Coastal Affairs has laid down regulations no. 1490 of 11 December 2003 on the technical standard of installations that are used in fish farming activities (the NYTEK Regulations).

The regulations stipulate that farmers can only use new installations and main components that are certified in accordance with NS 9415 and that such certification shall be performed by accredited certifying agencies.

Existing installations are required to have a capability certificate stating that the installation meets the operational requirements in NS 9415 by 1 January 2006 in accordance with the regulations. Capability certificates may only be issued by accredited inspection agencies.

What is a standard ?

A standard is a voluntary contract document that describes a good, service and/or work process. The purpose of standardization is to ensure uniformity, order and simplification, and to contribute to efficient operations and increase profitability. Standards provide equal competition terms and make the rules of the game known.

International standards shall contribute to the elimination of technical trade barriers and safeguard health, safety and environmental requirements.

Standardization work is based on the following main principles:

Openness

Voluntarism

Consensus (which entails a process and negotiations)

Section 31 of the Operating Regulations for Aquaculture places a general ban on releasing fish from fish farming installations.

Farmers also have a general obligation to prevent the escape of fish and to ensure that any escape is detected as quickly as possible so that the escape can be limited. The farmers shall assess the risk factors associated with the escape of fish and implement systematic measures to prevent the escape of fish.

Before a farmer can purchase new installations or receive a capability certificate for existing installations, he must have the locality classified based on the local wind, current and wave conditions in accordance with the NYTEK Regulations. This classification shall be performed by a competent agency, cf. Section 7 of the NYTEK Regulations.

Farmers are obligated to purchase installations and components that are certified by an accredited certifying agency for the purchase of any new installations or main components.

For mooring, a special certification scheme for suppliers of mooring solutions has been established. Certification of the entire installation at a locality is not required. However, it is very important that the main components fit together. The capabilities and limitations of the main components shall be stated in the user handbook.

Photo: Jean Gaumy, Norwegian Seafood Export Council

When a farmer receives an installation or main component, it shall be accompanied by a user handbook that shall be certified together with the product.

The farmer is obligated to install or assemble the installation or main component as described in the user handbook, and he is also obligated to observe the maintenance requirements stated in the user handbook, cf. Sections 10 and 15 of the NYTEK Regulations.

For existing installations, the farmers must obtain a capability certificate from an accredited inspection agency by 1 January 2006. The farmers are obligated to maintain installations for which a capability certificate has been issued so that their technical standard is not reduced significantly in relation to the standard at the time prior to when the certificate was issued, cf. Section 16 of the NYTEK Regulations.

The NYTEK Regulations and Section 31 of the Operating Regulations for Aquaculture apply complementarily. This means that a farmer must assess the technical aspects of his installation in accordance with the risk assessment pursuant to Section 31 of the Operating Regulations for Aquaculture, regardless of whether the installation is certified or has a capability certificate.

If a farmer finds, for example, that an installation with a capability certificate has been moored poorly, he must immediately implement measures and not wait until an inspection agency inspects the installation again for the issuance of a new capability certificate.

About the Ministry of Fisheries and Coastal Affairs and the Directorate of Fisheries

The Ministry of Fisheries and Coastal Affairs (FKD) is responsible for:

Fisheries industry

Aquaculture industry

Seafood safety, fish health and welfare

Harbours, infrastructure for sea transport and preparedness for acute pollution.

The Directorate of Fisheries is a specialist agency under the Ministry of Fisheries and Coastal Affairs that is responsible, for example, for the fish farming industry.

The Directorate of Fisheries is both an advisory and executive agency with respect to the preparation of draft regulations, supervision and control.

FISH FARMING INSTALLATIONS AND MOORING SOLUTIONS

Manufacturers of fish farming installations, including floating collars, rafts, lighters and nets, must have their products certified by an accredited certifying agency if they want to deliver their products to Norwegian fish farming activities. They must also provide a user handbook for the installation or main component, cf. Section 9 of the NYTEK Regulations. This user handbook shall be in accordance with the requirements in NS 9415.

Suppliers of chains, rope, etc., for the mooring og fish farming installations do not require certification. However, anyone who is involved in the dimensioning of mooring solutions for the specific localities must be certified.

Who is Standard Norge ?

Standard Norge (SN) is a neutral and independent member organization that develops standards required by the market. The standards are developed in cooperation with the users, who provide expertise and financing. These users may include companies, industry organizations, the Norwegian authorities, research and educational institutions, accreditation and certifying agencies, and other interested parties.

SN started its operations in 2003, and it is a continuation of the work performed earlier by the Norwegian General Standardizing Body (NAS), Norwegian Council for Building Standardization (NBR), Norwegian Standards Association (NSF) and Norwegian Technology Centre (NTS). Most of the standardization takes place internationally. SN is the Norwegian member of the ISO (International Organization for Standardization) and CEN (European Committee for Standardization). SN has exclusive rights to the development and publication of Norwegian Standards, and it participates in the development of international standards and publishes these in Norway.

ACCREDITED CERTIFYING AGENCIES

The NYTEK Regulations stipulate that all farmers shall purchase new installations that are product certified by an accredited certifying agency.

The main components include floating collars, rafts, lighters, nets and moorings. For product certification, the certifying agency reviews the quality system of the production operations and ensures that the product that is produced is in accordance with the requirements in NS 9415. It shall be possible to trace faults and identify any products that risk having the same fault in the event of any discrepancies.

A special scheme has been established for mooring. This is because each mooring must be adapted to the individual locality and general product certification is thus not a suitable measure for ensuring that fish farming facilities are moored in a secure manner. Instead of product certification of the actual mooring (chains, ropes, etc.), suppliers of mooring solutions must be certified. This means the enterprise or person that dimensions the moorings for the individual locality must be certified.

A list of all the accredited certifying agencies is available on Norsk Akkreditering's website (www.akkreditert.no)..

What is certification?

Certification is the issuance of documentation (certificate) from an independent third party (a certifying agency) that a product or a management system is in accordance with specific requirements.

The requirements may, for example, be based on a standard. A certifying agency is accredited by an accreditation agency. A certificate will accompany the delivery of a certified product.

ACCREDITED INSPECTION AGENCIES

It would be difficult to product certify existing fish farming installations, because it may be difficult to obtain the documentation on the installation that is required to determine whether all the detailed requirements in NS 9415 have been met.

The NYTEK Regulations contain therefore a transitional scheme for installations that were established prior to the regulations entered into force. All existing installations must obtain a capability certificate prior to 1 January 2006, cf. Section 12 of the NYTEK Regulations. The conditions for obtaining a capability certificate entail that all the operational requirements in NS 9415 must be met. However, the same documentation requirements and level of detail for the analysis of the installation do not apply.

Only accredited inspection agencies can issue capability certificates, cf. Section 12 of the NYTEK Regulations. A capability certificate is valid for three years or until a significant change is made to the installation. A new capability certificate must be obtained after that. All fish farming installations shall be certified by 1 January 2012.

Inspection agencies are accredited in accordance with NS-EN ISO/IEC 17020. Fish farming companies may also be accredited as an inspection agency under certain conditions. This standard states, for example, that it is expected that the inspection agencies participate in the exchange of experience with other inspection agencies and participate in standardization processes whenever relevant.

A list of all the accredited inspection agencies is available on Norsk Akkreditering's website (www.akkreditert.no).

COMPETENT AGENCIES

Before a farmer can purchase equipment or receive a capability certificate for an installation, he must have the locality he is using or will use classified based on the local wind, current and wave conditions in accordance with Section 7 of the NYTEK Regulations. This is because the locality's classification governs what dimensions the various main components shall have.

The procedure and criteria for classification are stated in NS 9415. Such classification shall be performed by a competent agency, but it may also be performed by an accredited inspection agency. A competent agency is an agency that can present the relevant professional qualifications to the client and be independent of the client. There is no requirement that the competent agency shall be accredited or certified.

It will be the farmers who hire a competent agency to classify the locality, and thus the farmers must ensure that the agency in question meets the conditions for being a competent agency.

NORSK AKKREDITERING

Norsk Akkreditering shall accredit certifying and inspection agencies, cf. Sections 4 and 5 of the NYTEK Regulations, and it shall ensure thus that the agencies who perform inspections and certifications in accordance with the NYTEK Regulations are qualified to perform these tasks.

Norsk Akkreditering bases the accreditation of certifying agencies on NS-EN 45011 – General requirements for agencies having systems for product certification, and assesses the quality system, qualifications and capability of the applicants in relation to the certification of floating fish farming installations in accordance with NS 9415.

Who is Norsk Akkreditering?

Norsk Akkreditering is the government agency that controls quality and quality control in Norway.

Organizationally, the accreditation agency is under the Ministry of Trade and Industry.

Professionally, Norsk Akkreditering is bound by several international agreements. In order to participate in these agreements, Norsk Akkreditering regularly reviews the control performed by a group of corresponding agencies in other countries. A common understanding of quality assurance is ensured in this manner.

Norsk Akkreditering is, for example, a member of the European Co-operation for Accreditation (EA). This membership ensures that Norsk Akkreditering has the same quality control as corresponding agencies in the EU.

Norsk Akkreditering bases the accreditation of inspection agencies on NS-EN ISO/IEC 17020:2004 General operating requirements for various types of agencies that perform inspections. NS-EN ISO/IEC 17020 has replaced NS-EN 45004, which is the standard mentioned in the regulations.

This standard stipulates general requirements concerning qualifications and an independent position. To determine what qualification requirements shall apply, Norsk Akkreditering compares the requirements in NS-EN ISO/IEC 17020 against the requirements in NS 9415. The key subject of evaluation is what qualifications are required to assess a floating fish farming installation against the requirements in NS 9415.

An accreditation is valid for five years. In addition, Norsk Akkreditering annually controls the agencies that are accredited.

What is accreditation?

Accreditation is governmental quality control. Laboratories, certifying agencies and inspection agencies may be subject to accreditation. The accreditation process entails a review of the quality system, qualifications and capability of the agency that is to be accredited.

An accredited organization has proven its qualifications through a neutral assessment by the accreditation agency. Organizations acquire accreditation to document their quality in relation to customers, requirements they place on themselves, or to fulfil requirements from the authorities.

MINISTRY OF FISHERIES AND COASTAL AFFAIRS AND DIRECTORATE OF FISHERIES

The NYTEK Regulations are issued by the Ministry of Fisheries and Coastal Affairs, which is the ministry that is responsible for making any amendments to the regulations.

The Directorate of Fisheries is responsible for the enforcement of the regulations. The Directorate of Fisheries is mainly responsible for three tasks in this context:

Supervising that the requirements in the NYTEK Regulations are observed. This is performed primarily through system audits based on internal control.

Answering questions concerning the interpretation of the regulations from industry participants and others.

DET KONGELIGE
FISKERI- OG KYSTDEPARTEMENT
Royal Ministry of Fisheries and Coastal Affairs

Deciding on applications for exemption from requirements in the regulations.

FISKERIDIREKTORATET

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Annex 5

Vision zero escape

Annex 5

NEW VISION NO ESCAPEES 2008-2009

Endorsed by the General Director of Fisheries 18.12.2007

Action group	What is the goal	How do we solve the problem
Motivate (01) Urge for desirable conduct through positive means	Obtain a positive focus and incitement for desirable action and attitude	(1) Hand out the Directorate of Fisheries environmental prize during Aqua Nor 2009 (2) Review ”Smiley Fish” – hand out when zero deviations after auditing? Possible list on the internet. (3) Standardised introduction regarding attitude towards escapes during audits etc (4) Procedure for better interaction with the insurance industry
Demand (02) Development of regulations	Examine possible regulation amends with the intention of preventing escapes	(1) Prepare a proposal for a revised NYTEK - regulation (2) Implement the work task at hand in the regulation committee - escapes (3) Prepare a proposal for the regulation regarding National Salmon Fjords/National Salmon Rivers (NLV/NLF) (4) Examine restrictions for moving fish (both the moving as such, and size requirements to fish/mesh?) (5) Propose regulations for transportation to/from aquaculture installations (6) Examine regulation demands for slaughteries (7) Examine provisions for time restricted biomass reduction and compulsory transfer
Measure (03) Monitor escaped fish and their harmful effects	Follow up the agreement regarding monitoring and make visible the need for suitable effect monitoring of escaped fish	(1) Follow up the commitment in the monitoring program concerning NLF/NLV (2) Propose the implementation of the monitoring program to Ministry of Fisheries and Coastal Affairs
Investigate (04)	Perform investigations into escape	(1) Investigation of scenes under the direction of the Directorate of Fisheries’ regional office

Action group	What is the goal	How do we solve the problem
Investigation of scenes. Assist the Escape Commission for Aquaculture (RKA)	episodes and collect information in harmony with the RKA and also on own accord.	(2) Manage the secretariat for the RKA (3) Report the RKA' work and results to the Ministry of Fisheries and coastal Affairs (4) Evaluate the RKA' work
Follow up (05) Follow up the demands for technical standards in the aquaculture industry	Ensure that the provisions for technical demands in the regulations are respected by the industry	(1) Audit, inspection and investigation of scenes in response to an escape (2) React to apparent breaches of regulations (3) Active and predictable follow up of equipment contractors and accredited companies where there is suspicion or flaws (4) Active dialogue with Norwegian Accreditation (NA) regarding effective follow up of current documents and accredited companies (5) Control campaign on smolt escapements 2008

Action group	What is the goal	How do we solve the problem
Amend (06) Better implements for the administration	Better implements for the administration	(1) Examine mandatory adipose fin clipping together with the Norwegian Food Safety Authority (2) Better positioning of aquaculture installations (Project STAK) (3) Order yearly environmental risk assessment reports for Norwegian aquaculture (4) Plan and implement contingency response exercises with regards to escapes (5) Implement possible instructions from the Ministry of Fisheries and Coastal Affairs concerning sterile salmon (6) Establish permanent procedures and standard equipment packages for sampling and tracking fish with regards to escapes from unknown source (7) Checklist for inspections (8) New instructions with regards to escapes (9) Joint instructions for the Norwegian Nature Inspectorate/County Govenors Environmental Department with regards to escapes (10) Interogating procedure with regards to escapes pursuant to own and RKA' categories. Linkage of this information to case lists. (11) Adapt procedures for registering escape cases for unknown source (12) Escape register as part of a new aquaculture register

Action group	What is the goal	How do we solve the problem
Standardize (07) Standardizing with regards to systemizing good actions	Initiate standardizing within own areas for the achievement of better security measures regarding escapes	(1) Participate in the international standardization work ISO/TC.234 and the corresponding Norwegian Standard NS/K 278 (SN). (2) Consider recommending NS for smolt facilities (3) Examine the need for NS for user handbooks
Communicate (08) Information and communication actions concerning escapes	Implement dialogue and communication that sets focuses on the work against escapes through appropriate measures	(1) One-day conference regarding escapes at Aqua Nor 2009 (2) Communicate quarterly statuses regarding vision NO ESCAPEES on the internet (3) Implement annually dialogue meetings with the industry (4) Accumulate experience involving the regional offices, RKA and the industry (5) Internet page/gateway for the industry where information regarding rules and regulations etc. are clearly laid out (6) More active journalism tied to escapes (Fiskets Gang) (7) Monthly updates of all cases and aggregated lists regarding escapes
Share (09) Describe good assessments and practice with regards to risk operations that illustrate the regulations functional demands	Communicate important knowledge concerning practise, which reduce the risk of escapes to staff members, producers and contractors.	Implement the project AkvaBest; (1) Internal experience registry in the Directorate of Fisheries (2) Version 1 of the experience registry on the internet

Action group	What is the goal	How do we solve the problem
Learning (10) Competence requirements for own employees, employees in the aquaculture industry	Implement competence requirements	(1) Define competence requirements for the Directorate of Fisheries' employees (2) Implement internal courses (3) Contribute to better tuition (courses) regarding aquaculture at sixth form comprehensive schooling (4) Contribute to courses for the industry; offer organisations a series of lectures (5) Identify and establish a few special competence regions for the work against escapes
Evaluate (11) Implement evaluation of Vision NO ESCAPEES and report to the Ministry of Fisheries and Coastal Affairs	Evaluate and report the efforts made visuable in vision NO ESCAPEES through practical methods	(1) Midway evaluation the progress during Nov. - Dec. 2008. (2) Report evaluation to the Ministry of Fisheries and Coastal Affairs (3) Ex-post evaluation of the progress during Nov. - Dec. 2009