Agenda Item 7.3
For information

COUNCIL

CNL(06)30

Draft Implementation Plan - Norway

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1. Introduction

1.1 Objectives of the national management strategy

The legal basis and overall goal for the management of wild Atlantic salmon is expressed in section 1 Objective of the "Act Relating to Salmonids and Fresh-Water Fish etc.":

"The objective of the Act is to ensure that natural stocks of anadromous salmonids, fresh water fish and their habitats, as well as other fresh-water organisms, are managed in such a way as to maintain natural diversity and productivity. Within this framework, the Act shall provide a basis for the improvement of stocks with a view to raising yields for the benefit of holders of fishing rights and sports fishermen.

Build on this legal basis and after a process including extensive stakeholder involvement the following goal for the management of wild Atlantic salmon was adopted in 1997 by Directorate of nature management and approved by the Ministry of environment:

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 habitat. Salmon habitat should be managed to preserve diversity of nature and its productive capacity.

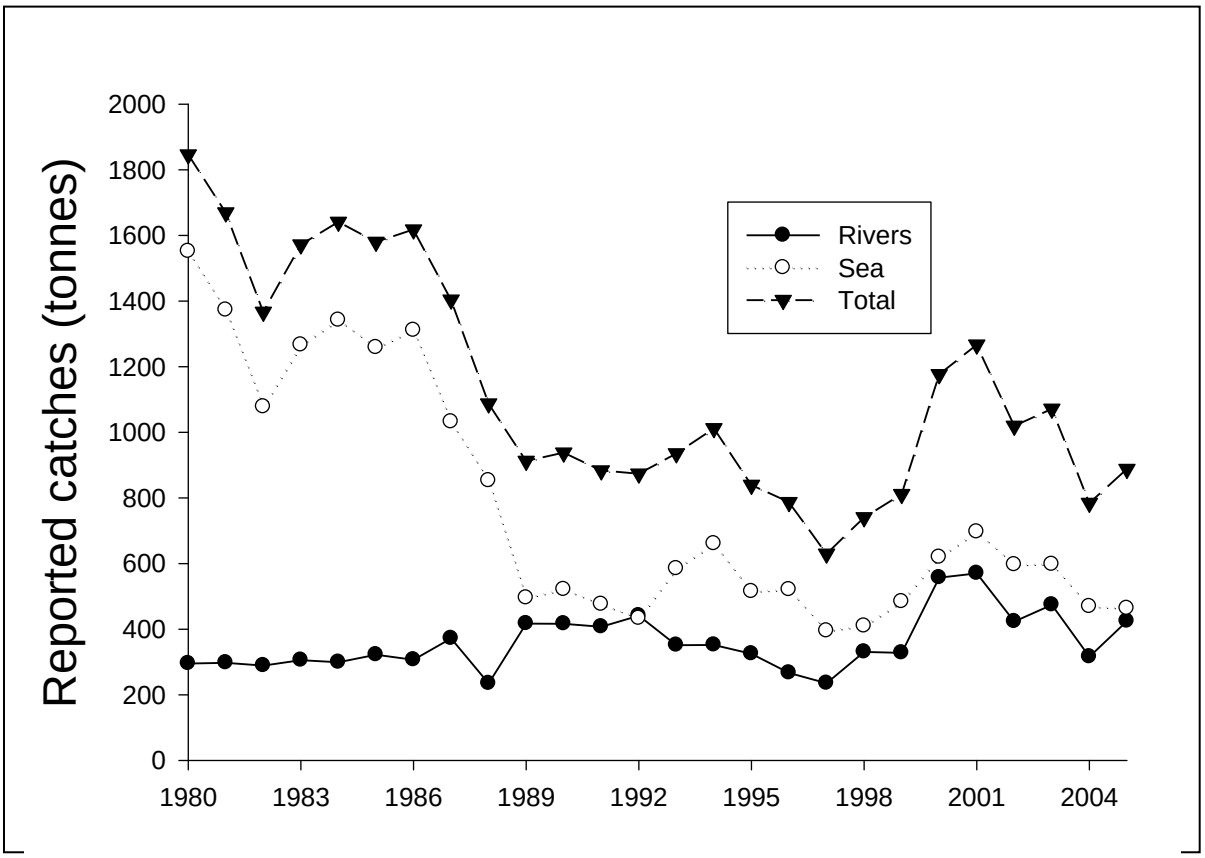
Threats and adverse impacts shall be identified and eliminated. Wherever this is not possible, adverse impacts on the production, abundance and composition of salmon stocks shall be counteracted or neutralized.

Harvesting of the salmon resource shall rest on the principle of sustainable resource management and the interests of different user groups and stakeholders shall be safeguarded.

1.2 Nature and extent of resource

Norway has 446 rivers with self-reproducing Atlantic salmon stocks, and about 40% of the remaining overall catches in the North Atlantic are caught in Norwegian coastal waters and salmon rivers. The wild salmon has historically been, and still is, important to Norwegian and Sami culture. Originally as a source of meat and spiritual value for the first inhabitants of the country, the Norwegian wild salmon stocks caught the attention of British anglers in the mid-1800s. Since then the biggest revenue from wild salmon is derived from selling fishing permits and providing food, accommodation, guiding etc. to foreign as well as Norwegian anglers. Approximately 150-200.000 anglers fish for salmon and sea trout every year. Most salmon rivers are located away from the major towns/cities of Norway, thus wild salmon is of significant economical value to the rural countryside. The socio-economic value of the 50 most important wild salmon stocks is estimated to be around 20 billion NOK (2,5 billion €) (Naverud 2001).

1.3 Overview of fisheries, including the existing management regime



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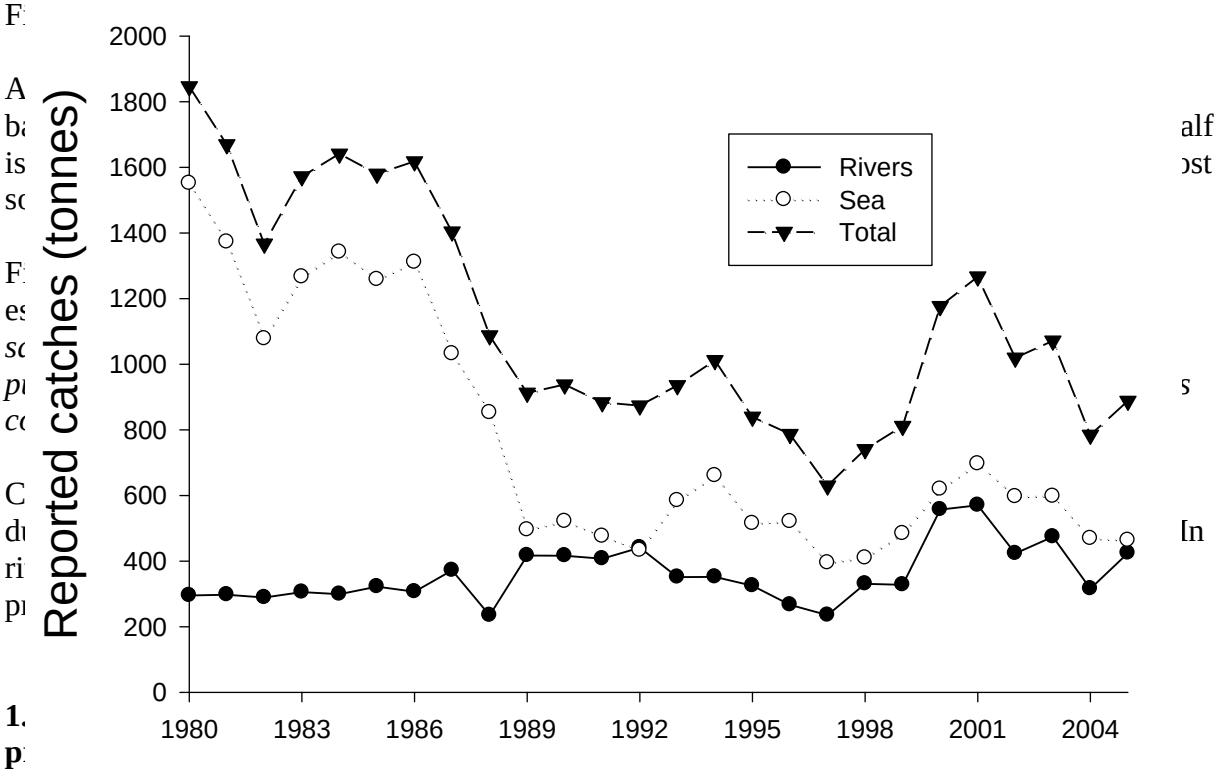

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Although the responsibility for the management of wild Atlantic salmon and the regulation of fisheries both in fresh- and salt water lies with the Ministry of environment (founded on "Act Relating to Salmonids and Fresh-Water Fish etc". No. 47 of May 1992) the responsibility and legal means to regulate most of the factors affecting salmon and salmon management lie with

other authorities and industries. The most important challenges, authorities and legislation involved in or affecting salmon management are shown in table 1.

Table 1: *Challenges, responsible authorities and legislation in salmon management*

CHALLENGES	**RESPONSIBLE AUTHORITIES**	**LEGISLATION**
Management of Salmon stocks	Environmental Authorities	Act relating to Salmonids and Fresh-Water Fish etc.
Hydropower development	Water Recourses Authorities, Environmental Authorities	Water Resources Act; Watercourse Regulation Act
Fish farming	Fisheries-, Environmental-, Veterinary- and Water Recourses Authorities	Aquaculture act; Food Safety Act, Pollution Control Act
Pollution	Environmental Authorities	Pollution Control Act
Gyrodactylus salaris	Directorate for Nature Management and Food Safety Authority	Act relating to Salmonids and Fresh-Water Fish etc.; Food Safety Act
Acid precipitation	Environmental Authorities	Pollution Control Act, Acid Precipitation Convention
Bycatch	Fisheries Authorities and Environmental Authorities	Act relating to sea-water fisheries, etc.; Act relating to Salmonids and Fresh-Water Fish etc.
Physical habitat deterioration in and along watercourses	Water Recourses-, Environmental-, Transport-, Agriculture-Authorities and Municipals	Water Resources Act; Act relating to Salmonids and Fresh-Water Fish etc.; Act relating to Land; Planning and Building Act

2. Status of stocks

2.1 Abundance

The total return of salmon to Norway has been estimated for the years 1984-2005. Numbers are shown in figure 2.

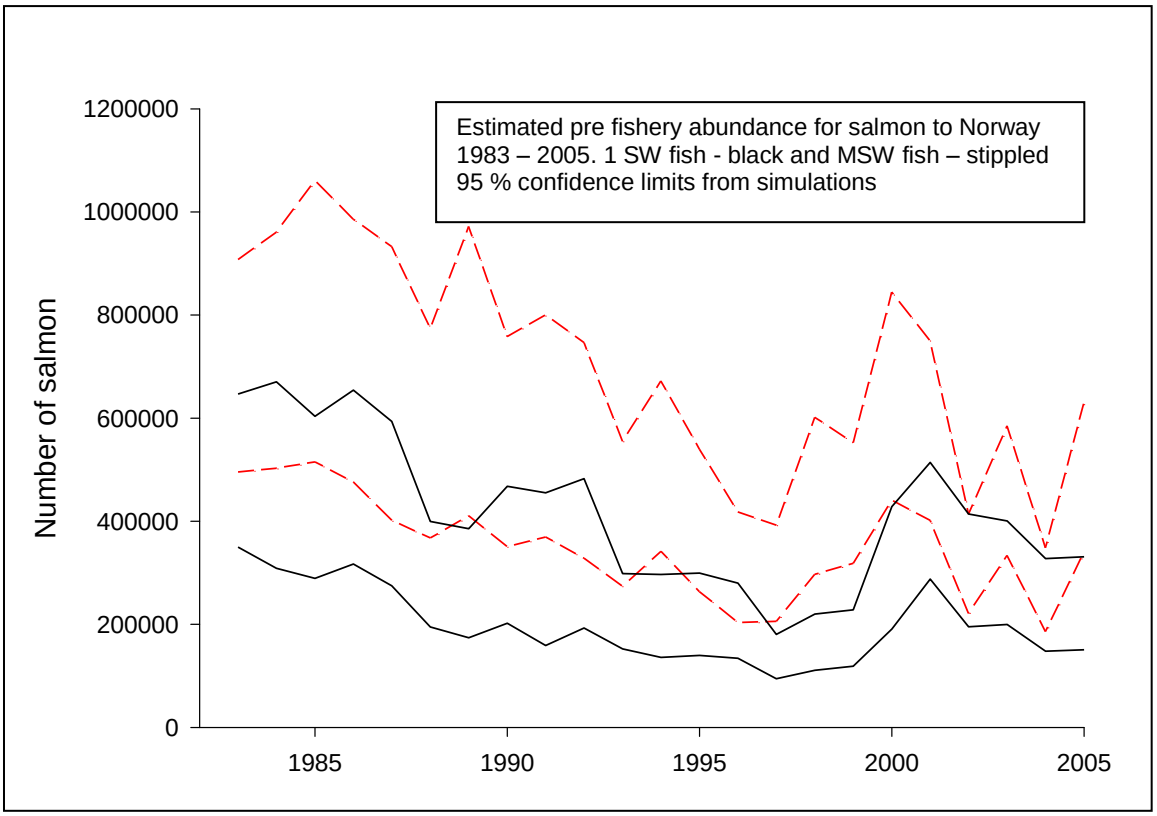

Figure 2: Estimated pre fishery abundance for salmon to Norway 1983 – 2005. 1 SW fish - black and MSW fish – red. 95 % confidence limits from simulations

In order to detect regional variations the coastline has been divided into 3 regions Southern Norway (from the Swedish border to Stadt), Mid Norway (from Stadt to Vesterålen) and Nothern Norway (from Vesterålen to the Russian border). Estimates for the three regions are shown in figures 3, 4 and 5.

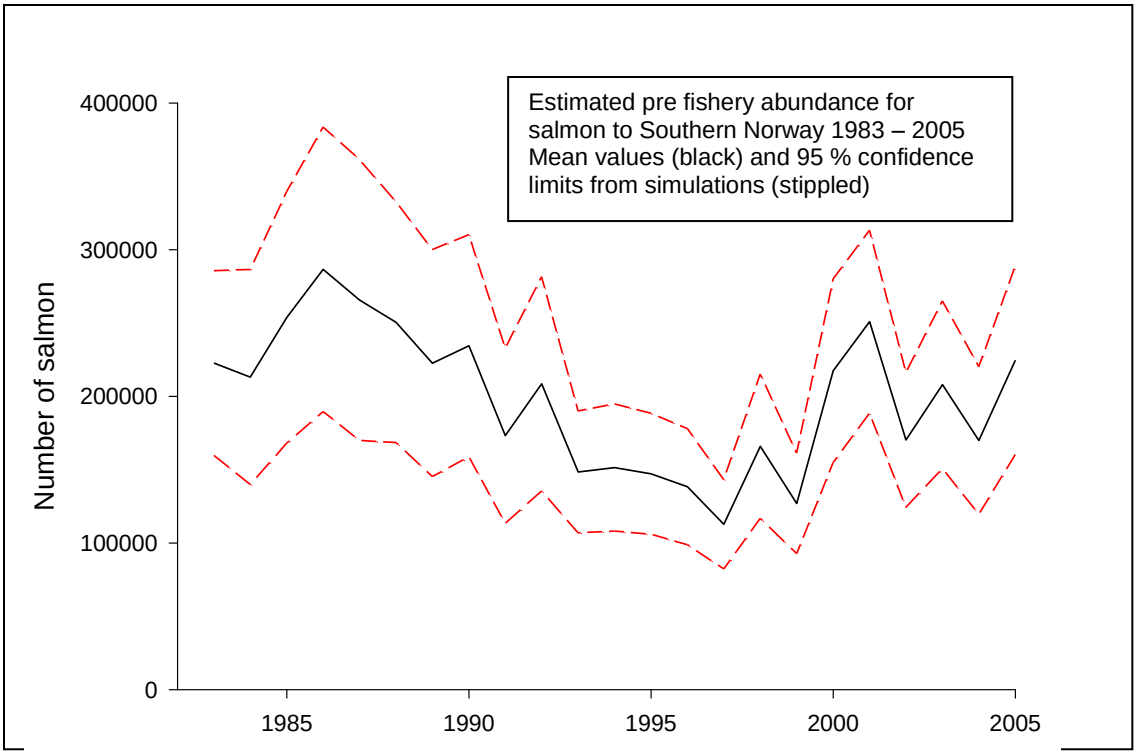

Figure 3: Estimated pre fishery abundance for salmon to Southern Norway 1983 – 2005.

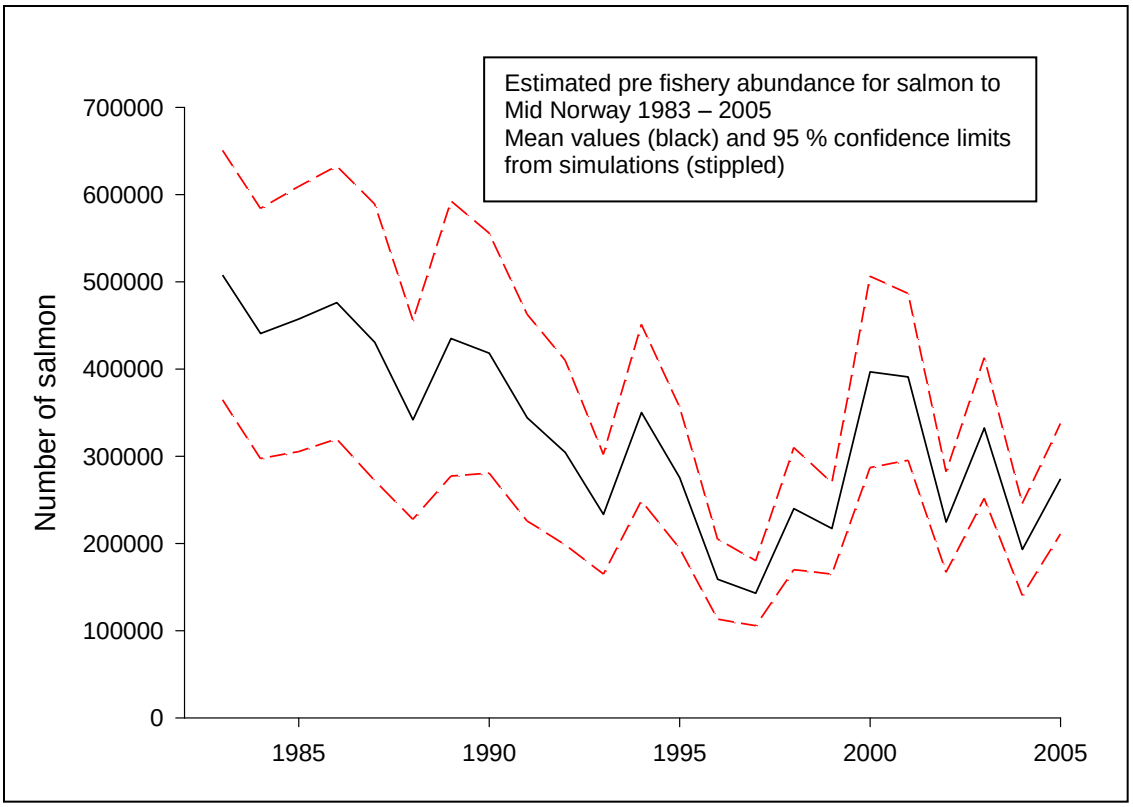

Figure 4: Estimated pre fishery abundance for salmon to Mid Norway 1983 – 2005

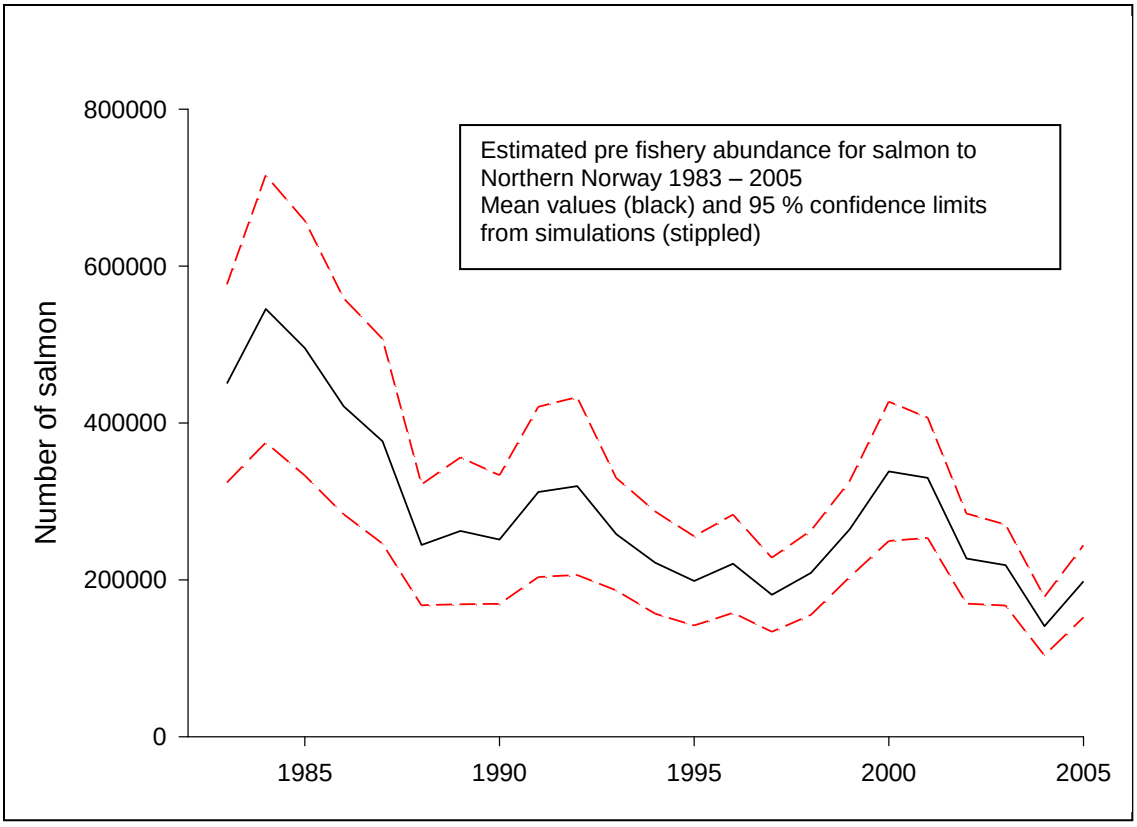

Figure 5: Estimated pre fishery abundance for salmon to Northern Norway 1983 – 2005

2.2 Diversity

In Norway there is only one yearly "salmon run", whereas in other parts of Europe there may bee a "spring run" and a "summer run". The salmon is widely distributed from the temperate South to the arctic North. There are numerous small populations and some large ones. There is large variation in phenotype and life history traits between stocks, reflecting the diverse conditions under which the salmon lives. A survey made by the Norwegian Institute of Nature Research in 2004 defined several categories of stocks based on duration of stay at sea and body size. : "Typical grilse stocks" (consists predominantly of salmon that spends one winter at sea), "grilse stocks with large grilse", "2SW stocks (with a large component of salmon that spends two winters at sea), and MSW stocks" (consists predominantly of salmon that spends two or more winters at sea). The "typical grilse stocks" are found mainly at the coast, while "2SW and MSW" stocks are found in the innermost part of the fjords. Norway has also two stocks of landlocked salmon.

Norway is perhaps the country were Atlantic salmon shows the greatest diversity. Nevertheless, diversity in Norwegian salmon has been little studied and documented. There is little knowledge about how various human activities impacts diversity, except in cases were entire stocks have been lost. The best-documented case is the selective effect of gillnets. During the height of the drift net fishery in the 1970'ies and 80'ies, the fishing pressure was much higher on 2 sea winter fish than on grilse. After the ban on gillnets, gear selectivity has not been regarded a serious problem. The biggest threats to salmon diversity today are the lethal parasite *Gyrodactylus,* and crossbreeding between wild salmon and escaped farmed salmon.

2.3 Threatened or endangered stocks

In order to compile an overview over stock status and keep track of developments the Directorate for Nature Management established a salmon stock registry in1993. The registry is based on information collected from a number of sources, including local salmon management authorities. This registry contains a category system for salmon (se ANNEX I), which is a classification of rivers based on the condition of the salmon stock in relation to adverse human impact. Category assignment is based on an overall judgement taking into consideration all factors of importance for the stock's existence and production. Only rivers that have or have had a self-reproducing stock are categorized. The system was significantly revised in 2002 and has resulted in a reduction of the number of salmon stocks compared with the previous version of the system.

The assessment from 2005 showed that 45 of 446 wild stocks are recognized as extinct, 30 threatened and 32 near threatened as displayed in table 1.

Table 1. Categorisation of salmon rivers updated by January 2006. The table shows the number of watercourses that have or have had self-reproducing salmon stocks by county and category, and the number of watercourses affected by various factors (only the impact-factor(s) which is decisive for assigned category is/are shown). One watercourse might be affected by several impact factors.

County	Number of watercourses with self-reproducing salmon stock	Category									Factor decisive for assigned category										
		1	2	3a	3b	4a	4b	5a	5b	X	Hydro-Power development	Other habitat deterioration	Acidification	Pollution by agriculture	Other water pollution	*Gyrodactylus salaris*	Sea-Lice	Other Fish Diseases	Overexploitation	Unknown factor	Other factors
Østfold	2							2			1	1	1	2	2						
Oslo og Akershus	10			8		2					3	7		4	6						
Buskerud	3				2			1								2					
Vestfold	3		2					1			1	1		1	1	1					
Telemark	3	1				1		1			3										
Aust-Agder	1		1								1										
Vest-Agder	9	3		1	5								8		1						
Rogaland	32	3		3	6	6		11		3	7	1	13	3	2					1	1
Hordaland	23	6	8	2	3	1		3			7		9		2		12			1	
Sogn og Fjordane	31	4	1	2	1	4	4	15			7	1	9			1	16				
Møre og Romsdal	62		9			7		34	12		7	4				8					
Sør-Trøndelag	58	4		2		23	1	22	6		16	13		8	1						1
Nord-Trøndelag	32	4	4	4		2		16	2		9	1				1		1			1
Nordland	99	16	1	5		15	1	51	10		15	5	1	4	2	11	2				5
Troms	36	1	2	5		1		25	2			1				2			2	1	7
Finnmark	42	3	2			1		20	11	5	6	2							5		1
The whole country	**446**	**45**	**30**	**32**	**17**	**63**	**6**	**202**	**43**	**8**	**83**	**37**	**41**	**22**	**17**	**26**	**30**	**1**	**7**	**3**	**16**

3. Threats to stocks, and current management measures

An overview over the most important adverse human impacts is given in table 1.

Acidification and infections by *Gyrodactylus salaris* are so far considered to be the main reasons for salmon stocks getting extinct or threatened by extinction. Hydropower development is the single most widespread adverse human impact in salmon rivers in Norway, resulting in the loss of stocks and significant reductions in the productive capacity of salmon rivers and salmon production. Infections by sea lice are considered to have lead to significant reductions in salmon returns due to unnatural high smolt mortality in years and regions with high levels of infestation rates. Based on the latest research results interbreeding between escaped farmed and wild salmon is now considered to be amongst the most severe threats to the further long-term existence of wild Atlantic salmon stocks in Norway.

Based on this information Norway has decided to focus on the following management areas and factors:

- Salmon Fisheries
- Acidification
- Hydropower development
- Other habitat deterioration
- Escaped farmed salmon
- Sea lice
- *Gyrodactylus salaris*

3.1 Salmon fisheries

Background
A background and overview on Norwegian salmon fisheries are given in section 1.3.

Status
Since 1986 there has been a significant reduction in fishing effort with marine fishing gear in Norway. The most significant measure was the ban on the drift net fishery from the 1989 fishing season. In recent years some significant regulations were introduced in Norwegian home waters. The most important was the ban on the use of bend nets along the Norwegian coast from the county of Rogaland to county of Troms in 1997. This resulted in a significant decline in the fishing effort with this gear. In 2003 the use of this gear was banned throughout the country, except in the northernmost county of Norway, Finmark. In 1998 the fishing season for bagnets was shortened by two weeks in the beginning of the fishing season at the west coast of Norway. The purpose of these regulations was to reduce exploitation on MSW salmon. The number of bend nets registered in 2005 was 661, the second lowest in the time series 1986-2005. The number of bagnets in use in Norway has been relatively stable in recent years, and in 2005 1,453 nets were registered, the lowest number since 1988. Since 1990 till present all adjustments and reductions of the salmon fishing season in different areas of the country have contributed to gradually reduce the overall fishing effort in sea fisheries significantly.

In the same period of time all fisheries on threatened stocks in rivers have been closed, and the fishing season has been shortened and/or the starting date has been postponed in most rivers.

Catch and release is not introduced as a management measure. Instead fishing pressure is adjusted according to the current status of the stocks.

The introduction of quotas in fishing regulations was considered by a Working Group, which was established by Directorate for nature management. Both river and coastal fisheries interests and fishing right holders both in rivers and along the coast were represented. The Working Group concluded that we didn`t yet have the necessary management tools to develop a system based on quotas, that was better and more precise than the system we already have.

In 2003 a 5-year regulatory regime was introduced as a means of rationalizing regulatory procedures, and in order to bring in new and revised guidelines for the management of salmon fisheries. In preparation for the 5-year regulatory regime the Norwegian Authorities undertook a comprehensive survey of the status of the stocks. The revised category-system was employed in the survey and the country was divided into 15 Regions with various regulatory measures in the sea fisheries according to the status of the salmon stocks in the region. The new system covers many of the questions raised in the NASCO Decision Structure for Management of North Atlantic Salmon Fisheries. The Decision Structure was then widely used in determining the regulatory regime. The regulations will be reviewed every year during the 5-year period and adjustments made only when it's urgent and can't wait till next period.

With a few exceptions fishing rights in freshwater belong to the owner of the shoreline. Along the coast owners of shoreline have the fishing right for fishing with bag-nets, bend- nets, etc. .

Responsible authorities
Ministry of environment: Overall responsibility
Directorate for nature management: Responsible for salmon management at a national level, regulates coastal fisheries and develops guidelines for regulations of river-fisheries
County Govenor: Regulation of river fisheries

Besides public authorities also landowners (fishing right holders) and their associations play a significant role when it comes to design local fishing rules. Any given fishing right holder can make more strict fishing rules within the laws and regulations and guidelines given by the authorities. Under certain conditions relating to mandatory organisation of the fishing right holders in a salmon river and rules for legally binding decision-making procedures, the landowner association can make recommendations for regulations that County Governors are obliged to follow up, unless they in an obvious manner would be inconsistent with guidelines given by the authorities.

Legislation
Act No. 47 of May 1992 Relating to Salmonids and Fresh Water Fish etc. The Act states that salmon are protected unless otherwise determined in provisions. Various provisions states among others when and where it is allowed to fish, what kind of fishing gear is allowed and how to report catches.

3.1 Factors affecting estuarine and freshwater salmon habitat

3.1.1 Acidification

Background
Due to the high acid sensitivity, production of salmon in many salmon rivers in southern Norway was greatly reduced as early as 1920, several decades before acid rain was recognized as an environmental problem. The causes of acidification of surface water in Scandinavia were clarified during the 1960´s and 70´s, almost one century after the first negative effect on fish populations. The first indications of acidification affecting fish are from episodic killings of Atlantic salmon (*Salmo salar*) in some southern rivers in Norway around 1910. Official Norwegian salmon catch statistics shows a large decline in catches around 1900. In the two southern counties, Aust-Agder and Vest-Agder, catches declined about 80% from 1885 to 1920. Sporadic catches of salmon were reported up to the late 1960´s, but the natural salmon stocks in this region were virtually extinct around 1960

Status
Due to acidification, 52 Norwegian stocks of Atlantic salmon are today classified as affected. International agreements on reduced atmospheric emissions will reduce acidification effects in Norway during the coming 10-20 years. However, the extreme acid sensitivity of salmon makes the destiny of this species in Southern Norway uncertain. Liming in combination with reduced emissions will be an important contribution to protection of the Atlantic salmon species in Norway.

To counteract negative impacts from acidification the Directorate for nature management has developed an Action plan on liming for the period from 2004 to 2010 on commission by the Ministry of environment. Liming is an effective measure to protect and restore fish populations in acidified waters. Liming of acidified salmon rivers has become important in Norway the last 15 years, and in 2005 22 rivers are limed in Norway at a cost of NOK 45 million (approximately £4 million). Mean densities of salmon fry have increased from 10 to 60 fish per 100 m2 from 1991 to 2002. The catches of salmon in the limed rivers now constitute close to 10% of the total catch of wild salmon in Norwegian salmon rivers. The catch has increased from 5 tonnes prior to liming in the early 1980s and up to 40 tonnes the recent years. Estimates of future river catches by rod indicate an increase of 75 to 100 tons a year in around 2015 in limed salmon rivers (15% of the total catch of wild salmon in Norwegian salmon rivers).

In 10 rivers the main goal is to re-establish a self-reproducing salmon population. The Norwegian Institute for Nature Research (NINA) has estimated that the salmon stocks in limed rivers will be fully re-established after about 15 years of liming. Two strategies of liming have been used: liming with or without a stocking program. So far both strategies seem to be successful, but we do not know the genetic effect or the long-term result of either strategy. Liming without stocking gives a surprisingly rapid re-colonisation of salmon. The salmon spawning after liming must have been strayers from other rivers or escaped farmed salmon. A research project started in 1996 with the aim to study the re-colonisation process of salmon, evaluate the genetic effects of stocking strategies, compare stocking and natural re-colonisation and study population dynamics of re-colonising salmon.

Responsible authorities
Ministry of environment

Directorate for nature management (in cooperation with the County Govenors): Liming in line with guidelines and funding by the Ministry of environment and monitoring of e.g. stock responses, environmental effects, stocking
Norwegian Pollution Control Authority: Monitoring water quality and emission levels

Legislation
International agreements: During the last two decades the European nations have adopted various agreements to reduce atmospheric emissions of acidifying compounds. The latest and most extensive was signed in Gothenburg in December 1999.
Pollution Control Act: The use of powdered limestone is clarified in relation to the Pollution Control Act. The use of industrially processed lime or other neutralizing substances must have a special permit under the Pollution Control Act.

3.1.2 Hydropower development

Background
A large proportion of the salmon rivers in Norway are regulated for hydropower purposes, which heavily affects the natural physical and biological processes of the watercourses. Often found physical impacts in regulated rivers are, dams and migration obstacles,, dewatering of river stretches, rapid fluctuations in water level, change in water temperature regime, deposition of fine sediments and gradual homogenisation and degradation of bottom substrate. The physical changes will typically affect biodiversity in terms of reduced diversity of species, reduced biomass and production, and depleted fish stocks and reduced fishing opportunities.

Status
A third of the Norwegian salmon rivers are developed for hydropower production, and hydropower development has been identified as a significant negative factor for a total of 85 salmon stocks. A majority of the highest-producing salmon rivers in the country are regulated, including several top-20 rivers such as Altaelva, Namsen, Gaula, Orkla, Driva, Surna, Lærdalselva, Suldalslågen and Numedalslågen. With respect to anthropogenic eradications of salmon stocks, river regulations are a major factor resulting in 19 lost stocks, which exceeds the effects of acid rain (16 lost stocks) as well as the detrimental introduction of *Gyrodactylus salaris* (10 lost stocks). The regulation regime in a number of key salmon rivers will be scrutinised with respect to biological and environmental constraints during the next decade. The modernised regime is supposed to mitigate much of the negative impact in general and increase salmon production in particular. On the other hand, a large number of small-scale projects in progress may impose a significant negative sum effect on salmon production, especially in larger tributaries to already heavily modified watercourses.

The environmental focus and constraints were considerably less before 1980 than during the 1980s and 1990s. As a rule, there were few or none provisions on minimum water flows in the pioneer period of hydropower development. After 1980, however, provisions on water flows have been included in most of the hydropower concessions. The need for mitigation and compensatory measures are considerable in salmon rivers with reduced water flow after water diversion, as well as in rivers with significant reduced water flow during critical periods of the year. In general, the concessionaire is obliged to stock a certain number of salmon smolts, largely corresponding to the estimated loss in smolt production. In less affected rivers, the

concessionaire might stock salmon eggs, fries or parr instead of smolts. The licensing authority could as an alternative or substitute decide other compensatory measures such as fish passages, biotope adjustments and habitat restoration. The general conclusion after effect studies in regulated rivers is that mitigation measures only to a small extent compensate for the negative effect on fish production.

Responsible authorities

The management of regulated watercourses and affected salmon stocks is a shared responsibility between the Ministry of Petroleum and Energy and the Ministry of Environment.

The Ministry of Petroleum and Energy (MPE) is responsible for the legislations and regulations of water use and physical impacts in watercourses. Norwegian Water Resource and Energy Directorate, a subordinate department of the MPE´s organization, is responsible for licensing all kind of water extraction projects and encroachments in the river courses. This includes groundwater extraction, water supply, hydropower, flood control projects and all other physical constructions in the rivers that may have negative impacts on the environment or other user interests. For more details, see annex 2.

The Ministry of Environment (ME) is responsible for the legislations on biodiversity in water-bodies and their surroundings. The regulation concession empower the authorities to instruct the concessionaire to fund specific physical and biological mitigation measures, such as building of weirs and fish ladders, and stockings of fish. The Directorate for Nature Management, a subordinate department of the ME´s organization, is responsible for the follow-up of the environmental aspects such as biological assessments, documentation of impacts on biodiversity and outdoor life, and mitigation measures.

Legislation

The legal base for hydropower development is:

- The Act of regulations (1917) and
- The Act of water resources (2001)

The manoeuvre regimes are established in a concession (permit) given by the State for a predefined or undefined period. In 1992, the Norwegian parliament decided that all manoeuvre regimes are subject to revision within a thirty-year period, i.e. not later than year 2022. In the nearest future (2006-2008), the manoeuvre regimes in the salmon rivers Eira and Surna in Mid Norway and Røssåga in North Norway will be revised. As a rule, the scope of the revisions will be on how the ecological status of the affected water bodies should be improved – and the previous exclusive focus on production and economy will be less pronounced. The oncoming implementation of the EU directive for water resources will significantly contribute to a stronger emphasis on the environmental objectives in heavily modified water bodies.

3.1.3 Other habitat deterioration

Background
The negative impact from a single "other habitat deterioration" is often small, while the combined effects of several small negative impacts often will cause problems for Atlantic salmon. Typical impacts on Salmon habitats from a variety of activities could be:

- Increased siltation/sedimentation
- Blocked migration (injury to fish, impaired access to spawning habitat and production areas, impaired migration to marine environment)
- Changed shelter/cover
- Changed substrate
- Changed river morphology
- Changed water quantity (alteration of flow regimes, transfers, modifications to natural/seasonal fluctuations, reduction in volume, changing water temperature
- Changed water quality (addition of chemicals, nutrient enrichment)

Examples of activities that could cause these impacts are canalisation, embankment, protection measures against erosions, in-river engineering, encroachment for transportation or constructions, extraction of gravel, use of water, removal of riparian vegetation, ditching, agriculture and culvers.

There is a lack of regulations for instructing measures to mitigate the harm caused by some of these activities, and often a single of these actions is so insignificant that the consequences for the salmon are not sufficient considered.

Status
One or a combination of several "other habitat deterioration" has, according to the categorisation of salmon rivers (table 2), been identified as a factor causing considerable damage to salmon stocks in 40 rivers. Viewed in light of the large number of these incidents the yearly smolt-production losses caused by "other habitat deterioration" are considered to be of the same scale as "Hydropower development", i.e. approximately one million smolts.

Habitat restoration/improvement projects are carried out in several salmon Rivers, by Hydro Electrical companies, Water Recourses and Environmental Authorities and by different Stakeholders. To run an inventory of finished and ongoing habitat measure project will be a task for the different responsible authorities.

In 2003 the Norwegian Parliament decided to establish a number of protected zones for Atlantic salmon. The aim is to provide enhanced protection to a number of Norway's most important salmon watercourses and appurtenant migratory areas in fjords and along the coast. In the protected areas the salmon and its habitat will be given priority over any other activity that may be harmful to the salmon and its habitat, unless it is necessary to secure human lives or significant economic values.

In the first phase 37 so called National Salmon Rivers and 21 National Salmon Fjords were established. The Parliament also decided that in the second phase a number of additional rivers should be designated. This means that when completed the system will include about 50 of the most important salmon rivers in Norway. The National Salmon Rivers and Fjords will give special protection to about 3/4 of the total Norwegian wild salmon production.

The management regime applied for protecting the Atlantic salmon habitat in the National Rivers, the implementation of the National Plan of Action to the Protection and Restoration of Atlantic Salmon Habitat (following NASCO Council No. CNL(01)51) and the implementation of the Water Framework Directive will be important instruments to cope with negative impacts caused by "other habitat deterioration".

Responsible authorities
The responsibility for regulating these activities is shared mainly between Water Recourses-, Environmental-, Transport- and Agriculture Authorities together with the municipals. The Ministry of Petroleum and Energy is in charge of all legislations regulating water use and physical properties of the watercourses, while the Ministry of Environment is in charge of legislations for protection of biodiversity of the watercourses and their surroundings. The Ministries of Transport and Communications and of Agriculture and Food are responsible of the activities connected to transportation, agriculture and forestry while much of the authority connected with building activities is delegated to the municipals.

Legislation
The legal base for hydropower development which is put to use in this perspective is the Act of water resources, while it is the Act relating to Salmonids and Fresh-Water Fish etc that come into use to protect the biodiversity. The Act relating to Land is the responsibility of the Agriculture Authorities while the Planning and Building Act is the responsibility of the Environmental Authorities. Parts of the last mentioned act are delegated to the municipals.

3.2 Impacts of aquaculture, introductions and transfers and transgenics

3.2.1 Escaped farmed salmon

Background
In 2005 the total production of farmed salmon in Norway was 588 000 tonns and a total of ca. 159 million smolts were released into to sea cages along the Norwegian coast. In comparison the estimated total number of wild fish this year returning to Norwegian salmon rivers in 2005 was about 700 000 salmon.

According to official statistics (1994-2004) by the authorities (Norwegian Directorate of Fisheries) the development in production and escaping of farmed salmon are shown in figure 6. The number of reported escapes has fluctuated around an average of 417 thousand salmon a year. In 2005 the preliminary number is 732 thousand escaped salmon, the highest ever recorded (one incident of mooring failure caused 480 thousand escapees and one incident of criminal damage caused 95 thousand escapees). The reported percentage of escaping itself is rather small, between 2‰ and 3‰ of the fish in the grow-out farms. As an average, this quantity is not measurable, the accuracy of the counters are about plus/minus 1%. This is a factor that complicates the recording of escaping.

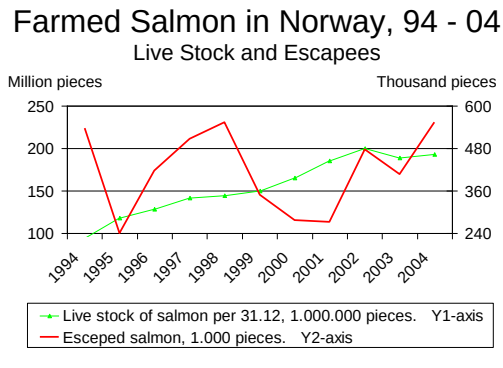

Figure 6.

The high percentages of escaped farmed salmon detected in Norwegian fisheries and river broodstocks indicate that the total number of farmed salmon yearly lost into the wild, probably is considerably higher then the numbers reported. Surveys on causes for escapes and monitoring programmes on escaped farmed salmon show that farmed salmon escapes at all ages and sizes, even before they become smolts, and up to market sized fish. Daily trickle losses due to e.g. handling, "small accidents" and minor holes in sea cages, account for a considerable percentage of the total number of farmed salmon escaping into the wild each year.

Status
The percentage of escaped farmed salmon in fisheries has been systematically monitored since 1988. In general the percentage of escaped farmed salmon has been lowest in river fisheries during the fishing season, higher in the spawning stock later in the year and highest in coastal fisheries. Fortunately percentages registered in river fisheries in later years seem to be considerably lower than in the late 80`s, despite the fact that the production of farmed fish has increased with 300% in that same period of time. Nevertheless with few exceptions, e.g. in areas with low density of salmon farms, the numbers of escaped farmed salmon have been high in all the years monitored. In some rivers escaped farmed salmon amount to more than 50% of the total brood stock, a situation that might already have lasted for a couple of decades.

The latest scientific evidence suggests significantly lower productivity and loss of genetic diversity in wild stocks as a result of interbreeding between escaped farmed salmon and wild salmon. Subsequently escaped farmed salmon is considered as a severe threat to the productivity and even long term existence of wild stocks of Atlantic salmon.

Responsible authorities
Minister of Fisheries and Coastal Affairs
Norwegian Directorate of Fisheries

Legislation
The Aquaculture Act (entered into force 1st January 2006)

Measures and regulations in relation to the requirements in the Williamsburg Resolution, concerning escapes:

- "Regulation concerning the management of aquaculture farms" 28. desember 2005 ("Akvakulturdriftsforskriften").

- Action plan on escapes of March 200 by the Norwegian Fish Farmer Association, in co-operation with the authorities (environment and fisheries) and the insurance association. The two measures of highest priority in the Action Plan were:
  - Quality management systems on production and operation
  - Approval scheme of floating fish farming plants

- Measures introduced in 2004:
  - Regulations concerning Internal Control were entered into force 1st January 2005 and made it mandatory for the fish farmer to establish system of internal control.
  - Regulations on the technical standard of installations that are used in fish farming activities (the NYTEK Regulations) were entered into force 1st January 2004. The

regulations stipulate that fish farmers can only use new installations and main components that are certified in accordance with NS 9415. Such certification has to be performed by an accredited certification body. Existing installations are required to have a proof of capability stating that the installation meets the operational requirements in NS 9415 by 1 January 2006 in accordance with the regulations. Proof of capability may only be issued by accredited inspection-bodies.

- Minimum distance between salmon farms and salmon rivers is 5 km.

- Emergency plan that among other things have to include an overview of
  - How escaping can be detected and limited
  - Increasing the efficiency of re-catch
  - Establishing precaution measures for towing of cages
  - Handling of fish and plants during loading and unloading.

- Mandatory reporting on escape incidences.

- 22 National Salmon Fjords introduced in 2003, whereof 13 are free of salmon farming. No new farms are allowed to be located within theses areas and special restrictions and more rigorous controls are to be applied.

3.2.2 Sea-lice/salmon lice

Background
Dense aggregations of farmed fish are ideal breeding grounds for diseases and parasites. In addition, stress on fish resulting from high density and intensive cultivation is often sufficient to allow pathogens to take hold and form disease reservoirs. In areas of Norwegian Coastline, sea-lice numbers are now significantly higher as a result of the millions of cultured fish in the sea.

At the fish farms, the problem with sea lice can be managed by de-lousing. But even with a low number of adult female lice, a great number of larvae are produced and according to the short time of life cycle (52 days for females at 10°C) the potential growth rate is exponential. A ”wall” of salmon lice larvae then meets the wild smolt migrating to the sea, and the balance between parasite and host is disrupted. Estimates shows that 10 –15 adult lice on a smolt can be lethal to young salmon and the average in 2001 was 80 sea lice per salmon! However, over the latest years this has improved and the conditions have changed considerably. In the spring 2004, only 3% of the migrating smolts in the Sognefjord were estimated to have lethal amounts of sea lice. However from central parts of Norway and further north the infection pressure is still considered to be high.

The improvement is credited to better management at the farms. In co-operation with the Directorate of Fisheries, the Directorate for Nature Management, the Association of Aquatic Veterinary Surgeons and the Norwegian Association of Fish Farmers, the Department of Veterinary Services at the Ministry of Agriculture has drawn up a *National plan of action against salmon lice on salmonids.* The responsibility for dealing with sea lice has been transfered to the Ministry of Fisheries and Coastal Affairs and the action plan is currently under revision. Nevertheless in the meantime the main principles from the expired plan are followed up.

Best results are achieved by co-ordinating measures for a region or fjord-system. Measures are therefore initiated at the county level, providing the best opportunity to reduce the problem of lice in the Norwegian aquaculture industry to a minimum.

The most important measures are:
- systematic registering and reporting of lice in fish farms
- systematic de-lousing schemes in winter and spring
- more extensive use of wrasse

Norwegian experts in this field agree that co-ordinated de-lousing at the onset of winter and in the spring is decisive if the risk of infecting emigrating wild salmon and recently released spring smolt is to be reduced. It will also be a strategically correct use of drugs, but it presupposes that effective means for de-lousing are available. All treatments must, however, be undertaken on the basis of knowledge about the actual occurrence of lice in the plants.

Most common used drug in Norway at present time is SLICE. The concern about resistance is considerable. Directions about variation in use of drugs are given and minimum level of lice attack that gives mandatory delousing actions are 0,5 mature female lice pr. Fish.

Responsible authorities
Ministry of Fisheries and Coastal Affairs
Norwegian Food Safety Authority

Legislation
The Aquaculture Act (entered into force 1st January 2006), Food Safety Act and Animal Protection Act
Measures, regulations:
- "Regulation concerning the management of aquaculture farms" 22. Dec. 2004 ("Akvakulturdriftsforskriften").
- "Regulation concerning the management of sea-lice infestations"
- (Lakselusforskriften)
- National action plan against salmon lice (run by Fish Farmers Association).

3.2.3 *Gyrodactylus salaris*

Background
The salmon parasite *Gyrodactylus salaris* is considered to be the maybe worst threat to Atlantic salmon in Norway. Salmon stocks are more or less wiped out wherever the parasite has been registered. If measures are not implemented to combat the parasite it will spread and

in the worst-case scenario the parasite will finally contaminate each and every Norwegian salmon stock, with disastrous consequences for Norwegian salmon and salmon fishing.

G. salaris does not occur naturally in the distribution area of the eastern Atlantic salmon population. It has been introduced in later years to rivers in Norway, to rivers on the Swedish west cost, and to one Russian river draining into the White Sea. The parasite was introduced to Norway in 1975, as a result of import of infected salmon smolt from the Baltic region. We know about 4 imports of infected fish.

Status

After introduction to Norway the parasite has so far been spread to 45 watercourses, mainly through stocking from infected hatcheries and from infected rivers to neighbouring rivers in a fjord system where the salinity is low. The parasite is a freshwater species, but it can live in brackish water for many hours. The parasite is also spread by moving Atlantic salmon and Rainbow trout in connection with farming.

In an attempt to contain the damage caused by *G. salaris* the Norwegian authorities have drawn up an action plan to combat the parasite. The main activities of this plan include: A surveillance programme, preventive measures, eradication measures and preserving fish stocks. The extermination of *G. salaris* from every infected river in Norway is the primary goal for the Norwegian authorities.

The most effective measure for reducing the risk of infection through fishing and outdoors activities is to inform the general public about the parasite, the laws and regulations in force, the status of infection, the risk of contamination and procedures for disinfecting gear.

Establishing facilities for disinfecting fishing gear and equipment used in infected rivers is a requirement for permission to operate organized outdoor activities such as fishing.

The presence of unregistered fish-farming facilities that move fish from one place to another represent a considerable risk of infection. Getting an overview of the unregistered fish-farming facilities is thus a priority task. Small-scale fish-farming using rainbow trout in the inland is of special concern. If an infection has been discovered in a fish-farming facility it will be sanitized. This means that it will be emptied of fish, disinfected and not used for a period of time before new fish can be brought in.

As a general rule, stocking of infected rivers with susceptible fish species is prohibited, although various stakeholders may demand to stock infected rivers with smolt to compensate the loss caused by the parasite. Placing salmon or other species that are vulnerable to *G. salaris* in infected rivers contributes to maintaining a high level of infection in the river, thus increasing the risk of spreading of the infection.

Eradication measures consist of fish barriers and chemical treatment of infected rivers.

Fish barriers: The principle behind fish barriers is to prevent the salmon from entering the river to spawn. After five to seven years the river above the fish barrier will be devoid of salmon, thus also devoid of parasites, as these die rapidly without a host. The young salmon will either be dead due to the parasitic infection or have migrated as smolt. Thus the infected river-stretch is reduced to the areas below the fish barrier, simplifying the work to combat the parasite.

Chemical treatment: Chemical treatment has been carried out in a total of 34 infected rivers in Norway. In 15 of the treated watercourses the parasite has been successfully eradicated, 11 of the treated rivers are still being monitored, and in 8 rivers the parasite has been registered again after chemical treatment. Five years of monitoring after treatment is necessary to be sure that the treatment has been successful and the river can be reported off the sick 45 to 19 (figure 5).

Figure 5. The distribution of *G. salaris* in Norway per 1. April 2006.

Responsible authorities

Ministry of environment
Ministry of Fisheries and Coastal Affairs

The responsibility for carrying out the action plan is divided between the Directorate for Nature Management and the Norwegian Food Safety Authority. The Directorate for Nature Management is responsible for eradication measures such as chemical treatment and fish barriers, preserving of fish stocks, information about the effect of *G. salaris* and chemical treatment, and international co-operation. The Norwegian Food Safety Authority is responsible for the surveillance program, epidemical monitoring, preventive measures against *G. salaris*, information about the status of distribution and exposure hazard, and international co-operation.

Legislation

Laws and regulations/directives being in force:

- Act relating to Salmonids and Fresh-water Fish
- Act relating to Food Safety with appurtenant regulation of G. salaris
- The Pollution Control Act

- The norwegian regulation implementing directive 98/8/EC (Biocidal products) , "Forskrift om godkjenning av biocider og biocidprodukter (biocidforskriften)"
- The Watercourse Regulation Act

3.4 Other influences affecting salmon abundance or diversity

4. Management approach

The following actions are preliminary and meant to give an impression on what chapter four in the Norwegian implementation plan might look like. Most of the actions listed are based on decisions and action plans, which are already in place. Nevertheless the political process in connection with the preparation of a parliamentary bill regarding the protection of salmon, which probably will result in relevant commitments, might also lead to adjustments of previous decisions and action plans, and result in decisions on new steps and actions. Thus the more finalized commitments in the Norwegian implementation plan will not be available before November or December this year.

4.1 Management of fisheries

4.1.1 Fisheries regulations

A new five-year regulation regime of fisheries will come into effect from 2008. The main focus will be on:

- Observed/estimated spawning stocks against spawning targets, which are currently under development.
- Reduction in mixed stock fisheries in general, where the stocks exploited cannot be identified
- Detected levels of escaped farmed salmon will be integrated in more active way in fisheries regulations, and might make significant additional restrictions in fisheries necessary
- Special focus on river Tana

4.2 Protect and restore salmon habitat

4.2.1 Liming as a mitigation measure in acidified salmon rivers

Follow up the current Action plan for liming of watercourses in Norway 2004 – 2010. The plan is based on stable level of funding of about 88 mill Norwegian Kroner each year. Reduced atmospheric emissions are expected to reduce the necessary expenditures on ongoing liming projects with about 2,5 % pr year. Expenditure cuts are supposed to cover necessary investments in three other ongoing liming projects and new projects.

Main strategies (prioritising of activities):

1. Management of ongoing liming-activities
2. Financing necessary investments in ongoing liming projects in three salmon rivers the county of Vest-Agder.
3. Initiate new liming projects

According to the action plan liming is to be initiated in 5 new salmon rivers (2 with a remaining salmon stocks, 3 where the original salmon stock has gone extinct). Liming of the river Nidelva I supposed to start in 2006.

The County Govenors in the region have prioritised additional 7 rivers that are not covered by he present action plan.

4.2.2 Supplementation of the National Salmon River and National Salmon Fjords scheme

Another 27 rivers, amongst them some of the most important and famous Norwegian salmon rivers, and adjoined fjords which are not already National Salmon Fjords, are currently under consideration. The final extent of the scheme will be decided based on a parliamentary bill by the end of this year. It is indicated that the final number of National Salmon Rivers will be about 50.

4.2.3 National Plan of Action for the Protection and Restoration of Atlantic Salmon Habitat

An inventory of salmon habitat according to the NASCO agreement is under development. By the end of this year we expect to have completed necessary data gathering for about 80 rivers, including all the National Salmon Rivers.

4.3 Manage aquaculture, introductions and transfers

4.3.1 Reduction of escapes from fish farm – Vision Zero Escapes

Following steps are or will be implemented to reduce the escaping:

- On April 2006 The Directorate of Fisheries introduced their action plan against escaping. The action plan consists five main items:
    A. Improved administrative provisions
    B. Improved knowledge
    C. Improved and increased achievement
    D. Improved communication and co-operation with other authorities
    E. Improved communication and co-operation with the industry

  Totally the action plan consists of 29 items.

- The ministry of Fishing and Coastal Affairs is to appoint a commission of damage survey related to escaping and wrecking of floating fish farm installations

- Revision the action plans against escaping from 2000 by the fish farmer association.
    - Bringing the action plan up to date

- Develop and improve the NYTEK scheme. According to the NYTEK-regulation new floating installations, or main components to such installation, require product certificate. While existing installations (in use before 01.01.2004) need a proof of capability. These certificates should comply with the requirement of NS 9451: 2003, and are to be performed by accredited bodies.

- In 2006 the directorate of fishing will step up their rate of supervision and control due of the latest increased escaping
    - Audit the system of internal control
    - Check the NYTEK status
    - Special inspections

- Comprehensive revision of NS 9415:2003. Marine fish farms. Requirements for design, dimensioning, production, installation and operation. The committee of standardization is managed by Standards Norway
    - The intention is internationalising of the revised standard though ISO

Amongst other measures proposed are also the development of indicators for harmful levels of escaped farmed fish in wild broodstocks, use of sterile fish in salmon farming, requirements for fish farmers to recapture escaped farmed fish in affected rivers.

You can read more about the plan under the following link (Norwegian only):
http://www.fiskeridir.no/fiskeridir/merkelapper/merkelapper/forside_kyst_og_havbruk/tiltaksplan_mot_roemt_oppdrettsfisk

4.3.2 Eradication of *Gyrodactylus salaris* from Norwegian salmon rivers

Due to the latest developments the current Action plan for Eradication of *Gyrodactylus salaris* from Norwegian salmon rivers has to be revised. This year the eradication treatments have been finalized in the Lærdal-region. The planning process aiming for eradication treatments to be carried out in 2006 and 07 has been started in the Steinkjer-region. In the Vefsn-region the planning process will start this year.

4.4 Actions to be taken in relation other influences

5. Evaluation

ANNEX 1 ***Categorising of salmon-river stocks***

In 1993 the Norwegian Directorate for Nature Management established a salmon stock registry. The registry is based on information collected from a number of sources, including local salmon management authorities. This registry contains a category system that is a classification of rivers based on the condition of the salmon stock in relation to adverse human impact. Category assignment is based on an overall judgement taking into consideration all factors of importance for the stock's existence and production. Only rivers that have or have had a self-reproducing stock are categorized. The system was significantly revised in 2002 and has resulted in a reduction of the number of salmon stocks compared with the old system. The category system for salmon can also be applied to sea trout (*Salmo trutta*) and sea char (*Salvelinus alpinus*) with certain modifications. The system is summarised below.

Category 1: Lost stock
Rivers where the stock has been lost as a result of human impact

The category concerns loss of stocks in nature. Rivers where a salmon stock is being reestablished, e.g. through stocking with fish from the gene bank or with fish of other origin, are categorized as normal with notes on its reestablishment.

Category 2: Threatened stock
Rivers where the stock is at high risk of becoming lost as a result of human impact

The stock is affected by human impact factors that have both sufficient damaging potential and scale to threaten the stock with loss. This will often be the case when the stock is exposed to human impact factors that inflict high death rates, e.g. *Gyrodactylus salaris* and river acidification.

The category does not include rivers where the stock is maintained through mitigatory actions see Category 3b).

Category 3: Vulnerable stock
Rivers where the stock can become threatened as a result of human impact

<u>3a: Rivers where the stock is near threatened</u>
A moderate increase in potential or scale of human impact factors can result in the stock becoming threatened. The chances that mitigatory actions will be successful are much higher than in the case of threatened stocks.

<u>3b: Rivers where the stock is maintained</u>
Rivers where the stock is maintained by mitigatory actions (liming, stocking, etc.), and can become threatened if these actions cease.

Category 4: Reduced stock
Rivers with considerably reduced young fish production and or adult fish stock resulting from human impact

These are rivers with reduced stocks that do not qualify for lower categories.

4a: Rivers with considerably reduced young fish production
The category also includes rivers where measures are undertaken to compensate for the reduced production (stocking, liming, opening of new anadromous stretches, etc.).
The reduction in production can be attributed to a reduction in the rivers capacity to produce salmon, and/or to a reduction in productive ability of the stock, e.g. due to reduced numbers of spawners. The causes of the reduction shall be noted. The reduction in production is regarded as considerable when it is easy to detect and is of size order 10% or more.

4b: Rivers with greatly reduced adult fish stock, but where young fish production is not considerably reduced
These are rivers where the adult fish stock is strongly reduced by human impact factors other than a sustainable fishery.

Category 5: Moderate or lightly affected stock
Rivers where the stock is moderately or lightly affected by human impacts

5a: Rivers with stocks requiring special concern
Rivers where a moderate increase in human impact can imply that the stock will be assigned a lower category.

5b: Rivers with stocks not requiring ”special concern”
Acidification of rivers and infection by the parasite Gyrodactylus salaris are the main causes for salmon stocks being either extinct or threatened. Some populations are also heavily affected by hydropower development. Furthermore, negative effects of aquaculture, such as large abundance of sea lice larvae near salmon farms, and genetic interactions between farmed and wild salmon are matters of concern.

ANNEX 2: Responsibilities of the Norwegian Water Resource and Energy Directorate (NVE) in relation to Hydropower development.

The Norwegian Water Resource and Energy Directorate (NVE) is responsible for licensing all kind of water extraction projects and encroachments in the river courses. This includes groundwater extraction, water supply, hydropower, flood control projects and all other physical constructions in the rivers that may have negative impacts on the environment or other user interests. All applications for hydropower projects bigger than 40 GWh or reservoirs bigger than 10 mill.m^3 are handled in accordance with the procedures in the Planning and Building Act (PBA), including an early notification and environmental impact assessments (EIA). Applications for projects smaller than 40 GWh and investment bigger than 50 mill.NOK (7 mill. $) must follow the regulations in the PBA regarding an early notification and EIA if the environmental impacts exceed limits stated in the Planning and Building Act. For all other projects the handling procedures are less complicated. There is no need for a notification and the program for impact assessments is decided by NVE without a hearing process. The impact assessments must be according to the rules in the Water Resources Act or The Water Courses Regulation Act, depending on whether or not the project includes reservoirs for storing water from one season to another. The guidelines according to the Planning and Building Act set up a framework for the impact assessments, but different projects have different sizes and impacts. Therefore it is important to concentrate on crucial impacts and to adjust the program for impact assessments so that the assessments focus on relevant issues. The impact assessments must concentrate on impacts which are of importance in the decision making process and for the evaluation of mitigating measures. The procedures are as follows:

1. A notification is worked out by the developer and sent to NVE. The notification includes a description of the technical plan, alternatives, environmental impacts and the developer's proposed program for impact assessments needed. The notification is sent by NVE to the relevant authorities and NGOs and published in local newspapers. NVE will arrange a public meeting in the affected area to inform about the project, the proposed program for impact assessments and the handling procedures. All comments on the notification must be received within 6 weeks. The intention is to elicit comments on the impact assessment program and what should be taken into consideration during the planning.
2. NVE decides, after consultation with the Ministry of Environment, on a program for the impact assessments, based on the information in the notification, the comments received and NVE's own evaluation. The issues included in the program must be relevant for the decision-making.
3. The applicant is responsible for preparing the impact assessments and to present them to NVE. I would like to emphasise the importance of co-ordination between the impact assessments and the development of the technical plan. One of the major goals of the impact assessment process is to adjust the technical plan so as to avoid or minimise the negative environmental impacts.
4. The Application and the impact assessment are sent to the relevant authorities and NGOs and published in local newspapers with a time limit of 12 weeks for comments. A public meeting should take place in the project area with a presentation of the plan, conclusions of the impact assessments and the handling procedures. The applicant is given the opportunity to comment on the statements received.

5. Based on the comments received and NVE's own evaluation, NVE decides if the impact assessments have been developed in accordance with the program stated in point 2 (see above), and that the case in question is sufficiently prepared.
6. NVE make their final evaluation of the project based on the application, the impact assessments and the comments received. The evaluation consists of a discussion of all the costs and benefits of the project, including environmental issues. A license is recommended only if the total benefits are considered bigger than the cost.
7. NVE's evaluation and conclusions are sent in the form of a recommendation to the Ministry of Petroleum and Energy who are responsible for preparing the case for the Government after a short hearing with affected municipalities an the ministries involved. Large projects are presented to the parliament.

The procedures ensure participation from related authorities, affected communities and the public. All documents are publicly available and all parties are invited to express their opinion on both the need for impact assessments and whether a license should be granted or not.
The legislation establishes conditions for the licenses. Based on experience and co-operation with the relevant authorities, NVE has developed a set of standard terms of license, which covers:

- Time limitation for licenses.
- Rules for revision every 30 years of the terms of license
- Construction deadlines. The construction must start within 5 years after the license is granted.
- Nature conservation. Authority to require mitigating measures regarding:
    - -landscape
    - -biotope adjustments to maintain biological diversity
    - -weirs in the affected river stretch
    - -fish stocking
    - -pollution
- Preservation of ancient monuments
- Hydrological measurements
- Approval of detailed plans regarding landscape and safety
- Monitoring of long-term environmental effects
- Punishment for operation in conflict with the rules of operation