DIRECTORATE OF FISHERIES

Environmental challenges

Plans, tools and regulations in Norwegian aquaculture

DIRECTORATE OF FISHERIES

The Directorate of Fisheries welcomes You to Aqua Nor 2007 in Trondheim.

The environment is also the focal point for the administration of aquaculture and the coastal zone. Therefore, for the first time during Aqua Nor, the Directorate of Fisheries will hand out a new environmental award.

The number of escapes from the aquaculture industry is unacceptably high, and the Directorate of Fisheries is trying to contribute to eliminate this. There was therefore implemented last year an extensive action plan against escaped farmed fish, under the name “Vision No Escapees”. The plan consists of 30 different actions, with the main weight on preventive action.

In April 2007 the authorities carried out a regulation regarding more stringent responses for violations of the aquaculture legislation. After handling in the Norwegian Parliament in May this year, 29 national salmon fjords and 52 salmon rivers where established to protect wild salmon populations. The fisheries and environmental authorities are also collaborating in questions such as use and protection of the coastal zone.

The Directorate of Fisheries’ work in conjunction to the aquaculture industry is also in collaboration with a range of other governmental authorities and the industry itself. This is in compliance with our vision “Marine Life – Our *Common* Responsibility”.

However, we do not only want to use a pointer, but also urge for environmental thought. The Directorate of Fisheries will therefore, yearly, hand out an environmental award, as a reward for environmental contribution in the fishery and aquacultural sector.

In this way, we wish to stimulate individuals, companies and organisations to take more environmental responsibility and thus contribute to increased sustainability for the industry as a whole. The environmental award will be a diploma and a piece of art that the winner may use for marketing purposes.

The Directorate of Fisheries would like to thank You all for the cooperation so far, and looks forward to a continued joint environmental contribution and a sustainable aquaculture industry.

Sincerely

Peter Gullestad
Director General of Fisheries

DIRECTORATE OF FISHERIES

Vision No Escapees
The Directorate of Fisheries' action plan

At the end of April 2006 the General Director of Fisheries carried out an action plan, consisting of 29 items, in order to visualise and communicate the Directorates work against escaped farmed fish. First, it was due to the large number of salmon escapes, which made it necessary to develop such a plan, but the increase in cod escapes has also been a worry. The action plan is the result of dialog from a wide perspective of the aquaculture industry, other administrative departments and environmental organizations.

The action plan consists of a mix of direct actions, examinations and processes, which will reduce the extent of escapees or the damage created by the escapes. No Escapees is a vision, it would be unrealistic to hope to gain zero escaped farmed fish, how ever, it is of vital importance to reduce the numbers as much as possible. The name also points to the authorities where preventive work is the primarily task at hand.

Vision No Escapees consists of 5 main areas:

A. Better regulations
I.e. whether to define an upper limit for quantity of fish permitted in any unit.

B. Better administrative tools
I.e. develop vulnerability indicators used in assessing the effect of escapees.

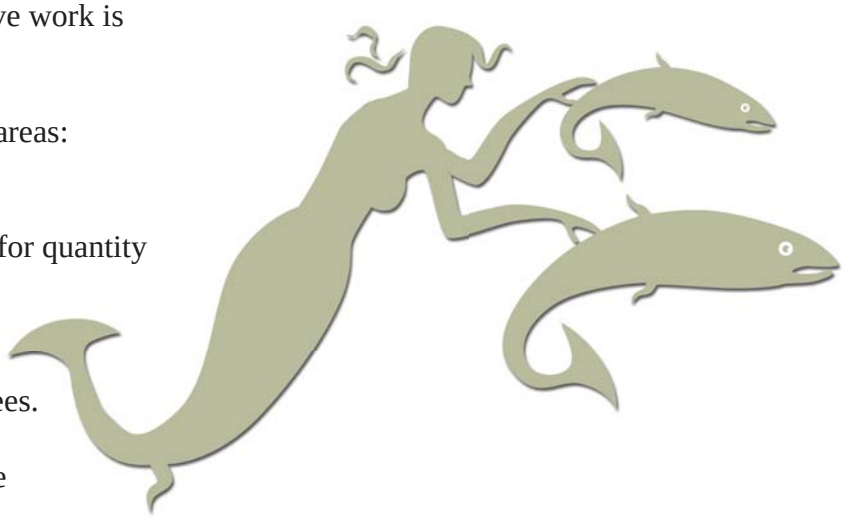
C. Increased and better efforts
I.e. increased control efforts from the authorities.

D. Better communications and interactions between the other governmental departments
I.e. develop a working relationship with the Norwegian Coastguard and the Norwegian Nature Inspectorate.

E. Better communication and interaction with the industry and organizations
I.e. development of a permanent aquaculture escape commission.

Some of the actions have already been finalised, however most of them are on-going processes. A few of the actions have demanded more efforts than originally predicted. Due to the shortage of funds and very high escapee numbers for 2006, the Directorate of Fisheries does not expect all the actions to be finalised by the end of 2007. Even though increased funds where set aside in the Governmental budget for 2007.

The forecast for 2008-2009
After an evaluation half way through spring 2007, the Directorate of Fisheries stated that fish escapes are such a serious environmental problem, that the level of ambition can not be decreased. The only action method possible is to reduce the speed of accomplishment. In the autumn 2007 the action plan will therefore be carried out for two new years, 2008-2009.



A general view of the individual actions and more information regarding Vision No Escapees can be found at www.fiskeridir.no.

DIRECTORATE OF FISHERIES

The Directorate of Fisheries' action plan
(April 2006 – December 2007)

A Better regulations

A1 Three quick suggestions for amendments of rules: (1) double safeguarding of outlets, (2) mesh size in compliance with fish size and (3) the visibility of aquaculture installations on ship radars.
A2 Examine the possibility of developing improved regulations.
A3 Develop special husbandry procedure requirements for cod cultures.
A4 Requirements for re-catching escaped fish after an escape episode.
A5 Examine requirements for aquaculture in large units, perhaps an upper limit for quantity of fish permitted in any unit.
A6 Consider a mandatory scale sampling from remaining fish groups, when the Directorate of Fisheries inspects the installation after an episode of escapees.
A7 Review and consider more stringent demands for sites.

B Better administrative tools

B1 Risk assessment aquaculture.
B2 Evaluate the escapee statistics and establish a better database for escapees.
B3 Develop and establish effect indicators/ vulnerability indicators used in assessing the effects of escapees.
B4 Develop and implement a risk bases control system for aquaculture – AKVARISK.
B5 Monitoring program National Salmon Fjords/ National Salmon Rivers.
B6 Examine the possibility of sterilizing aquaculture fish.
B7 Minimum requirements for good husbandry, contents of contingency plans and monitoring escapes.
B8 Develop new research based implements.

C Increased and better efforts

C1 Full production – aquaculture control.
C2 Control campaign 2006.
C3 Initialisation of a separate monitoring program for environmental effects due to aquaculture.
C4 Positioning of aquaculture installations (STAK).
C5 Evaluate routines and actions in conjunction with fish escapes.
C6 Contingency response exercises jointly with administrative authorities and fish farmers (against fish escapes).

D Better communication and interaction with the other governmental departments

D1 Better interaction with the police and prosecuting authorities.
D2 Examine the possibility for an operational cooperation with the Norwegian Coastguard and the Norwegian Nature Inspectorate.

E Better communication and interaction with the industry and organizations

E1 A permanent escape commission including a system for public sharing of experience.
E2 Contribute in the development of voluntarily standards beyond the administrations minimum requirements.
E3 Better interaction with the insurance industry.
E4 Contribute to the audit of NS 9415.
E5 Make known enterprises engaging in escapee free operations and run responsible husbandry procedures.
E6 Dialogue and information efforts.

DIRECTORATE OF FISHERIES

Smolt escapes

The amount of fish escapes from Norwegian fish farms has increased over the last years. Rådgivende Biologer AS suggested in their report, “Escaped farmed fish in the sea and rivers, amount and origin” (Report 947/06), that tests from fish shells taken in Norwegian rivers showed that a large proportion of these were from fish that had escaped during the smolt stage.

The Directorate of Fisheries has in 2007 a particular focus on risk assessment, action and control tied to smolt escapes. The Smolt Campaign comprises, in full, a control arrangement where smolt is followed from the smolt facility through the transport phase, in a well boat, to include the outset of fish, into the on-growth installations in the sea.

The aquaculture legislation has been expanded with two new provisions, which will amplify fish farmers’ responsibility with respect to preventing escapes in the smolt phase:

• Demands for double safeguarding of outlets from smolt facilities (comes into force 1.1.2008)

Regulation regarding aquaculture operational procedures § 31.3rd subsection: ”Land based aquaculture facilities must have a suitable device to prevent fish from escaping through the outlet or through other means.

The device must contain a minimum of double safeguarding or other device with equivalent safeguarding. Documentation that other devices of equivalent calibre has at least the same escape safeguarding effect as the double safeguarding, must be submitted.”

Filters in tanks that are not fixed in the operational phase are not considered as a suitable device/first safeguarding for preventing fish escapes. Smolt producers must, in good time before the New Year, make the adjustments needed in the outlet system to be able to comply the new demand.

• Mesh size (came into force 19.2.2007)

Regulation regarding aquaculture operational procedures § 31.4th subsection: ”Mesh size in the net-pen must be adjusted to the fish size, in such a way that the fish can not escape through the net-pen.” On-growth producers must ensure, before outset, that the mesh size is adjusted for the smallest fish in the smolt batch.

Contingency plan – Regulation regarding aquaculture operational procedures § 7
Smolt facilities must have an up to date contingency plan containing a general view over how to discover escapes, containment and how to increase the efficiency of re-capturing escaped fish, hereby use of re-capture nets (cultivation nets with very small mesh size). Smolt facilities are also obliged to re-capture fish cf. regulation regarding aquaculture operational procedures § 33.

Risk assessment – Regulation regarding Aquaculture operational procedures § 31
All fish farmers are, in view of the attempt to minimize the risk of escapes, obliged to implement a risk assessment. The risk assessment will make up a basis for systematic actions.

Typical areas of risk during the smolt phase:
- Too large light openings in filters and grates.
- Under dimension of filters/filters do not tolerate plugging.
- Insufficient fixtures of filter.
- Too large separator in the drainage divider – fish can be lost in the outlet.
- Possibility of over steer water flow due to high pressure.
- Flooding of fish tanks – outlet in floor is not secured.
- Unsecured outlet in dead fish tank – fish can be lost in outlet through dead fish system.
- Impaired hoses due to sunlight or sharp angels, hoses of flexible material are especially vulnerable and must therefore be stored under proper conditions.
- Splicing of hoses with different dimensions, defect hose clamps.
- Insufficient personnel when observing risk based procedures.
- Long distance between the smolt facility and the well boats shipping facility.
- Hoses which must partly lie in the sea.
- Bad shipping facilities.
- The nets should be checked by a diver before smolt is pumped into the cages.

Cleaning up shellfish installations where operation has ended

The aim is that when operations have ended, there must not exist installations, animals, wastes or other equipment that can interfere with or damage the environment where the activity has been held.

There exists a demand for a complete clean up operation in the event of closure of the farm. The demand is incumbent on those whom last engaged in aquaculture on the site, see the aquaculture act §13 and the regulations relating to aquaculture operations §15.

This is in accordance to the juridical environmental principle, where polluter must pay. The clean-up operation must be completed within 6 months after closure, see the regulations relating to aquaculture operation §15.

Lack of fulfilment of the clause concerning complete clean up has been noticeable with regard to the mussel industry.

Reaction to unfulfilled clean up
The Directorate of Fisheries has statutory right to give the responsible a current compulsory fine. The fine is given to force the fulfilment of the clean up duty. First an advanced warning is sent out, then a subsequent resolution with a fixed deadline. If the clean up has not been carried out within the time limit, the compulsory fine begins to run.

In practice, it has been seen that it can take a long time before the clean up is completed. Inspection of this type of cases has normally been carried out by The Directorate of Fisheries' boat «Munin». After an inspection of the site, data is forwarded to the regional office for a follow-up. The Directorate of Fisheries' south region has experienced that this does not give an adequate close follow-up of the shellfish industry.

Shellfish campaign South Region
Due to this the south regional office decided to expend greater efforts into the follow-up. They actuated a campaign where the focus point was the regulated demands set for shellfish farming. Such a campaign was very time- and resource consuming, and good cooperation with the Coastguard was necessary for its success.

Sites with permission for shellfish farming, were inspected to ensure that they were in compliance with the aquaculture legislation. The shellfish campaign revealed however, that several farms where not in compliance with given legislation. These were imposed with improvements, and the demands were followed-up with current compulsory fines.

The Directorate of Fisheries focused on demands in the regulation relating to aquaculture operations, such as; general requirements regarding establishment and operations, information signs with regards to proprietor and site number, and the conformity of the establishments with respect to enclosed drawing, descriptions and maps.

Sites were also considered revoked due to passivity, if within a period of two years there had not been conducted any activity on the site. Lacking maintenance/care could also entail that passivity is set in motion.

Furthermore, sites where operations had come to a close, were inspected with regards to fulfilment of the clean up demand. Those sites where the demand had not been fulfilled within the time limit of six months were followed-up with an advanced warning and subsequent resolution and warning of current compulsory fine.

Where the time limit was not held, the current compulsory fine was collected immediately.

The caseworker focused on continuous contact and follow-up of the proprietor until the demand for clean up was fulfilled.

Successful cleaning
As a result of the shellfish campaign, farms in operation have been improved, and passive licenses have been revoked. Furthermore, sites were operation had come to a close were tidied up. We can also conclude, that the Directorate's southern regional office has acquired a much better overview of the shellfish farming industry in the south of Norway.

The current compulsory fine officiates as leverage, in compliance with its intention. One example from South Region is illustrated in these pictures.

Site with unfulfilled clean up.

DIRECTORATE OF FISHERIES

Use and protection in the coastal zone
Cooperation between the fisheries- and environmental authorities

The Directorate of Fisheries contributes to three very important environmental improvement processes in the coastal zone. The Directorate for Nature Management operate these processes in a close cooperation with the Directorate of Fisheries. This is in harmony with the Directorate of Fisheries' motto «Marine Life – Our Common Responsibility».

1. Marine protection plans. National plans for marine protected areas in the coastal zone.

- A marine protection plan is the protection of areas in the sea where protection applies in most cases to benthic plants and animals.
- 36 areas were proposed in phase I. Pristine areas, within a few of these, will be set aside as reference areas. These will remain untouched and compared with the developments in areas, which are used for fishing (bottom trawls and dredging).
- Reference areas will be defined in regional processes, including stakeholders.
- There will be the possibility to combine use and protection in most areas.
- Phase I – the 36 protection areas along the coast will be completed in 2008.
- The Directorate of Fisheries' message: We must protect to be able to harvest.

2. Marine biological diversity. Mapping and monitoring marine biological diversity in the municipalities.

- Knowledge of marine habitats and nature types is a necessary foundation for municipal coastal zone planning.
- Upholding of marine biological diversity are necessary in securing future harvests of the marine resources and for developing a healthy and safe aquaculture industry.
- Overexploitation of marine resources and wrong use of area can in turn be very costly both for the industries and the ecosystems.
- The first part of the national program has now ended (pilots, instruction manuals, mapping methods etc.), and the project running from 2007 aims at a new phase where practical mapping out in the municipalities will be implemented. Goal: Half of Norway's 280 coastal municipalities will be finished mapped in the course of 2010.

3. Water framework directive. Implementation of EU's Water Framework Directive.

- EU's Water Framework Directive will imply an immense change of the principles for water management in Europe, and will also set a frame for the work regarding water management in Norway for many years to come.

- The directive stipulates the establishment of ecological-based environmental goals for watercourses, their belonging fjords and coastal waters. This will create a challenge for Norwegian water management.

- In attaining the defined environmental goals regarding good ecological and chemical status in water, the countries must implement a characterization of all water bodies as well as comply with continuous monitoring and implementation of action plans, where necessary.

- Improved water quality gives a healthier environment and enhanced products – i.e. farmed fish.

- The Water Framework Directive's implementation in Norway will be completed within 2015.

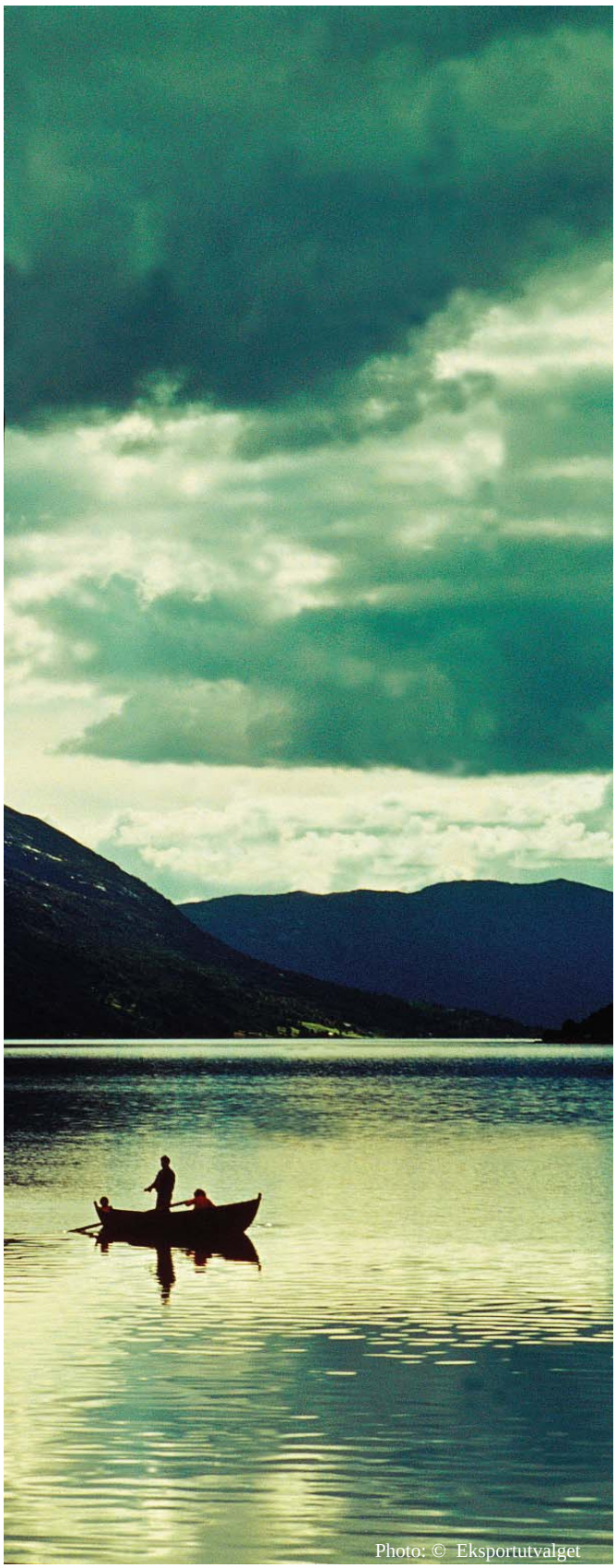


Photo: © Eksportutvalget

General view of municipalities with coastal zone plans
Status for coastal zone plans per 31.12.2006

County	Adopted coastal zone plans	Plans on- going preparation	Rolling plans	Lacking plans
Østfold	3		3	1
Akershus				7
Oslo				1
Buskerud				4
Vestfold	3	1	1	6
Telemark			3	
Aust-Agder	1	4		
Vest-Agder	4	1	2	1
Rogaland	8		12	3
Hordaland	22	5	5	
Sogn og Fjordane	11	5	2	6
Møre og Romsdal	14	6	11	5
Sør-Trøndelag	8		6	2
Nord-Trøndelag	11		6	
Nordland	27		15	
Troms	5		19	
Finnmark	13		3	1
Total (out of 277 coastal municipalities)	**130**	**22**	**88**	**37**

Status for municipal coastal zone plans as of 31.12.2006 shows that 87 percent of the coastal municipalities in Norway have adopted a coastal zone plan. The most northern municipalities are “best in class”.

From Nord-Trøndelag to the Russian boarder only one municipality has not adopted a coastal zone plan.

The lacking of plans on the coast of Skagerrak
Interest for space is increasing in the coastal zone and the municipalities try to adopt plans to ensure that conflicts of interests can be avoided. Planning is more difficult in the South due to strong recreational interests. In the North it is mostly industrial interests one must consider.

Planning at county level
Aust-Agder has adopted a county part plan for the coastal zone, and therefore lifts the planning process up from the primary municipal level. Many municipalities on the coast of Skagerrak have similar interests, and therefore it could be useful to lift the planning up to county level such as Aust-Agder has done.

DIRECTORATE OF FISHERIES

Demands to floating aquaculture installations - NS 9415

NS 9415 is a Norwegian Standard, which contains demands to floating aquaculture installations and the main components, which the installations are comprised of. These main components are considered as floating collars, mesh, moorings and raft/barges.

The demands in the standard are aimed at both the producers of such equipment and also the aquaculture industry.

Demands for physical design
The standard contains, amongst other, demands for physical design, installation, use and servicing of the aquaculture installation and the main components.

The standard also contains demands for a site survey. Measurements regarding current, waves and wind must be carried out in sites that are to be used for aquaculture.

Based on experience
NS 9415 has been prepared by Standard Norway with participation from the fishery- and environmental authorities, research- and development institutions, consulting corporations, fish farmers and the equipment contractors. The standard is based on reports, reviews and experience from the aquaculture industry.

The preparation of NS 9415 was parallel to the preparation of the new regulation (Nytek) concerning technical demands for aquaculture installations.

The Nytek regulation does not include demands regarding technical demands for floating aquaculture installations, but refers to the demands set down in NS 9415 and compel thus the producers and the fish farmers to follow the demands in the standard.

As of now the NS 9415 is undergoing revision.

DIRECTORATE OF FISHERIES

National Salmon Fjords and Salmon Rivers

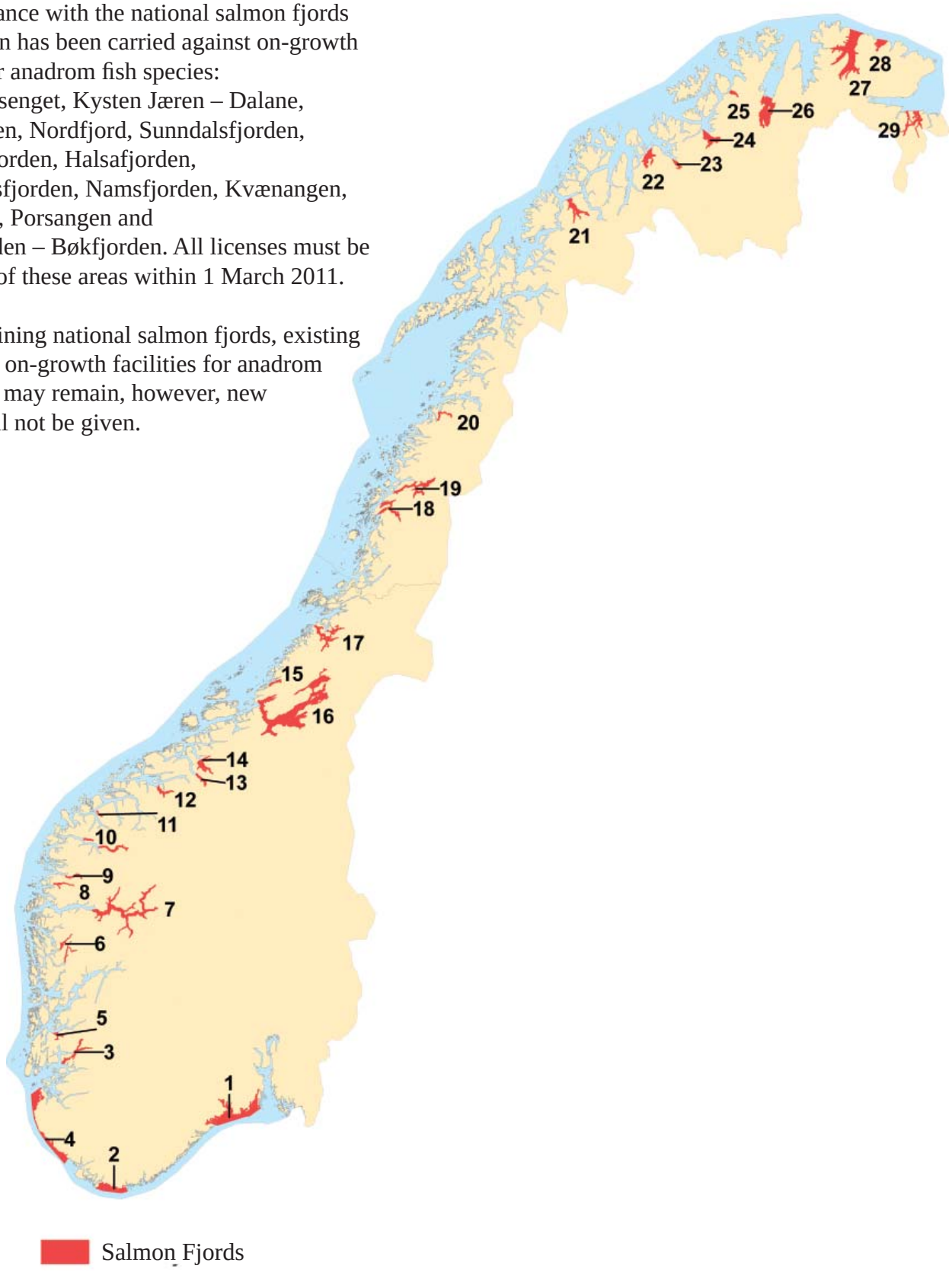
In compliance with the carried motion by parliament 25 February 2003 (round 1) and 15 May 2007 (round 2), there has now been established 29 national salmon fjords (NLF) and 52 national salmon rivers (NLV).

The object to establish such national salmon fjords and salmon rivers is to give a selection of the most important wild salmon populations in Norway particular protection against encroachment and other activities in the rivers, and against aquaculture activities in the fjords and coastal areas.

1. Svennerbassenget (Sandøy – Strømtangen)	Vestfold,Telmark
2. Lindesnes – Mannesfjorden (Lindesnes – Fugløya, mot åpent hav langs grunnlinjen)	Vest Agder
3. Sandsfjorden (Austbø – Jelsa og Vardnes – Breidvik)	Rogaland
4. Kysten Jæren – Dalane (Tungenes fyr – Åna - Sira)	Rogaland
5. Etnefjorden – Ølsfjorden (Rossanaeset – Notaneset)	Hordaland
6. Fjordene ved Osterøy (Molvik – Tysso, Skreaneset – Olsnesnipa)	Hordaland
7. Sognefjorden (Ortmark – Nessane)	Sogn og Fjordane
8. Dalsfjorden (Holmedal – Strømsnes)	Sogn og Fjordane
9. Førdefjorden (Rett linje ved Kvammen)	Sogn og Fjordane
10. Nordfjord (Stårheim – Hamnes, Finnvika – Åseneset)	Sogn og Fjordane
11. Ørstafjorden (Grønvikskjær – Pålskjær)	Møre og Romsdal
12. Romsdalsfjorden, indre del (Hamneneset – Okseneset)	Møre og Romsdal
13. Sunndalsfjorden (Fjøseid – Merraberget)	Møre og Romsdal
14. Halsafjorden (Aksnes – Flesa)	Møre og Romsdal
15. Åfjorden (Langhaugan – Hestneset)	Sør-Trøndelag
16. Trondheimsfjorden (Agdenes fyr – Brekstad)	Sør- og Nord-Trøndelag
17. Namsfjorden (Kårbringeskjær – Knappholman, Husvika – Kaldklauv, Fosnes – Namsos kommuner)	Nord-Trøndelag
18. Vefsnfjorden (Leinesodden – Sandnessjøen, Hamnes - Bjørga)	Nordland
19. Ranafjorden (Leirholmen – Velsvåg)	Nordland
20. Beiarfjorden (Kvarsnes – Hamnes, Røsnes – Nordsandnes)	Nordland
21. Malangen (Tennskjer – Ansnes)	Troms
22. Reisafjorden (Maurnes – Meiland)	Troms
23. Kvænangen (smalt sund vest for Balderselva)	Troms
24. Altafjorden (Altneset – Isnestoften)	Finnmark
25. Repparfjorden (Tappen – Klubbukt)	Finnmark
26. Porsangen (Ytre Veidnes – Kjerringvikneset)	Finnmark
27. Tanafjorden (Russevik – Skarveneset)	Finnmark
28. Kongsfjorden (Nålneset – Vestneset, mot åpent hav langs grunnlinjen)	Finnmark
29. Neidenfjorden – Bøkfjorden (Skoalaidvakki rundt Kjøøya til Geresgåppi, Bøkfjorden fyr – Raigebakti)	Finnmark

In co-ordinance with the national salmon fjords a prohibition has been carried against on-growth facilities for anadrom fish species: Svennerbassenget, Kysten Jæren – Dalane, Sognefjorden, Nordfjord, Sunndalsfjorden, Romsdalsfjorden, Halsafjorden, Trondheimsfjorden, Namsfjorden, Kvænangen, Altafjorden, Porsangen and Neidenfjorden – Bøkfjorden. All licenses must be moved out of these areas within 1 March 2011.

In the remaining national salmon fjords, existing licences for on-growth facilities for anadrom fish species may remain, however, new licences will not be given.



DIRECTORATE OF FISHERIES

The regulation regarding reactions
Violation penalties and compulsory fines

Framework
The regulation regarding reactions concerning violations of the aquaculture act was passed by the Ministry of Fisheries and Coastal Affairs, and was set in motion 1 April 2007.

The regulation ensures that provisions in compliance with the aquaculture act are implemented, and implies that those whom violate the regulations will be met with more stringent reactions.

The regulation gives the Directorate of Fisheries statutory right to implement a compulsory fine, violation penalty or come to a decision of taking drastic action for the liable ones expense.

2. Compulsory fine
Compulsory fines are administered to compel the liable into fulfilling the demands laid down in the aquaculture legislation. It can be given as a current compulsory fine or as a non-recurring fine. The non-recurring fine is calculated roughly in each individual case. The current compulsory fine is calculated according to fixed rates, which estimates from the basic amount in the National Insurance (G). The basic amount is regulated once a year, and is pt. (01.05.07) NOK 66 812,-. A current compulsory fine with an increased rate can also be administrated. Such cases can be where there is danger of substantial harmful effects to the environment, that the one liable has not complied with several earlier notices, or if there exits other particular circumstances.

Calculated normal rate:
The current compulsory fine is calculated to 15 (G) divided by 365...

$$\frac{15 \times \text{NOK } 66.812,-}{365} = \text{NOK } 2.745,\text{- per day}$$

Calculated increased rate:
The current compulsory fine is calculated to 150 (G) divided by 365.

$$\frac{150 \times \text{NOK } 66.812,-}{365} = \text{NOK } 27.456,\text{- per day}$$

3. Violation penalty – a whole new reaction
Violation penalty is an administrative sanction. The regulation regarding reactions, states that the Directorate of Fisheries' regional offices can administrate the violation penalty, when concerning violations of distinct regulations. This includes excess biomass as well as provisions that are often violated in conjunction with fish escapes.

Violation penalty is an alternative to being charged with a crime.

3.1 Measuring violation penalties regarding excess biomass
The violation penalty with regards to excess biomass must be set so high so that it does not pay to excess the permitted biomass. The profits gained due to excess of biomass will however oscillate. Due to the varying sales price, the regulation states that the violation penalty for excess biomass shall be calculated from the prevailing gross sales price, for the relevant species. The Directorate of Fisheries determines this monthly. The calculation of the fine, will hereby, ensure that it is not worthwhile to produce more fish than permitted. Information concerning reactions gives good legal protection, due to that the individual fish farmer's predictability and conformity is ensured.

Examples:
When exceeding the permitted biomass […] the violation penalty amounts to the exceeded amount of excess biomass multiplied by the prevailing gross sales price at the time the violation took place.

For May 2007 the prevailing gross sales price was NOK 21,328 for salmon and NOK 22,400 for trout. Calculated violation penalty for May 2007:

Species	**Gross sales price 2007**	**Violation:**	**10 tons**	**50 tons**	**200 tons**	**500 tons**
Salmon	NOK 21,328	**Fine (NOK.):**	213.280	1.066.400	4.265.600	10.664.000
Trout / Rainbow trout	NOK 22,40	**Fine (NOK.):**	224.000	1.120.000	4.480.000	1.200.000

3.2 Estimating violation penalties concerning other violations
Violation penalties for other violations are tied to illegal use of site, and to those regulations that are usually violated in conjunction with fish escapes. The fine is tied to the fundamental amount in the National Insurance (G), and it is possible to multiply it with 1, 3, 6 or 10. The largest amount the fine can amount to, as of to date, is calculated to NOK 655.050,-. In special circumstances it is possible to increase it by multiplying G with 15, which amounts to NOK 982.575,-.

When estimating which alternative to use, one must emphasize on the degree of blame, profit, administration costs and the extant of the violation.

Examples:

Basis for calculation: National Insurrance (G)	**1 G**	**3 G**	**6 G**	**10 G**	**15 G**
Fine (NOK):	66.812	200.436	400.872	668.120	1.002.180

DIRECTORATE OF FISHERIES

MAB-calculator

Areas for use
The calculator is based on developed algorithms for calculating growth, use of feed and biomass development. Its primarly use is meant for controlling the fish farmers crediability regarding monthly biomass reports, but can also be used to track effects from disease or poor environments, where such information exists (i.e. environmental reports in accordance to NS 9410, parasites, disease or oxygen saturation). Insufficient growth and feed utilisation can also be an indication that the biomass is not adapted to the carrying capasity.

Mode of operation
The fish farms information regarding temperature, date, weight in and weight out are added to the calculator. The model calculates the growth taking into account the natural seasonal related light influence. This effect can be turned. In case there is a need to check out information from a fish slaughterhouse, the model can be set in revers to calculate backwards.

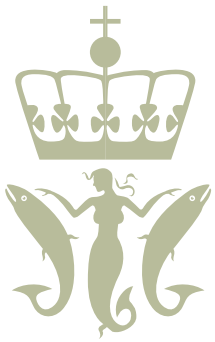
Using the fish farmers information as a starting point, a so called VFenvironment is adjusted in such a way that the result (weight out) is identical with the fish farmers report.

Based on this, it is possible to calculate whether growth has been normal or not. What is regarded as normal can be adjusted based on experience. The feed loss (%) is adjusted to the amount feed reported by the fish farmer.

The calculator gives an indication to whether the feed use and biomass information is crediable or not. Spesific Growth Rate (% daily growth) is calculated and can be checked against tabels and other models. In cases where growth is low, this can be due to situations with poor environmental factors such as low oxygen level, high temperature, insufficient current, algae or poor water quality. Factors such as large biomass or situations where disease is influencing gut function and retention time can also give poor growth.

The calculator will in such instances also give an indication to possible effects tied to feed usage. High temperature and low oxygen can have particular increased effects. Fish eat next to nothing, growth is poor and the feed comsumed is poorly utilized. The calculator has a module which calculates how oxygen uptake, growth and feed usage are influenced by parameters such as oxygen, temperature and salinity.


Photo: © Eksportutvalget



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Marine Life - Our *Common* Responsibility