



Council

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***Special Liaison Meeting to Review Measures to Minimise Impacts of
Aquaculture on Wild Stocks***

Presentation by Iceland

**NASCO EIGHTEENTH ANNUAL MEETING
MONDARIZ, SPAIN, JUNE 2001**

**Special Liaison Meeting to Review Measures to Minimise Impacts of
Aquaculture on Wild Salmon Stocks**

Árni Ísaksson:

Major Provisions in Icelandic Laws and Regulations

Presentation by Iceland

**Section II. General measures
Licensing and Monitoring**

**Laws and Regulation Regarding Aquaculture
Acts**

- Act no 73/1997 on Planning and Building
- Act no 106/2000 on Environmental Impact Assessment
- Act no 7/1998 on Environmental and Food Control
- Act no 44/1999 on Nature Conservation
- Act no 55/1998 on Treatment, Production and Distribution of Marine Products
- Act no 76/1970 on Salmonid Fisheries with later amendments. A revision of the Aquaculture section of the Act passed through Parliament in late May 2001.

Regulations

- Regulation no 48/1994 on Pollution Control
- Regulation no 597/1989 on Disease Prevention and Health Inspection of Aquaculture Facilities.
- Regulation no 105/2000 on Transfer and Release of Salmonids and Prevention of Disease and Genetic interaction
- Regulation no 226/2001 specifying Areas where Farming of Fertile Salmon is Prohibited.

Environmental Impact Assessments

- Marine Fish Farms under 200 ton production exempt from Environmental Impact Statement (EIS).
- Marine Fish Farms exceeding 200 ton production subject to evaluation and decree by the Icelandic Planning Agency regarding the need for an EIS.
- Freshwater Fish Farms under 20 ton production exempt from EIS.
- Freshwater Fish Farms exceeding 20 ton production subject to evaluation and decree by the Icelandic Planning Agency regarding the need for EIS.

Licensing System

- Split into an "Environmental Licence" dealing with pollution control and an "Operating Licence" dealing with ecological, genetical and disease issues.
- "Environmental Licences" either by the Environmental and Food Agency or communal Health Inspection Authorities.
- "Operating Licence" by the Directorate of Freshwater Fisheries.

Environmental Licences

- Pertains mostly to pollution, harmful chemicals, distribution of suspended solids and other local environmental issues.
- Environmental licensing of Marine Fish Farms exceeding a production of 200 tonnes by the Environmental and Food Agency.
- Environmental licensing of Freshwater Fish Farms exceeding a production of 20 tonnes by the Environmental and Food Agency.
- Environmental licensing of stations with a smaller production as well as ranching stations by communal Health Inspection Authorities.

Environmental Licence Specifications(Act no.7/1998 on Environmental and Food control)

- Issued by the Environmental and Food Agency for major fish farms (>200 tonnes)
- Section 1 specifies the production volume, tonnage produced and general requirement concerning waste treatment.
- Section 2 specifies criteria concerning environmental standards as well as pollution control.
- Section 3 specifies control and monitoring visits and relevant fees.
- Coast-based salmon farms must discharge wastewater far enough to ensure rapid dilution of the effluent.
- Marine cage farms must conform to harbour rules, be clearly marked and fitted with caution lights if necessary.
- Marine Farms must collect environmental information and run monitoring routines to ensure a healthy environment.
- The farm must fulfil environmental criteria according to Pollution Control Regulation.
- The farm must fulfil environmental criteria with respect to use of antibiotics and disinfectants.

Operating Licence Specifications (Salmonid Fisheries Act no 76/1970 with later amendments)

- Pertains to ecological, parasitological, disease and genetic interactions
- Issued by the Directorate of Freshwater Fisheries after consulting the Fish Disease Committee, the Fish Disease Veterinarian, the Freshwater Fisheries Committee as well as the Institute of Freshwater Fisheries regarding genetic and ecological interactions.
- An EIS reports, if required, must be available
- Applicant must provide a valid Environmental Licence.
- Applicant is expected to provide satisfactory information on potential threats to wild salmonid stocks as a result of the proposed aquaculture activity. That failing he can be obligated to cost additional research related to ecological, parasitic, disease and genetic threats prior to processing of application.
- If application is satisfactory, the Directorate issues an operating licence for a 5 year period.

Validation of the Operating Licence

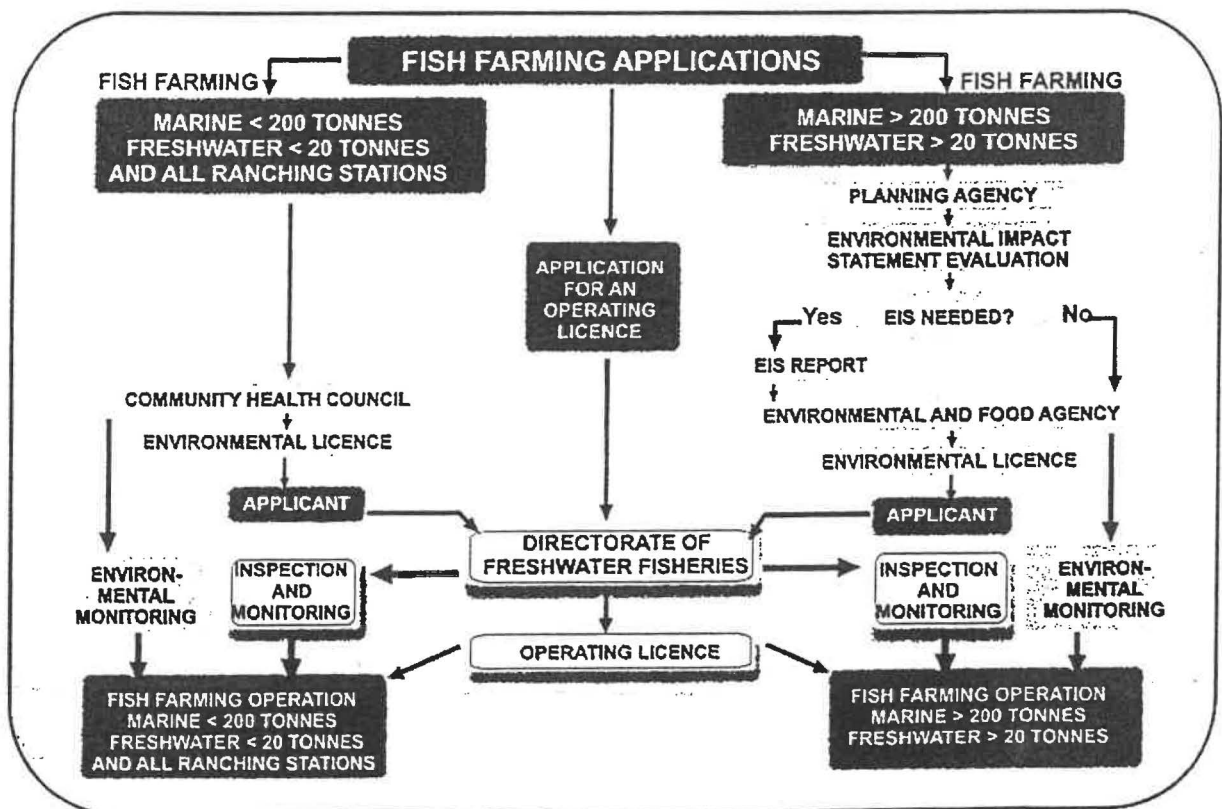
- The Operating Licence becomes valid after the aquaculture facility has been assessed and approved by the Directorate and the Office of the Fish Disease Veterinarian.
- The Operating Licence shall contain specifications regarding the species being reared, total production allowed and any precautionary conditions related to the escape of fish from cages and their recovery.

- The Operating Licence may impose financial obligations upon the applicant regarding tagging, surveillance and additional research related to disease, parasitic as well as genetic threats to wild salmonid stocks locally and in nearby areas.
- The Operating Licence is non-transferable and can not be leased or pawned.
- The operator of an aquaculture facility must report accidental releases to the Directorate of Freshwater Fisheries.

Surveillance and Monitoring of Fish Farms

- Local environmental factors and sea-cage integrity are monitored and inspected by the Environmental Agency and communal Health Inspection Authorities.
- General Fish Health, including fish diseases and parasitic infections are monitored and inspected by the Office of the Fish Disease Veterinarian, which also issues health certificates.
- Overall technical and rearing performance as well as compliance with operating licence requirements is monitored and inspected by the Directorate of Freshwater Fisheries.
- Aquaculture facilities are required to keep a diary or a log book, recording daily events such as health status, feeding regime, fish transfers and various other factors.
- Marine fish farms will be inspected at least twice a year, landbased farms once a year.
- All hatcheries and fish farms must report annually to the Directorate regarding total production, origin of brood stock, feed use, annual sales and other relevant issues.

ICELANDIC FISH FARMING AND RANCHING LICENSING AND MONITORING SYSTEM



Section III. Transfers and Release

Measures to Minimize Genetic, Parasitic and Disease Interactions (Salmonid Fisheries Act no 76/1970 with later amendments)

- River association intending to perform enhancement through smolt or fry releases or maintenance of angling through smolt releases must make a 5 year Enhancement Plan for the salmon river, which is subject to approval of the Directorate of Freshwater Fisheries.
- River associations intending to perform enhancement must get a permit for collecting broodfish from the Directorate.
- Local stocks must be used for enhancement in salmon rivers. Exemption for the use of a salmon stock from a similar habitat can be granted by the Directorate following an environmental evaluation. Such exemptions, however, are only granted in accordance with the 5 year Enhancement Plan.
- Transfer of wild, ranched and reared salmonids into a natural watershed for angling is prohibited. Exemption can be granted by the Directorate after receiving comments from the Fish Disease Veterinarian on possible disease interactions and from the Institute of Freshwater Fisheries on possible ecological and genetic interactions.
- Transfer of species not-specified in the respective operating licences between rearing and ranching stations is prohibited as well as the transfer of life fish and their eggs between watersheds. The Directorate can grant an exemption upon receiving comments from the Fish Disease Veterinary officer, the Fish Disease Committee and the Institute of Freshwater Fisheries regarding possible genetic interactions.
- The use of selectively bred salmon strain shall be confined to salmon farms and its use for enhancement and ranching is prohibited. The Directorate can grant a research organization an exemption for small scale experiments after consulting the Institute of Freshwater Fisheries.

Measures to Minimize Genetic, Parasitic and Disease Interactions (Regulation no 105/2000 on Transfer and Release of Salmonids and Prevention of Disease and Genetic interaction)

Transfer and Release of Salmon of Wild Origin

- Transfer of wild salmonids and their eggs between watersheds is subject to approval by the Directorate of Freshwater Fisheries. Wild broodfish must be slaughtered and monitored for disease according to specifications from the Fish Disease Committee.
- The Directorate can grant a permission for the use of non-local stocks in rivers with none or small stocks of salmon provided that the effects on nearby rivers are considered negligible.
- The Directorate can also permit transfer of wild salmonids into sea cages and landbased rearing stations with the approval of the Fish Disease Committee.

Transfer and Release of Salmon of Reared and Ranched Origin

- Ranching stations can use ranching stocks from approved facilities.
- Reared brood fish, disinfected eggs and juveniles of reared origin can be transferred freely between rearing facilities as long as it conforms to disease regulations.
- Transfer to stations with runoff into rivers must, however, be confined to the species found in the watershed and the approval of the Directorate is needed for the introduction of other species.

- The release of salmonids of foreign origin for enhancement or ranching is prohibited. The Directorate can, however, grant an exemption to a research organization for a period of two years with the approval of the Fish Disease Committee and subject to the tagging of all fish released.

Reciprocal Distance between Aquaculture Units and their Distance from Salmon Rivers

- Minimum distance from sea-cages to rivers with an annual catch exceeding 100 salmon is 5 km.
- Minimum distance from sea-cages to rivers with an annual catch exceeding 500 salmon is 15 km. The distance can be shortened to 5 km. if sterile salmon are being used.
- Minimum distance between sea-cages and from those to land-based operations or ranching stations shall be 2 km.
- A conditional 2 year exemption can be granted by the Directorate with the approval of the Fish Disease Committee.

Section IV. Setting of Regulatory Measures and Aquaculture Zones **Salmonid Fisheries Act no.76/1970** **with later amendments**

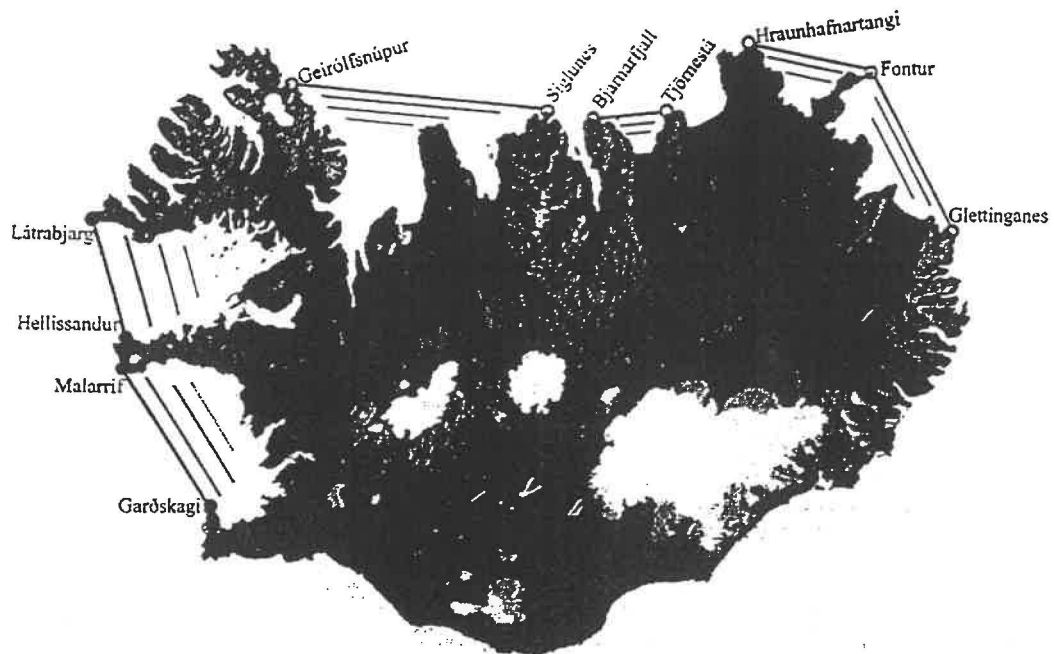
Regulatory Measures

The Ministry of Agriculture can set regulatory measures covering the following items:

- The Contents and the Issuing of an Operating licence.
- Microtagging of all or part of the smolts used in sea-cages
- The use of Sterile salmon in Aquaculture
- The use of Feed in salmonid farms.
- Maintenance of Farming Facilities including sea-cages.
- Monitoring, Inspection and Assessment of salmonid farms.
- Transfer of Salmonids between salmonid farms and ranching stations.
- Transfer of Wild Salmonids and their eggs between watersheds.
- Wild salmon Coastal Protection Areas, where salmon farms are prohibited
- Setting up of specific Aquaculture Areas.
- Setting up of a maximum Production Quota in Aquaculture areas

Aquaculture Zones and Salmon Protection Areas

- Protection areas can be set up to prevent disease, parasitic and genetic interaction through a regulatory measure.
- Specific aquaculture areas can be set up through a regulatory measure.
- Total production quota in an aquaculture area can be specified through a regulatory measure.
- A regulatory measure has been set, which prohibits rearing of fertile salmon in sea cages in certain fjords and bays in Iceland (Regulatory measure no 226/2001)
- A Fish Farming Committee composed of Administrative and Scientific personell from the Agricultural and Marine Departments has been recently established to coordinate fish farming activities of salmonids and marine species in various areas.



Areas where Rearing of Fertile Salmon is Prohibited

Section V. Control of Fish Diseases and Zoning

Disease Legislation and Authorities Responsible for Surveillance and Disease Control.

- The Salmonid Fisheries Act, no. 76/1970 was amended and extended in 1970, which provided the Fish Disease Enforcing Authorities with a wide range of statutory powers, and established certain legal obligations for river owners, fish farmers and fish importers.
- Fish Disease Committee, which assists the Minister of Agriculture in matters related to prevention and control fish diseases, was established at that time. It is headed by the Chief Veterinary Officer but otherwise comprised of the Director of Freshwater Fisheries and the Director of the Institute for Experimental Pathology of Animals.
- In 1985 a new law (no. 61/1985) about a "Veterinary Officer for Fish Diseases", was brought into force in response to changing fish disease risks, as fish farming was expanding and knowledge of such disease increasing. This law was followed by a new regulation in 1986 (no. 403/1986) concerning measures to prevent and control fish diseases and provide health inspection at fish farms.
- In 1986 a new law was enacted establishing the Fish Disease Laboratory as a separate department of the Institute for Experimental Pathology.

Natural Salmonid Species and the Legislation Concerning their Health Control.

- There are three natural and one imported salmonid species in Iceland; that is Atlantic salmon (*Salmo salar* L.), Brown trout (*Salmo trutta*), Arctic char (*Salvelinus alpinus*) and rainbow trout (*Onchorhynchus mykiss*). There are both sea-run and stationary populations of trout and char.
- The fishing rights are private and all the owners on a river system are obliged to form a "River Association, which manages the cultivation and restocking projects.
- There are 45 major salmon rivers around Iceland, of which many are following a cultivation plan on restocking. Since 1985 there is also a compulsory monitoring program for fish diseases regarding wild brood fish, in the same manner as for the farmed salmonids.

System of Disease Monitoring, Health Status and Implementation of International Regulations

- Since 1985 all fish farms in Iceland have been under obligatory and regular fish health surveillance.
- From 1993 Iceland has followed the European Union (EU) regulations and used the requirements layed down in Council Directive 91/67/EEC and the disease control measures provided for in Directive 93/53/EEC as a guidelines in the national fish health monitoring system.
- The sampling and diagnostic procedures as given in Commission Decision 96/240/EEC were followed.
- The fish health status in Icelandic aquaculture in general is very promising. The main reasons for that is presumed to be the geographical isolation of the country, strict import policy, secure water supply for the farms and effective fish health surveillance.

Fish Diseases Occurring on Fish Farms in Iceland during the last Decade:

| | Annual incidence of new outbreaks / no. of farms | | | | | | | | | | |
|----------------------|--|------|------|------------------|------|------|------|------|------|------|------|
| Fish disease: | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
| Atyp. furunculosis | 2* | 1* | 3* | 1* | 0 | 0 | 0 | 1* | 0 | 0 | 0 |
| BKD | 1* | 0 | 1* | 1 ^o * | 4* | 1* | 0 | 0 | 0 | 0 | 0 |
| Winter ulcers | 1* | 0 | 2* | 0 | 1* | 0 | 0 | 0 | 0 | 0 | 0 |
| Cold water vibriosis | 0 | 0 | 0 | 1* | 0 | 0 | 0 | 0 | 1* | 0 | 0 |

- * On growing farm - land based (salinity: 10 - 25‰)
- On growing farm - sea cages (full salinity)
- ° Hatchery/smolt farm (fresh water)

Public Authorities Administering Importation of Live Fish and their Gametes

- The Minister of Agriculture has supreme authority on matters concerning imports and all matters related to fish diseases.
- He is advised by the "Fish Disease Committee".
- The enforcement and surveillance authority rests with the "Veterinary Officer for Fish Diseases".
- Disease diagnosis and sample analysis rests with the "Fish Disease Laboratory".
- During the last fifty years the import of live fish, eggs and gametes to Iceland has been very restricted. Fish species have only been imported as disinfected eggs, with one exception, and these imports are as follows:

Importation of Salmonids, other Fin-fish and Molluscs to Iceland

1951: Disinfected rainbow trout eggs (*Salmo gairdneri*) from Denmark.

1984 - 1987: Disinfected salmon eggs (*Salmo salar* L.) from Norway, one import yearly from VHS and IHN free zones.

1994: Seabass larvae (0,5 gr) (*Dicentrarchus labrax*) from France, from zones free of VHS and IHN.

1995 - 2001: Disinfected seabass eggs (*Dicentrarchus labrax*) from France, 1-2 imports yearly, from zones free of VHS and IHN.

1999: Disinfected turbot eggs, 4 dl (*Psetta maxima*) from France.

1988: Red abalone (*Haliotis rufescens*) from California, U.S.A.

1996: Red abalone (*Haliotis rufescens* + *Haliotis discus hannai*) from Japan.

Official Certification Systems and Listing of Diseases for the Export of Live Fish and their Gametes

- The official certification associated with export of live fish, eggs and gametes is under the supervision of the Veterinary Officer for Fish Diseases. The certification is never made without intensive disease screening and laboratory examination.

There are 3 following categories of diseases:

- List A diseases: Transmissible diseases which have the potential for very serious and rapid spread and which are of serious socio-economic importance in the international trade of live fish, eggs and gametes. List A diseases will be met with stamping out procedures as these diseases are considered as dangerous and exotic in Iceland. Measures are taken immediately and reports submitted to the OIE.
- List B diseases: Transmissible diseases which are considered to be of socio-economic importance within the country and which are significant in the international trade of live fish, eggs and gametes. Measures are variable, from stamping out to general vaccination.
- List C diseases: Diseases registered once a year.

Potential Diseases Listed in Iceland by the Veterinary Officer for Fish Diseases

| List A diseases: | List B diseases: | List C diseases: |
|--|---|---|
| Infectious salmon anemia (ISA) Infectious pancreas necrosis (IPN) Infectious haematopoietic necrosis (IHN) Epizootic haematopoietic necrosis (EHN) Oncorhynchus masou virus (OMV) Viral haemorrhagic septicaemia (VHS) Spring viraemia of carp (SVC) Viral nervous necrosis (VNN) Gyrodactylosis | Furunculosis Atypical furunculosis Piscirickettsiosis Bacterial Kidney disease (BKD) Enteric red mouth (ERM) Systemic spironucleosis Pancreas disease (PD) Erythrocytic inclusion body syndrome Proliferative kidney disease (PKD) Salmon louse infection Marine louse infection Whirling disease Swimbladder nematode of eel | Viral erythrocytic necrosis (VEN) Ulcerative dermatic necrosis (UDN) Papillomatosis Mycobacteriosis Epitheliocystis Winter ulcers Vibriosis |

Fallowing and Other Possible Emergency Measures in the event of a Positive Disease Diagnosis.

- According to Act no. 25/1993, governing animal diseases and preventive measures against them the, Minister of Agriculture may prescribe any measures, by suggestions from the Chief Veterinary Officer, deemed necessary to eradicate or prevent the spreading of List A and List B diseases.
- According to the Salmonid Fisheries Act no. 76/1970 the Minister of Agriculture can prescribe, if so advised by the "Fish Diseases Committee", any measures necessary to eradicate and prevent spreading of contagious fish diseases
- Stamping out procedures followed by cleaning, disinfection and fallowing will be carried out if List A fish diseases (and in some cases List B fish disease) are diagnosed.

Disease Zones and Degree of Contact between the Farmed Aquatic Animals and those of Natural Populations.

- Iceland is just divided into two different disease zones, open sea water zone and a land based fish farming zone. For many years there has only been one particular fish farm using sea cages on open sea. Almost all of the on-growing fish farms in Iceland have been land-based, supplied exclusively with pumped fresh and sea water from bore-holes.
- The pumped water supply has no contact to surface water or open sea and therefore no possible contact with wild fish. The land-based zone is recognised by the Official Authorities, in accordance with the recommendations of the International Aquatic Animal Health Code of the EU, as being free of virus diseases as well as many bacterial diseases like BKD, Enteric red mouth and Furunculosis.

Use of Medicines and Disinfectants

- Use of Medicines Controlled by the Veterinary Officer for Fish Diseases
- Use of Disinfectants Controlled by the Environmental and Food Agency

Disinfection of Angling Equipment

- All fishing equipment brought to Iceland for angling purposes must be disinfected at the port of entry.
- Such facilities are provided at the Keflavík International Airport as well as at the Seyðisfjörður ferry terminal on Iceland's east coast.
- A valid certificate of disinfection from a veterinary officer is accepted and encouraged to reduce delays.

Licensing, monitoring and regulation of aquaculture in Iceland

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Summary

The legislation concerning aquaculture and aquaculture products is rather complicated in Iceland. Licences are issued by two governmental institutions, one agency under the Ministry for the Environment and the other under the Ministry of Agriculture. A number of institutions are involved in the process of licensing in order to take care of the interests of different stakeholders. Environmental issues are monitored by the Environmental and Food Agency or the local Health Inspection Authority. Disease control, health inspection of fish farms and permission for slaughtering are the responsibility of the Veterinary Officer for Fish Diseases. Control of slaughtering, food processing and the products are the responsibility of the Directorate of Fisheries. The local Health Inspection Authority is responsible for controlling the food products for the domestic market.

Introduction

In 1993 the number of aquaculture stations in Iceland was 76. Of these, 36 stations were juvenile rearing, 39 were land-based tank and pond stations, seven were marine cage farms and nine were salmon ranching stations, mostly on a small scale. Two of these stations carried out aquaculture research. In 1996 the number of aquaculture stations had decreased to 60. Of these, 45 stations were juvenile rearing, 41 were land-based tank and pond stations, six were marine cage farms and five were salmon ranching stations. Four stations carried out marine aquaculture research. In 1997 the number of stations was estimated as 44 with salmon ranching in only three stations.

In 1996 the total volume of Icelandic fish farming was estimated at 213 000 m³. Marine and brackish water systems consisted of 159 000 m³, with land-based tanks contributing 91 000 m³ and cage volume contributing 68 000 m³. The total volume in Icelandic aquaculture has been stable over the period 1995–98.

Total annual aquaculture production in Iceland in 1995–98 is shown in Table 1 (data from the Directorate of Freshwater Fisheries). Sea ranching and brown trout production has stopped, salmon production is stable, but the production of arctic char and some other marine species is growing.

In 1996 the total feed consumption in marine systems was 4100 tonnes (90% dry organic matter). Total nitrogen in the feed was estimated as 265 t and total phosphorus as 36 t. Total discharges of nutrients were not estimated.

The Icelandic laws and regulations discussed in this paper are published by number and year in 'Stornartidindi (Stornartidindi, Sidumula 29, 108 Reykjavik, Iceland)'. The law texts can be accessed at the Icelandic parliament's internet address ([HTTP://www.althingi.is](http://www.althingi.is)) and the law and regulation texts can be accessed at the Icelandic government's internet address

Table 1

Total annual aquaculture production (tonnes year⁻¹) in Iceland in 1995–98

| Species/year | 1995 | 1996 | 1997 | 1998 |
|---------------------------|------|------|------|------|
| Salmon (sae ranch return) | 290 | 239 | 46 | 34 |
| Salmon (aquaculture) | 2590 | 2743 | 2554 | 2686 |
| Arctic char | 470 | 628 | 644 | 640 |
| Brown trout | 10 | 1 | <1 | 0 |
| Atlantic halibut | | | 2 | 10 |
| Sae bass | | | 3 | 12 |
| Abalone | | | | 0.6 |
| Total | 3740 | 3816 | 3739 | 3703 |

([HTTP://stjr.is](http://stjr.is)). The Salmonid fisheries act can be accessed at [HTTP://www.veidimalastjori.is](http://www.veidimalastjori.is).

The regulatory and licensing system

The agencies involved

The Environmental and Food Agency is the state authority for the environmental licensing of aquaculture. The Agency issues licences to large stations and the local Health Inspection Authorities issue licenses to small farms. A number of other state and communal authorities are involved in the process of licensing and have control responsibilities. These are the Directorate of Freshwater Fisheries, the Nature Conservation Agency, the Veterinary Officer for Fish Diseases, the Planning Agency and the local planning and building authorities. Slaughtering, processing, transport and export are controlled by the Directorate of Fisheries, and products for domestic consumption are controlled by the local Health Inspection Authorities.

The regulatory structure and licensing

Act No. 7/1998 on Environmental and Food Control

This Act covers health and food control, pollution control, environmental monitoring, research and information. The Environmental and Food Agency is the state authority for the supervision of the implementation of the Act. The local Health Inspection Authorities are primarily responsible for the implementation. The Act takes notice of the European Economic Area (EEA) agreement between EFTA and the European Union. The Minister for the Environment has the authority to publish detailed regulations concerning the implementation of pollution control and regulations based on relevant Council Directives regarding environmental issues. The Minister is authorized to set regulations concerning the operational licences for polluting companies, including site selection, environmental and discharge standards, monitoring, control routines and research. There are also pollution treatment mea-

asures including BAT in relevant industries if necessary, Environmental Monitoring and Audit Systems (EMAS and ISO 14001), and surveys to check pollution risks, water use in industries, environmental and effluent standards for chemicals, water pollution control measures, effluent standards for pollutants and Environmental Quality Standards (EQS) for waters and groundwater. Water quality standards in Icelandic regulations cover dangerous chemicals in Council Directives (76/464 and related) and certain dangerous substances discharged into water.

Regulation No. 48/1994 (with amendments) on Pollution Control

This regulation sets the requirements for permission to discharge to water and groundwater and for BAT in operating licences for industries. Urban sewage treatment is regulated according to Council Directive 91/271/EEC. Local municipalities are responsible for the implementation of these regulations except for some industries and larger aquaculture plants. Council Directive (91/676/EEC) on the protection of waters against nitrate pollution is legislated in the regulation. Consequently, there are requirements to designate zones as being vulnerable to nitrate pollution, to establish a code of good agricultural practice and to implement suitable monitoring programmes on nitrate content and symptoms of eutrophication in surface water, groundwater, drinking water intended for human consumption, estuarial and coastal waters. The Planning Authorities, in co-operation with the Nature Conservation Agency and the Environmental and Food Agency, designate areas where polluting discharges are not allowed because of important use, ecosystems, geology or other issues. Pipelines with polluting discharges shall be placed at least 5 m below the mean low spring tide level or 20 m out to sea from the low spring tide line.

Environmental licensing for aquaculture

The Environmental and Food Agency

The Environmental and Food Agency issues a licence to marine aquaculture operations with an annual production of over 200 t and fresh water farms with annual production exceeding 20 t. The local Health Inspection Authorities issue licences to all other aquaculture plants. The return of salmon in salmon ranching stations is not considered as an aquaculture operation in the environmental licensing system. Environmental licences for salmon ranching and their control are therefore issued exclusively by local Health Inspection Authorities.

The Environmental and Food Agency prepares a draft licence. The draft is sent for official comments and public hearing for 8 weeks. The Agency has 4 weeks from the end of the hearing period to process the received comments on the draft, and finalize the licence. The Agency's decision and the final draft can be the subject of an appeal to the Minister for the Environment. The Minister has 8 weeks to make a decision.

Applications for a licence shall contain a detailed description of the production processes, information on pollution risk, pollution control, the site of the plant, the local environment and other relevant issues. The Agency consults with the local Health Inspection Authority, the Nature Conservation Agency, the Planning Agency and the Directorate of Freshwater Fisheries.

If an environmental impact assessment is needed according to Act no. 63/1993 (based on Council Directive 85/337/EEC), it must be carried out before the licence is issued. Before a licence is granted, the company may have to finance necessary

research in order to evaluate possible environmental effects and to start environmental monitoring routines for the control.

The licence process at local Health Inspection Authorities is similar to that at the Environmental and Food Agency. However, the process takes less time – the hearing time is 4 weeks instead of eight. Decisions can also be the subject of an appeal to the Minister for the Environment. The Environmental and Food Agency publishes guidelines for the Health Inspection Authorities.

Requirements in aquaculture licences

Requirements for pollution control are specified in the licence. The licence document has three chapters. Chapter 1 states the permitted production volume, clauses regarding amendment of the licence and general requirements concerning conduct and waste treatment. There are also references to other acts and regulations that concern production. Chapter 2 contains specific criteria concerning discharges and environmental standards (if available) and specific requirements concerning pollution control. Chapter 3 concerns control visits and fees for the control. The frequency of control visits and more detailed visits to take measurements for monitoring are stated.

Requirements concerning the carrying capacity

There is no description on how to evaluate carrying capacity for aquaculture, but the following requirements are in place in the licensing process and in the licences concerning carrying capacity: (1) detailed information on pollution risk in the application; (2) the Environmental and Food Agency shall prepare an evaluation report that follows the draft licence for public hearing; (3) in the licence, there are requirements concerning unexpected negative environmental effects.

Land-based tanks with discharge to the sea

Water treatment is not currently required for land-based aquaculture tanks which discharge to the sea. However, the plant must fulfil the above-mentioned requirements in the Pollution Control Regulation for pipelines with polluting discharges (at least 5 m below the mean low spring tide level, or 20 m out to sea from the low spring tide line). It is not always possible to fulfil this criterion because of the power of the ocean surf. The general requirement is that the wastewater is discharged in an optimal manner to ensure rapid dilution. The plant must also fulfil the environmental criteria according to the Pollution Control Regulation.

Marine cage farms

Cage farms at sea shall be positioned far outside common sea routes in co-operation with nearby harbour authorities. Cage farms shall be clearly marked and easily noticeable during day-time and fitted with caution lights at night if necessary. This shall be in accordance with navigation laws. The co-ordinates and marking shall be put on sea charts if necessary. For the purpose of controlling the environmental effects, the plant is obliged to collect environmental information and run monitoring routines.

Other controlling agencies

Act No. 44/1999 on nature conservation

This Act sets general criteria for nature conservation and concerns all human interference with nature. The Nature Conservation Agency shall therefore be consulted before an aquaculture plant is built and the licence is issued. The Agency can request requirements concerning pollution, land use, planning and building criteria, import of new species to the area

and transport of different stocks that can result in genetic mixing. The builder of a plant is responsible for contacting the Agency, but the Environmental and Food Agency and the Planning Agency consult the Nature Conservation Agency when a draft licence is prepared and when a regional plan is to be changed. The Nature Conservation Agency only issues permission in protected areas. Generally, the Nature Conservation Agency is against aquaculture or other polluting industries in areas that are protected or listed in the Agency's priority program.

Act No. 73/1997 on planning and building

A new aquaculture plant must be in accordance with the regional or local planning. If aquaculture has not been planned, a change must be made to the current plan. This change must be evaluated and sent to local hearing.

In regional and local plans, the goals for the evolution of the area are set. The plan takes notice of the current land use, interacting effects of different types of land use and the effects of human impacts on the environment, natural resources and the human community.

Act No. 63/1993 on environmental impact assessment

In regulation no. 179/1994, based on Act no. 63/1993, more detailed requirements are set. In the regulation, the Minister for the Environment can decide that an environmental impact assessment is required before a licence is issued. Those who apply for licences, or the authorities implicated in the process, can suggest that the Minister should require an environmental impact assessment if they fear there is a danger of significant effects on the environment. The Act is based on the Council Directive 85/337/EEC.

Act No. 93/1995 on foodstuffs

The responsibility for food control is delegated to different ministries and control authorities. The Ministry of Agriculture is responsible for the Veterinary control of export and import of animal agricultural products, treatment, supervision and inspection of slaughter products and health control in aquaculture. The Ministry of Fisheries is in charge of the treatment, transport and processing of marine products for export, including the slaughtering of aquaculture products. The Directorate of Fisheries is the control authority.

The Ministry for the Environment is in charge of all other food control in Iceland. The Environmental and Food Agency is the state control authority and implementation of the food control is carried out by the local municipal health inspection authorities. A licence is needed from the local health inspection authorities (that are also responsible for the control) for food production and distribution. In regulation no. 522/1994 on food control the criteria are set for food treatment and control routines. Regulation no. 518/1993 sets maximum residue limits for pesticides and other contaminants. For fish and fish products the following limits apply: aldrin and dieldrin (0.05 mg kg^{-1}); cypermethrin (0.05 mg kg^{-1}); DDT (0.5 mg kg^{-1}); endrin (0.05 mg kg^{-1}); Heptachlor and heptachloroepoxide (0.05 mg kg^{-1}); hexachlorobenzene (0.05 mg kg^{-1}); alpha, beta or gamma Hexachlorocyclohexane (HCH) (0.05 mg kg^{-1}); Chlordane (0.1 mg kg^{-1}); Mirex (0.1 mg kg^{-1}); piperonylbutoxide (20 mg kg^{-1}); pyrimiphosmethyl (1 mg kg^{-1}); pyrethrins (3 mg kg^{-1}); Aflatoxin M₁ (0.005 mg kg^{-1}); lead (0.2 mg kg^{-1}); radioactivity; histamine (200 mg kg^{-1}); cadmium (fish meat: 0.1 mg kg^{-1} ; Shellfish: 0.5 mg kg^{-1}); mercury (0.5 mg kg^{-1}); nitrosamine (0.007 mg kg^{-1}); Polychlorinated biphenyl (PCB) (0.2 mg kg^{-1}); Paralytic Shellfish Poison (PSP) toxin (0.8 mg kg^{-1}); Patulin (0.05 mg kg^{-1}); Tetrachlorethylen (0.1 mg kg^{-1}); tin (150 mg kg^{-1}). The regulation is based on Council Directives 67/427/EEC, 76/671/EEC, 76/621/EEC, 76/895/EEC, 79/700/EEC, 80/891/EEC, 86/362/EEC, 86/363/EEC and 90/642/EEC including later amendments.

Act No. 55/1998 concerning treatment, production and distribution of marine products

The purpose of this Act is to ensure healthy and unpolluted marine products. Treatment, production and distribution shall be according to good practices and health standards. The Directorate of Fisheries issue licences to fish processing industries that satisfy requirements. The Directorate can delegate the implementation of the control to accredited private control companies. The private control companies report to the Directorate. The fish processing companies are responsible for establishing internal quality control routines for production in order to ensure fulfilment of the Act and regulations based on the Act.

More detailed requirements and criteria can be found in Regulation no. 233/1999 on health control in treatment, processing and distribution of marine products and fish products. The act is based on Council regulation 2406/96, Council Directives 91/493, 95/71, 92/48 and Council decisions 93/51, 93/140, 93/351, 94/356 and 95/149. Regulation No. 260/1999 concerns the catch, treatment, processing and distribution of live mussels. The Directorate of Fisheries is responsible for the microbiological and chemical monitoring control of the quality of mussel fishing grounds and mussel flesh. Standards are set for microbiological parameters and algal toxins. The concentration of Diarrhetic Shellfish Poison (DSP) must be below detection limits and the standard for Amnesic Shellfish Poison (ASP) is 20 mg kg^{-1} . The regulation is based on Council Directives 91/67, 91/492 and 91/493 and the Council Decisions 92/532, 93/22, 93/25, 93/51, 93/55, 93/169, 93/351, 93/383 and 94/356. The Act and regulations set the standards for slaughtering facilities and the health control of slaughtering, processing and distribution of aquaculture products.

Operating licences for aquaculture

The Salmonid Fisheries Act No. 76/1970 (with later amendments primarily No. 63/1994, No. 24/1997 and No. 50/1988)

The primary purpose of the aquaculture section in the Icelandic Salmonid Fisheries Act is to ensure viable and sustainable aquaculture and ranching of freshwater species without endangering the local populations of anadromous and freshwater fish. An operating licence should only be issued after full compliance with the terms and conditions in the environmental licences has been determined. This requires a close co-operation between environmental authorities, veterinarian authorities and the Directorate of Freshwater Fisheries. The operating licence also exempts fish farms and ranching stations from various protection clauses of the Salmonid Fisheries Act, which specifically pertain to wild salmonid populations, such as gear and time limitations for salmonid fishing.

- A licence is needed from the Directorate of Freshwater Fisheries for fish farming and salmonid ranching. The Directorate shall appraise the station. If workmanship is deemed satisfactory, an operating licence is issued.
- However, operating licences must not be issued without veterinary certification, stating that the farm satisfies requirements for measures to prevent and control fish diseases. The

operating licence shall specify the maximum production permitted.

- Those in charge of rearing stations, ocean ranching stations and cage rearing stations shall annually submit a report on the activities of the stations to the Directorate of Freshwater Fisheries, with respect to quantity produced, rearing volume, use of feed, supply of fish and their origin and other relevant issues.
- The Regulation on the Transport and Release of Salmonids and the Control of Diseases and Genetic Mixing Between Salmonid Stocks (no. 401/1988) states general criteria to ban or minimize the transport of live fish between unrelated waters.
- A minimum distance is set between land-based, cage and sea ranch salmon stations and salmon rivers. The minimum distance from rivers is 5 km if the annual angling catch is between 100 and 500 salmon and 15 km if the annual catch is over 500 salmon. The minimum distance between land-based tank stations, cage stations and sea ranch stations is 2 km.

According to the above-mentioned Act and the Regulation Concerning Measures to Prevent and Control Disease in Fish and Health Inspection of Fish Farms (no. 403/1986), the Minister of Agriculture has supreme authority in matters concerning fish diseases. The Veterinary Officer for Fish Diseases, under the supervision of the Chief Veterinary Officer, and in co-operation with the district veterinarians, shall attend aquaculture stations to control, diagnose and make routine medical checks. The Veterinary Officer for Fish Diseases controls the animal health condition, medical and pesticide use, condition of the cultures, water use and equipment. He issues permits for medicine and pesticide use, keeps a record of the use and gives a certificate and permission for slaughtering. A fish disease committee, led by the Chief Veterinarian, is the co-ordinating authority regarding fish diseases and has the power to recommend the quarantine of aquaculture facilities as well as the eradication of diseases from such facilities to the Minister of Agriculture.

Environmental and food monitoring

Disease and medicine control

The Veterinary Officer for Fish Diseases controls the animal health condition, medicine and pesticide use, condition of the cultures, water use and equipment. The Veterinary Officer shall at all times keep a record of fish farms in the country, conditions and equipment, water sources, use of water (amount), wholesomeness of water, origin of the breeding stock, purchase and sale of roe and fry, and whatever else that may be of interest regarding infectious diseases and their spread. The Veterinary Officer also follows the requirements laid down in Council Directive 91/67/EEC (with later amendments), concerning the animal health conditions governing the placing on the market of aquaculture animals and products. The Veterinary Officer for Fish Diseases, in co-operation with the district veterinarians, gives permission for the use of medicine and pesticides and controls their use.

If antibiotics are added to the fish feed, or for any other antibiotic regime, the fish shall not be used for human consumption until 40 days after completion of the regime (water temperature greater than 8°C). If the water temperature has been less than 8°C, the fish shall not be used for human consumption until 90 days after completion of the regime. In order to give a certificate of medication, the supervising veterinarian will take samples to check for possible residues of particular

drugs in conjunction with the rules laid down by the Fish Disease Committee. The samples are analysed at the Fish Disease Laboratory. Monitoring for the detection of residues in aquaculture animals following procedures laid down in Council Directive 96/23/EC on measures to monitor certain substances and residues thereof in live animals and animal products.

According to the annual report of the Veterinary Officer for Fish Diseases, the total use of medicines and pesticides in aquaculture in Iceland in 1998 was as follows: oxilinic acid: 262 kg; sulphadiazine-trim. 25 kg; amoxycillin: 24 kg; malachitgreen: 11 kg; formalin: 800 L; fenoxethanol: 210 kg; MS-222: 0.5 kg (data from the Veterinary Officer for Fish Diseases). The Directorate of Fisheries is in charge of the health control of slaughtering, slaughtering facilities, fish processing industries and the distribution of aquaculture products for export. The Directorate is also responsible for the monitoring control of the quality of mussel fishing grounds.

Waste and pollution control

The Environmental and Food Agency and the local Health Inspection Authorities control environmental effects, waste management, water pollution and treatment, general conduct and the health control of products for the national market. The frequency for visits and monitoring according to the pollution control regulation depends on the plant size as shown in Table 2. If unexpected negative environmental effects appear, the plant is obliged to take measures to solve the problem, including a decrease in the production. The Environmental and Food Agency must approve the measures.

Criteria for land-based tanks with discharge to the sea

Environmental criteria to be met are as follows: particulates may not sediment or deposit at the beach in the vicinity of the outlet; mats of micro-organisms or chum, oil-film, waste or other objects must not be observed; wastewater must not have an unpleasant smell or colour. A licence for a large station (greater than 1000 t annual production) does not require water treatment, but measurements of environmental parameters are required for 2 years after the production capacity has been reached. This is to test the dilution models the company presented in the application for the licence and to test if the company complies with the environmental criteria in the vicinity of the outlet.

Criteria for marine cage farms

The farm shall collect all accessible knowledge about currents in the area and monitor the bottom around and under the cages with a sediment sampler or a video camera in order to measure the collection and distribution of sediments. The results can be accessed by the control authority at a visit or by request. After

Table 2

The frequency of control visits and control measurements for aquaculture plants in Iceland

| Size category | Aquaculture with discharge to the sea | | |
|---------------|---------------------------------------|-----------------|----------------------|
| | Annual production | Control visit | Control measurements |
| I | > 1000 tonnes | Every 6 months | Every 3 years |
| II | 200–1000 tonnes | Every 12 months | Every 5 years |
| III | 100–200 tonnes | Every 12 months | Every 10 years |
| IV | < 100 tonnes | Every 24 months | Never |

5 years, the station shall publish a report of the distribution of pollutants from the station in order to evaluate the environmental effects. If unexpected negative environmental effects appear, the plant is obliged to take measures to solve the problem, including decreasing production.

A few cage farms have operated in brackish water lagoons in Iceland. Two such farms are still operating, in areas with a high water exchange rate. In one of the stations, sediments are removed regularly from the bottom by pumping. The other station, which used to pump up the sediments, now moves the cages regularly.

The optimal conditions for pollution control may not be the best conditions for the farm. Many farms that started in Iceland could not tolerate the weather conditions, high wind, currents and surf in Icelandic waters. Cage farms continued only in the most sheltered areas. In some of these areas algal blooms were a problem and operation has decreased considerably in such problem areas.

The local Health Inspection Authorities are responsible for food control in Iceland. The food companies run internal quality control routines (HACCP) in order to ensure high quality, safety and that food products are healthy for human consumption. The regulation is based on Council Directives 89/397/EEC, 85/591/EEC, 93/43/EEC and 93/99/EEC.

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