

Surveillance of Fish Diseases in the Nordic Countries

By T. Håstein¹, A. Hellström², G. Jonsson³, N. J. Olesen⁴, E. R.-Pärnänen⁵

¹National Veterinary Institute, P.O.Box 8156 DEP, 0033 Oslo, Norway, ²National Veterinary Institute, P.O.Box 7073, SE-75007 Uppsala, Sweden, ³Veterinary Officer for Fish Diseases, Keldur, Vesturlandsveg, IS-112, Reykjavik, Iceland, ⁴Danish Veterinary Laboratory, Aarhus, Denmark, ⁵National Veterinary and Food Research Institute (EELA), P. O. Box 368, Fin-00231 Helsinki, Finland.

Due to the increasing importance of disease problems in the fish farming industry and the impact disease may have on both feral and farmed fish in the Nordic countries, monitoring and surveillance on diseases have for many years been considered to be of socio-economic importance. All the Nordic countries have a national legislation as basis for their surveillance and disease control in aquatic animals and regulations listing notifiable diseases of concern to the countries. The list of diseases vary between the countries. In addition, Denmark, Finland and Sweden are ruled by Directive 91/67/EEC as regards placing on the market of aquaculture animals and products. The surveillance for viral diseases in all the Nordic countries has mainly been based on the testing procedures given in the EU Commission Decision 96/240/EC.

The list of diseases to be monitored or surveyed for varies between the Nordic countries. All the Nordic countries run a surveillance programme for Viral Haemorrhagic Septicaemia (VHS) and Infectious Haematopoietic Necrosis (IHN) based on EU regulations and a monitoring programme for Infectious Pancreatic Necrosis (IPN) on a national level. Iceland and Norway have also established a surveillance programme for Viral Nervous Necrosis (VNN) on a national level, while Finland and Sweden has established a surveillance programme for Spring Viraemia of carp (SVC) on a national level in order to obtain additional guarantees within the EU for that disease. Norway is the only country that has established a control programme for *Herpesvirus scophthalmi* in turbot, for *Anguillicola* spp in eel and for pasteurellosis in sea bass. These programmes are due to start year 2000. Monitoring of Bacterial Kidney Disease (BKD) takes place in all the Nordic countries; in some of the countries it is being compulsory and in others it is carried out on a voluntary basis. Due to the importance of the haptorworm

Gyrodactylus salaris for wild stocks of Atlantic salmon, a surveillance programme for this parasite is under consideration in Norway, while in Finland regular monitoring for the parasite takes place in certain regions recognised to be free of the parasite in order to obtain additional guarantees within the EU. Similarly, Finland, Iceland and Sweden run a national control programme for furunculosis for the same reason and Finland has asked for additional guarantees for certain areas in which the disease do not occur.

The measures taken when disease occur vary from restrictions on movements to stamping out procedures as well as disinfection procedures and other means to establish control of a disease. The ultimate goal is to eradicate or keep the level of disease to a minimum.

Introduction

On a global scale, fish and fishery products are the main food supply for human beings and these products constitutes more than 80% of the total amount of seafood consumed. It is widely

known that the supplies of fish from traditional fisheries are more or less constant (FAO Aquaculture Statistics) and that the shortage in fish and fish products has to be met by aquaculture. The potential for the aquaculture industry to meet the challenge as regards food security has been clearly demonstrated by the rapid expansion of the fish farming industry world wide (Roberts & Muir, 1995). Fig. 1 shows the development of aquaculture compared to global fisheries in the period 1987-1997 (FAO). The figures show that the total capture in fisheries is relatively constant at some 90 millions metric tonnes while there has been an increase in aquaculture production from 10 millions metric tonnes to 28 millions metric tonnes in the same period.

The way fish farming is conducted and the species farmed vary considerably in the world depending on geographical conditions, water resources, temperature etc.

Fish farming in the Nordic countries

In the Nordic countries, the fish farming industry is mainly based on salmonid species, Atlantic salmon (*Salmo salar*) and rainbow trout (*Oncorhynchus mykiss*), but in the later years

several different marine species such as halibut (*Hippoglossus hippoglossus*), turbot (*Scophthalmus maximus*) and sea bass (*Dicentrarchus labrax*) have gained increased importance.

Table 1 gives an overview over the fish species farmed in the Nordic countries as well as the size and production of these species.

The rational for disease surveillance

Over the last decades, several emerging or serious diseases in fish have been diagnosed in farmed and feral populations, creating large problems in the fish farming industry and thus being the subject of surveillance and monitoring programmes in many countries (Håstein, 1995). The differences between infectious diseases in fish and those of terrestrial animals means that the approach to the problems and the eradication efforts differ as the diseases may spread effectively through flowing water (Håstein, Hill & Winton, 1999).

Following is the described basis for and the results of monitoring and surveillance programmes as well as established measures on some of the diseases considered to be of major concern in the Nordic countries.

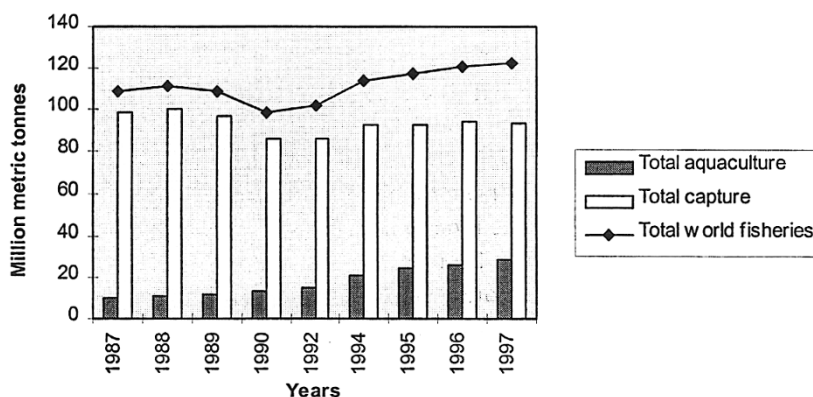


Fig. 1. Aquaculture and global fisheries production (FAO information).

Table 1. Fish farming in the Nordic countries; No. of farms, species and production

Country	No. of farms	Species kept under farming conditions	Total production all species Metric tons
Denmark	478	Eel, Rainbow trout	46.000
Finland	333	Arctic char, Baltic salmon rainbow trout, whitefish	16.597
Iceland	40	Atlantic salmon, Arctic char, rainbow trout, halibut, Sea bass	3.669
Norway	1169 (salmonids) 381 (others)	Atlantic salmon, Arctic char, brown trout, Cod, eel, halibut, turbot, sea bass	390.764
Sweden	177	Arctic char, Baltic salmon, rainbow trout, grass carp	6.200

Basis for the monitoring and surveillance in the Nordic countries

All the Nordic countries have a national legislation as basis for their surveillance and disease control in aquatic animals, as well as regulations listing notifiable diseases of concern to the countries. The list of notifiable diseases vary from country to country. In addition to their national legislation, Denmark, Finland and Sweden are ruled by Directive 91/67/EEC as regards placing on the market of aquaculture animals and products, but even Iceland and Norway have accepted the principles laid down in the Directive.

The monitoring and surveillance for viral diseases in all the Nordic countries has mainly been based on the testing procedures given in the EU Commission Decision 96/240/EC while for the bacterial and parasitic diseases, standard diagnostic procedures for such diseases has been used for screening purposes.

The list of diseases under monitoring and surveillance varies between the Nordic coun-

tries. All the countries runs a surveillance programme for Viral Haemorrhagic Septicaemia (VHS) and Infectious Haematopoietic Necrosis (IHN) based on EU regulations (*Ariel, Helgason, Mortensen & Olesen, 1999*) and a monitoring programme for Infectious Pancreatic Necrosis (IPN) on a national level. The Nordic countries have also a clinical monitoring for infectious salmon anaemia (ISA) as no validated surveillance methods so far have been established. Iceland and Norway has also established a surveillance programme for Viral Nervous Necrosis (VNN) on a national level, while Finland and Sweden have established a surveillance programme for Spring Viraemia in carp (SVC) on a national level in order to obtain additional guarantees within the EU for that disease. Norway is the only country that have established a control programme for *Herpesvirus scophthalmi* in turbot, for *Anguillicola* spp in eel and for pasteurellosis in sea bass which will start year 2000.

Monitoring for Bacterial Kidney Disease

Table 2. Diseases and target species under surveillance in the Nordic countries

Disease	Target species	Country
Viral Diseases		
Infectious salmon anaemia (ISA)	Salmonids	Denmark, Finland, Iceland, Norway, Sweden
Infectious pancreatic necrosis (IPN)	Salmonids	Denmark, Finland, Iceland, Norway, Sweden
Infectious haematopoietic necrosis (IHN)	Salmonids	Denmark, Finland, Iceland, Norway, Sweden
Viral haemorrhagic septicaemia (VHS)	Salmonids	Denmark, Finland, Iceland, Norway, Sweden
Spring viremia in Carp (SVC)	Carp	Finland, Sweden
Viral nervous necrosis (VNN)	Halibut	Iceland, Norway,
<i>Herpesvirus scophthalmi</i> infection	Turbot	Norway
Bacterial diseases		
Bacterial kidney disease (BKD)	Salmonids	Denmark, Finland, Iceland, Norway, Sweden
Furunculosis	Salmonids	Finland, Iceland, Sweden
Pasteurellosis	Sea bass	Norway
Parasitic diseases		
<i>Gyrodactylus salaris</i>	Salmonids	Finland, Norway
<i>Anguillicola</i> spp	Eel	Norway

(BKD) takes place in all the Nordic countries; in some of the countries being compulsory and in others carried out on a voluntary level.

Due to the importance of the haptorworm *Gyrodactylus salaris* for wild stocks of Atlantic salmon, a surveillance programme for this parasite is under consideration in Norway, while in Finland regular monitoring for the parasite takes place in certain regions recognised to be free of the parasite to obtain additional guarantees within the EU. Similarly Finland, Iceland and Sweden runs a national control programme as regards furunculosis for the same reason and Finland has asked for additional guarantees for certain areas in which the disease does not occur.

Aim of surveillance

The aim of the monitoring and surveillance programmes for fish diseases in question in the Nordic countries is either to document and maintain freedom of disease, to eradicate a disease or to keep a disease under control within certain bounds. For some of the diseases that

may be present on a low level such as IPN in Finland and Sweden, the ultimate aim will probably be eradication.

Surveillance programmes and target populations

The main target population for the monitoring and surveillance programmes is salmonids for most of the diseases under surveillance.

The size of the target populations is given in Table 1. All types of farms are included in the survey such as hatcheries, brood stock farms as well as grow out farms, table 2 shows the diseases under surveillance and the target species for the disease in question.

Denmark, Norway and Scotland run a surveillance programme with the aim of deriving information on VHS virus and other viral infections in wild marine populations is carried out in European coastal waters from the English channel in the south to the Spitsbergen area as well as in the Baltic sea (*Mortensen, Heuer, Lorenzen, Otte, Olesen, 1999, Olesen, 1997*).

Similar examinations were carried out by Sweden in the Baltic sea and Kattegat in 1998 and the beginning of 1999.

Organisation

The basis for the different surveillance and monitoring programmes in formal terms is partly based on EU regulations, OIE criteria or criteria derived from national legislation. For some of the diseases such as IHN and VHS, the participation is compulsory in all the Nordic countries as regards approval and maintenance of disease free status for the two diseases either for the whole country, for zones or for farms in non approved zones. In Denmark a control program for VHS started as early as in 1965, while in Finland, Iceland, Norway and Sweden an official surveillance program started in 1995, 1993, 1994 and 1993 respectively. For other diseases such as furunculosis the participation is compulsory in some countries such as Sweden, while it is voluntary or even non existing on a regular basis in other countries such as Norway.

In Finland, the surveillance programme for *G. salaris* has been compulsory for the last three years.

Sampling

The sampling of fish for surveillance vary between the Nordic countries depending on the infrastructure of the health control in the different countries. In Sweden the National Fish Health Service (Fiskhälsan FH AB) are responsible for all sampling, while in Norway, the responsible Authority is the district veterinary officers (DVO) or local fish health services operating under instruction of the DVO. In Finland the municipal veterinarians do the necessary sampling when inspecting the farms which is done biannually.

In Iceland, the responsible authority as regards sampling is under the supervision of the Veteri-

nary Officer for Fish Diseases.

In Denmark, the Danish Veterinary and Food Administration do the necessary sampling and control.

Analyses of the diseases under surveillance are carried out at official veterinary laboratories i.e. National Veterinary Institute in Norway and Sweden, the Veterinary Officer for Fish Diseases, Keldur, in Iceland, Danish Veterinary Laboratory in Denmark and National Veterinary and Food Research Institute (EELA) in Finland.

Test and testing procedures

The surveillance for viral diseases in all the Nordic countries has mainly been based on the testing procedures given in the EU Commission Decision 96/240/EC. According to the decision, fish farms are inspected clinically biannually and samples for virological examinations are collected by rotation in 50% of the fish farms each year to document freedom for IHN and VHS. In Denmark, Finland, Iceland and Sweden, all or some of the same samples are used for IPN testing. In Denmark, the control of IPN is based on the monitoring of IPN free broodstock farms and on growing farms as IPN is considered to be endemic in non controlled farms. In Norway testing for IPN virus is done in a specific monitoring programme in brood stocks of Atlantic salmon and rainbow trout as IPN virus neutralisation is used in the examinations for IHN/VHS virus.

The examination procedures given in the OIE Diagnostic Manual for Aquatic Animal Diseases are the basis for examinations as regards BKD, *Gyrodactylus salaris* and VNN while for furunculosis, pasteurellosis and *Anguillicola* spp, standard bacteriological or parasitological procedures are used, respectively. The frequency in the testing of these diseases is varying between the countries.

Measures taken when positive diagnosis occur

In all the Nordic countries, it is the Veterinary Authorities that is responsible for the implementation of measures that will be used in order to control a given notifiable disease. The implementation involves both central and regional veterinary officers.

In all the Nordic countries except non-approved zones in Denmark, stamping out procedures followed by cleaning, disinfection and fallowing will be carried out if VHS is diagnosed (Olesen, Korsholm, 1997, Olesen, 1998). In non-approved zones in Denmark, a stamping out program will be started if 1/3 of the farms in a river system agrees to an eradication program to get rid of the disease.

Since IHN and SVC is considered to be absent in all the Nordic countries, stamping out procedures will be applied to these diseases. As regards IPN, the detection of the disease or the virus as such, will be subject to restrictions followed by a sanitation programme laid down by the Board of Agriculture in Sweden, while in Norway the mere detection of IPN virus will not bring about any restrictions. Clinical IPN will, however, lead to restrictions on movement of live fish in Norway as long as mortality and signs of the disease occur. In Finland, isolation of IPN virus will lead to restrictions on movement of live fish in continental zones, while clinical IPN probably will result in more strong measures. These have so far not been determined. Prevention may be achieved by avoiding introduction of disease free eggs and/or fish into disease free farms as well as using protected water supply (e.g. spring-, borehole water).

In Iceland, detection of furunculosis is also followed by stamping out because the disease is recognised as a List A disease, while in Sweden active measures are taken only if the disease occur in freshwater, but not in sea water where the

disease is considered to be enzootic. In Norway, restrictions are laid upon farms if the furunculosis is diagnosed. Hatcheries are not allowed to sell live fish while affected fish farms in sea water may keep the fish until reaching marketable size for slaughtering.

In all the Nordic countries an infected farm may restock after fallowing if no signs of infection appear after a sanitation programme has been carried out.

Economic compensation

In Sweden, all expenses will be paid by the Board of Agriculture for IHN, VHS, SVC and IPN as these diseases are included in the epizootic act. Similarly, in Finland, the government will pay for all expenses if IHN and VHS are detected, probably also for SVC. In Norway affected farm(s) will have to pay themselves for any measures imposed by the authorities for the time being, because no compensation is granted.

In Denmark expenses will probably be paid in case of IHN and ISA outbreaks and in case of a VHS outbreak in approved zones free of VHS, expenses might be covered as well.

Certification

Health certificates and/or transportation documents is needed in connection with deliveries of live fish for stocking into grow out farms and restocking into rivers. Additionally, in Norway it is not allowed to move fish prior to slaughter, when they are stocked in a sea water site. This is to prevent spread of disease if disease occur.

Record keeping

In all the Nordic countries, the record of findings are kept by the responsible authorities, both regionally and centrally. The diagnostic laboratories also keep the necessary documentation on the examinations carried out. Furthermore all farms have to keep records on events in

the farms that can be requested by Competent Responsible Authority.

Current status

While still a few cases of VHS is diagnosed in Denmark each year, Finland, Iceland, Norway and Sweden are considered to be free from VHS. However, VHS was diagnosed in one farm in Norway and Sweden in 1998. All Nordic countries have status as free from IHN and SVC although only Finland and Sweden is carrying out a specific surveillance programme for SVC.

IPN is considered to be the main viral disease problem in Norway. The disease is endemic in Denmark but not considered as a mayor problem. The disease level of IPN is low in Finland and Sweden and so far not reported in Iceland. Iceland is considered to be free from classical furunculosis, while the disease appears to be endemic in Denmark, Finland, Norway and Sweden. However, some areas in Finland are reported free of furunculosis and the authorities has established so-called protective zones to which live fish and fish eggs only can be transported if special permission is granted.

BKD has been reported from all the Nordic countries but the level appear to be relatively low (Heuer, Lorenzen, Korsholm, Hansen, Olesen, 1999, Lorenzen, Korsholm, Olesen, Heuer, 1997). In Iceland. the disease has occasionally been detected in wild Atlantic salmon returning to spawning grounds while it has not been detected in farms for the last 4 years. BKD was for the first time detected in wild salmon in the Baltic sea in 1999, so it is quite apparent that a reservoir of the disease exists in the wild.

Gyrodactylus salaris has been described from Denmark, Finland, Norway and Sweden, but it is only in Norway that disease caused by this parasite has given high mortality in feral fish populations in Norway. The parasite has now totally been detected in 40 rivers and 37

farms/hatcheries since its first detection.

Anguillicola crassus has so far been reported from Denmark, Norway and Sweden, but the distribution in the wild is not known.

Conclusion

Although some differences occur, all the Nordic countries have established appropriate surveillance and monitoring for fish diseases of concern to the fish farming industry. Due to these systems and good management practises, the fish disease situation in the Nordic countries is generally good compared to other countries in the world.

References

- Ariel E, Helgason S, Mortensen HF, Olesen NJ (1999). Report of the Third annual Meeting of EU National Reference Laboratories for Fish Diseases, Aarhus, Denmark 9.th-11th June 1999. 31 pp.
- Decision 96/240/EC: Laying down the sampling plans and diagnostic methods for the detection and confirmation of certain fish diseases.
- Directive 91/67/EEC: Placing on the market of aquaculture animals and products.
- FAO Aquaculture production and statistics 1988-1997, Fishery Information, Data and Statistics Unit, FAO Fisheries Department, 203pp.
- Heuer OE, Lorenzen E, Korsholm H, Hansen RG, Olesen NJ (1999). BKD i Danmark: Status efter to sæsoner. Ferskvandsfiskeribladet, 97, 5, p 116-118.
- Håstein T. (1995). Disease problems, use of drugs, resistance problems and preventive measures in fish farming world wide. In Sustainable Fish Farming, eds. Reinertsen H & Haaland H., 183-194.
- Håstein T, Hill BJ, Winton JR (1999). Successful aquatic animal disease emergency programmes. Rev. sci. tech. Off. int. Epiz., 18 (1), 214-227.
- Lorenzen E, Korsholm H, Olesen NJ, Heuer OE (1997). Påvisning af bakteriel nyresyge (BKD) hos regnbueørred i Danmark. Ferskvandsfiskeribladet, 95, 7, p 160-168.
- Mortensen HF, Heuer OE, Lorenzen N, Otte L, Olesen NJ (1999). Isolation of Viral Haemorrhagic Septicaemia Virus (VHSV) from Wild Marine Fish Species in the Baltic Sea, Kattegat, Skager-

- rak and the North Sea. *Virus Research*, 63, 95-106.
- OIE Diagnostic Manual for Aquatic Animal Diseases* (1997), 251pp.
- Olesen NJ, Korsholm H* (1997). Control measures for viral diseases in aquaculture: Eradication of VHS and IHN. *Bull. Eur. Ass. Fish Pathol.* 17, 229-233.
- Olesen NJ* (1997). Isolering og karakterisering af VHS virus fra saltvandsfisk . *Ferskvandsfiskeribladet*, 95, 6, p 129-130.
- Olesen NJ* (1998). Sanitation of Viral Haemorrhagic Septicaemia (VHS). *J. Appl. Ichthyol.* 14, 173-177.
- Roberts RJ, Muir JF* (1995). 25 years of world aquaculture: Sustainability, a global problem. In *Sustainable Fish Farming*, eds. Reinertsen H & Haaland H., 167-181 .