

Annual report 2007

Surveillance and control programmes for terrestrial and aquatic animals in Norway

Editor Edgar Brun
Technical editor Hanne Mari Jordsmyr
Scientific editors Hege Hellberg and Ståle Sviland
National Veterinary Institute

Responsible institutions
National Veterinary Institute
Norwegian Food Safety Authority



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Preface

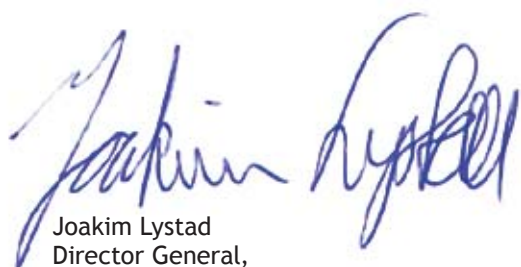
We are pleased to present the results of the surveillance programmes for terrestrial and aquatic diseases in Norway in 2007. These results, together with the animal disease report to the World Organization for Animal Health (OIE), confirm that Norway continues to ensure a very good situation concerning diseases in terrestrial and aquatic animals.

We continue to be free of all relevant serious contagious diseases in terrestrial animals. It is though a concern that there has been a slight increase in cases of salmonella. This has been uncovered through the ongoing surveillance programme, showing the importance well structured programmes represent as an element in our early warning system.

In aquaculture we recognize the need to intensify controls to better cope with the needs of a big and growing export industry. Infectious Salmon Anaemia (ISA) has been a major disease that we have had to focus on for many years. At the end of 2007 the first outbreak of Viral Haemorrhagic Septicaemia (VHS) was confirmed in Norway since 1974.

We hope the reader will find relevant and interesting information in this report. For more information in English concerning the Norwegian Food Safety Authority we refer to our web page at www.mattilsynet.no.

Oslo, July 2008,

A handwritten signature in blue ink, appearing to read 'Joakim Lystad', is positioned above the printed name and title.

Joakim Lystad
Director General,
Norwegian Food Safety Authority

Introduction

This report contains information on the official surveillance programmes for diseases in aquatic and terrestrial animals in Norway in 2007. These programmes are run by the Norwegian Food Safety Authority and are planned and coordinated by the National Veterinary Institute.

Since 1994 Norway has had a free trade agreement (European Economic Area agreement or EEA) with the EU that has encompassed most of our veterinary legislation. This agreement includes Norway's commitment to follow harmonised legislation concerning surveillance and control of animal diseases. The surveillance programmes in Norway are therefore categorized according to their legal basis as programmes implementing EEA directives and regulations, programmes related to additional guarantees within the EEA region and programmes based solely on national requirements.

Surveillance programmes for documentation and control

Programmes implementing EEA-directives and regulations

Bovine brucellosis was eradicated in Norway over 50 years ago and the last case of tuberculosis was recorded in 1986. Based on this information a freedom of disease status was approved by the EFTA Surveillance Authority (ESA) in 1994 on historical data. In order to maintain the free-status a surveillance programme was established in 2000. The status of enzootic bovine leucosis (EBL) has been documented and the few infected animals have been eliminated. On this basis, Norway has applied for free-status for enzootic bovine leucosis. This status was officially approved by ESA early in 2007.

Surveillance for bovine spongiform encephalopathy (BSE) in cattle and scrapie in sheep and goats is performed according to the requirements of the EU regulations. Norway has never had a case of BSE and in later years all scrapie cases have been of the NOR98 variant. Early in 2007 Norway received additional guarantees for classical scrapie based on our ongoing national surveillance and control programme. Following revision of the OIE categories for BSE status, Norway applied to OIE for BSE negligible status in 2007. This status was approved at the OIE general assembly in May 2008.

As part of the EEA-agreement in 1994, Norway achieved the status of freedom from *Brucella melitensis* in small ruminants based on historical data. In order to maintain this position, a surveillance and control programme was established in 2004.

In poultry, programmes for Newcastle disease, *Mycoplasma* and *Salmonella* were established according to EU-directives. In the autumn of 2005 the threat of global avian influenza increased substantially. A surveillance programme on avian influenza in wild birds was initiated

as part of the preparedness for preventing introduction into commercial poultry flocks. In 2006 a surveillance programme in commercial flocks was also initiated.

This report also contains information on the programme for control of residues in live animals and animal products of ruminants, pigs and poultry.

The programmes for aquatic animals are of paramount importance for the intensive and export oriented aquaculture industry in Norway. The purpose is twofold, combining prevention of spread of diseases through trade from infected premises or regions, and the documentation of a free-status to benefit the export of aquaculture products. The surveillance for viral haemorrhagic septicaemia (VHS) and infectious haematopoietic necrosis (IHN) was initially based on the recognition of free-status for these diseases on historical data. In 2004 the entire coastline of Norway was recognized as an approved zone with regard to *Bonamia ostreae* and *Marteilia refringens*. The decision is based on the results of the surveillance and control programmes for bonamiosis and marteiliosis which were initiated in the autumn of 1995.

Programmes related to additional guarantees within the EEA region

Some diseases are not regulated by common EEA rules. However, countries may apply for additional guarantees based on their documented status. In 1994, additional guarantees for infectious bovine rhinotracheitis (IBR) in cattle and Aujeszky's disease (AD) in pigs were granted to Norway.

The favourable *Salmonella* situation in Norway was recognized by the ESA in 1994. The additional guarantees were based on the national surveillance and control programmes for cattle, pigs and poultry.

Other national surveillance and control programmes

Several diseases of great national significance have no legal basis in the EU legislation. Norwegian authorities and industries have for years used great efforts and resources to control and eradicate diseases such as bovine virus diarrhoea (BVD) in cattle, and maedi in small ruminants.

Responsibilities for the programmes

The surveillance and control programmes are part of the legislation for terrestrial and aquatic animal health and food in Norway. This legislation is decided by the Ministry of Agriculture and Food, the Ministry of Fisheries and Coastal Affairs and the Ministry of Health and Care Services jointly as regulations under the Norwegian Food Law. The Norwegian Food Safety Authority is responsible

Ongoing programmes for terrestrial and aquatic animals in 2007 (the year of initiation in parentheses)

Animal category	Programmes according to EU-directives and regulations	Programmes approved by ESA	Other national surveillance and control programmes
Cattle	BSE (1998) Residual substances (1999) EBL (1994) Tuberculosis (2000) Brucellosis (2000)	IBR/IPV (1992) <i>Salmonella</i> (1995)	Paratuberculosis (1996) BVD (1992)
Swine	Residual substances (1999)	AD (1994) <i>Salmonella</i> (1995)	TGE (1995) PRRS (1995) Swine influenza (1997)
Small ruminants	Scrapie (1997) Brucellosis (2004)		Maedi (1997) <i>E. coli</i> (2006)
Poultry	Residual substances (1999) Newcastle disease <i>Mycoplasma</i> <i>Salmonella</i> (1995-breeding flocks) <i>Campylobacter</i> (2001) AI wild birds (2006) AI poultry (2005)	<i>Salmonella</i> (1995-96)	ILT (1997) ART (1997)
Farmed deer	Tuberculosis (2000)		CWD (2005)
Llama			Paratuberculosis (2000)
Fish	VHS/IHN (1994)		<i>Gyrodactylus salaris</i> (2000) BKD (2006)
Shellfish	<i>Bonamial Marteilii</i> (1995)		

BSE=bovine spongiform encephalopathy, EBL=enzootic bovine leukosis, IBR=infectious bovine rhinotracheitis, IPV=infectious pustular vulvovaginitis, BVD=bovine virus diarrhoea, AD=Aujeszky's disease, TGE=transmissible gastroenteritis, PRRS=porcine reproductive and respiratory syndrome, ILT=infectious laryngotracheitis, ART=avian rhinotracheitis, AI=avian influenza, HPAI=highly pathogenic avian influenza, CWD=chronic wasting disease, VHS=viral haemorrhagic septicaemia, IHN=infectious haematopoietic necrosis, BKD= Bacterial kidney disease.

for implementation of all measures related to this legislation. The National Veterinary Institute ensures the scientific quality of the programmes with regard to epidemiological design, testing and analysing with approved methods and by presenting and interpreting the results according to accepted standards. Sampling is performed by or under the supervision of official inspectors in the Norwegian Food Safety Authority.

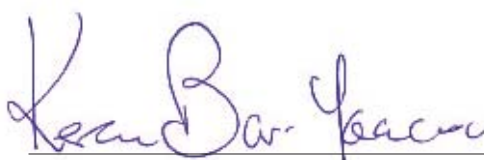
The economic funding for the programmes is agreed between the Norwegian Food Safety Authority and the National Veterinary Institute as part of the annual steering agreement between these institutions.

Impact of the programmes

The programmes serve several purposes for Norwegian authorities and for the agriculture and aquaculture industries. The scientific documentation shows that Norway complies with legal commitments in relation to international agreements. The programmes contribute also to decreasing the risk associated with trade of animals and animal products and in the case of zoonotic diseases the programmes constitute a scientific documentation with great significance for food safety. Finally, the documentation provided is important for industries exporting aquatic and terrestrial animals and products.



Roar Gudding
Director general,
National Veterinary Institute



Keren Bar-Yaacov
Chief Veterinary Officer,
Norwegian Food Safety Authority

Main results from the surveillance and control programmes in 2007

Scrapie Nor98 is regularly detected in sheep in Norway, and was for 2007, diagnosed in nine sheep coming from nine different flock. Classical scrapie was detected in 2007. From 2000 to 2007, more than 130,000 bovines have been investigated for BSE. All samples have been negative. More than 700 cervids were examined for Chronic Wasting Disease (CWD), all with negative results.

The situation for viral diseases in swine is favourable. The surveillance for Aujeszky's disease, swine influenza, transmissible gastroenteritis, and porcine respiratory and reproductive syndrome in pigs was negative in 2007, giving additional documentation of freedom from these specific virus infections in the Norwegian swine population. This status is currently unique in an international context.

Since the surveillance programme for paratuberculosis started in 1996, infection with *M. a. paratuberculosis* has been detected in nine cattle herds, six sheep flocks and in 27 goat herds. The infection is regarded endemic in the six counties containing half of the goat population in Norway. Positive sheep herds have been detected both in 2006 and 2007 while the last cattle herd found positive was back in 2002.

A small proportion of examined poultry and wild birds do test positive for Influenza A. However, the known high pathogenic strains of H5 or H7 have so far not been detected. The only other poultry programme running in 2007 was the infectious laryngotracheitis (ILT)-programme in broiler and layers, was also negative.

The action plan for *Campylobacter* sp. in poultry has been running since 2001 as an important preventive measure against human infection. The annual prevalence at flock level decreased the first years from 7.7 % to 3.6 % in 2005. A steady increase has since been noticed reaching 5.7 % positive flocks in 2007.

The *Salmonella* programmes document a very steady status and that the Norwegian cattle, swine, sheep, and poultry populations only sporadically are infected with *Salmonella* sp. However, as *S. Thyphimurium* and *S. subsp. diarizonae* being the ones usually found, this year *S. Enteritidis* PT4 was for the first time diagnosed in poultry in Norway. The source was not found. The prevalence of *S. Enteritidis* in poultry worldwide has increased substantially since 1987 and is a common cause of gastroenteritis in humans. In poultry, the infection may range from clinically inapparent to diarrhoea with moderate mortality.

The result of the surveillance for *Escherichia coli* in sheep has not been finalized. The programme was initiated by the outbreak in humans in 2006 and has no clinical impact on sheep. Results from samples collected both in 2006 and 2007 will be presented in a mutual report in 2008 .

Gyrodactylus salaris is a major problem for wild salmon and procedures have been established to evaluate treatment efficacy and rules for the return to free status for a river. No new infected rivers have been detected the last two years leaving the total number of once infected rivers to 46. The outbreak of VHS in rainbow trout clearly shows the limitations of a static surveillance programme and underlines the need for an efficient passive surveillance showing competence and awareness at field level for detection of "new" diseases. The aquatic surveillance programmes show in general, that the Norwegian aquaculture has a health status in relation to worldwide important and devastating diseases.

Species	Infection	Start	Extent of program
Cattle	IBR/IPV	1992	10 % of dairy cattle 10 % of beef cattle
	<i>Brucella abortus</i>	2000	In cases of abortion
	BVD	1992	12,5 % of all dairy a
	EBL	1994	10 % of dairy cattle 10 % of beef cattle
	Bovine tuberculosis	2000	Inspection of carcass of suspected lesions
	BSE	1998 2000 2001	Investigation of clinical Testing of imported Testing of fallen stock Testing of animals Testing of randoml
	Swine	AD	1994
TGE		1994	
PRRS		1995	
Swine influenza		1997	
Poultry	Avian influenza in wild birds	2005	Cloacal and trachea during the hunting
	Avian influenza in poultry	2005	Flocks decided at r
	ILT	1997	All chicken (broiler)
	ART	1997	All turkey breeder turkey broiler flock
	<i>Campylobacter</i>	2001	All broiler flocks
Small ruminants	Scrapie	1997	Testing of clinically
		2002	Testing of fallen st
		1997	Random sampling o
	Maedi	1997	Testing of primary
	<i>Brucella melitensis</i>	1997	All breeding flocks o 2008 and additional
		2004	All breeding flocks 2008 and additional sheep flocks and go
<i>E. coli</i>	2006	520 randomly selec	
Several species	Salmonellosis	1995	Cattle: 3,000 lymph Swine: 3,000 lymph from all breeding h Poultry: faecal sam or >250 layers/bree
	Paratuberculosis	1996	Testing of clinically Testing of all llama randomly selected
Wild animals	CWD	2007	Wild/farmed <i>Cervid</i> a) clinical/sick, eut b) traffic killed ani c) animals found de d) healthy animals All sampled animal
	<i>Echionococcus multilocularis</i>	2007	Red foxes (<i>Vulpes</i> s hunting season (Ap
Fish	VHS/IHN	1994	Sampling 50 % of al farms tested in the
	BKD	2005	Sampling 50 % of al farms only producti course of a two-ye
	<i>Gyrodactylus salaris</i>	2000	Sampling of approxi and rainbow trout t fingerlings/parr/sm
Oyster	Bonamiosis	1995	Sampling of selecte twice annually
	Marteiliosis	1995	Sampling of selecte twice annually

Names in 2007	Number of samples examined in 2007	Positive samples in 2007	Previous positive results
Large herds	1,575 bulk milk samples	None	1992: 1 positive herd
Small herds	4,241 blood samples from 412 herds	None	
Animals	12 fetuses from 11 herds 26 blood samples from 15 cows (12 herds)	None None	
Large and beef cattle herds	1,575 bulk milk samples 387 pooled blood samples 20 individual blood samples from 8 herds	None	1998-2003: restrictions imposed on 413 herds 2004: new restrictions on 4 herds 2005: new restrictions on 2 herds
Large herds	1,575 bulk milk samples	None	1995-1996: 7 herds
Small herds	4,241 blood samples from 412 herds	None	2002: 1 herd
Animals at slaughter, submissions for testing	No samples examined	-	1984: 1 herd 1986: 1 herd
Randomly suspect animals	No samples examined	-	None
Large animals and their progeny	9 samples	None	None
Large and emergency slaughtered animals	9,456 samples	None	None
Large selected at <i>ante mortem</i> control	48 samples	None	None
Large randomly selected slaughtered animals	9,999 samples	None	None
Large all nucleus herds of the sow pools and large and fattening herds are tested	4,628 samples from 456 herds	None	None
«	4,621 samples from 456 herds	None	None
«	4,437 samples from 456 herds	None	None
«	4,625 samples from 456 herds	None	1998: 1 herd (H3N2)
Large nasal swabs from healthy birds shot during season.	1,559 birds from 5 counties	183 positive for AI; no HPAI, 10 LPAI H5 and no H7	2005: 80 AI positive; 2 LPAI H5 2006: 85 AI positive; 10 LPAI H5
Large risk by RA and breeding flocks	1399 samples from 124 breeding flocks 1545 samples from 125 commercial flocks, 85 samples from 11 hobby flocks	15 flocks AI pos, no H5 nor H7	2006: 12 flocks AI positive
Large (broiler and layer) breeder flocks	4,318 samples from 85 holdings (139 flocks)	None	2005: 1 seropositive flock
Large flocks and randomly selected flocks	The programme was not active in 2007	-	2003: 2 flocks (1 holding), 2004: 2 flocks (1 holding), 2005: 1 seropositive flock, 2006: None
	Samples from 4,145 flocks	237 (5.7 %) positive flocks	2001: 7.7 % pos flocks 2002: 6.3 % pos flocks 2003: 4.9 % pos flocks 2004: 3.3 % pos flocks 2005: 3.6 % pos flocks 2006: 4.9 % pos flocks
Large randomly suspect animals	11 samples	None	1997-2005: 25 individuals, 2006: None
Large flock	4,821 samples	7 positive individuals	2002-2005: 16 individuals, 2006: 6 individuals
Large of slaughtered animals	12,186 samples	2 positive individuals	2001-2005: 18 individuals, 2006: 4 individuals
Large and secondary flocks	184 samples	None	2003-2005: 2 flocks, 2006: 1 flock
Large of sheep once during the period 2006-2007 300 randomly selected sheep flocks	29,633 samples from 1004 flocks	None	1998-2005: 6 flocks, 2006: None
Large of sheep during the period 2006-2007 300 and 210 randomly selected goat herd, respectively	29,633 samples from 1004 sheep flocks 5,734 samples from 183 goat herds	None	None
Large selected sheep flocks	499	Not yet analysed	-
Large lymph node samples	2,218 lymph node samples	1 sample	1995-2002: Only a few positive samples each year, 2003: 5 positive (2 cattle, 2 swine, 1 broiler), 2004: 3 positive samples (2 cattle, 1 swine), 2005: 3 positive samples (2 cattle, 1 swine), 2006: None
Large lymph node samples, faecal samples from all flocks of >50 broilers	3,554 lymph node samples and 2,170 faecal samples from 122 herds	None	
Large samples from all flocks of >50 broilers	11,044 faecal samples and boot swabs from 1,386 holdings	2 holdings	
Large feeders	swabs from carcasses	8 samples	
Large randomly suspect animals older than 48 months and cattle, goat and sheep herds	Organ and faecal samples from 280 cattle, 1,606 goats, 419 sheep and 48 llamas	3 goat herds 2 sheep herds	1997: 4 cattle herds (imported animals) 1998-2004: 5 cattle herds, 17 goat herds and 2 sheep flocks, 2005: 5 goat herds 2006: 2 goat herds, 2 sheep herds
Large <i>Canidae</i> (hunted animals, domestic animals, dead, and shot during hunting (wild). Animals should be >18 months of age)	564 samples from hunted animals 88 from found dead animals 38 from routine examination 30 unspecified	None	
Large (<i>Vulpes</i>) shot during the licensed period (April-July)	811 faecal samples from foxes collected during from 2002-2007	None	
Large of salmonid and turbot farms (all farms during the course of a two-year period)	1,369 pooled samples from 436 sites	None	None
Large of salmonid farms except sea-water farms and food fish (all farms tested in the last year period)	4,102 samples from 150 sites	None	None
Large of approximately half of all fresh water salmon farms. Sampling of Atlantic salmon from approximately 106 rivers	2,700 fish from 83 salmonid farms 3,675 fish from 97 rivers	None	1975-2006: 39 positive salmonid farms, last time 2002 (3 hatcheries) 1975-2006: 46 positive rivers
Large of salmonid farms and wild populations	238 oysters from 5 sampling points	None	None
Large of salmonid farms and wild populations	238 oysters from 5 sampling points	None	None

Annual report 2007

The livestock and aquaculture populations in Norway



Petter Hopp

Responsible institutions
National Veterinary Institute
Norwegian Food Safety Authority

The livestock and aquaculture populations in Norway

Petter Hopp

The livestock population

Norway covers an area of 323,895 square km and has a population of about 4.7 million people of which about 0.8 million live in or in the vicinity of the capital Oslo. The livestock production is targeted for the national market. Table 1 gives an overview of the livestock population and the number of animals slaughtered in 2007.

Until 1994 there was a general ban on the import of live animals and animal products to Norway. Live animals could only be imported if derogation was given by the Veterinary Authorities. Consequently, there have been very few imports of live animals to Norway. Table 2 shows the number of live animals and animal products imported to Norway in 2006 and 2007.

As a consequence of the European Economic Area (EEA) agreement which was implemented in 1994, the trade of certain animals and animal products within the area was regulated through EU harmonised directives, and the general ban on import of these animals and products to Norway was lifted. There was a general increase in the

interest to import live animals during that decade. The authorities encouraged beef production, and the need for suckling cows was met by import of live animals.

The cattle population

Approximately 13,700 dairy herds were registered in Norway in 2007 of which approximately 1,100 also kept suckling cows. The average number of dairy cows per herd was 18.2. The number of specialized beef herds with at least one suckling cow was about 4,100 with a mean number of 13.0 suckling cows per herd. Overall, the number of Norwegian dairy herds has decreased over the last 15 years (Figure 1).

From 1980 to 1986, approximately 560 cattle were imported. There were no imports from 1987 to 1990. The European Economic Agreement in 1994 allowed more imports of live cattle. Nevertheless, as seen in Figure 2, the number of imports has been limited and most imported animals came from Sweden and Denmark. Close to 100 % of the imports have been beef cattle. In 2007, 31 live cattle were imported to Norway (Table 2).

Table 1. The livestock population in Norway and the number of slaughtered animals in 2007

Animal category	Number of		
	Herds*	Animals*	Slaughtered animals*
Cattle	19,300 ¹	902,000 ¹	319,000 ²
Dairy cows only**	12,600 ¹	229,700 ¹	-
Suckling cow only**	4,100 ¹	53,100 ¹	-
Combined production (cow)**	1,100 ¹	30,800 ¹	-
Goat	1,300 ¹	71,500 ¹	19,500 ²
Dairy goat**	490 ¹	41,000 ¹	-
Sheep	15,400 ¹	2,243,400 ¹	1,139,700 ²
Breeding sheep > 1 year**	15,100 ¹	854,000 ¹	-
Swine	2,800 ¹	815,400 ¹	1,470,100 ²
Breeding animal > 6 months**	1,700 ¹	59,300 ¹	-
Fattening pig for slaughter	2,500 ¹	449,000 ¹	-
Poultry			
Egg laying hen (> 20 weeks of age)	1,800 ¹	3,436,200 ¹	907,900 ²
Flocks > 250 birds**	710 ¹	3,412,700	-
Broiler	550 ²	-	54,423,900 ²
Turkey, duck and goose for slaughter	100 ¹	334,200 ¹	1,125,100 ²
Flocks > 25 birds**	46 ¹	333,800	-
Ostrich	5 ¹	50 ¹	-

¹ Register of Production Subsidies as of 31 July, 2007, ² Register of Slaughtered Animals.

* Numbers > 100 rounded to the nearest ten, numbers > 1000 rounded to the nearest hundred, ** Included in above total.

Table 2. Import of live animals and animal products to Norway in 2006 and 2007

Species	Imported product	2006		2007	
		No. of consignments	No. of animals or products	No. of consignments	No. of animals or products
Cattle	Live animals	1	8 ¹	3	31 ¹
	Semen (doses)	C	35,404 ¹	C	45,000 ¹
	Embryos	3	50 ¹	NA	22 ¹
Swine	Live animals	1	1 ¹	0	0 ¹
	Semen (doses)	12	170 ¹	NA	520 ¹
Sheep	Live animals	4	71 ¹	1	4 ¹
	Embryos	-	0 ¹	-	0 ¹
	Semen (doses)	1	24 ¹	NA	200 ¹
Goat	Live animals	1	20 ¹	1	5 ¹
	Semen (doses)	-	0 ¹	-	0 ¹
Reindeer	Live animals for slaughter	2	150 ²	NA	600 ²
Fur animal	Live animals	42	16,361 ²	18	22,025 ³
Poultry	Day-old chicks	10*	97,499* ¹	20*	148,881* ¹
	Fertilised eggs	126*	5,587,650* ¹	67*	3,058,090* ¹
Turkey	Day-old chicks	4*	8,050* ¹	8*	20,490* ¹
Duck and goose	Live birds	2*	1,345* ¹	1*	400* ¹
Halibut	Live fish	NA	NA	NA	NA
Turbot	Live fish	8	187,000 ²	NA	NA
Atlantic salmon	Live fish	1	286,000 ²	NA	NA

¹ Data from Norwegian Livestock Industry's Biosecurity Unit (KOORIMP), ² Data from the Norwegian Food Safety Authority, ³ Data from Statistics Norway.
*Only commercial imports, hobby imports are not registered. C=Continuous import, not possible to differentiate consignments. NA= Not available.

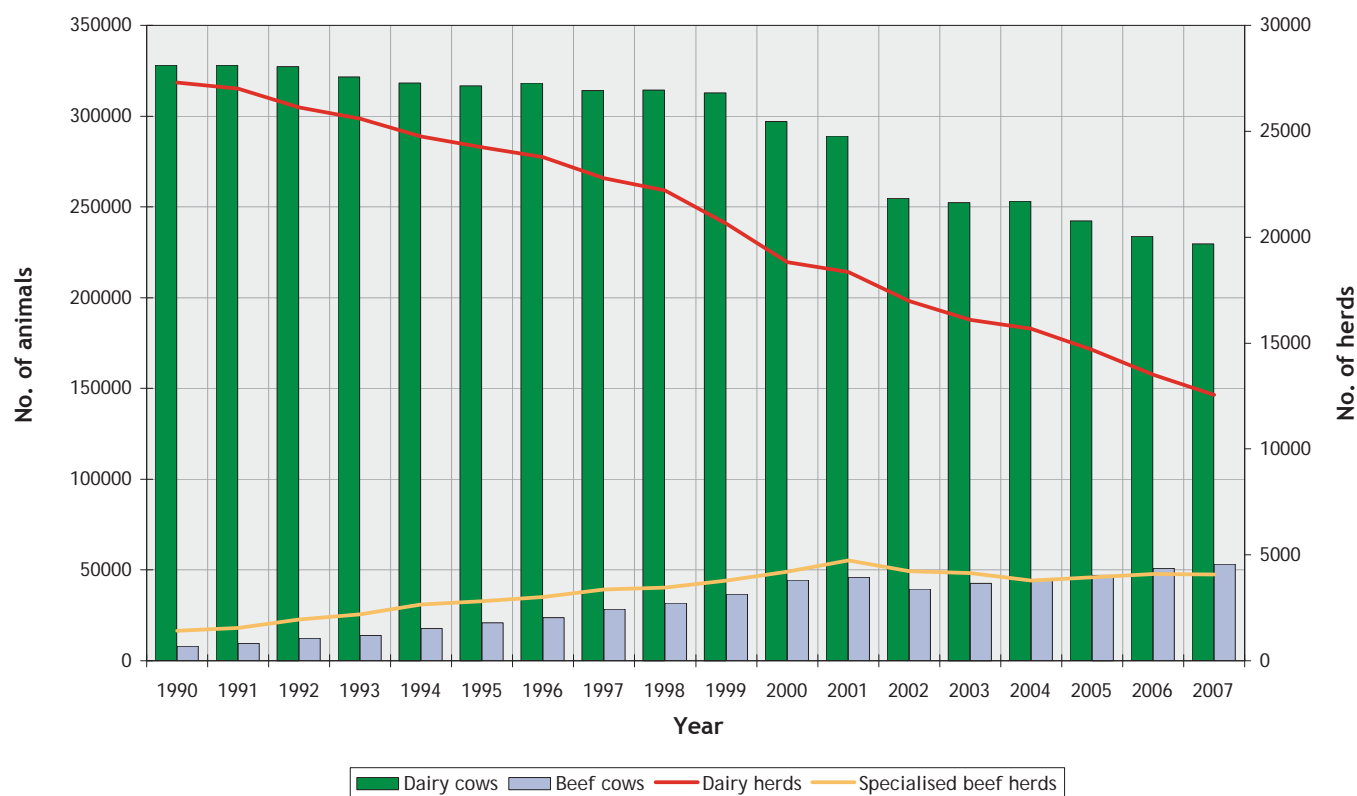


Figure 1. The number of dairy and beef cows in holdings with specialized dairy and beef production during the time period 1990-2007 (Statistics Norway and Register of production subsidies (RPS) for 2007).

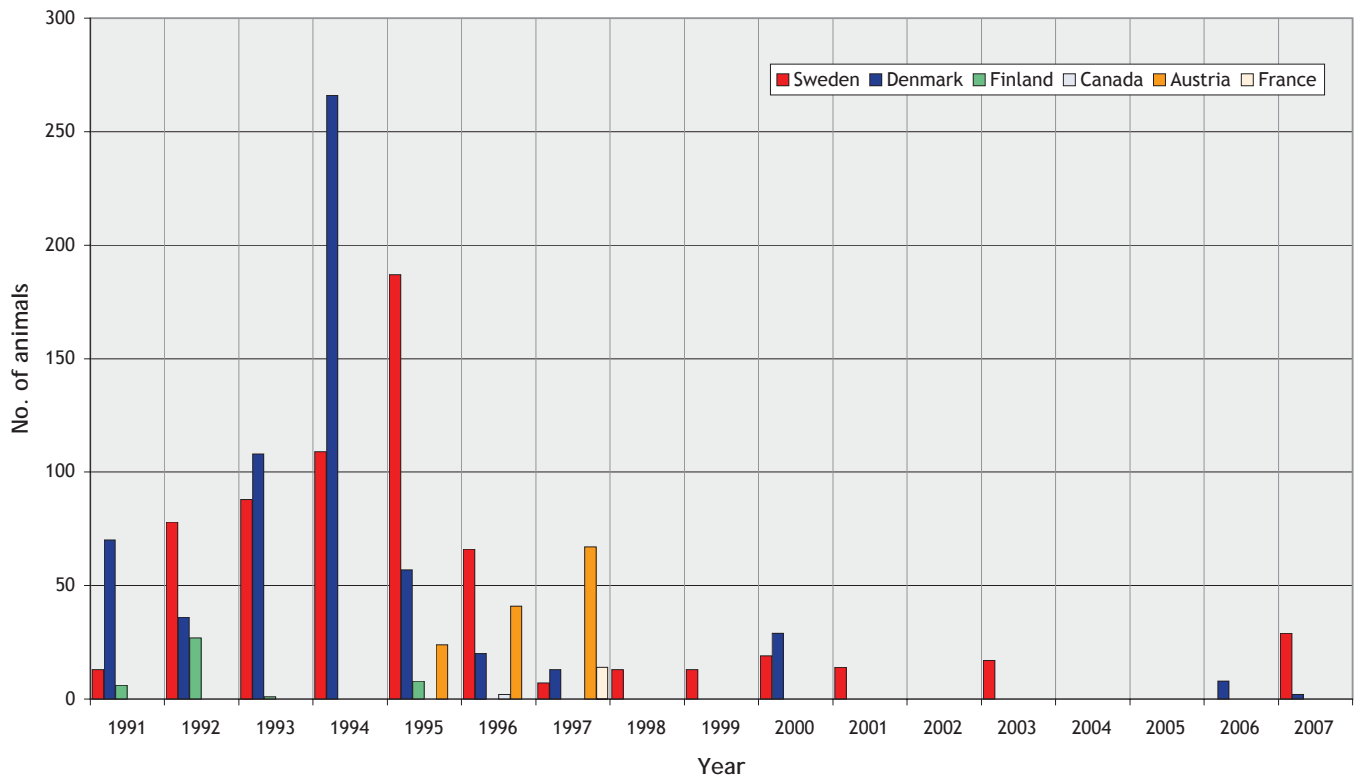


Figure 2. Imports of live cattle to Norway during the time period 1991-2007.

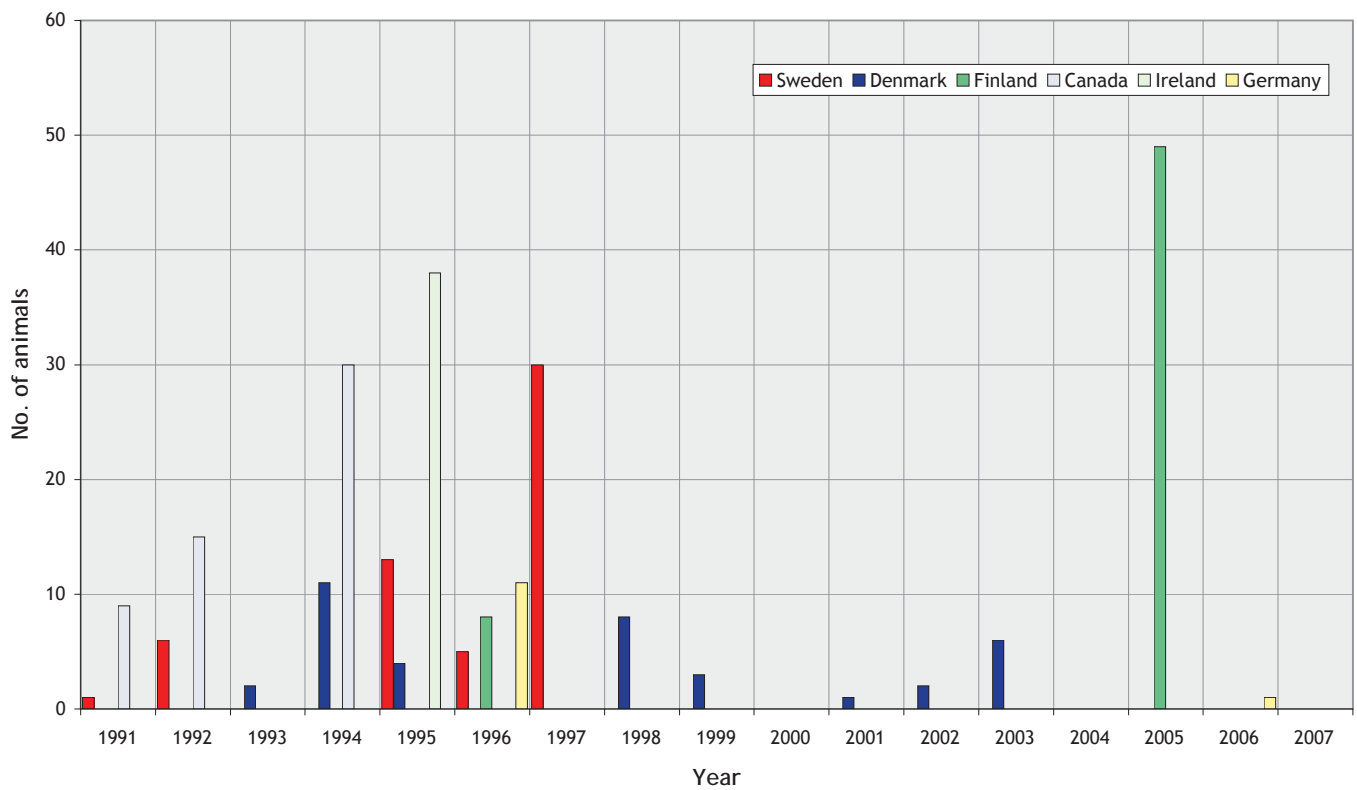


Figure 3. Import of live swine to Norway during the time period 1991-2007.

The swine population

The population consists of approximately 59,300 breeding swine aged more than six months. Approximately 150 approved elite and multiplier breeding herds house 5 % of the live sows in the population, while more than 95 % of the sows purchased on the national market are raised in these herds. About 50 % of the swine production is located in the counties of Hedmark, Oppland, Rogaland and Nord-Trøndelag. In 2007, about 1.5 million swine were slaughtered. In 2007, there was no import of live swine to Norway (Figure 3).

The sheep population

The Norwegian sheep population consists of approximately 854,000 sheep above one year of age. The sheep flocks are widely distributed over the country, with the biggest population found in the south-west. The sheep population consists of combined meat and wool producing breeds, with the breeds Dala sheep, Spæl sheep, Steigar sheep and Rygja sheep predominating. Each year about 1.1 million sheep are slaughtered and approved for human consumption. In 2007, 4 live animals were imported.

The goat population

The Norwegian goat population is comprised of approximately 41,000 dairy goats and is principally composed of one Norwegian breed. The goat flocks are located in mountainous regions in the southern part of the country, in the fjord districts of the western part, and in the counties of Nordland and Troms in northern Norway. The main product is milk used for cheese production. About 19,500 goats are slaughtered and approved for human consumption each year. In 2007, 5 live animals were imported.

The poultry population

The Norwegian poultry production is strictly regulated and the population has a hierarchical structure. Egg and broiler meat production are the most important branches, but the production and consumption of turkey is increasing slightly.

Figure 4A shows the location and structure of the Norwegian layer population comprising two hatcheries, 16 pullet rearing farms and about 700 commercial layer farms. The layer population consists of two white layer strains (Lohmann white and Shaver white).

The commercial broiler production takes place in three hatcheries with one strain (Ross), about 62 breeding farms with parent holdings and about 550 commercial broiler flocks. None of these farms are located in the northern part of Norway, as shown in Figure 4B.

The broiler industry import day-old parent flocks mainly from Sweden. The layer industry imports day-old grand-parent flocks mainly from Germany (Lohmann white), but also from France (Shaver white and ISA Warren) and USA (HyLine).

The population of farmed fish and shellfish

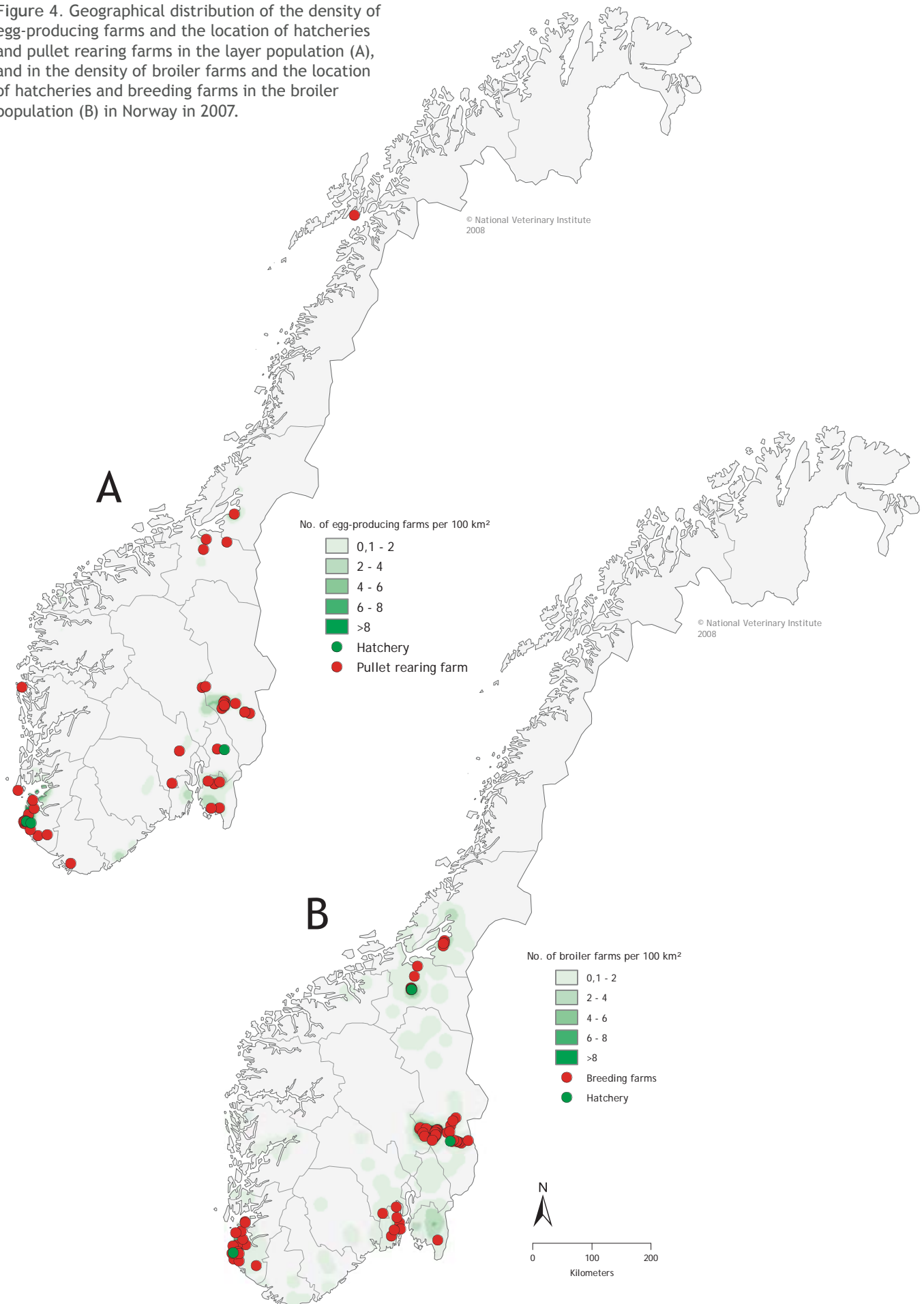
Atlantic salmon is the most important species in the fish and shellfish farming industry. The counties of Nordland and Hordaland are the major counties for seawater farms producing Atlantic salmon. The production volume of Atlantic salmon has been increasing the last ten years, while the volume of rainbow trout production has been stable the last five years (Table 3).

Table 3. Production volume of the most important species in Norwegian aquaculture during the time period 1992-2007¹.

Year	Atlantic salmon (tons)	Rainbow trout (tons)	Cod (tons)	Arctic char (tons)	Halibut (tons)	Blue mussels (tons)	Scallops ² (tons)	Oysters (tons)
1992	141,000	-	-	-	-	-	-	-
1993	170,000	-	-	-	-	-	-	-
1994	204,686	14,571	569	262	63	542	-	-
1995	261,522	14,704	284	273	134	388	-	-
1996	297,557	22,966	191	221	138	184	-	-
1997	332,581	33,295	304	350	113	502	-	-
1998	361,879	48,431	203	200	291	309	-	-
1999	425,154	48,692	157	498	451	662	67.1	40.6
2000	440,861	48,778	169	129	548	851	37.6	7.6
2001	436,103	71,764	864	318	377	920	22.3	2.5
2002	462,495	83,560	1,258	319	424	2,557	5.0	1.7
2003	509,544	68,931	2,185	272	426	1,829	1.2	1.6
2004	563,815	63,401	3,165	350	649	3,747	45.5	3.3
2005	586,512	58,875	7,409	352	1,197	4,885	3.0	2.0
2006	629,888	62,702	11,087	881	1,185	3,705	4.0	1.0
2007	736,168	77,578	9,611	391	397	2,473	6.0	4.0

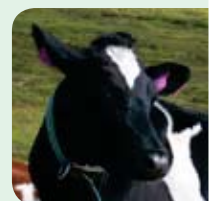
¹ Data from The Directorate of Fisheries, ² From the wild population.

Figure 4. Geographical distribution of the density of egg-producing farms and the location of hatcheries and pullet rearing farms in the layer population (A), and in the density of broiler farms and the location of hatcheries and breeding farms in the broiler population (B) in Norway in 2007.



Annual report 2007

The surveillance and control programmes for *Salmonella* in live animals, eggs and meat in Norway



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Responsible institutions
National Veterinary Institute
Norwegian Food Safety Authority

The surveillance and control programmes for *Salmonella* in live animals, eggs and meat in Norway

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The Salmonella surveillance programme in 2007, documents that the Norwegian population of cattle, swine, sheep, and poultry are only sporadically infected. The estimated prevalence is below 0.3 %. S. Enteritidis was for the first time diagnosed in poultry in Norway.

Introduction

The occurrence of *Salmonella* in Norwegian production animals and animal products is very low compared to most other countries, and has been so during the last decades.

The recorded incidence of human salmonellosis has quite increased in Norway during the last three decades. However, the overall situation seems to have been stable the last years. For the majority of salmonellosis cases (approximately 80 %), the patients have acquired the disease abroad (1).

As it is very important to maintain this favourable situation in Norway, the Norwegian *Salmonella* surveillance and control programmes (2) were established in 1995, and launched simultaneously with comparable programmes in Sweden and Finland (3, 4). The programmes are approved by the EU Commission (EFTA Surveillance Authority Decision No. 68/95/COL of 19.06.1995), allowing Norway to require additional guarantees regarding *Salmonella* when importing live animals, feed and food products of animal origin from the European Union.

The surveillance covers live animals (pigs, cattle and poultry), fresh meat (pigs, cattle and sheep) and poultry meat. Any *Salmonella* isolated in the programme irrespectively of serovar, is notifiable to the Norwegian Food Safety Authority which maintains overall responsibility. When *Salmonella* is isolated, action is taken to eliminate the infection, prevent transmission, and prevent contamination of food products. This is the first time *S. Enteritidis* has been diagnosed in poultry in Norway since the surveillance started in 1995. The National Veterinary Institute coordinates the surveillance programmes, examines the faecal samples and publishes the results in monthly and annual reports. Private laboratories perform the examination of samples collected at slaughterhouses and cold stores.

Aims

The aims of the programme are to ensure that Norwegian food-producing animals and food products of animal origin are virtually free from *Salmonella*, to provide reliable documentation of the prevalence of *Salmonella* in the livestock populations and their products, and to prevent an increased occurrence of *Salmonella* in Norway.

Materials and methods

The *Salmonella* surveillance and control programme for live animals includes examination of faecal samples from swine, faecal samples or boot swabs from poultry, and lymph node samples from cattle and swine (at least five ileo-caecal lymph nodes from each animal). The *Salmonella* surveillance and control programme for fresh meat and poultry meat includes examination of swab samples from cattle, swine and sheep carcasses, and samples of crushed red meat from slaughterhouses and cold stores.

The number of samples examined in the different parts of the programme is estimated to be sufficient to detect at least one *Salmonella*-positive sample if the prevalence in the population is at least 0.1 %, with a confidence level of 95 %, assuming a 100 % sensitive test.

Sampling scheme for live animals

Poultry

The present *Salmonella* programme has been established pursuant to Article 5 of regulation (EC) 2160/2003 of the European Parliament and of the Council of 17 November 2003 on the control of *Salmonella* and other specified food-borne zoonotic agents.

Table 1. Sampling of *Gallus gallus* breeder flocks, and breeder flocks of turkey, duck and geese

Production	Sampling time	Sampling place	Sample material	Sampling by"
Rearing flocks	Day old	Holding	5 transport crates from one delivery: Crate liners (>1m ² in total) or Swab samples (>1m ² in total). Analysed as one pooled sample.	F
	4 weeks old	Holding	2 pairs of boot swabs. Analysed as one pooled sample.	F
	2 weeks before being moved	Holding	2 pairs of boot swabs. Analysed as one pooled sample.	F and O: Once a year in each holding
Adult flocks	Every 2 nd week	Holding	5 pairs of boot swabs. Analysed as two pooled samples. [2 x 150 g faeces, analysed separately, if birds kept in cages].	F and 3 x O: 0-4 weeks after moving, 8-0 weeks before slaughter, once in between

"O = Official personnel (Norwegian Food Safety Authority), "F = Farmer

Table 2. Sampling of laying flocks

Production	Sampling time	Sampling place	Sample material	Sampling by"
Rearing flocks	Day old	Holding	5 transport crates: Crate liners (>1m ² in total) or Swab samples (>1m ² in total). Analysed as one pooled sample.	F
	2 weeks before being moved	Holding	2 pairs of boot swabs. Analysed as one pooled sample. Cage birds: Faecal samples (150g).	F and O: Once a year in each holding
Laying flocks	Every 15 weeks	Holding	2 pairs of boot swabs. Analysed as one pooled sample. Cage birds: Faecal samples (150g).	F and O: One of the samples

"O = Official personnel (Norwegian Food Safety Authority), "F = Farmer

Table 3. Sampling of broiler, turkey, duck and geese flocks

Sampling time	Sampling place	Sample material	Sampling by"
7-19 days before slaughter	Holding	2 pairs of boot swabs. Analysed as one pooled sample.	F and O: Once a year in each holding

"O = Official personnel (Norwegian Food Safety Authority), "F = Farmer

Table 4. Sampling in elite and multiplier breeding swine herds in the *Salmonella* surveillance and control programme in 2007

Herd category	No. of herds sampled (total*)	No. of samples examined	No. of positive samples	<i>Salmonella</i> serovar
Elite breeding herds	50 (50)	944	0	
Multiplier herds	72 (100)	1,226	0	

* Total number of herds is estimated as elite and multiplier breeding herds per 1 January 2007 excluding herds which ended breeding activity during 2007 before being tested.

Table 5. Number of individual lymph node samples from swine and cattle examined in the *Salmonella* surveillance and control programme in 2007

Species	No. of slaughterhouses sampled (total*)	No. of samples examined	No. of positive samples	<i>Salmonella</i> serovar
Sows	14 (27)	1,012	0	
Slaughter pigs	23 (27)	2,542	0	
Cattle	29 (37)	2,218	1	<i>S. paratyphi</i> C

* Slaughterhouses where the number of slaughtered animals of a species is less than 100 according to the Slaughter Statistics for 2007 are not included in the sampling scheme.

Table 6. Samples from poultry in the *Salmonella* surveillance and control programme in 2007

Poultry breeding flocks	No. of samples tested	No. of holdings tested	No. of positive holdings	<i>Salmonella</i> serovar
Grandparents				
Layers and broilers	62	3	0	
Parents				
Layers and broilers	2,247	74	1	<i>S. enterica</i> subsp. <i>diarizonae</i> (61:k:1,5,7)
Turkeys	24	3	0	
Ducks	9	2	0	
Total - Breeders	2,342	79	1	
Other commercial poultry				
Pullets	269	20	0	
Layers	1,944	676	0	
Meat production - Broilers	4,419	598	1	<i>S. Enteritidis</i> (PT4)
- Turkeys	424	63	0	
- Ducks	85	9	0	
Unknown	1,561	125	0	
Total - Non breeder holdings	8,702	1,378	1	
Total	11,044	1,386	2	

Table 7. Number of swab samples from carcasses of swine, cattle and sheep examined in the *Salmonella* surveillance and control programme in 2007

Species	No. of slaughterhouses sampled (total*)	No. of samples examined	No. of positive samples	<i>Salmonella</i> serovar
Swine	23 (27)	3,472	5	<i>S. Typhimurium</i>
Cattle	29 (37)	2,096	1	<i>S. Typhimurium</i>
Sheep	23 (36)	2,496	2	<i>S. enterica</i> subsp. <i>diarizonae</i> (61:k:1,5,7)

* Slaughterhouses where the number of slaughtered animals of a species is less than 100 according to the Slaughter Statistics for 2007 are not included.



All breeding flocks and commercial production flocks are included in the surveillance programme. All breeder flocks are certified and the sampling is in accordance with table 1. All layer flocks are sampled twice during the rearing period and every 15 weeks during the egg laying period (table 2), whilst broiler flocks and flocks of turkeys, ducks and geese other than breeders are sampled one to three weeks before slaughter (table 3). Result of the testing must be ready before slaughter so actions can be taken for positive flocks.

Swine

In Norway there are approximately 150 elite and multiplier breeding herds for swine. More than 95 % of marketed breeding animals are purchased from these herds. All elite and multiplier breeding herds are surveyed annually at herd level. Pooled faecal samples are collected from all pens (up to a maximum of 20) containing piglets aged two to six months. If there are less than three pens of piglets at this age, additional individual faecal samples are collected from all sows (up to a maximum of 59) (5).

The pig population is surveyed by sampling a representative proportion of all pigs slaughtered in Norway. A total of 3,000 lymph node samples from swine (both sows and slaughter pigs) should be collected at slaughter. The sample size for each slaughterhouse ranges from 20 to 240 and is based upon the number of onsite slaughtered animals in relation to the national total. The sampling is distributed evenly throughout the year (6).

Cattle

The surveillance is based on sampling a representative proportion of all cattle slaughtered in Norway. A total of 3,000 lymph node samples from cattle should be collected at slaughter. The sample size for each slaughterhouse ranges from 20 to 100 and is based upon the number of onsite slaughtered animals in relation to the national total. The sampling is distributed evenly throughout the year (6).

Clinical cases - all animal species

Animals with clinical symptoms consistent with salmonellosis should be sampled for bacteriological diagnosis. In addition, all sanitary slaughtered animals are tested for the presence of *Salmonella*. Data from these two categories of animals are not included in this report.

Sampling scheme for fresh meat

Swab samples from carcasses

The testing of slaughtered pigs, cattle and sheep for *Salmonella* is done by swabbing carcass surfaces. For each animal species, a total of 3,000 swab samples should be collected at slaughter. For each slaughterhouse, the sample size ranges from 20 to 100 and from 20 to 240 for cattle and swine, respectively. The number of swab samples of cattle and swine from each slaughterhouse equals the number of lymph node samples. The number of swab samples from sheep ranges from 20 to 160 per slaughterhouse. The sampling is distributed evenly

throughout the year. The sampling is done near the end of the slaughter line before the carcasses are refrigerated. Approximately 1,400 cm² of each carcass is swabbed (somewhat less for sheep) (6).

Food products

The surveillance and control programme for cutting plants and cold stores are based upon samples of crushed meat taken from the equipment or from trimmings. Each sample consists of 25 grams. Each production line is sampled separately. The sampling should be performed randomly during operation. The number of samples taken in cutting plants and cold stores is given by the production capacity of the plant, and ranges from one sample per week to two per year (6).

Pre-packed fresh meat intended for cold stores does not have to be examined if they come from cutting plants that are included in the programme. However, freshly packed or repacked meat should be sampled.

Laboratory methods

All lymph nodes from one animal are divided into two equal parts. One half is used for testing and the other half is stored at 4°C until the results of the bacteriological examination is ready. The lymph node from at most five animals are pooled and homogenized before bacteriological examination. Swab samples are pooled in groups of five before testing.

If the pooled sample is confirmed positive for *Salmonella*, the individual samples are examined separately.

Microbiological examination of the samples is carried out according to the Nordic Committee on Food Analysis method No. 71, but slightly amended to make the method applicable to the various kinds of materials.



For faecal samples and boot swabs in the poultry programme testing for the presence of *Salmonella* spp. is carried out using ISO 6579:2002/Amd.1:2007(E): Annex D: Detection of *Salmonella* spp. in animal faeces and in environmental samples from the primary production stage. A sample is considered positive for *Salmonella* spp. when *Salmonella* spp. is detected by specified method and verified by the national reference laboratory (National Veterinary Institute).

Results

Live animals

Poultry

A total of 11,044 faecal samples and boot swabs from 1,386 different holdings were examined (Table 6). *Salmonella* Enteritidis PT4 was detected in one broiler flock. This is the first time *S. Enteritidis* has been diagnosed in poultry in Norway since the surveillance started in 1995. The source of this *S. Enteritidis* infection was not found. The prevalence of *S. Enteritidis* in poultry worldwide has increased substantially since 1987 and is in humans a common cause of gastroenteritis. In poultry *S. Enteritidis* can be transmitted both horizontally and vertically. In a flock infections can range from clinically inapparent to causing diarrhoea with moderate mortality.

Swine

A total of 2,170 faecal samples from 122 elite and multiplier breeding herds (including AI centres and testing stations) were examined in 2007 (Table 4). *Salmonella* was not detected in any of the samples. A total of 3,554 lymph node samples from slaughtered pigs were examined. Approximately 28 % of the samples were taken from sows and 72 % from slaughter pigs. None of the samples was positive for *Salmonella* giving an estimated *Salmonella* prevalence of 0 % (95 % confidence interval: 0 % - 0.1 %) at the individual carcass level.

Cattle

In 2007, a total of 2,218 lymph node samples from cattle were examined (Table 5). One of the samples were positive for *Salmonella* giving an estimated *Salmonella* prevalence of 0.08 % (95 % confidence interval: 0 % - 0.3 %) at the individual carcass level.

Fresh meat

Swab samples from cattle, sheep and swine carcasses

A total of 8,064 swab samples from 36 slaughterhouses were examined in 2007 (Table 5). *Salmonella* was detected in eight samples.

Cutting plants and cold-stores for fresh meat and poultry meat

A total of 1,466 samples of crushed meat from 64 different plants were examined. *S. Typhimurium* was detected in one of the samples, and *S. enterica* subsp. *enterica* O:9 (non motile) in another.

Discussion

The results from the *Salmonella* surveillance programmes in 2007 document that the Norwegian cattle, swine, sheep and poultry populations are only sporadically infected with *Salmonella*. This is in accordance with previous findings (7-11). The estimated prevalence is below 0.3 % in the examined populations for any of the years the surveillance programmes have run. The number of positive samples has never exceeded ten in total per year. *S. Typhimurium* is isolated most frequently from swine, cattle and poultry, while *S. enterica* subsp. *diarizonae* is found most frequently from sheep. *S. Enteritidis* was in 2007 detected for the first time in poultry in Norway.

Between 15 % and 25 % of the recorded human cases of salmonellosis are domestic in origin showing that domestic food products of animal origin represent a minor risk with regard to *Salmonella* infection in humans. In 2002 it was shown that two clones of *S. Typhimurium* in the wild fauna (wild birds and hedgehogs) represented a risk for human infection (12). Such wild animal reservoirs may also be considered a risk for farm animals. The prevalence of *S. Typhimurium* is still low, it may be assumed that farm animal populations have been and still are quite well protected from these reservoirs.

The number of swab and lymph node samples examined per species should have been 3,000 per year. The required sample size was reached for the swine population, but not for the cattle and sheep populations. A follow up of the personnel taking and reporting the samples is needed. Never the less, the programme was able to document a very low *Salmonella* prevalence in the examined populations.

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Annual report 2007

Residues in live animals and animal products in Norway



Dag Grønningen

Responsible institutions
National Veterinary Institute
Norwegian Food Safety Authority

Residues in live animals and animal products in Norway

Dag Grønningen

Totally 4,249 samples (95.5 % of plan) from animals and primary animal products were collected in 2007. 78 samples (1.8 %) were classified as non-compliant, containing substances from groups: A2 Thyrostats, A3 Steroids, B1 Antibacterial substances and B3c Heavy metals.

Introduction

Since 1993, the surveillance programme has included bovine, porcine, sheep, poultry and reindeer products in accordance with EU Directive 86/469. In 1999 it was expanded to include live animals, milk, eggs, honey, and fish. The number of samples and substances tested in the programme was at the same time substantially increased in accordance with EU Directive 96/23 (1) and EU Decision 97/747/EC (2).

The programme for surveillance of residues in live animals, fish, and animal products were taken over by the Norwegian Food Safety Authority from 1 January 2004. Each year's program produces a report on land animals and fish separately. National Veterinary Institute publishes the land animals' part (3). The results of fish and products thereof are reported by National Institute of Nutrition and Seafood Research (in Norwegian, 4).

Aims

The aim of the present programme is to ensure food safety by monitoring the occurrence of residues of veterinary medicines, prohibited substances and environmental contaminants in live animals and animal products.

Regulations

To prevent consumption of animal products that contain potentially harmful residues, the Residue Control Regulation (RCR) was introduced in 2000 (5). This aims to prevent production, import and sale of products containing residues of prohibited substances, contaminants and veterinary drugs above Maximum Residue Limits (MRL). The legislation implements EU Directive 96/23 and requires control measures for any activity in agricultural and animal production.

The RCR determines MRLs for veterinary drugs. The use of veterinary drugs without MRLs in production animals is prohibited. In 2002 the EU introduced the phrase Minimum Required Performance Limit (MRPL) through Commission Decision 2002/657/EC (6). It is intended to harmonise the analytical performance of methods for substances for which no MRLs have been established or are prohibited.

Since the entry into force of Decision 2002/657/EC (1 September 2002), the correct term for those analytical results exceeding the permitted limits is "non-compliant". A non-compliant result means that the result has a sufficient statistical certainty (99 % for substance for which no MRLs has been established, and 95 % for all other substance) and can be used for legal purposes.

Materials and methods

Group of substances

EU regulations define the species (Table 1) and groups of substances (Appendix) to be included in the programme.

Samples of live animals (e.g. bovines, pigs, poultry, and horse) are monitored for the presence of prohibited substances (Group A) only.

Each country may select the specific substances to be monitored. In Norway this selection based of knowledge in Norwegian Food Safety Authority and advice from the Norwegian Medical Agency, as well from the Norwegian School of Veterinary Science, Aker University Hospital and the National Veterinary Institute.

Sampling plan

The sampling plan for the various animal species and products is determined on the basis of earlier production (Table 1). The plan is designed to ensure an even sampling throughout the year and throughout the country.

Table 1. The number of animals slaughtered and production figures for animal products in Norway in 2005

Categories	Production
Bovine	332,996 *
Porcine	1,469,430 *
Sheep	1,296,809 *
Equine	1,734 *
Reindeer	2,054 tons
Wild game	105,499 animals
Poultry	56,473 tons
Milk	1,530 mill litre
Eggs	46,656 tons
Honey	986 tons

* Total number of approved carcasses.

Information on each sample is registered in a protocol at the time of sampling and sent to the central registration unit.

Laboratory analysis

Samples are analysed within three months of sampling. Values exceeding MRLs and any prohibited substances detected are reported immediately.

All analyses are carried out by national reference laboratories. The Norwegian laboratories are accredited by the Norwegian Accreditation and thereby meet the requirements of the standard ISO/IEC 17025. Substances A1, A3, A4, A5 and B2d are analysed at the Hormone Laboratory, Aker University Hospital. Substances A2 are analysed at Ghent University, Belgium. Substances A6, B1, B2b, B2e, and B2f are analysed at the Laboratory for Veterinary Drug Residue Analysis in Food, the Norwegian School of Veterinary Science (NVH). Substances B2a and B2c are analysed at the Laboratory for Analysis of Veterinary Drugs, NVH. Substances B3a and B3b are analysed at the Laboratory of Environmental Toxicology, NVH, and the Bioforsk Lab, Ås. Substances B3c and B3d are analysed at the Section of Chemistry, National Veterinary Institute.

Table 2. The number of live animals tested in 2007

Substances	Bovines		Pigs		Poultry	
	No	NCom	No	NCom	No	NCom
A1 Stilbenes	77		9			
A2 Thyrostatics	44	12	9	6	1	
A3 Steroids	77	4	15			
A4 Resorcylic acid lactones	71		10			
A5 Beta-agonists	80		8		2	
A6 Annex IV substances*	72		13		5	
Total A	421	16	64	6	8	0

*A6: Annex IV: chloramphenicol; nitrofuranes; dimetridazole, metronidazole and ronidazol.

No: Number of animals tested in 2006.

NCom: Number of non-compliant animals.

Results and comments

General

It was planned to collect 4,449 samples in 2007. Totally 4,249 samples from animals and primary animal products were collected. 78 samples (1.8 %) were classified as non-compliant.

The report (in Norwegian) delivered to the Norwegian Food Safety Authority contains a more detailed description of the substance being analysed, the laboratory methods, and the results (7).

Live animals

Table 2 presents an overview of the number of samples tested in 2007 grouped according to substances, and number of non-compliant samples. In addition nine samples of horse were tested for A5: Beta-agonists and one sample tested for A6: Annex IV. All of these horse samples were compliant.

Thyrostatics

2-thiouracil was detected in 12 samples of bovines, and 6 samples of pigs. See a possible explanation under Animal products; Thyrostatics. Norway considers this as non-compliant laboratory samples.

Steroids

17-alfa-nondrelon was detected in four samples of pregnant bovines. The literature tells that bovines produce this substance during the state of pregnancy (8). Norway considers this as non-compliant laboratory samples.

Animal products

Table 3 presents an overview of the number of animal products sampled in 2007.

Thyrostatics

2-thiouracil was detected in 16 samples of bovines, 18 samples of pigs, and three samples of sheep. 2-mercapto-benzimidazol was detected in one bovine. This substance

Table 3. The total number of animal products/foods in the surveillance and control programme in 2007

Substances	Bovines		Pigs		Sheep		Horses		Poultry		Reindeer		Milk		Eggs		Honey		Wildgame		
	No.	NCom	No.	NCom	No.	NCom	No.	NCom	No.	NCom	No.	NCom	No.	NCom	No.	NCom	No.	NCom	No.	NCom	
A1 Stilbenes	81		45		27				15		1										
A2 Thyrostatics	75	16	24	18	12	3	4		14		1										
A3 Steroids	108		54		21		2	1	13		3										
A4 Resorcylic acid lactones	73		37		19		4		13												
A5 Beta-agonists	81		33		25		4		15		4										
A6 Annex IV substances*	70		32		19		4		123		5		40		87		5				
Total A	488	16	225	18	123	3	18	1	193	0	14	0	40	0	87	0	5	0			
B1 Tiamulin (pigs); penicillin (milk)			38										71	1							
B1 Enrofloxaim	53		45		52																
B1 Sulfonamides	69		50		71		3		40		9		71		71						
B1 Tetracyclines	29				41				40		9		45		67		10				
Total B1	151	0	133	0	164	0	3	0	80	0	18	0	187	1	138	0	10	0			
B2a Anthelmintics	95		68		107		4		17		18		75								
B2b Anticoccidials	11		10		20		2		66						129						
B2c Carbamates and pyrethroids	35		10		35		3		10		9						10				
B2d Sedatives	21		28		29		2														
B2e NSAIDs	54		36		10		25		9				32								
B2f Glucorticoids	20		20				2						18				10*				
Total B2	236	0	172	0	201	0	38	0	102	0	27	0	125	0	129	0	20	0			
B3a Organochlorine compounds	20		22		15		3		8		7				20		10				
B3b Organophosphorous compounds	21		26		14		3		4				11				10				
B3c Chemical elements	53	7	43		56	10	6		16		15	11	17		40		5			72	44
B3d Mycotoxins	14		22		17		2		2				48								
Total B3	108	7	113	0	102	10	14	0	30	0	22	11	83	0	60	0	25	0		72	44
Total B	495	7	418	0	467	10	55	0	212	0	67	11	395	1	327	0	55	0		72	44
Total A+B	983	23	643	18	590	13	73	1	405	0	81	11	435	1	414	0	60	0		72	44

*: 10 samples of honey are screened for substance groups B2c, B2f, B3a, and B3b. No.: Number of animal products/foods in 2007. NCom: Non-compliant results (detection for banned substances or above MRLs or national limits for veterinary drugs and contaminants). A6: Annex IV: chloramphenicol; nitrofuranes; dimetridazole, metronidazole and ronidazol. Wild game: elk, roe deer and red deer.

was detected for the first time in Norway in 2006. A possible explanation maybe that the laboratory has developed a method that detects a possible background of natural occurrence of thyrostats in animals fed with cruciferous (9). Norway considers this as non-compliant laboratory samples.

Steroids

17-alfa- and 17-beta-nondrelon was detected in one sample of stallion. The literature tells that non-castrated stallion produce these substance (10). Norway considers this as non-compliant laboratory sample.

Antibacterial substances

Penicillin G was detected in one sample of milk. Norway considers this as non-compliant laboratory sample.

Heavy metals

Residues of cadmium exceeding MRLs were detected in 7 samples of bovine and 10 samples of sheep.

No MRLs have been established for wild game. If we use MRLs set for bovine: Residues of cadmium in 11 reindeer, 31 elk, 7 roe deer, and 6 red deer were detected. In addition lead was detected in one reindeer, two elk, two roe deer, and four red deer. Norway considers all residues of cadmium and lead exceeding MRLs as non-compliant laboratory samples.

Chemical elements accumulate in organs throughout life as a result of environmental pollution, particularly in free ranging animals (farmed and wild game, sheep).

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Appendix

Group A – Substances having anabolic effect and unauthorized substances

1. Stilbenes, stilbene derivatives, salts and esters
2. Thyrostatics
3. Steroids
4. Resorcylic acid lactones
5. Beta-agonists
6. Annex IV substances. (incl. chloramphenicol, nitrofuranes, dimetridazole and metronidazol)

Group B – Veterinary drugs and contaminants

1. Antibacterial substances, (incl. sulphonamides, fluoroquinolones)
2. Other veterinary drugs
 - a. Anthelmintics
 - b. Anticoccidials
 - c. Carbamates and pyrethroids
 - d. Sedatives
 - e. NSAIDs
 - f. Other pharmacologically active substances
3. Environmental contaminants and other substances
 - a. Organochlorine compounds, incl PCBs
 - b. Organophosphorus compounds
 - c. Chemical elements
 - d. Mycotoxins

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The surveillance and control programmes for paratuberculosis in Norway



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The surveillance and control programmes for paratuberculosis in Norway

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Mycobacterium avium subsp. paratuberculosis was recorded in three new goat herds and two new sheep flocks in 2007. For the first time since the programme started, clinical paratuberculosis was registered as a herd problem.

Introduction

Paratuberculosis was first diagnosed in cattle and goats in Norway in 1907 and 1934, respectively (1, 2). *Mycobacterium avium subsp. paratuberculosis* infection is a notifiable disease (List B) in ruminants in Norway. The control of this disease in cattle is enforced by government legislation. Confirmation of infection most often results in the culling of the herd. Affected herd owners are compensated by the government, which also covers the expenses involved in testing. In goat herds, government restrictions combined with vaccination are used to control paratuberculosis. Vaccination is performed using an inactivated vaccine (3).

A national surveillance and control programme for paratuberculosis was established in 1996 (4, 5, 6).

Descriptions of occurrence of the disease in Norway, control measures taken up to 1995, and results from the surveillance and control programmes from 1996 to 2001, can be found in the annual report for 2001 (5).

Aim

The aim of the surveillance programme for paratuberculosis is to estimate the prevalence of the infection in the Norwegian population of vaccinated goats. In addition, cattle, goats from unvaccinated herds, sheep and llamas in limited numbers are screened for infection with *M. a. paratuberculosis*.

Materials and methods

Cattle, goats, sheep and llamas were included in the programme in 2007. Faecal samples were collected on the farms by the Norwegian Food Safety Authority, while organ samples were collected at slaughterhouses.

Active surveillance

Cattle

The target population consisted of all cattle herds delivering milk to dairies in the sampling period and all beef cattle herds receiving state support according to records of July 2006. Fifty herds on farms that also had goats or that were in areas where registered in goat herds were selected for sampling. Faecal samples were collected from the five oldest cows in each herd.

Goats

One hundred and ten vaccinated and fifteen unvaccinated herds were selected for sampling. All goat herds on farms that also had cattle or sheep were selected. Faecal samples were taken from the ten oldest goats, or from sick goats.

Sheep

Forty flocks on farms that also had goats or flocks from the areas where paratuberculosis is registered in goat herds were selected. Faecal samples from the ten oldest sheep, or from sick sheep were collected.

Llamas

Llama was introduced as a new species to Norway in 1997-98. A few animals have been imported from Sweden and from South America over the last years. Faecal samples from animals over four years of age are collected each year. In addition, organ samples are collected from llamas at slaughter and from animals that die when over four years of age.

Herds with restrictions

Infected herds and contact herds are included in the programme.

Passive clinical surveillance

Clinical surveillance has been a part of the programme since 2000. For cattle, special emphasis is placed on the collection of samples from animals with reduced milk production, loss of weight, diarrhoea lasting more than 14 days, and animals that are over four years of age.

Sampled herds and animals

A total of 275 faecal samples and five organ samples were collected from cattle, while 1,572 faecal samples and 34 organ samples were collected from goats. A total of 400 faecal samples and 19 organ samples were collected from sheep, and 46 faecal samples and two organ samples were collected from llamas (Table 1).

Histopathological examination

Samples from jejunum, ileum, ileocecal valve, and mesenteric lymph nodes were examined histopathologically. The tissue was fixed in 10 % neutral-buffered formalin, processed by routine methods and stained with haematoxylin and eosin (HE) and the Ziehl-Neelsen (ZN) method for acid-fast bacteria.

Bacteriological examination

The samples were decontaminated with 4 % sodium hydroxide and 5 % oxalic acid with 0.1 % malachite green (7), and inoculated onto selective and non-selective Dubos medium with mycobactin (2 µg/ml) and pyruvate (4 mg/ml) (8). Incubation time was 16 weeks.

Mycobactin dependency, acid-fastness by Ziehl-Neelsen staining, and presence of the insertion segment IS900 by a PCR technique (9) were used to identify the isolates.

Results

Histopathological examination

Formalin-fixed tissue samples from five cattle from five different herds were examined with no positive results (Table 2).

Thirty-five goats from five suspected herds or contact herds were examined. Granulomatous lesions were found in lymph nodes of 23 goats. (Table 2).

Nineteen sheep from four contact flocks were examined. Granulomatous lesions were found in the intestines and lymph nodes of two sheep in a herd confirmed with bacteriology to be infected with *M. a. paratuberculosis* (Table 2).

Samples from two llamas were examined with no positive results (Table 2).

Bacteriological examination

A total of 280 cattle in 58 herds were examined for paratuberculosis by bacteriological methods (Table 2). *M. a. paratuberculosis* was not found.

A total of 1,607 dairy goats from 127 herds were examined for paratuberculosis by bacteriological methods (Table 2). *M. a. paratuberculosis* was isolated from 125 samples from goats in three new herds. The kids in two of these herds were vaccinated against paratuberculosis since 1992-1993. One herd stopped vaccinating in 2004, and the majority of positive samples came from this herd.

A total of 400 sheep from 44 flocks were examined for paratuberculosis by bacteriological methods. *M. a. paratuberculosis* was isolated from five sheep from two different flocks (Table 2).

A total of 48 llamas from 16 herds were examined for paratuberculosis by bacteriological methods (Table 2). *M. a. paratuberculosis* was not isolated.

Discussion

Since the surveillance programme for paratuberculosis started in 1996, infection with *M. a. paratuberculosis* has been detected in altogether nine cattle herds, six sheep flocks and in 27 goat herds.

Table 1. Number of samples collected for examination for *Mycobacterium avium* subsp. *paratuberculosis* in 2007

		Faecal samples no. of animals	Intestinal samples no. of animals	Total no. of animals	Total no. of herds
Cattle	Random sample	255	0	255	51
	Suspected or imported cases	2	3	5	4
	Control of infected herds and contact herds	18	2	20	2
Goat	Vaccinated	738	0	738	74
	Unvaccinated	347	0	347	36
	Suspected cases	1	6	6	4
	Control of infected flocks and contact flocks	486	29	515	14
Sheep	Random sample	390	0	390	40
	Control of infected flocks and contact flocks	10	19	29	4
Llama		46	2	48	16

Table 2. Results of histopathological and bacteriological examination of cattle, goats, sheep and llamas in 2007

Species	Type of samples	Bacteriology			Histopathology		
		No. of samples	No. of herds	No. of pos. samples	No. of samples	No. of herds	No. of pos. samples
Cattle	Faeces	275	53	0			
	Intestinal samples	5	5	0	5	5	0
Goat	Faeces	1,572	123	101			
	Intestinal samples	35	5	24	35	5	23
Sheep	Faeces	400	41	1			
	Intestinal samples	19	4	4	19	4	2
Llama	Faeces	46	14	0			
	Intestinal samples	2	2	0	2	2	0

The infection was recorded in three new goat herds and two new sheep flocks in the surveillance and control programme in 2007. The infected sheep flocks had close contact with goat herds.

As in 2006, the surveillance programme for 2007 gave priority to samples from vaccinated goat herds while cattle and sheep were sampled less. By following this priority over a few years, the prevalence estimate could possibly come closer to the true prevalence in the endemic areas. This could be very useful because the dairy organisation (TINE) and the Norwegian Goat Health Services have started an eradication programme for three widespread infectious diseases in goats. The programme started in 2001 and concentrated on caprine arthritis encephalitis and caseous lymphadenitis the first years. From 2004 they included herds in areas with paratuberculosis as well.

For the first time since the programme started, clinical disease due to paratuberculosis as a herd problem was registered in Norway in 2007. The herd joined the disease eradication programme in 2004 and terminated vaccination against paratuberculosis. In January 2007, clinical disease was observed in several animals, and the disease was shown to be widespread in the herd.

Paratuberculosis is endemic among goats in six out of 19 counties in Norway. All the cases among cattle and sheep can be attributed to one of two reasons; either brought into the country with imported cattle (seven cattle herds, one sheep flock) or contact with infected goats (two cattle herds, five sheep flocks). Importation of live cattle was nearly stopped by 1996 and has since been replaced by importation of semen and embryos. But importation of sheep and goats may together with the presence of infected goat herds represent a risk for spread of the infection to other ruminants.

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The surveillance and control programme for bovine spongiform encephalopathy (BSE) in Norway

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The surveillance and control programme for bovine spongiform encephalopathy (BSE) in Norway

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All 19,508 samples, originating from 9,908 herds, were tested negative for BSE in 2007.

Introduction

The BSE surveillance programme was initially based on passive surveillance (1998-2000), with active surveillance introduced in May 2000. In the period 1998-2000 the samples were investigated by histopathological examination. From 2001 onwards the samples were examined by an Enzyme-Linked ImmunoSorbent Assay (ELISA) method for detection of resistant prion protein (PrP^{Sc}) (Platelia® BSE ELISA Bio-Rad was replaced by TeSeE® ELISA Bio-Rad in June 2003). In addition, clinically suspected animals were investigated by histopathological examination according to the protocol of the Office International des Epizooties (OIE) (1, 2). The number of samples examined in each category in the period 1998-2006 is presented in Table 1. BSE has never been detected in any of the examined animals.

Aim

The aim of the surveillance programme is to document that the Norwegian cattle population is free from BSE.

Surveillance programme

Programme outline

For 2007 the surveillance programme was in accordance with the European Commission Regulations (EC) No 999/2001 Annex III with amendments. The programme included examination of the following categories:

- clinically suspected animals irrespective of age
- all animals older than 24 months of age, which have died or been culled, but not slaughtered for human consumption (fallen stock)
- all emergency slaughtered animals older than 24 months
- all animals older than 24 months, with abnormal findings at ante-mortem examination, rejected for human consumption, or which died at the abattoir or during transport (referred to as ante-mortem animals)
- all slaughtered animals with unknown age or origin irrespective of age
- all imported cattle from any country irrespective of age
- 10,000 randomly selected healthy routinely slaughtered animals older than 30 months

Table 1. Examination for BSE in cattle sampled by the Norwegian surveillance programme according to categories from 1998-2006

Reason for submission to the laboratory	1998-2000	2001	2002	2003	2004	2005	2006
Clinically suspected animals	78	14	2	2	3	1	0
Fallen stock		1,352	1,482	1,872	2,145	2,318	2,364
Emergency slaughtered		7,073	7,246	7,322	9,217	8,462	8,177
Ante-mortem animals		2,612	3,562	4,102	1,355	102	36
Imported slaughtered animals	19*	88	39	39	24	10	4
Healthy slaughtered animals		2,400	9,907	10,726	10,443	10,486	10,455
Total	97	13,539	22,238	24,063	23,187	21,379	21,036

* All the samples were examined in 2000.

Implementation

The farmers were requested to report all cases of clinically suspected animals irrespective of age, fallen stock older than 24 months and when delivering an imported animal to slaughter to the Norwegian Food Safety Authority. The brain or head from clinically suspected cattle or a spoon sample from the medulla oblongata from fallen stock and were submitted and analysed at the National Veterinary Institute, Oslo. Inspectors from the Norwegian Food Safety Authority collected the spoon samples of the medulla oblongata from the other categories at the abattoirs and sent them within 24 hours in a cool insulated container to the National Veterinary Institute in Oslo, Sandnes, or Harstad.

Laboratory methods

Clinically suspected animals

The whole brain was divided mid-sagittally into equal halves. One half was formalin-fixed and processed according to a standard routine protocol, embedded in paraffin, sectioned at 5 µm and stained with haematoxylin eosin (HE). Immunohistochemical staining for detection of PrPSc was performed on selected sections using a monoclonal anti-PrP antibody (SAF 84, courtesy of J. Grassi, CEA, France). From the non-fixed half, tissue from the obex area was analysed by ELISA for detection of PrPSc (TeSeE®, Bio-Rad) as described by the manufacturer.

Risk population and routine slaughtered animals

Non-fixed brain tissue from the obex area was analysed by ELISA for detection of PrPSc (TeSeE®, Bio-Rad) as described by the manufacturer. In cases with positive or inconclusive test results, the remaining half obex was fixed in 10 % neutral buffered formalin, embedded in paraffin, sectioned at 5 µm, and stained with HE. Subsequently, the sections were analysed by immunohistochemical detection of PrPSc using the same protocol as for specimens from clinical suspects.

Brain samples were rejected for examination when it was evaluated as unsuitable which means that the sample was severely autolysed, the dorsal part of the obex area was cut obliquely, the obex was not present, or the medullar anatomy was not recognisable.

Results and discussion

The National Veterinary Institute received samples from 19,574 cattle. Of these, 66 (0.3 %) samples were unsuitable for examination. The categories and number of animals examined are presented in Table 2.

For 350 samples (1.8 %) the herd of origin was not reported. However, it is important to note that in case of a positive test result from such a herd, the identity could be traced via the carcass number. The remaining 19,224 samples originated from 8,487 dairy cattle herds and 1,421 beef cattle herds. The mean number of examined animals per herd was 1.9.

Clinically suspected animals (passive surveillance)

In 2007, no animals were investigated as clinical suspects. Improved methods for clinical examination to distinguish between real suspected BSE cases and cases with central nervous disease of other causes has probably resulted in few clinical suspected cases in later years. It is likely that animals with diseases related to the central nervous system have been examined either as fallen stock, emergency slaughtered animals or ante-mortem animals, and thus included in these categories.

Surveillance of slaughtered animals and fallen stock (active surveillance)

Fallen stock older than 24 months comprises approximately 0.96 % of the adult population (National Cattle Registry (Husdyrregisteret), per 31.12.2007), i.e. approximately 3,600 animals. The majority of samples from fallen stock were collected on farm. The difference between the examined number and the expected number of fallen stock is partly explained by the fact that many cattle herds are located in remote areas where sampling is time consuming and cumbersome. In addition, a proportion of the cattle is grazing on mountain and forest pastures where sampling of dead animals is difficult. An additional reason could be that information to the farmers relating to their duty to report to the Norwegian Food Safety Authority all cases of fallen stock older than 24 months is insufficient.

Norwegian cows are slaughtered at a low age, the mean age is 54 months for dairy cows and 74 months for suckling cows (suckling cows constitute only 17,5 % of the cattle

Table 2. Examination for BSE in cattle sampled by the Norwegian surveillance programme according to category in 2007

Reason for submission to the laboratory	No. of samples	No. of rejected samples	Negative	Positive
Clinically suspected animals	0	0	0	0
Fallen stock	2,213	51	2,162	0
Emergency slaughter	7,304	10	7,294	0
Ante-mortem animals*	48	0	48	0
Imported animals	9	0	9	0
Healthy slaughtered animals	10,000	5	9,995	0
Total	19,574	66	19,508	0

* Abnormal findings at ante-mortem examination, rejected for human consumption, or which died at the abattoir or during transport.

Table 3. Age distribution of cattle tested for BSE-agent in 2007

Age groups (months)	Total population (%)	Relative number of tested animals				
		Fallen stock (%)	Emergency slaughter (%)	Ante mortem animals (%)	Healthy slaughtered animals (%)	Total tested (%)
< 24	59.6	1.7	3.5	0.0	2.0	2.5
24-29	7.9	11.5	15.0	6.3	8.2	11.1
30-35	6.0	9.4	7.7	18.8	11.4	9.8
36-47	9.9	20.6	17.3	27.1	22.8	20.4
48-59	6.8	16.3	16.6	20.8	20.9	18.7
60-71	4.1	16.5	15.6	6.3	14.6	15.2
72-83	2.4	10.8	11.9	12.5	9.6	10.6
84-95	1.4	6.2	6.3	4.2	5.4	5.8
96-107	0.8	3.1	3.3	2.1	2.8	3.0
108-119	0.4	2.1	1.4	0.0	1.2	1.3
120-131	0.2	0.7	0.8	2.1	0.6	0.7
132-143	0.1	0.5	0.3	0.0	0.2	0.3
144-155	0.1	0.4	0.2	0.0	0.1	0.2
≥ 156	0.1	0.4	0.3	0.0	0.2	0.2
Total number of animals	915,391	2,162	7,294	48	9,995	19,499*

* Nine imported animals not included

There were 1,098 samples (5.6 %) from cattle with unknown age. The age of these cattle are assumed to be distributed like the age distribution of the cattle with known age within each target group.

Table 4. Regional distribution of Norwegian cattle and cattle tested for BSE PrPSc in 2007

Counties	Total population (%)	Relative number of tested animals				
		Fallen stock (%)	Emergency slaughter (%)	Ante mortem animals (%)	Healthy slaughtered animals (%)	Total tested (%)
Oslo, Akershus, Østfold	4.5	8.2	6.1	4.2	4.8	5.7
Hedmark, Oppland	18.2	12.1	18.4	14.6	14.8	15.8
Buskerud, Vestfold, Telemark	6.3	10.1	6.6	18.8	7.1	7.3
Rogaland, Agder	20.8	27.0	13.7	0.0	26.2	21.6
Hordaland, Sogn og Fjordane	10.3	9.0	9.2	4.2	12.8	11.0
Trøndelag, Møre og Romsdal	29.7	22.7	37.4	45.8	25.1	29.5
Nordland	7.3	6.3	6.1	8.3	7.1	6.6
Troms, Finnmark	2.8	4.6	2.5	4.2	2.1	2.6
Total number of animals	915,391	2,162	7,294	48	9,995	19,499*

* Nine imported animals not included

There were 350 samples (1.8 %) from cattle with unknown region. These regions are assumed to be distributed following the region distribution of the cattle from known region within each target group.



population older than 24 months) (National Production Recording Scheme 2007, Norwegian Beef Herd recording System 2007).

The low age at culling implies that 43 % of the samples are originated from cattle younger than 4 years. The age distributions of cattle sampled in different categories are shown in Table 3. Results from the BSE-monitoring programme in the EU 2006 show that none of 287 verified cases of BSE were younger than 48 months, in contrast to 29 positive cattle in the age group 72-83 months (3). These results indicate that BSE-monitoring of animals younger than 48 months is of low value.

The geographical distribution of the cattle population and the animals of different categories tested are presented in Table 4. Figure 1 indicates that there is a correlation between the collection of samples for emergency slaughter and healthy slaughtered animals from different regions and the distribution of the cattle population in the regions, but corresponding figures for the fallen stock population show considerable variation between regions.

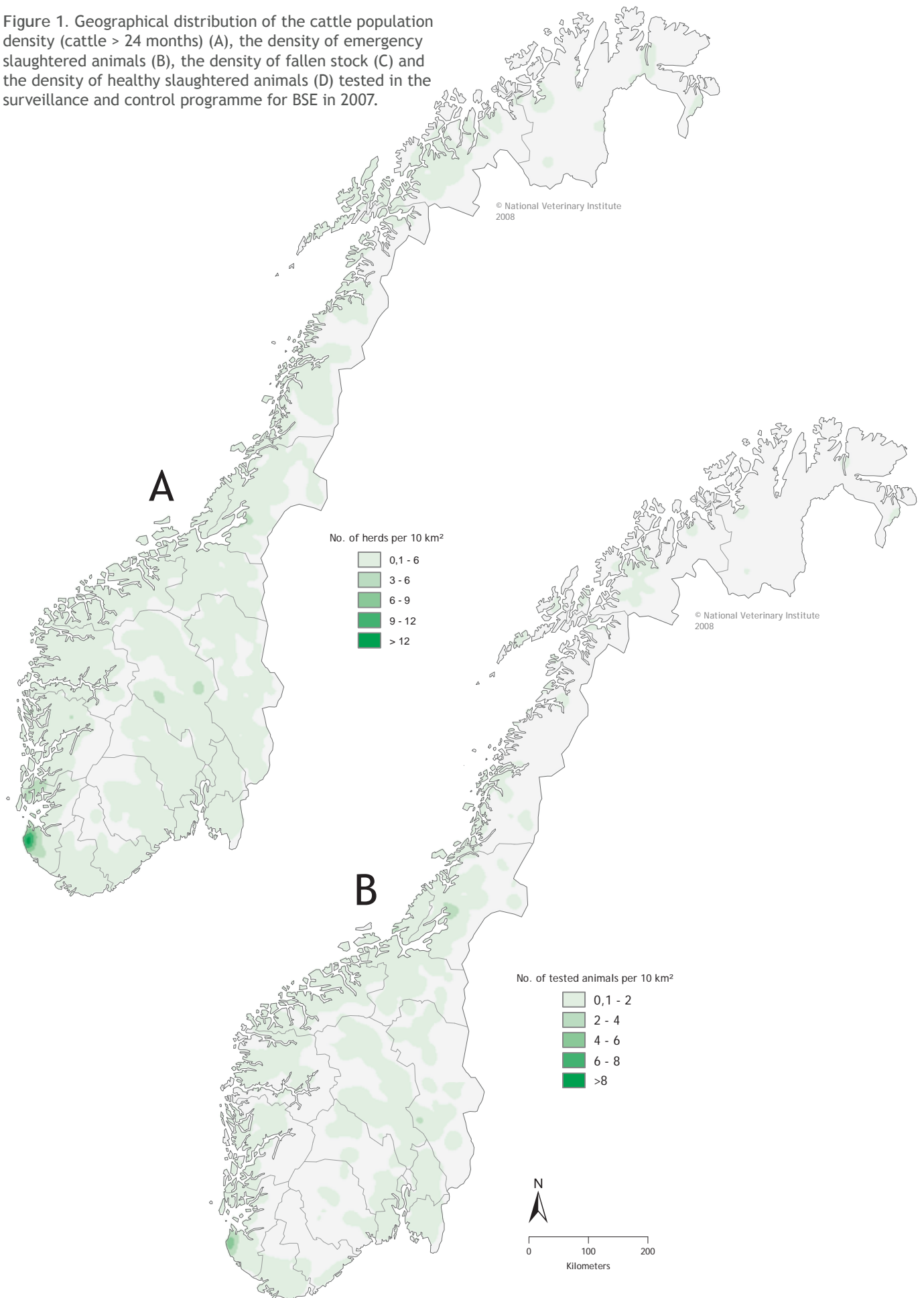
Conclusion

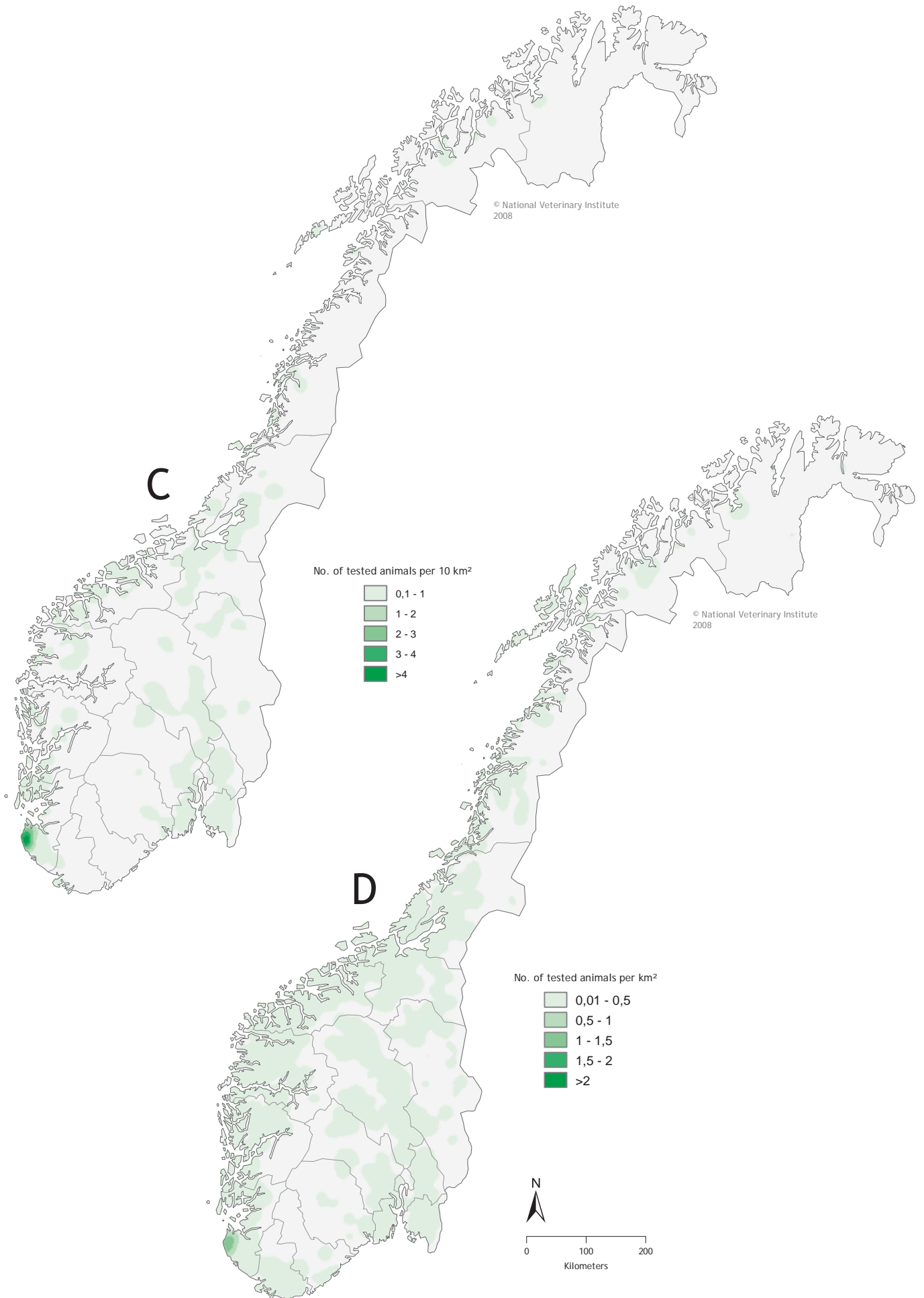
As mentioned in the first BSE surveillance report in 2001 (4) and supported by a recent quantitative risk assessment for BSE in Norway (5), the Norwegian cattle population has probably never been infected with BSE-agent due to few imports to Norway of cattle and products potentially infected with the BSE-agent, limited use of meat and bone meal in concentrates intended for ruminants, and the use of high temperature and pressure in the domestic production of meat and bone meal. The compiled results from the surveillance and control programme for BSE in the years 2001 to 2007 (6) with approximately 144,000 negative samples clearly support this view.

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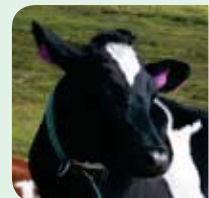
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Figure 1. Geographical distribution of the cattle population density (cattle > 24 months) (A), the density of emergency slaughtered animals (B), the density of fallen stock (C) and the density of healthy slaughtered animals (D) tested in the surveillance and control programme for BSE in 2007.





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The surveillance and control programme for infectious bovine rhinotracheitis (IBR) and infectious pustular vulvovaginitis (IPV) in Norway

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The surveillance and control programme for infectious bovine rhinotracheitis (IBR) and infectious pustular vulvovaginitis (IPV) in Norway

Annette Hegermann Kampen, Jorun Tharaldsen, Gry Grøneng

All milk and blood samples tested in 2007 were negative for antibodies against bovine herpes virus (BHV-1).

Introduction

In the early 1960s, two outbreaks of infectious pustular vulvovaginitis were diagnosed in cattle in Norway. Subsequently, no new cases of BHV-1 (infectious bovine rhinotracheitis/infectious pustular vulvovaginitis - IBR/IPV) were reported until 1993, when several animals in one single herd were found serologically positive after primary testing of bulk milk collected in 1992. However, clinical signs of IBR/IPV were never recorded on the farm. All animals on the farm were slaughtered. Attempts to isolate the virus from organ samples gave negative results. Sixteen contact herds and all dairy herds in the same region were serologically negative (1, 2). Likewise, 40 red deer that were shot in the neighbourhood during the hunting season the same year were serologically negative. After this incident, IBR/IPV virus infection has not been demonstrated in Norway.

EFTA Surveillance Authority (ESA) has recognised Norway as free from IBR since 1994. Decisions concerning the additional guarantees relating to IBR/IPV for bovines destined for Norway are described in ESA Decision 74/94/COL. Maintenance of the ESA Decisions accepting the IBR-free status of Norway requires annual reports of the surveillance of the disease.

The Norwegian Food Safety Authority is responsible for carrying out the surveillance and control programme for IBR/IPV. The National Veterinary Institute is in charge of planning the programme, collecting the bulk milk samples from the dairies and performing the tests. Blood samples from beef herds are collected by inspectors from the Norwegian Food Safety Authority.

Aims

The aim of the surveillance and control programme for IBR/IPV is to document freedom from the infection in Norway according to the demands in ESA Decision 74/94/COL with amendments, and to contribute to the maintenance of this favourable situation.

Material and methods

The surveillance of cattle for IBR/IPV in 2007 included both dairy and beef herds. Bulk milk samples from the dairy herds were provided by the dairies. From the beef herds, individual blood samples were collected on the farms from cattle older than 24 months.

The target population consisted of all cattle herds delivering milk to dairies during the sampling period. In 2007, bulk milk samples from 1,575 randomly sampled dairy herds were tested. The group of beef herds to be sampled was based on a register of all beef herds receiving governmental support according to recordings of July 2006. A total of 4,241 individual blood samples from 412 beef herds were analysed in pools with a maximum of 20 samples in each. The sampled herds represented 11.2 % of the Norwegian cattle herds (Table 1).

The number of herds in the surveillance and control programme for IBR/IPV in 2006 is given in Table 1. The geographic distribution of the total number and the number of tested dairy and beef herds are shown in Figures 1 and 2.

All samples were tested for antibodies against bovine herpes virus 1 (BHV-1) using a blocking ELISA (3) at the National Veterinary Institute in Oslo.

Table 1. Total number of dairy herds and beef herds within the frame of the Norwegian surveillance and control programme for IBR/IPV in 2007

Herd category	Total no. of cattle herds*	No. of herds tested	% tested of the total no. of herds
Dairy herds	13,700	1,575	11.5
Beef herds	4,100	412	10.0
Total	17,800	1,987	11.2

* Based on data from the Register of production subsidies as of July 31 2007.

Table 2. Samples in the surveillance and control programme for IBR/IPV in the Norwegian bovine population during the period 1993-2007

Year	Dairy herds	Beef herds		No. of positive samples
	No. of bulk milk samples tested	No. of beef herds sampled	No. of individuals tested	
1993	26,642	0	0	1
1994	24,832	1,430	5,954	0
1995	25,131	1,532	9,354	0
1996	2,863	303	1,523	0
1997	2,654	2,214	16,741	0
1998	2,816	2,191	17,095	0
1999	2,930	2,382	18,274	0
2000	1,590	340	2,892	0
2001	2,564	434	3,453	0
2002	2,308	462	3,693	0
2003	1,845	449	3,901	0
2004	1,573	402	3,364	0
2005	1,919	484	4,766	0
2006	1,673	479	4,624	0
2007	1,575	412	4,241	0

Results

All bulk milk samples and blood samples tested in 2007 were negative for antibodies against BHV-1. Table 2 shows the results of the testing during the period from 1993 to 2007.

Discussion

The surveillance and control programme for IBR/IPV has been evaluated, and in a simulation model it was shown to have a sensitivity of 98.7 % when used for bulk milk testing if a blocking percentage of 30 % was the cut-off between infected and non-infected herds. The test sensitivity is even higher when testing serum samples, - the specificity estimated to 100 % (4).

In addition to the surveillance programme, all breeding bull candidates are serologically tested before entering the breeding centres, and all breeding bulls are subject to a compulsory test each year.

The results of the programme since 1992/93 strongly indicate that the Norwegian cattle population is free from IBR/IPV-infection (2, 4, 5).

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Figure 1. Geographical distribution of the dairy herd population density (A) and the density of dairy herds tested (B) in the surveillance and control programme for IBR/IPV in 2007.

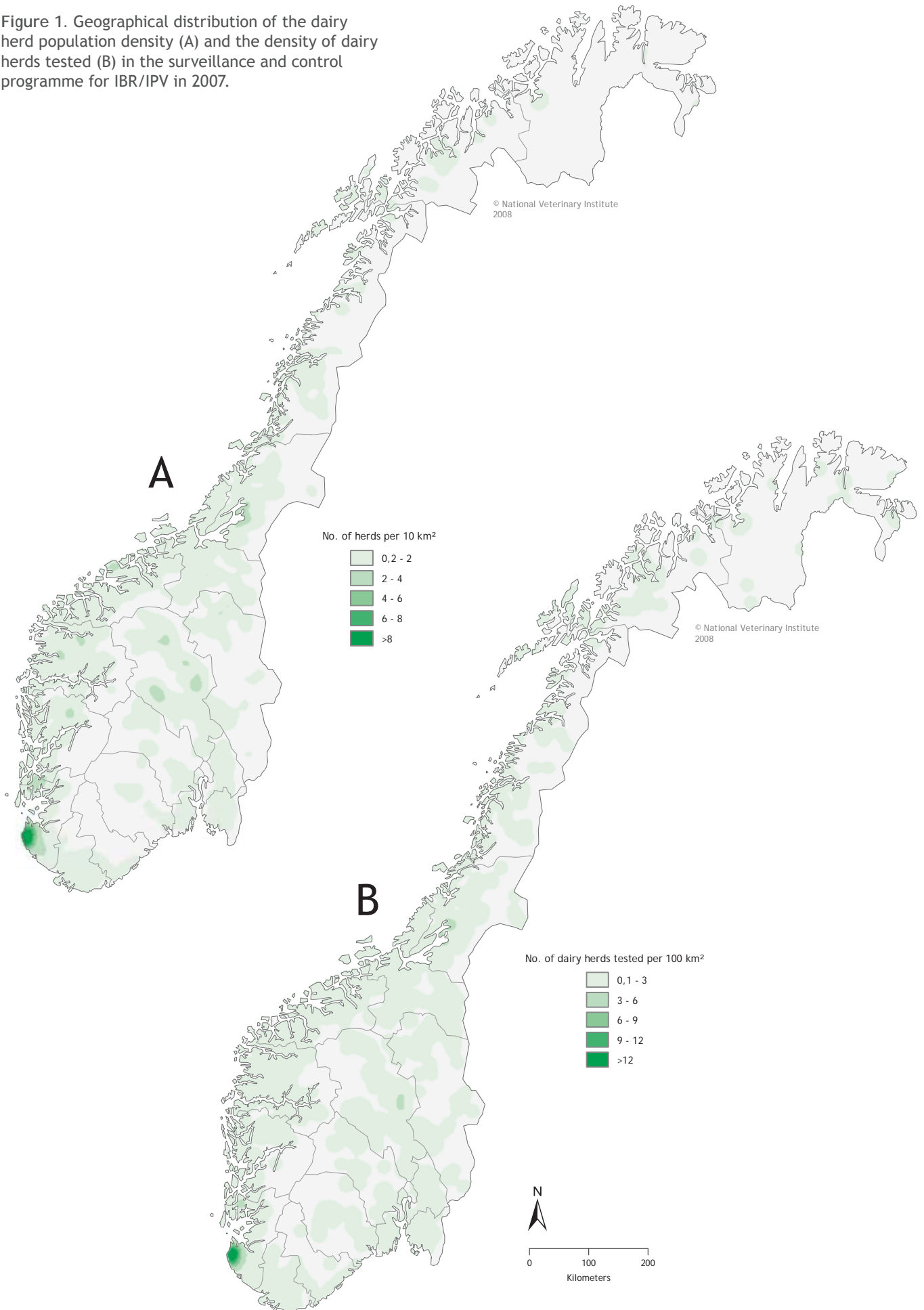
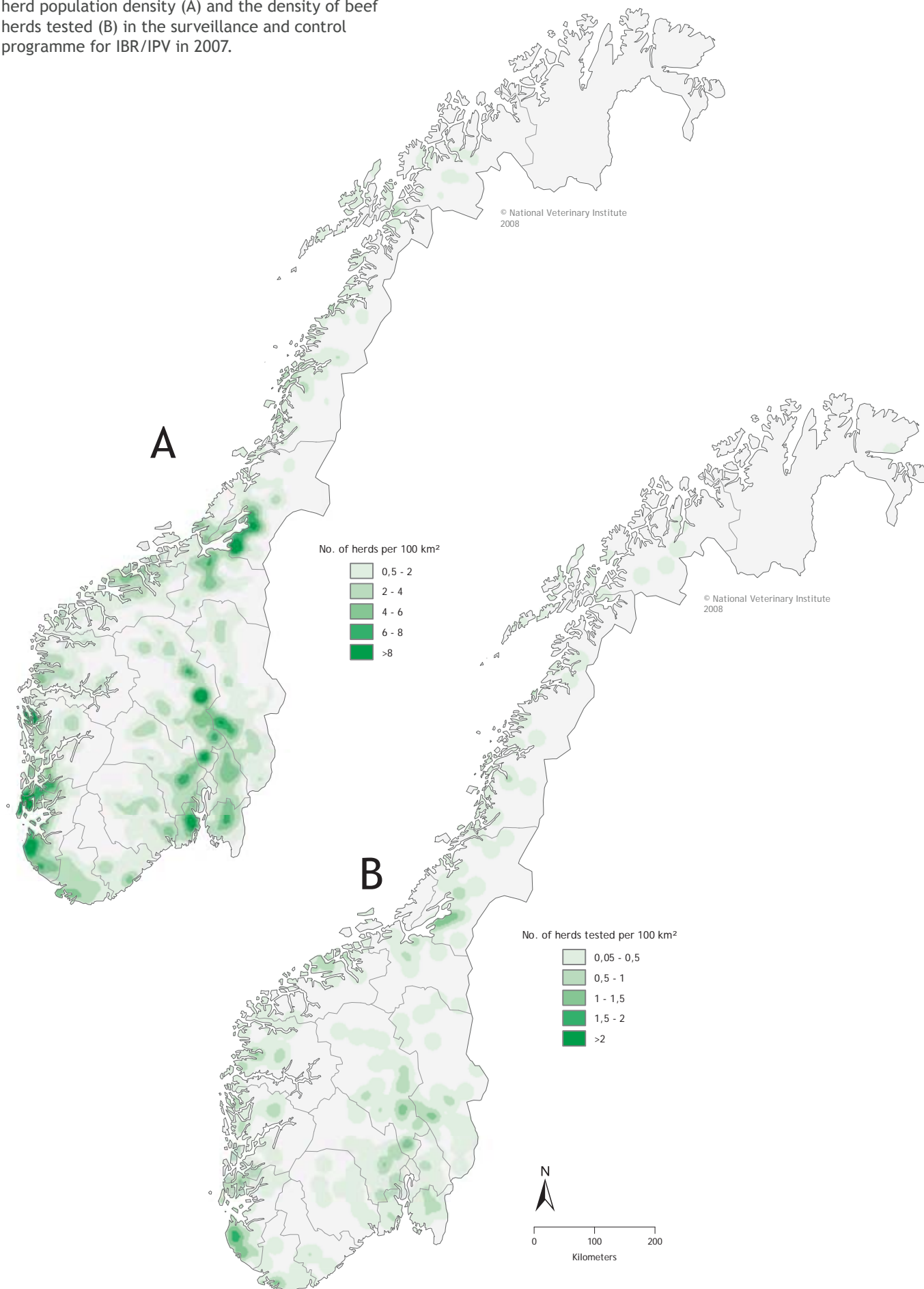


Figure 2. Geographical distribution of the beef herd population density (A) and the density of beef herds tested (B) in the surveillance and control programme for IBR/IPV in 2007.



Annual report 2007



The surveillance and control programme for enzootic bovine leukosis (EBL) in Norway

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The surveillance and control programme for enzootic bovine leukosis (EBL) in Norway

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All milk and blood samples tested in 2007 were negative for antibodies against bovine leukaemia virus (BLV).

Introduction

Enzootic bovine leukosis (EBL) had never been reported in Norway until antibodies against BLV were detected in eight dairy herds in samples collected through the surveillance and control programme in 1995 (1) (Figure 1A). No new herds tested positive during the period 1997-2001 (2).

In 2002, a bulk milk sample from one dairy herd tested positive for BLV (Figure 1A). Further investigations showed that only one of the cows in the herd was antibody positive. The cow, which was healthy and had no clinical signs, was slaughtered and pathological investigations gave no indication of leukosis. Further testing of individual blood samples of all cattle older than 24 months in the affected herd and six contact herds was negative. The conclusion was that the positive antibody result was due to a false positive reaction. The follow-up study was terminated in 2003 with no further positive findings (3, 4). Free status from EBL was granted to Norway by the EFTA Surveillance Authority in 2007.

The Norwegian Food Safety Authority is responsible for carrying out the surveillance and control programme for EBL. The National Veterinary Institute is in charge of planning the programme, collecting the bulk milk samples from the dairies, and performing the tests. Official inspectors from the Norwegian Food Safety Authority collected the blood samples from the beef herds.

Aims

The aim of the surveillance and control programme for EBL is to document freedom from the infection in Norway according to Council Directive 64/432/EEC as amended and to contribute to the maintenance of this favourable situation.

Materials and methods

The surveillance and control programme included both dairy and beef herds. Bulk milk samples from the dairy herds were provided by the dairies. From the beef herds, individual blood samples were collected on the farms from cattle older than 24 months.

The target population of dairy herds consisted of all cattle herds delivering milk to dairies during the sampling period. In 2007, bulk milk samples from 1,575 randomly sampled dairy herds were tested for antibodies against BLV. The target population of beef herds is all beef herds receiving governmental support according to recordings of July 2006. A total of 4,241 individual blood samples from 412 beef herds were analysed in pools, with a maximum of 20 samples in each. The sampled herds represented approximately 11.2 % of the Norwegian cattle herds (Table 1).

The geographical distribution of the total number of herds and the tested number of dairy and beef herds are given in Figures 1B, 2A and 2B.

Table 1. Total number of dairy herds and beef herds within the frame of the Norwegian surveillance and control programme for EBL in 2007

Herd category	Total no. of cattle herds*	No. of herds tested	% tested of the total no. of herds
Dairy herds	13,700	1,575	11.5
Beef herds	4,100	412	10.0
Total	17,800	1,987	11.2

* Based on data from the Register of production subsidies as of July 31 2007.

Table 2. Antibodies against BLV in the Norwegian bovine population during the period 1995-2007

Year	Dairy herds	Beef herds		No. of positive samples
	No. of bulk milk samples analysed	No. of beef herds sampled	No. of individuals analysed	
1995	25,131	1,532	9,354	8 (bulk milk)
1996	25,278	303	1,523	1 (bulk milk)
1997	26,903	2,214	16,741	0
1998	23,581	2,191	17,095	0
1999	19,933	2,382	18,274	0
2000	1,590	340	2,892	0
2001	2,564	434	3,453	0
2002	2,308	462	3,693	1 (bulk milk)
2003	1,845	449	3,901	0
2004	1,573	402	3,364	0
2005	1,919	484	4,766	0
2006	1,673	479	4,624	0
2007	1,575	412	4,241	0

Bulk milk samples and blood samples were examined by an indirect ELISA (SVANOVA®) (5). For verification and for follow-up of suspect cases, LACTELISA BLV Ab and SERELISA BLV Ab from SYNBIOTICS were used.

Results

All bulk milk samples and blood samples tested in 2007 were negative for antibodies against BLV. Table 2 shows the results of the testing during the period from 1993 to 2007.

Discussion

The requirement from the EU for granting an EBL free-status is that the herd prevalence must be lower than 0.2 %, which represents 36 herds out of the total number of 17,800 herds.

No new cases have been reported since 1995, and the continuous surveillance since 1995 shows that the Norwegian cattle population is free from EBL according to the requirements (2, 3, 4, 6). From 1995 to 1999, all cattle herds were tested annually. Since 2000, a minimum of 10 % of dairy and beef cattle herds have been tested each year.

Together with the possible isolation period of six months and the testing protocol for imported animals, the surveillance and control programme for EBL should be an effective means to detect introduction of new infection.



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Figure 1. Geographical location of cattle herds in which antibodies against the EBL-virus have been found (A) and the geographical distribution of the cattle herd population density (B) in the surveillance and control programme for EBL in 2007.

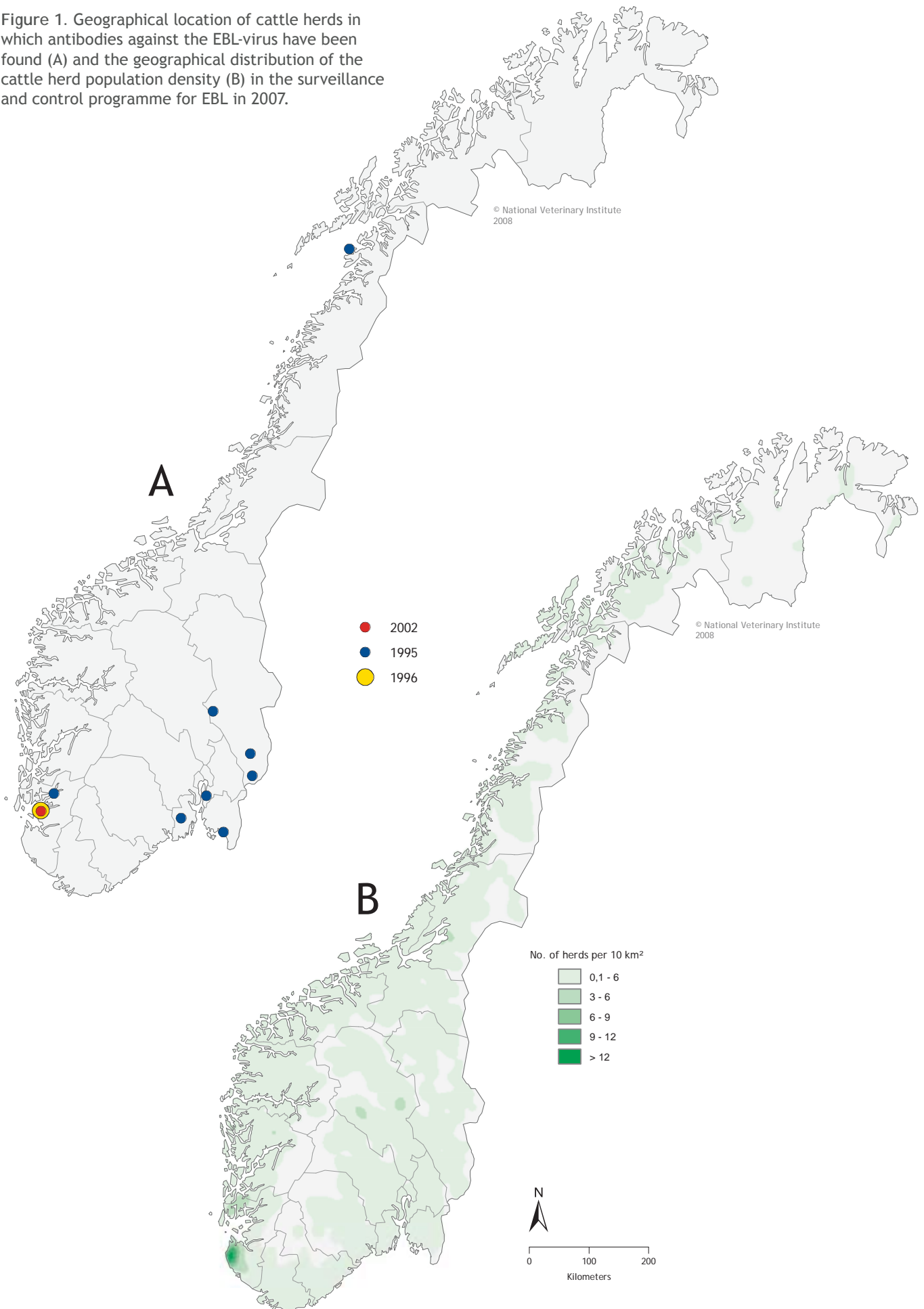
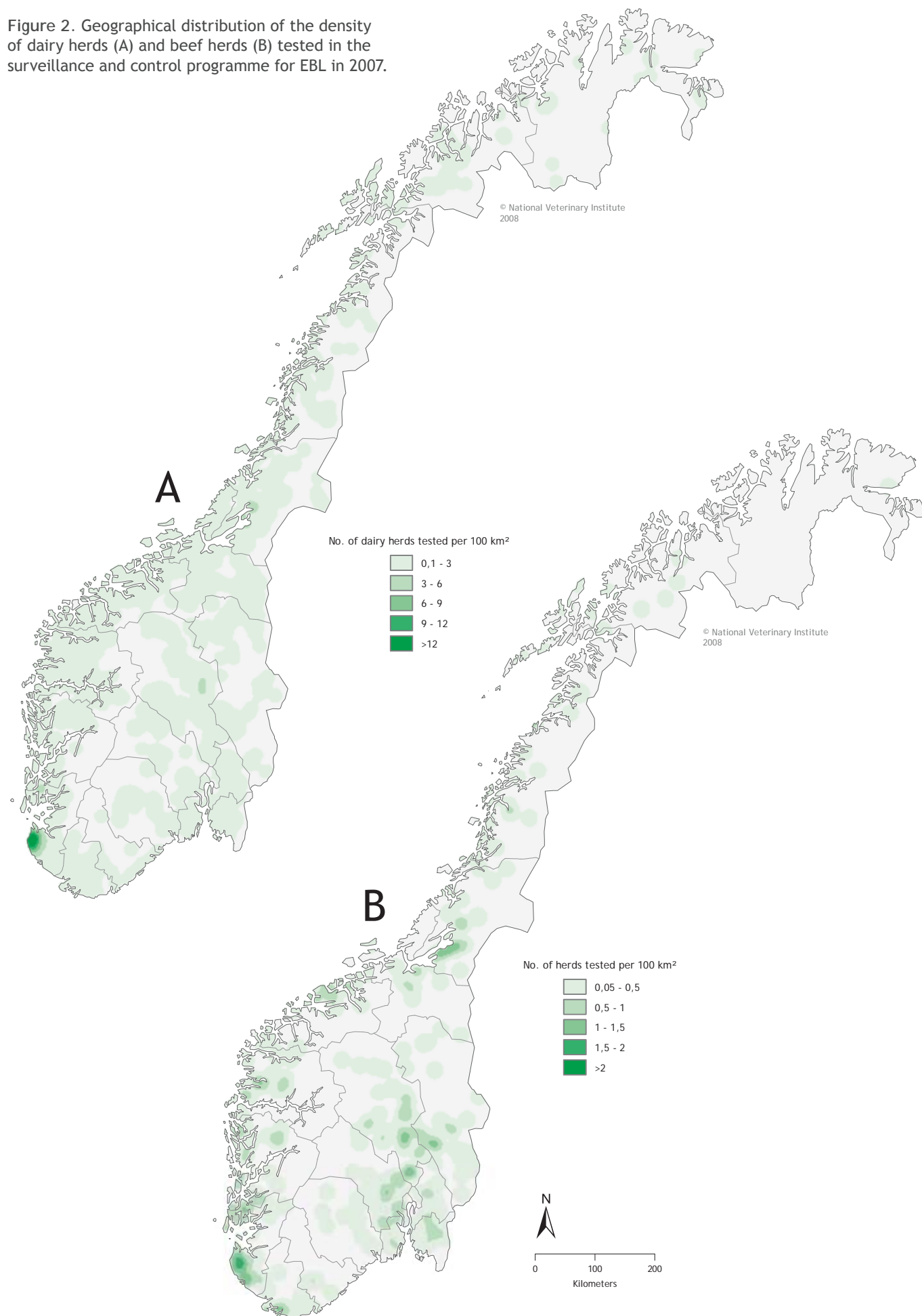


Figure 2. Geographical distribution of the density of dairy herds (A) and beef herds (B) tested in the surveillance and control programme for EBL in 2007.



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The surveillance and control programme for *Brucella abortus* in cattle in Norway

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The surveillance and control programme for *Brucella abortus* in cattle in Norway

Ståle Sviland, Annette Hegermann Kampen, Berit Djønne, Bjørn Bratberg, Jorun Tharaldsen, Petter Hopp

Brucella abortus in cattle was not detected in 2007.

Introduction

Eradication of bovine brucellosis in Norway was achieved in 1950 (1, 2).

Since 1994, the EFTA Surveillance Authority (ESA) has recognised Norway as a state officially free from brucellosis as described in ESA Decision 66/94/COL, later replaced by ESA Decision 227/96/COL.

A surveillance and control programme for *Brucella abortus* was launched in 2000. All samples were negative in 2000, 2001, 2003 and 2004 (2, 3, 4). In 2002 however, two bulk milk samples were antibody positive. Further investigation did not confirm these positive results and it was concluded that the positive serological results most likely were false positive reactions. (5).

Since 2005 the programme has consisted of passive clinical surveillance.

The Norwegian Food Safety Authority is responsible for carrying out the programme. The National Veterinary Institute is in charge of planning the programme, performing

the analyses and reporting the results. The samples are collected by inspectors of the Norwegian Food Safety Authority.

Aim

The aim of the programme is to document freedom from *Brucella abortus* in cattle according to demands in Directive 64/432/EEC with amendments and to contribute to the maintenance of the present favourable situation.

Material and methods

Herd criteria for submission of clinical material are:

- abortions occurring between the fifth month of pregnancy and 14 days before expected birth
- at least two abortions within this pregnancy period the last twelve months

Table 1. Number of foetuses and cows examined for brucellosis in the Norwegian cattle population during the years 2000-2007

Year	Material	Dairy cattle		Beef cattle		Total	
		Animals	Herds	Animals	Herds	Animals	Herds
2000	Foetuses					17	14
2001	Foetuses	21	18	0	0	21	18
2002	Foetuses	18	17	10	6	28	23
2003	Foetuses	30	25	4	3	34	28
2004	Foetuses	25	21	2	2	27	23
	Cows	28	19	2	2	30	21
2005	Foetuses	16	14	8	7	24	21
	Cows	48	26	8	4	56	30
2006	Foetuses	11	11	0	0	11	11
	Cows	19	13	1	1	20	14
2007	Foetuses	11	10	1	1	12	11
	Cows	14	11	1	1	15	12

Material for submission:

- foetus and the foetal membranes
- blood sample from the cow at the time of abortion and a second blood sample collected 14-21 days later

Post-mortem investigations

Foetuses are subjected to a full autopsy. Specimens from lungs, myocardium, liver, kidneys, (whole) brain, and foetal membranes are fixed in 10 % neutral phosphate-buffered formalin. The specimens are processed according to a standard routine protocol, sectioned at 5 µm and stained with haematoxylin and eosin.

Bacteriological investigations

Foetal membranes and organs from the aborted foetus (liver, spleen and stomach contents) are sampled. Direct smears from these materials are examined following Gram and Modified Ziehl-Neelsen staining. Samples are cultured on selective *Brucella* agar containing 5 % horse serum, Amphotericin B, Bacitracin, Polymyxin B and Vancomycin at 37 °C in a 10 % CO₂ atmosphere. The media are examined regularly and incubated for up to 14 days. Suspicious bacterial colonies are tested for motility, nitrate reduction, and for the production of catalase, indol, cytochrome oxidase, and urease. Non-motile, nitrate-reducing, indol-negative, and catalase-, cytochrome oxidase- and urease-producing isolates are sent to a reference laboratory for further identification.

Serology

Individual, paired blood samples are tested for antibodies against *Brucella abortus* in an indirect ELISA (Svanova®). The initial screening is performed using a single well per sample, and doubtful or positive reactions are retested in duplicates. If the result is negative when retested, the sample is concluded to be negative for antibodies against *Brucella abortus*. If the result still is doubtful or positive, the sample is tested with a competitive ELISA (C-ELISA, Svanova®). Positive samples in this test are subjected to a complement fixation test (CF). If the CF test is also positive, the result is reported with recommendation of a new blood sample from the suspected animal four to six weeks after the initial sampling. If this is positive, or if there should be a need for immediate follow-up, the animal is tested with an intracutane test using Brucellergene OCB from *Brucella melitensis* (Synbiotics®).

Results and discussion

A total of 12 foetuses from 11 different herds and 26 blood samples from 15 cows (paired samples from 11 cows and 4 single samples) were analysed in 2007 (Table 1).

Post-mortem investigations of foetuses in 2007 did not reveal pathological changes indicative of brucellosis, and all bacteriological and antibody investigations were negative for *Brucella abortus*.

In conclusion, there was no detection of *Brucella abortus* in cattle in Norway in 2007. With the exception of a single relapse in 1953, bovine brucellosis has not been detected in Norway since 1950 (1, 2, 3, 4, 5).

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The surveillance and control programme for bovine virus diarrhoea (BVD) in Norway

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The surveillance and control programme for bovine virus diarrhoea (BVD) in Norway

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Bovine virus diarrhoea virus was not detected in any of the herds sampled in 2007.

Introduction

Bovine virus diarrhoea (BVD) is caused by bovine virus diarrhoea virus (BVDV) in the genus pestivirus. The virus is the cause of mucosal disease and hemorrhagic syndrome, but the economically most important manifestations of disease are related to infection in pregnant animals, resulting in embryonic death, abortion and congenital defects. Persistently infected calves may be born and serve as the main reservoir of infection to other animals (1). Bovine virus diarrhoea is a notifiable disease in Norway.

A surveillance and control programme, financed by the authorities and the industry, was started in December 1992 (2). A detailed description of the programme and a discussion of important factors for its progress were described in the annual report for 2006 (3). During the programme period, the number of herds with restrictions decreased from 2,950 in 1994 to none at the end of 2006. The programme therefore entered a new phase in 2007, when the aim shifted from control and eradication of disease to surveillance and documentation and the number of herds included in the programme was considerably reduced.

Aim

The aim of the surveillance and control programme for BVD is to document freedom from the infection in Norway and to contribute to the maintenance of this favourable situation.

Material and methods

In 2007, 12.5 % of all Norwegian dairy and beef cattle herds were selected for examination.

Testing scheme and laboratory techniques

Bulk milk or pooled blood samples from young stock was tested for antibodies against BVDV, using an indirect enzyme-linked immunosorbent assay (ELISA; Svanova Biotech AB, Uppsala, Sweden)(4). Depending on the level of antibodies in bulk milk, dairy herds were divided in four groups. The results were expressed as sample to positive ratio (S/P-ratio) (5). Herds with moderate or high levels of antibodies against BVDV in bulk milk were further tested by pooled blood samples from young stock.

Identification of persistently infected animals was done by testing blood samples from every individual in the herd for antibodies, and testing for the presence of virus in antibody negative individuals and in animals with weak positive serological results using an antigen-capture ELISA (IDEXX Laboratories, Inc., Westbrook, Maine, USA). Positive reactions in new infected herds were to be verified with the polymerase chain reaction (PCR) and sequence analysis.

Results

Bulk milk samples from a total of 1,575 dairy herds were tested for antibodies against BVDV in 2007 (Table 1).

Table 1. Number of Norwegian cattle herds and individual cattle tested for antibodies against BVDV (results not shown) and number of cattle herds and individual cattle with BVDV positive results.

Year	Bulk milk samples	Pooled milk samples from primiparous cows	Pooled blood samples from young stock	Individual blood samples		No. of virus positive	
	No. of herds ¹	No. of herds ¹	No. of herds ¹	No. of herds	Samples	Herds	Individual blood samples
1993	26,424	5,031	5,000	NA	46,000 ²	NA	1,300 ²
1994	26,148	3,228	4,107	NA		NA	
1995	25,577	3,191	5,347	NA	36,065	NA	1,180
1996	25,167	1,849	3,163	NA	21,437	NA	685
1997	24,862	1,297	3,292	1,515	16,023	265	525
1998	24,038	1,415	3,407	780	7,091	98	198
1999	23,584	924	3,060	648	7,619	92	224
2000	21,796	100	1,610	423	6,947	72	129
2001	19,910	53	4,198	386	6,287	56	174
2002	18,771	-	2,854	284	3,962	28	43
2003	17,549	-	2,100	149	1,135	9	22
2004	7,3653	-	1,351	84	1,017	2	6
2005	7,4813	-	1,230	48	356	1	4
2006	14,620	-	997	28	113	0	0
2007	1,575	-	387	8	20	0	0

¹One sample from each herd was examined, ²Approximate numbers, NA=Data not available

Weak or moderate levels of antibodies against BVDV were detected in bulk milk from 38 and 7 herds, respectively.

Blood samples for serological testing of pooled samples from young stock were submitted from 17 dairy herds (4 %) and 370 (96 %) beef cattle herds, in total 387 different herds (Table 1). One of these samples was seropositive. Twenty animals from 8 herds were investigated individually in 2007. BVDV was not detected in any of these animals (Table 1).

Discussion

No herds had restrictions because of BVD at the beginning of 2007. Testing of bulk milk from all dairy herds and a 20 % representative sample of all beef cattle herds during 2006 with no findings of new infected herds, indicated that the goal of eradicating BVD in Norway could be considered achieved. The results of the surveillance and control programme for 2007 confirm this conclusion. No new infected farms were found and no restrictions were imposed on any farm due to BVD in 2007.

Although Norway is currently free from the disease, there are still challenges for the future. Import of animals and unknown wildlife reservoirs may pose a threat to the present status. This reminds us that farmers, practitioners and authorities should be alert, and efficient surveillance should be continued to detect a possible reintroduction of BVD in Norway and control its spread.

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The surveillance and control programme for bovine tuberculosis in Norway

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The surveillance and control programme for bovine tuberculosis in Norway

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In 2007, no samples from slaughtered cattle were submitted for Mycobacterium sp. examination.

Introduction

Apart from two single-herd outbreaks in Sogn og Fjordane county in 1984 and 1986 Norway has been considered free from bovine tuberculosis since 1963 (1, 2, 3, 4). And since 1994, the EFTA Surveillance Authority (ESA) has recognised Norway as officially free from bovine tuberculosis, as described in ESA Decision 225/96/COL replacing ESA Decision 67/94/COL. In 2000, a surveillance and control programme for bovine tuberculosis was launched. The programme includes compulsory veterinary inspection of all bovine carcasses at slaughter, with submission of suspicious materials to the National Veterinary Institute for further examination.

Aims

The aims of the programme are to document absence of bovine tuberculosis, according to Directive 64/432/EEC with amendments, and to contribute to the maintenance of this favourable situation.

Material and methods

Submission of material from slaughter houses

Lung tissue, lymph nodes and other organs with pathological lesions where bovine tuberculosis can not be excluded, are submitted for examination.

The Food Safety Authority collects the samples during routine meat inspection.

Histopathological examination

Tissues are fixed in 10 % neutral phosphate-buffered formalin for more than 24 hours, processed according to a standard routine protocol, embedded in paraffin, sectioned at 5 µm and stained with haematoxylin and eosin and Ziehl-Neelsen (5).

Bacteriological examination

Samples are examined as described in the OIE manual (5). Samples are homogenised, decontaminated with 5 % oxalic acid and centrifuged. The top layer of the sediment is used for culturing and microscopic examination. The sediment is inoculated onto slopes of Petraghani medium, Stonebrink's medium and Middelbrook 7H10 medium. The slopes are incubated aerobically at 37 °C for two months and checked every week for growth of acid-fast bacilli, determined by the Ziehl-Neelsen method.

Table 1. Number of samples tested for bovine tuberculosis during the period 2000-2007

Year	No. of samples	No. of herds	No. of positive	
			Samples	Herds
2000	0	0	0	0
2001	3	3	0	0
2002	0	0	0	0
2003	1	1	0	0
2004	4	4	0	0
2005	1	1	0	0
2006	3	3	0	0
2007	0	0	0	0

Results and discussion

Table 1 shows the number of samples collected and the results since the programme started in 2000. For 2007, no organ samples with the suspicion of bovine tuberculosis were submitted to the National Veterinary Institute.

The low number of and absence of submitted samples indicates a low prevalence of suspicious pathological lesions. Continuous meat inspection and effective eradication measures, combined with restricted import of live cattle, have contributed significantly to this situation.

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The surveillance programme for specific serogroups of *E. coli* in sheep in Norway



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The surveillance programme for specific serogroups of *E. coli* in sheep in Norway

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Sheep flocks were sampled in 2006 and 2007 in a survey to investigate possible geographical variation and risk factors for the occurrence of Escherichia coli O103 and O157 and their accompanying virulence factors.

Introduction

Escherichia coli are bacteria normally present in the intestinal flora of both humans and animals. Some *E. coli* may be pathogenic for humans. Of these, only Shiga toxin-producing *E. coli* (STEC), also known as Verotoxin-producing *E. coli* (VTEC), has a defined zoonotic origin with domestic ruminants regarded as the major reservoir.

The Shiga toxins are encoded by the genes *stx*₁ and *stx*₂. The toxins are the major virulence factors of STEC and the cause of haemorrhagic uremic syndrome (HUS) in humans.

STEC attach in the human gastrointestinal tract through a complicated mechanism encoded among others by the gene *eae* and this attachment induces the (hemorrhagic) diarrhoea seen in human patients. This virulence characteristic is also seen among the Enteropathogenic *E. coli* (EPEC). A subgroup of these; the atypical EPEC appear to be more closely related to STEC in their serotype profiles and genetic characteristics and in recent years it has become clear that atypical EPEC not only has a human reservoir, but also an animal reservoir.

The most well known human pathogenic serotypes of STEC are O26:H11, O111:H8, O103:H2, O145:H21, and O157:H7. However, other serotypes may also cause human infections as observed in the Norwegian outbreak in 2006 with 17 human cases caused by STEC O103:H25 (1). The source of the infection was dry-cured sausages with the bacteria originating from contaminated sheep meat.

With the exception of 2006, the annual reported incidence of human STEC infections in Norway has been low (0-17 cases per year) with approximately half of the cases domestically acquired (1). Altogether, three outbreaks have been registered in the same period (1997-2007); with 4, 4, and 17 human cases, respectively.

The animal reservoir

There is limited knowledge of the prevalence of STEC in the Norwegian ruminant populations. Studies performed in Norway from 1995 to 1999 reported cattle herd prevalences of STEC O157 of 0.5 % to 1 % (2, 3). Only one study has focused on detecting herd prevalence of STEC O157 in sheep. The study did not detect any STEC O157 (2).

In a surveillance programme for STEC O157 in cattle, sheep, and goat carcasses running in the period 1998-2004, the total carcass prevalence was 0.06 % for cattle and 0.03 % for sheep. None of the 510 goat carcasses tested were positive (4).

There are less data on the other serogroups. Two studies in cattle have focused on detecting serogroups O26, O103, O111, and O145. The detection of *eae*-negative STEC O103 was reported from 3.2 % of the herds in one of the studies. In both studies *stx*-negative *E. coli* of the serogroups O26, O103, O145, and O111 were detected (4). In a study of one sheep flock conducted in 2000, 2 lambs (1.6 %) were positive for STEC O103 (5). The isolates were not H-typed, but carried *stx*₁ and *eae*. In addition, *stx*-negative isolates were detected from 62 of the 96 samples tested.

International studies also report *stx*-negative and *eae*-positive *E. coli*, and *stx*- and *eae*-negative *E. coli* isolates of these serogroups (O26, O103, O111, O145 and O157), indicating that these are relatively common in the microbial flora of animals. During the 2006 outbreak in Norway (1), *stx*-negative and *eae*-positive *E. coli* O103:H25 was detected from several products of sheep origin with no clear epidemiological link, indicating that this serotype is common among sheep in Norway. However, the relationship and ratio between true *stx*- and *eae*-negative *E. coli*, true *stx*-negative and *eae*-positive *E. coli* (possible atypical EPEC), and *stx*-positive and *eae*-negative

E. coli (STEC), and *stx*- and *eae*-positive *E. coli* (STEC) of a serotype, is unknown and there is a need for more data for assessing these relationships.

The 2006 outbreak (1) emphasised the need for more knowledge regarding *E. coli* of serogroups O26, O103, O111, O145 and O157 in the sheep population. The Norwegian Food Safety Authority therefore decided to initiate a national surveillance programme with sampling in November 2006 and autumn 2007. The National Veterinary Institute was asked to design the programme, perform the analyses, and the reporting of the results. The samples would be collected by inspectors from the Norwegian Food Safety Authority.

Aims

The aims of the survey are to gather knowledge on the occurrence of some specific serogroups of *E. coli* and their virulence factors in sheep, and to investigate possible geographical variation and risk factors.

Material and methods

In November 2006 faecal samples were to be collected from 100 randomly selected sheep flocks (farms). Only sheep flocks with at least 50 sheep more than 1 year old were eligible. From each of these flocks, 50 single faecal samples should be taken from the youngest animals (lamb first, then one-year olds etc.).

During autumn of 2007 faecal samples were to be collected from 520 randomly selected sheep flocks (farms). Only sheep flocks with at least 30 winter-fed sheep at 1st January 2007 were eligible. From each of these flocks, 50 single faecal samples should be taken from the youngest animals (lamb first, then one-year olds etc.).

Autumn was chosen as sampling period to give representative data from the time of year when most sheep is slaughtered and thereby indications of possible contamination risks to sheep products. Lambs are chosen as young ruminants shed more of these bacteria and are also proportionally slaughtered most.

From each farm, a questionnaire addressing potential risk factors for the occurrence of STEC was to be filled in.

From each farm, pools of 10 individual samples will be analyzed for the various *E. coli* serogroups. A modified method of NMKL 164 where the Immunomagnetic separation (IMS) method has been further modified by inclusion of an

ELISA step is used for detection of *E. coli* O157 and O103. IMS-ELISA for other serogroups is currently under development. ELISA positive samples will be plated onto selective agar for colony isolation. Thereafter, *E. coli* isolates will be O:H serotyped and further characterized for virulence factors by PCR.

Results and discussion

In 2006, samples were collected from 94 sheep flocks. Between 48 and 50 single samples were collected from each flock, with the exception of three flocks where 25, 36 and 39 single samples were collected.

In 2007, samples were collected from 499 sheep flocks.

On arrival at the laboratories the samples were frozen at -80 °C. All samples will be analyzed within September 2008.

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The surveillance and control programme for maedi in Norway



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The surveillance and control programme for maedi in Norway

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None of the investigated flocks was diagnosed with maedi.

Introduction

Maedi is a progressive viral pneumonia in sheep first described in Iceland in 1939 (1). The disease occurs in several European countries as well as in other continents. The disease visna is caused by the same virus as maedi, but is a neuropathogenic manifestation of the infection (1, 2). Maedi-visna is classified as a list B disease in Norway and is notifiable to the Office International des Epizooties. In Norway, maedi was officially reported for the first time in 1972 (3).

In November 2002 and January 2003, post mortem examinations of lungs from two diseased sheep from two different farms in Nord-Trøndelag county showed histopathological changes consistent with maedi. During the following investigations more than 15,000 sheep in 300 flocks were serologically examined for maedi-visna infection, and 50 flocks were found to be seropositive (4, 5). The outbreak demonstrated the need for a new, nationwide surveillance and control programme, which was started in November 2003 (4, 6).

An overview of the number of new infected flocks registered each year up to 2007 is given in Figure 1.

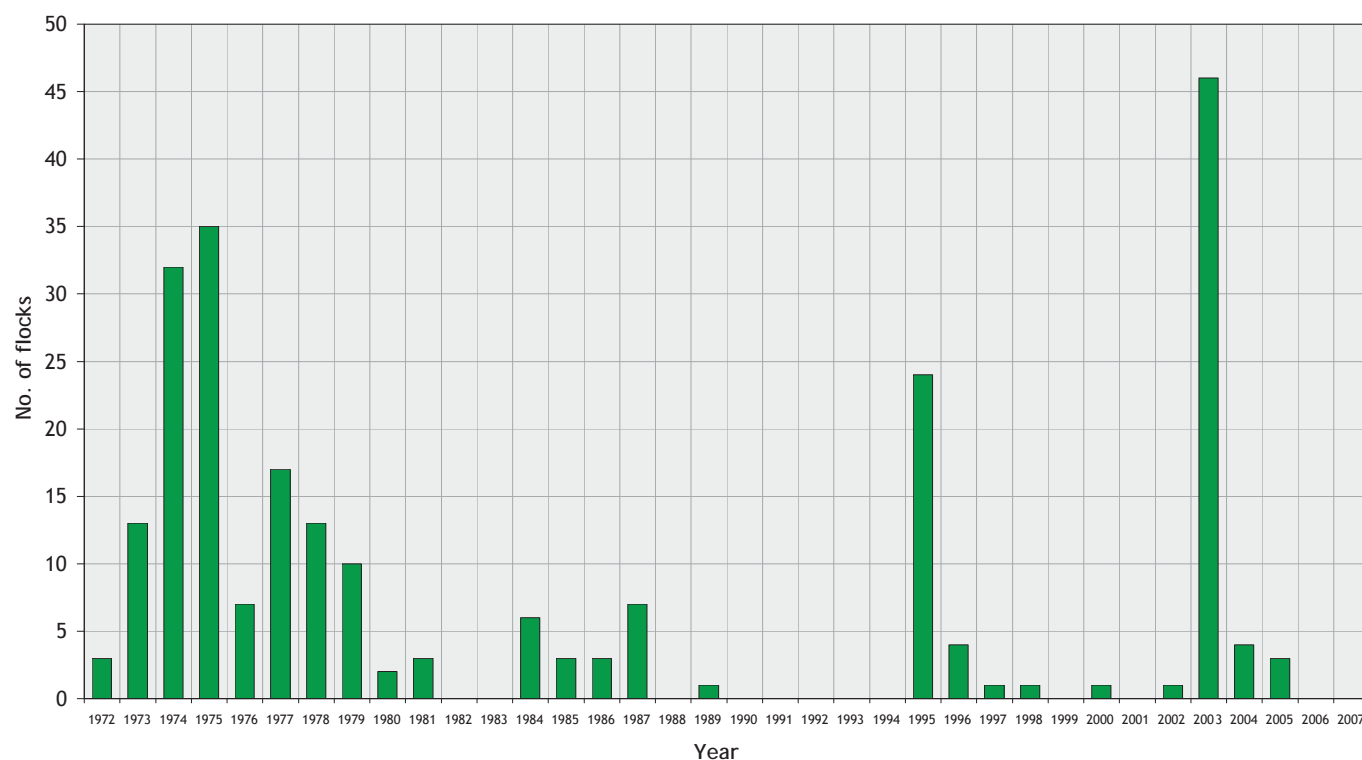


Figure 1. The number of new flocks infected with maedi during the period 1972 to 2007. The bars for 2003 - 2007 show both seropositive flocks detected through the investigations after the outbreak in Nord-Trøndelag county and seropositive flocks identified in the programme.

Aim

The aims of the surveillance and control programme for maedi are to document the status for maedi-visna virus infection in sheep in Norway, and to identify infected flocks for disease control.

Materials and methods

Ram circles and their member flocks registered by The Norwegian Sheep and Goat Breeders Association constitute the target population for the programme. Approximately 1,650 flocks were part of this breeding system in 2007, of a total of 15,400 sheep flocks. Of these, 746 flocks were selected for testing. In addition, sheep from 300 randomly selected flocks not belonging to any ram circle were included.

Thirty animals per flock were sampled in flocks with less than 100 sheep, 35 animals were sampled in flocks with 100 to 200 sheep, and 40 animals per flock were tested in flocks with more than 200 animals. All rams and sheep more than one-and-a-half years old were sampled in each flock.

The programme in 2007 was based on serological examination of blood samples from the selected sheep for antibodies against maedi-visna virus with the ELISA from Pourquier (ELISA CAEV/MAEDI-VISNA serum verification kit, Institut Pourquier, Montpellier, France). Sero-positive ELISA-results were retested in duplicate with the same ELISA and verified by an agar gel immunodiffusion test (AGIDT, Meditect, Veterinary Laboratories Agency, Weybridge, UK). In the case of inconclusive results (including single reactors), new blood samples from the animals were taken one to two months after the first sampling. These samples were tested in duplicates in both tests (7).

Due to the known cross-reactions in the serological tests between maedi-visna virus and caprine arthritis encephalitis virus (CAEV) infection, blood samples from sero-positive flocks with both sheep and goats are tested with a PCR-method developed at the National Veterinary Institute. The PCR-method is designed to amplify sequences from both CAEV and maedi-visna virus, followed by sequencing to differentiate the two virus types.



The meat inspectors at the abattoirs still play an important role in the programme by monitoring sheep and especially sheep lungs for detection of suspicious cases consistent with maedi-visna virus infection.

Results

Samples from a total of 1004 flocks were analysed in 2007, this is approximately 7 % of the total Norwegian sheep flocks. Of these flocks, 696 were members of ram circles, corresponding to approximately 42 % of the total number of flocks in ram circles (Table 1). The geographical distribution of the Norwegian sheep population and the density tested flocks are shown in Figure 2.

In 2007, none of the investigated flocks were concluded positive for maedi. Twelve sheep from a flock with close contact with goats were positive in the serological tests, while one gave inconclusive results. One sheep in this flock was confirmed to be infected with CAEV by PCR. Five sheep from another flock were positive in the serological tests, while eight gave inconclusive results. New samples were received from eight sheep, but lentivirus was not detected in any of these samples. Further follow up was not performed, since the flock had been slaughtered in the meantime.

Table 1. The number of flocks and sheep tested in the Norwegian surveillance and control programme for maedi

Year	Total no. of sheep flocks*	Total no. of flocks in ram circles	No. of flocks sampled	No. of animals tested	No. of positive flocks
2003	18,400	2,227	456**	13,951	1
2004	17,439	2,600	1,230	36,911	1
2005	16,500	2,519	940	29,248	2
2006	15,800	2,198	911	27,846	0
2007	15,400	1,654	1,004	29,633	0

* Based on data from the register of production subsidies as of 31 July the respective year. ** Sampling period: November 20 to December 31.

Discussion

The programme, which started in 2003, was designed to increase the sensitivity of detecting infected flocks without increasing the costs per flock. This was done by increasing the number of sampled animals per flock and applying a more sensitive, but less labour-intensive test.

The sample size per flock was adjusted so that if none of the tested animals were seropositive, the prevalence of maedi-visna infected animals in a flock would be less than 6 %, given a confidence level of 95 % and 100 % test sensitivity.

A commercial ELISA from Inst. Pourquier is employed in this programme. Another ELISA and the AGIDT were previously used when the first test was positive. In 2006, the second ELISA test was omitted, as a study showed that this would increase the overall sensitivity of the test regimen without lowering the specificity (7).

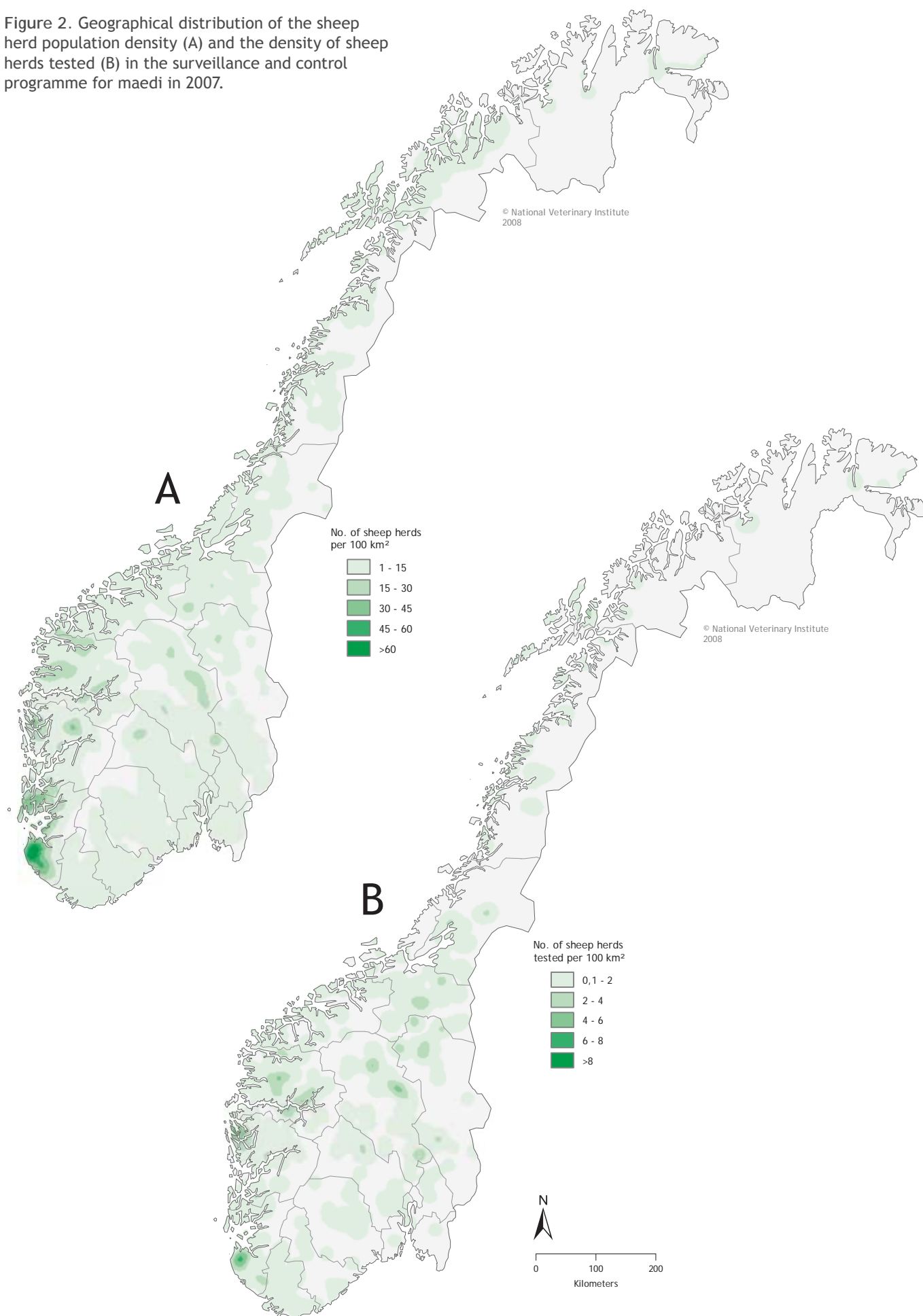
Results from the surveillance and control programme for maedi, including data from November 2003 through 2006, show a preliminary prevalence of less than 0.2 % positive flocks (4, 8). Knowledge about the distribution of the disease so far indicates that it is regionally clustered, and that a more extensive spread of maedi-visna virus has probably been prevented by the restrictions on transfer of sheep across county borders.

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Figure 2. Geographical distribution of the sheep herd population density (A) and the density of sheep herds tested (B) in the surveillance and control programme for maedi in 2007.



Annual report 2007

The surveillance and
control programme for
Brucella melitensis in small
ruminants in Norway



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The surveillance and control programme for *Brucella melitensis* in small ruminants in Norway

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Brucella melitensis was not detected in any sheep or goat flock sampled in 2007.

Introduction

Brucellosis in sheep and goats is mainly caused by *Brucella melitensis*, although infection with *Brucella abortus* and *Brucella ovis* can also occur. The infection usually results in abortion in pregnant females and can cause orchitis and epididymitis in affected males (1, 2). *Brucella melitensis* infection is a zoonosis, and the bacterium causes a serious infection in humans known as Malta fever, characterised by undulant fever, chills, sweat and debilitation (2).

Brucella melitensis is prevalent in sheep and goats in several Mediterranean countries (1), but has never been diagnosed in animals in Norway or any of the other Nordic countries (3, 4). Brucellosis is classified as a list A disease in Norway and is notifiable to the Office International des Epizooties.

After the agreement on the European Economic Area in 1994, Norway achieved status as free from *Brucella melitensis* in small ruminants on a historical basis. However, documentation is required to maintain the status. Hence, a surveillance and control programme for *Brucella melitensis* in sheep was established in 2004, and goats were included in the programme from 2007.

The Norwegian Food Safety Authority is responsible for carrying out the programme. The samples are collected by inspectors from the Norwegian Food Safety Authority, while the National Veterinary Institute is in charge of planning the programme, performing the analyses and reporting the results.

Aims

The aims of the programme are to document freedom from *Brucella melitensis* in sheep and goats according to the demands in EU Directive 91/68/EEC with amendments and to contribute to the maintenance of this favourable situation.

Material and methods

Flocks belonging to ram circles registered by the Norwegian Sheep and Goat Breeders Association and their associated flocks constituted the main test population in sheep. Approximately 1,650 flocks were part of this breeding system in 2007, of a total of 15,400 sheep flocks. A total of 746 flocks in the breeding system were selected for sampling. In addition, sheep from 300 randomly selected flocks not belonging to any ram circle were included in the programme.

In goats, 210 of a total of 1,300 goat flocks were selected for sampling.

In flocks of less than 30 animals, all animals were sampled. In flocks of 30 to 100, 100 to 200, and more than 200 animals, samples from 30, 35, and 40 animals were analysed, respectively. The number of flocks in the surveillance and control programme for *Brucella melitensis* in small ruminants in 2007 is given in Table 1.



Table 1. Results and total number of flocks within the frame of the Norwegian surveillance and control programme for *Brucella melitensis* in small ruminants in 2004-2007

Year	Total no. flocks*		Total no. of animals		No. of flocks tested		No. of animals tested		No. of positive samples	
	Sheep	Goats	Sheep > 1 year	Goats	Sheep	Goats	Sheep	Goats	Sheep	Goats
2004	17,439		918,500		1,655		50,501		0	
2005	16,500		927,400		935		28,406		1**	
2006	15,800		894,100		911		27,812		0	
2007	15,400	1,300	854,000	71,500	1,004	183	29,633	5,734	0	0

*Based on data from the register of production subsidies as of July 31 the respective year. **Probably unspecific reaction.

Blood samples were examined for antibodies against *Brucella melitensis* using the rose bengal plate agglutination test (RBT) for the initial screening. A competitive ELISA (C-ELISA, Svanova Biotech AB, Uppsala, Sweden) was used to follow up unclear or positive reactions due to cross reactions.

Results

A total of 29,633 samples from 1,004 sheep flocks and 5,734 samples from 183 goat flocks were analysed in 2007. This is approximately 7 % of the total Norwegian sheep flocks and 14 % of Norwegian goat flocks. 696 of the sheep flocks were members of ram circles, corresponding to approximately 42 % of the total number of flocks in ram circles in Norway.

All samples tested for antibodies against *Brucella melitensis* in 2007 were negative. The results from the surveillance and control programme for *Brucella melitensis* in small ruminants in 2004 to 2007 are shown in Table 1.

Discussion

Approximately 90 % of the Norwegian sheep flocks in ram circles were screened for antibodies against *Brucella melitensis* during 2004 and 2005. In 2006, a new round of testing started, aiming at testing all flocks in ram circles within a three-year period (4).

The surveillance programme for *Brucella melitensis* in sheep was evaluated in 2006. When taking into account results accumulated from 2004 to 2006, it was estimated that there is a 99 % probability that the prevalence of sheep flocks being positive for *Brucella melitensis* is lower than 0.2 % (5).

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Annual report 2007

The surveillance and control programmes for scrapie in Norway



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Responsible institutions
National Veterinary Institute
Norwegian Food Safety Authority

The surveillance and control programmes for scrapie in Norway

Petter Hopp, Ståle Sviland, Sylvie Lafond Benestad, Olav Eikenæs, Torfinn Moldal

In 2007, scrapie Nor98 was diagnosed in nine sheep coming from nine different flocks. Classical scrapie was not detected.

Introduction

Scrapie was first diagnosed in indigenous Norwegian sheep in 1981. Increasing numbers of scrapie-infected flocks were identified in the 1990s, culminating with 31 detected flocks in 1996 (Figure 1). By the end of 2006, scrapie had been diagnosed in a total of 119 sheep flocks and one goat herd (1). Scrapie has been a notifiable disease in Norway since 1965, and control measures have involved destruction of all sheep in affected flocks and in close contact flocks until 2004. The Norwegian scrapie surveillance and control programme was launched in 1997 (2).

In 1998 a new type of scrapie, scrapie Nor98, was detected in Norway. The diagnosis of scrapie Nor98 is verified by Western blot. Scrapie Nor98 differs from classical scrapie in several aspects, including the Western blot profile, the distribution of protease resistant prion protein (PrP^{Sc}) in the brain, and absence of detectable PrP^{Sc} in lymphoid tissue (3). The main clinical sign observed in scrapie Nor98 cases has been ataxia. The PrP genotype distribution among scrapie Nor98 cases differs markedly from that of the previous cases with classical scrapie (4).

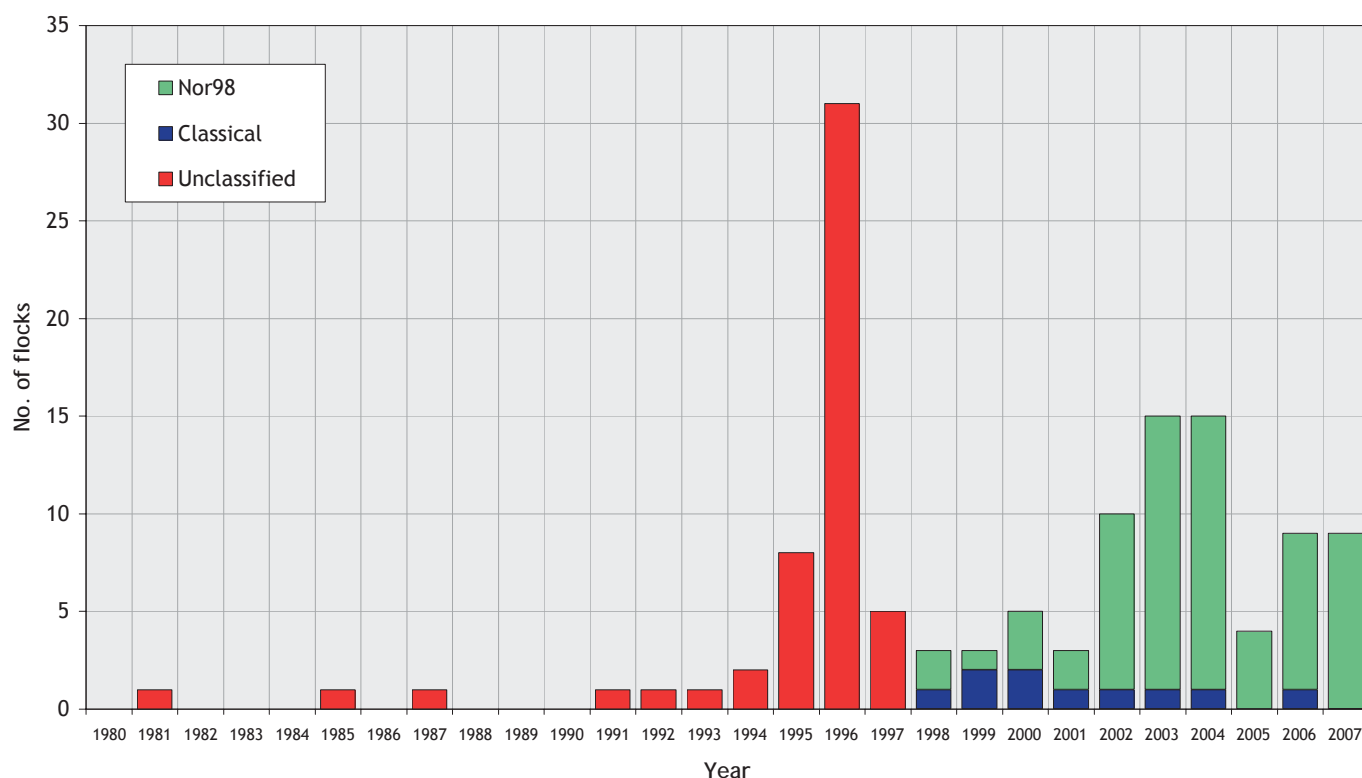


Figure 1. Annual number of sheep flocks and goat herds diagnosed with classical scrapie and scrapie Nor98 during the time period 1980-2007. Before 1998 the cases were not classified according to type of scrapie, but the majority of the scrapie cases are supposed to have been the classical type.

The Norwegian Food Safety Authority is responsible for carrying out the surveillance and control programme for scrapie. The samples are collected at the abattoirs or in the herds by inspectors from the Norwegian Food Safety Authority. The Norwegian Food Safety Authority also carries out inspections of sheep flocks and goat herds, all of which should be inspected every second or third year. The National Veterinary Institute is performing the laboratory examinations and the reporting of the results.

Aims

The aims of the surveillance and control programme are to identify scrapie infected sheep flocks and goat herds to support disease control and to estimate its prevalence in sheep and goats in the fallen stock and in the sheep population slaughtered for human consumption.

Materials and methods

In 2007, the surveillance programme was performed according to the European Union Regulations, Regulation (EC) No. 999/2001 Annex III, with amendments and included examination of the following categories of small ruminants:

- all small ruminants with clinical signs consistent with scrapie, irrespective of age
- 10,000 sheep older than 18 months, which had died or been killed on the farm, but not slaughtered for human consumption (fallen stock)
- 10,000 randomly sampled healthy sheep older than 18 months slaughtered for human consumption
- 500 goats older than 18 months which had died or been killed on the farm, but not slaughtered for human consumption (fallen stock)
- 3,000 randomly sampled healthy goats older than 18 months slaughtered for human consumption

Animals with clinical signs consistent with scrapie

When the sheep and goat farmers recognised sheep or goats with clinical signs consistent with scrapie, they were responsible for reporting the animal to the local Food Safety Authority. The Food Safety Authority evaluated the reported cases. If indicated, the animals were subject to either post mortem examination at a laboratory, or formalin-fixed and unfixed brain halves and medial retropharyngeal lymph nodes were submitted for laboratory examination. All the animals were examined at the National Veterinary Institute.

Surveillance of fallen stock

The sheep and goat farmers were responsible for reporting small ruminants older than 18 months that died or were killed on the farm due to disease. Inspectors from the Norwegian Food Safety Authority collected the samples

which consisted of retropharyngeal lymph nodes and unfixed medulla oblongata obtained through the foramen magnum using a metal spoon specially designed for the purpose. Alternatively the samples consisted of formalin-fixed and unfixed brain halves and unfixed retropharyngeal lymph nodes. The samples were examined at the National Veterinary Institute in Oslo.

Abattoir surveillance

Brain samples from apparently healthy sheep and goats older than 18 months were collected by the Norwegian Food Safety Authority. The sheep samples were collected at 34 abattoirs, which process all the commercially slaughtered sheep in Norway.

To ensure an appropriate distribution of the samples, the inspectors at the local Norwegian Food Safety Authority were responsible for the sampling to be representative for each region and season, and the sample selection should be designed to avoid overrepresentation of any group as regards to the origin, species, age, breed, production type or to any other characteristic.

The brain samples consisted of medulla oblongata, and often also a small part of the cerebellum and midbrain, obtained through the foramen magnum using the specially designed metal spoon. The samples were examined at the National Veterinary Institute's regional laboratories in Sandnes, Trondheim and Harstad.

Laboratory examination procedures

A rapid test (TeSeE Sheep & Goat ® ELISA, Bio-Rad) was performed for all submitted samples on a pooled brain tissue sample of obex and cerebellum when both areas were available or on the obex alone when the cerebellum was not available. In clinical suspects, tissues from the midbrain, cerebrum and retropharyngeal lymph node were examined additionally by the rapid test. In case of inconclusive or positive result a western blot analysis (TeSeE Western Blot, Bio-Rad) was used as confirmative test. Samples from clinical suspects were examined by western blot independently of the result in the rapid test. The differentiation between classical scrapie and scrapie Nor98 was based on the Western blot profile. Differentiation between classical scrapie and BSE in sheep was performed by using differential western blot (Discriminatory Western Blot, Bio-Rad).

Histopathological and immunohistochemical examination were usually performed supplementary when scrapie was confirmed.

PrP genotyping

PrP genotyping was performed on all scrapie positive sheep. To obtain an indication of PrP genotype distribution in the Norwegian sheep population every 16th sheep slaughtered and examined for PrP^{Sc} was PrP genotyped (Regulation (EC) No. 999/2001 Annex III, as amended by Regulation (EC) No 2245/2003).

Genotyping of scrapie positive sheep was performed on unfixed brain samples at the Department of Production Animal Clinical Sciences, Norwegian School of Veterinary Science. Genomic DNA was isolated using the DNeasy Tissue kit (QIAGEN). Polymorphisms in the PrP gene were detected through automated sequencing of a PCR-generated product covering codons 99 to 209 of the PrP open reading frame (forward primer 5' AGGCTGGGGTCAAGGTGGTAGC; reverse primer 5' TGGTACTGGGTGATGCACATTTGC). Genotyping of unfixed brain samples from the abattoir was performed at the Department of Basic Sciences and Aquatic Medicine, Norwegian School of Veterinary Science. DNA was extracted using the DNeasy 96 Tissue Kit (QIAGEN). The samples were amplified with the described forward and reverse primers modified by 5' attachment of M13-21 and M13 rev tails allowing the use of commercially available fluorescence labelled primers, and sequenced using Big Dye Primer chemistry (Applied Biosystems). Polymorphisms were identified by manual inspection of the sequence electropherograms.

Prevalence

The classical scrapie prevalences and scrapie Nor98 prevalences in the fallen stock and abattoir populations were estimated assuming a binominal distribution.

Results

Sheep

Scrapie Nor98 was diagnosed in nine sheep from nine flocks. Seven scrapie Nor98 cases were identified in fallen stock, and two cases were apparently healthy animals slaughtered for human consumption (Table 1). There was not detected any case of classical scrapie in 2007.

Table 1. Brain samples from sheep and goats submitted for examination for scrapie in 2007

Reason for submission to the laboratory	No. of samples	No. of rejected samples	Negative	Positive
<i>Sheep</i>				
Animals with clinical signs consistent with scrapie	11	0	11	0
Fallen stock	4,416*	11	4,398*	7
Healthy slaughtered animals	9,143*	3	9,138*	2
Animals killed under scrapie eradication	182	0	182	0
Total sheep	13,752	14	13,729	9
<i>Goats</i>				
Animals with clinical signs consistent with scrapie	0	0	0	0
Fallen stock	416	0	416	0
Healthy slaughtered animals	3,049	3	3,046	0
Animals killed under scrapie eradication	2	0	2	0
Total goats	3,467	3	3,464	0

* 96 samples (86 healthy slaughtered and 10 fallen stock) from unspecified small ruminants tested negative. These samples are included in the figures given for sheep.

Table 2. Year of birth, reason for submission to laboratory examination, breed, prion protein genotype and type of scrapie of the scrapie cases detected in 2007

Case no.	Year of birth	Reason for submission to laboratory examination ¹⁾	Breed ²⁾	Prion Protein Genotype	Scrapie type
1	2000	Fallen stock	Dala sheep	AF ₁₄₁ RQ/AF ₁₄₁ RQ	Nor98
2	2002	Fallen stock	Sheep	ARR/ARR	Nor98
3	2002	Fallen stock	Sheep	AHQ/AF ₁₄₁ RQ	Nor98
4	2002	Fallen stock	Sheep	AF ₁₄₁ RQ/ARQ	Nor98
5	2002	Fallen stock	Norwegian white breed	AF ₁₄₁ RQ/AF ₁₄₁ RQ	Nor98
6	1998	Fallen stock	Norwegian white breed	AF ₁₄₁ RQ/AF ₁₄₁ RQ	Nor98
7	2002	Fallen stock	Norwegian white breed	AHQ/ARR	Nor98
8	2000	Healthy slaughtered animals	Spæl sheep	AHQ/ARQ	Nor98
9	1999	Healthy slaughtered animals	Norwegian white breed	AF ₁₄₁ RQ/ARQ	Nor98

¹⁾ The categories are: Healthy slaughtered animals, Animals killed under scrapie eradication measures, Suspect (clinical signs consistent with scrapie including animals showing clinical signs at ante-mortem inspection), Fallen stock (monitoring of fallen stock including animals examined because of other diseases than scrapie).

²⁾ Crossbred long-tailed breeds: Rygja Sheep, Steigar Sheep, Dala Sheep, Norwegian White Sheep; indigenous short-tailed breed: Spæl Sheep.

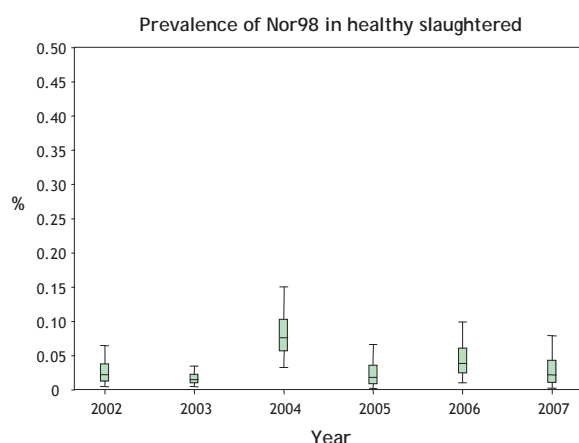


Figure 2. Box and whiskers plot of the prevalence of scrapie Nor98 in slaughtered animals during 2002-2007. The boxes represent the 25 % to 75 % quartiles and the whiskers represent the 2.5 % and 97.5 % exact binomial confidence intervals.

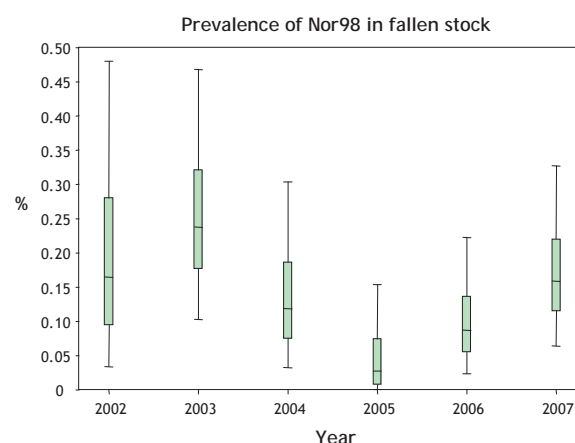


Figure 3. Box and whiskers plot of the prevalence of scrapie Nor98 in fallen stock during 2002-2007. The boxes represent the 25 % to 75 % quartiles and the whiskers represent the 2.5 % and 97.5 % exact binomial confidence intervals.

The individual age and breed were registered and the prion protein genotype examined for all nine scrapie cases (Table 2). Eight sheep had PrP genotypes with at least one allele with polymorphisms at codon 141 (AF141RQ) or 154 (AHQ). One sheep had the PrP genotype ARR/ARR.

In total, 13,752 samples from sheep were received. Of these, 14 (0.1 %) samples were unsuitable for examination. The numbers of animals examined within each category are presented in Table 1. The prevalence of scrapie Nor98 in the fallen stock of sheep was estimated to 0.16 % (0.01-0.3 %), (95 % confidence interval [CI]) (Figure 2), and the prevalence of scrapie Nor98 in sheep slaughtered for human consumption was estimated to 0.02 % (0.003-0.1 %), (95 % CI) (Figure 3).

For 575 (4.2 %) samples (573 healthy slaughtered and 2 fallen stock), the flock of origin was not reported. In the event of a positive sample from slaughtered animals, the flock identity could be traced using the carcass number. The remaining 13,177 samples were collected from carcasses originating in 5,781 different sheep flocks. The geographical distribution of the sheep populations is shown

in Figure 4A and the origin of the sheep samples and the scrapie cases are shown in Figure 5A. The mean number of animals tested per flock was 2.3 (range 1-22, flocks eradicated due to scrapie are excluded). From 1,665 flocks more than two samples were tested. The samples were obtained throughout the year, with approximately 40 % of the samples collected in September and October, which is the main slaughtering season for sheep in Norway.

PrP genotyping was performed on 597 sheep randomly sampled from the healthy slaughtered population. The PrP genotypes are grouped in accordance with the British National Scrapie Plan (NSP) (Table 3).

Goat

Scrapie was not detected any goat in 2007.

In total, 3,467 samples from goats were received. Of these, 3 (0.1 %) samples were unsuitable for examination. The numbers of animals examined within each category are presented in Table 1.

For 104 (4.2 %) samples (103 healthy slaughtered and 1 fallen stock), the flock of origin was not reported. In the event of a positive sample from slaughtered animals, the flock identity could be traced using the carcass number. The remaining 3,363 samples were collected from carcasses originating in 433 different herds. The geographical distribution of the goat populations and the origin of the goat samples are shown in Figure 4B and Figure 5B, respectively. The mean number of animals tested per herd was 7.8 (range 1-92). From 287 herds more than two samples were tested.

Table 3. PrP genotypes in the healthy slaughtered population in 2007 grouped in accordance with the British National Scrapie Plan (NSP)

Genotype category	Number	%
NSP1, genetically most resistant, ARR/ARR	72	12.0
NSP2, genetically resistant, ARR/ARQ, ARR/ARH, ARR/AHQ, VRR/ARQ	256	43.0
NSP3, genetically low level resistant, ARQ/ARQ	102	17.0
NSP3, genetically low level resistant, AHQ/AHQ, ARH/ARH, ARH/ARQ, AHQ/ARH, AHQ/ARQ	73	12.0
NSP4, genetically susceptible, ARR/VRQ	29	5.0
NSP5, genetically highly susceptible, ARQ/VRQ, ARH/VRQ, AHQ/VRQ, VRQ/VRQ	65	11.0
Total	597	100.0

Discussion

Scrapie Nor98 was diagnosed in nine sheep, each case originating in different flocks. The ages and genotypes of these sheep, and the results of the immunohistochemical examinations, were in accordance with the previous

experience of scrapie Nor98 (5). Most cases had at least one of the alleles AF141RQ or AHQ which previously have been found to be associated with scrapie Nor98 (4). There were one scrapie Nor98 cases, which had the ARR/ARR genotype, which is considered to be strongly resistant (NSP1) towards classical scrapie.

Following the EU Regulation (EC) No. 999/2001 Annex VII, as amended by Regulation (EC) No 1915/2003 all sheep in the positive scrapie Nor98 flocks were genotyped. Animals with a VRQ allele and animals without at least one ARR allele were killed and animals older than 18 months were examined for PrP^{Sc}. From July 2007 these control measures were changed in accordance with regulation (EC) no 253/2006, which states that genotyping might be performed on only a proportion of the animals in the flock positive for scrapie Nor98. No animal has to be removed from the flock on the basis of PrP genotype.

The absence of additional scrapie Nor98 cases in the eradicated flocks this year as well as previous years, suggests that scrapie Nor98 is, if contagious at all, less contagious than classical scrapie. This is supported by a case-control study on scrapie Nor98 in Norwegian sheep flocks, where animal-to-animal contact or movement of sheep between sheep flocks were not found as risk factors for scrapie Nor98 (6).

Scrapie Nor98 was diagnosed in several different breeds. The sheep were between five and ten years old, which are in agreement with the result from previous years with the mean age being six years (Table 2). In contrast, the mean age of cases with classical scrapie has been 3.5 years.

The scrapie Nor98 cases detected in 2007 were located in 4 different counties, in all of them the disease has previously been diagnosed. Scrapie Nor98 is diagnosed in most parts of Norway, in 14 of 19 counties. In contrast, the classical form of scrapie, has been detected only in the western part of Norway (3 counties) and in Nordland County.

The prevalence estimates of scrapie Nor98 in fallen stock and in sheep slaughtered for human consumption have varied during 2002-2007; however most estimates have been within the confidence intervals (Figure 2 and Figure 3) (1). The results from the surveillance programmes indicate that the prevalence of scrapie Nor98 in the sheep population has not changed since the start of the programme.

Classical scrapie was not diagnosed in 2007 and was last detected in one flock in 2006. When the classical form of scrapie was detected, the whole flock was killed. With the exception of one classical scrapie case detected in fallen stock in 2006, all classical scrapie cases have been detected through examination of clinical cases or by follow up of contact flocks. By virtue that more than 109,000 sheep were examined since 2002, the prevalence of this type of scrapie is considered to be very low.

The difference between the number of examined sheep from fallen stock (4,416) and the calculated number according to EU regulation No 2245/2003 (10,000), may partly be due the fact that about 60 % of the fallen stock population die while on remote mountain and forest pastures. An additional explanation is that sheep and goat farmers are not informed of their duty to report to The

Norwegian Food Safety Authority that all small ruminants that die, or are killed due to disease, on their farms. In spite of this, the numbers of animals examined in the sheep fallen stock and slaughtered populations are sufficient to estimate the prevalences of scrapie Nor98 in these populations.

For monitoring of sheep, between one and 22 animals have been tested for PrP^{Sc} in the same flock. Although this is an improvement from previous years, it indicates that in some flocks a higher number of animals has been examined than would be expected following random sampling from the slaughtered population.

Scrapie was not detected in goats in 2007. The first and only scrapie case in naturally infected goats in Norway was diagnosed in 2006. This was a scrapie Nor98 type and the goat came from a county with a large goat population. Both classical and atypical scrapie in goats has been diagnosed in several countries in Europe (5). From 2005 Norway increased the scrapie testing of goats considerably.

Acknowledgment

The authors thank the Norwegian School of Veterinary Science for the PrP-genotyping and all who have contributed to sampling, preparation and examination of the samples.

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Figure 4. Geographical distribution of the sheep (A) and goat (B) population density in 2007.

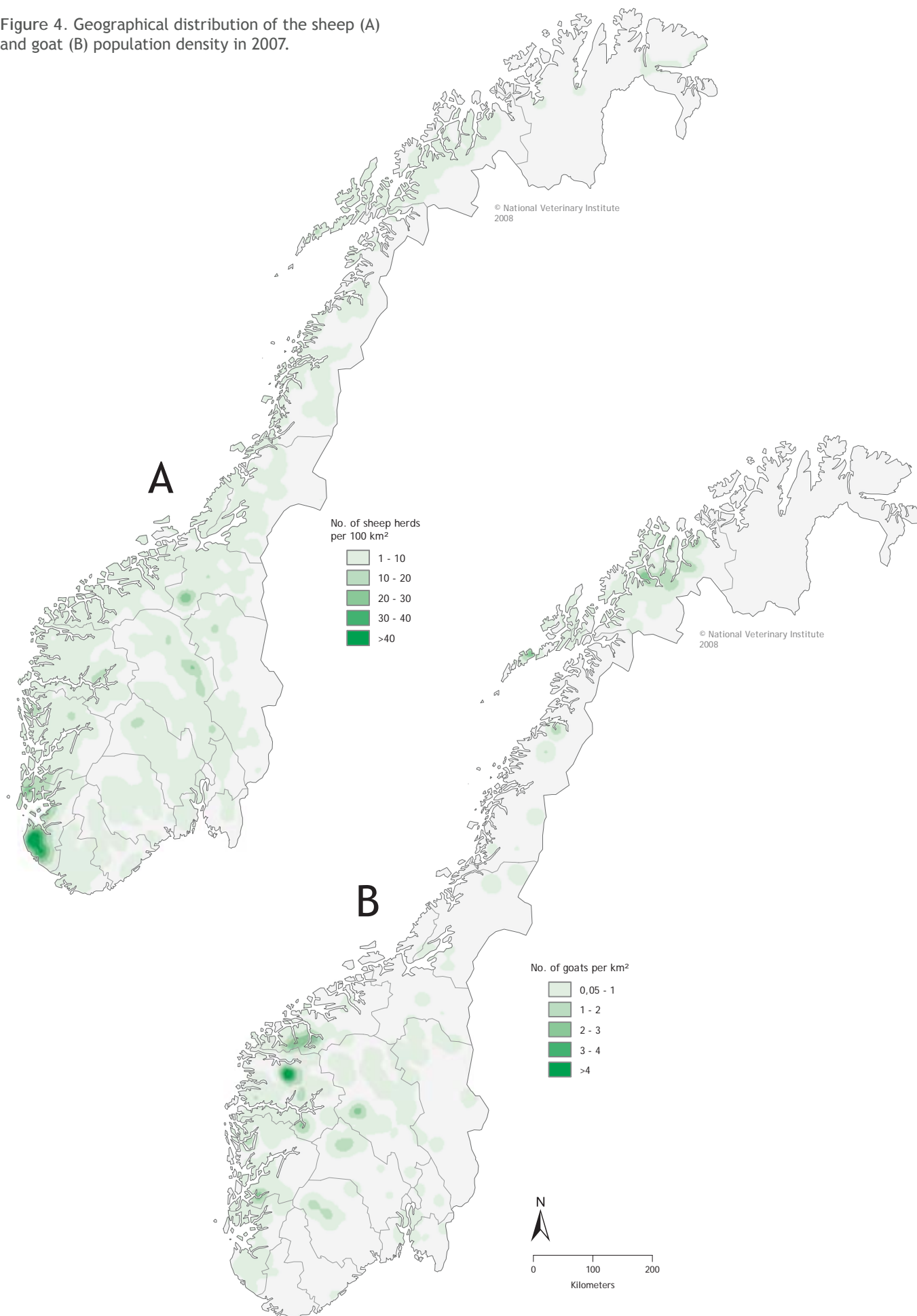
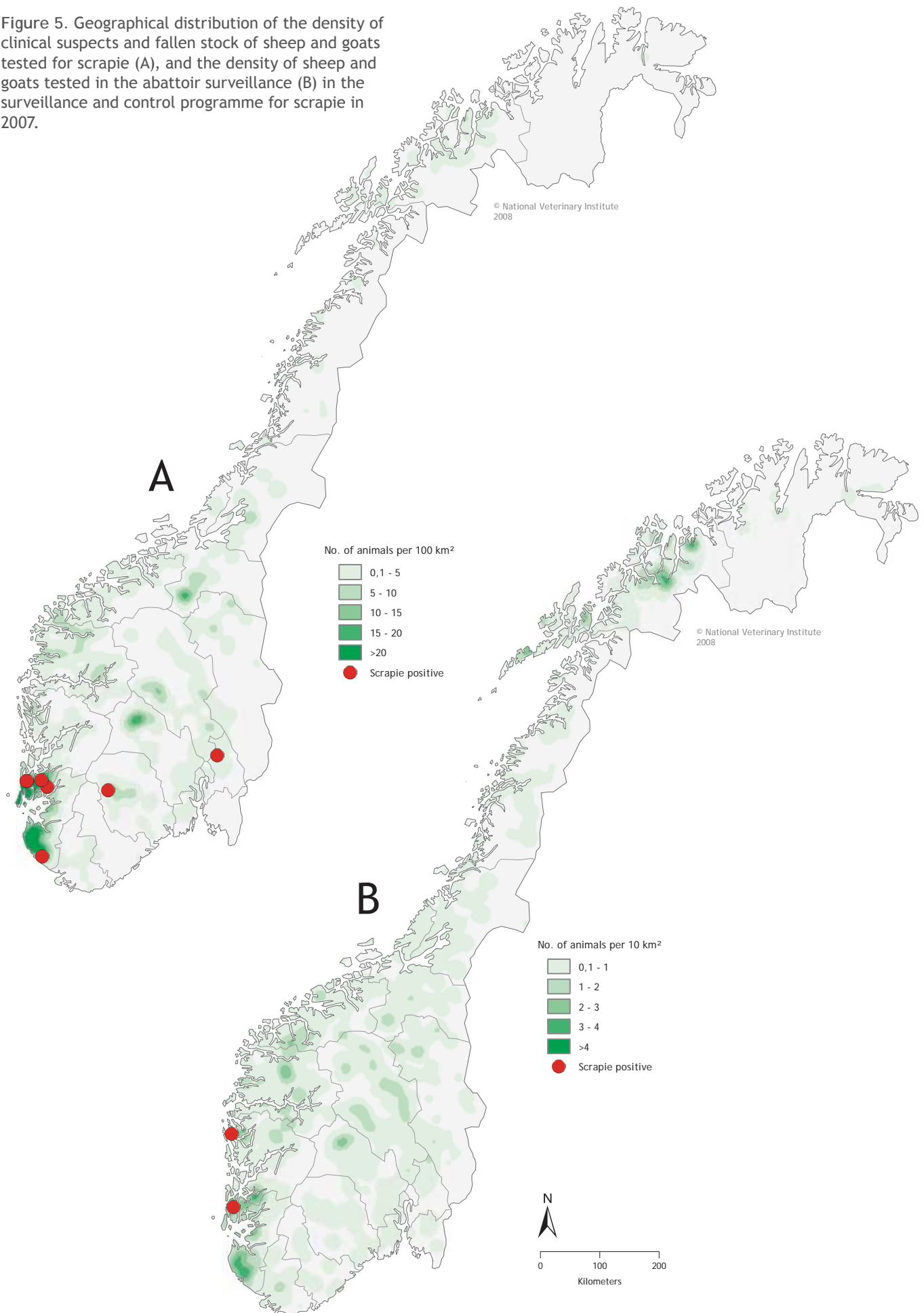


Figure 5. Geographical distribution of the density of clinical suspects and fallen stock of sheep and goats tested for scrapie (A), and the density of sheep and goats tested in the abattoir surveillance (B) in the surveillance and control programme for scrapie in 2007.



Annual report 2007

The surveillance and control programme for specific virus infections in swine herds in Norway



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The surveillance and control programme for specific virus infections in swine herds in Norway

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Surveillance in 2007 did not detect any cases of Aujeszky's disease, transmissible gastroenteritis, porcine respiratory corona virus, porcine respiratory and reproductive syndrome or swine influenza.

Introduction

The national surveillance and control programme for specific virus infections in swine was launched in 1994 in order to document the status of Aujeszky's disease (AD), transmissible gastroenteritis (TGE), and porcine respiratory corona virus (PRCV) in the Norwegian swine population. Porcine respiratory and reproductive syndrome (PRRS) and swine influenza (SI) were included in the programme in 1995 and 1997, respectively. From 1997 to 1999 porcine epidemic diarrhoea (PED) was also included (1), (Table 1).

The Norwegian Food Safety Authority is responsible for running the programme, while the National Veterinary Institute is responsible for planning, laboratory analyses and reporting.

The EFTA Surveillance Authority (ESA) has recognised the swine population in Norway as free from AD since July 1 1994, and has defined additional guarantees to protect the swine health status in Norway. The additional guarantees relating to AD for pigs destined for Norway are described in ESA Decision 75/94/COL, amending ESA Decision 31/94/COL, later replaced by ESA Decision 226/96/COL.

Aims

The aims of the programme are, through serological surveillance, to document absence of specific infectious diseases in the Norwegian swine population and to maintain this favourable situation.

Table 1. Monitoring of the Norwegian swine population for antibodies against Aujeszky's disease (AD), transmissible gastroenteritis (TGE), porcine respiratory corona virus (PRCV), porcine epidemic diarrhoea (PED), porcine respiratory and reproductive syndrome (PRRS) and swine influenza (SI) during the years 1994 to 2007

Year	Herds in population	Herds tested	Animals tested	Animals positive	Diseases included
1994	7,799	1,112	12,010	0	AD, TGE, PRCV
1995	7,471	956	11,197	0	AD, TGE, PRCV, PRRS
1996	7,045	468	4,968	0	AD, TGE, PRCV, PRRS
1997	6,661	512	4,925	0	AD, TGE, PRCV, PRRS, PED, SI
1998	6,275	491	4,695	2*	AD, TGE, PRCV, PRRS, PED, SI
1999	5,761	470	4,705	0	AD, TGE, PRCV, PRRS, PED, SI
2000	4,827	458	4,600	0	AD, TGE, PRCV, PRRS, SI
2001	4,554	472	4,972	0	AD, TGE, PRCV, PRRS, SI
2002	4,150	492	4,899	0	AD, TGE, PRCV, PRRS, SI
2003	4,005	483	4,783	0	AD, TGE, PRCV, PRRS, SI
2004	4,006	492	4,935	0	AD, TGE, PRCV, PRRS, SI
2005	3,762	468	4,644	1*	AD, TGE, PRCV, PRRS, SI
2006	3,339	457	4,569	0	AD, TGE, PRCV, PRRS, SI
2007	3,010	456	4,641	0	AD, TGE, PRCV, PRRS, SI
Total			80,543	3*	

* 2 positive for SI H3N2 in 1998 and 1 positive for PRCV in 2005, probably unspecific reactions.

Material and methods

All the 151 nucleus and multiplying herds were to be tested. In addition, the nucleus units of all the 13 sow pools and a random selection of the remaining swine population were included in the programme. The random selection was conducted from all swine herds receiving governmental production subsidies according to records of July 31 2006. The register contains 3,010 commercial swine herds, of which 280 integrated and piglet-producing herds and 60 fattening herds were selected.

The counties Østfold, Akershus, Vestfold and Rogaland were considered to be "high risk areas", and a relatively larger proportion of farms from these counties were selected.

Samples were collected at the farms, except for the fattening herds, which were collected at six different abattoirs. From all herds, samples from ten pigs were to be collected.

Aujeszky's disease

All serum samples were tested for antibodies against AD virus using a commercial blocking ELISA (SVANOVIR™). The test detects antibodies against glycoprotein B (previously glycoprotein II) on the surface of the virus. For follow up of positive or dubious results, the SVANOVIR™ PRV-gE was used.

Transmissible gastroenteritis virus and porcine respiratory coronavirus

A combined blocking ELISA (SVANOVIR™) was used to detect antibodies against TGEV/PRCV. Depending on the reaction pattern of two different monoclonal antibodies against TGEV/PRCV and TGEV respectively, the test is able to distinguish between antibodies against TGEV and PRCV.

Porcine reproductive and respiratory syndrome

All serum samples were tested for antibodies against PRRS virus using the HerdChek PRRS 2XR Antibody Test Kit (IDEXX) which detects the most predominant European or American type of PRRS viruses. In the case of dubious or positive results, the samples were retested with blocking ELISAs and immune-peroxidase tests (IPT) at the National Veterinary Institute in Denmark.

Table 2. Number of samples submitted to the laboratory and the test results for AD, swine influenza, and PRRS, PRCV and TGE in 2007

Disease	Received	Rejected	Negative	Positive
AD	4,641	13	4,628	0
SI	4,641	16	4,625	0
PRRS	4,641	4	4,637	0
TGE	4,641	20	4,621	0
PRCV	4,641	22	4,619	0

Swine influenza

To test for swine influenza, the samples were analysed for antibodies against the serotypes H1N1 and H3N2 in the hemagglutination inhibition test (HI), according to the method described in the OIE Manual of Diagnostic Tests and Vaccines for Terrestrial Animals (2). The antigens were produced at the National Veterinary Institute in Oslo.

All the serological analyses were performed at the National Veterinary Institute in Oslo. All inconclusive or positive samples in the routine tests were re-tested by specified reference tests.

Results

Blood samples from 4,641 individual animals were submitted and the results are shown in Table 2. The distribution of tested herds in relation to type of production is given in Table 3. The mean number of animals tested per farm was 10 (range 5 - 65).

Discussion

The results from the surveillance and control programme support freedom from specific virus infections in the Norwegian swine population. Antibodies against any of the specified viruses have been detected only twice since the start in 1994. A low level of antibodies against swine influenza (H3N2) was detected in samples from pigs in one herd in 1998, and one out of ten pigs from a fattening pig herd had antibodies against PRCV in 2005. To date, there have been no clinical recordings indicating the presence of any of the viral infections included in this surveillance and control programme (1, 3, 4).

The Norwegian swine industry has structurally changed during the last ten years with a decline in number of herds but an increase in herd size. The produced tonnage of pork meat has been relatively stable. The fraction of sampled farms has not declined substantially since the start of the programme, the figures being 14.3 % and 15.1 % in 1994 and 2007, respectively. The geographical distribution of investigated farms is in accordance with the spatial distribution of the total swine herd population (Figure 1).

Farmed wild boars and pigs kept as pets are not included in the programme. There is no wild boar population registered in Norway.

The EU has not approved the programmes for virus infections other than AD for granting of additional guarantees, so they are continuously based on national decisions.

In conclusion, the surveillance and control programme for specific virus infections provides solid documentation of the favourable health situation in the Norwegian swine population.

Table 3. Distribution of swine herds in the surveillance and control programme 2007 related to the type of production

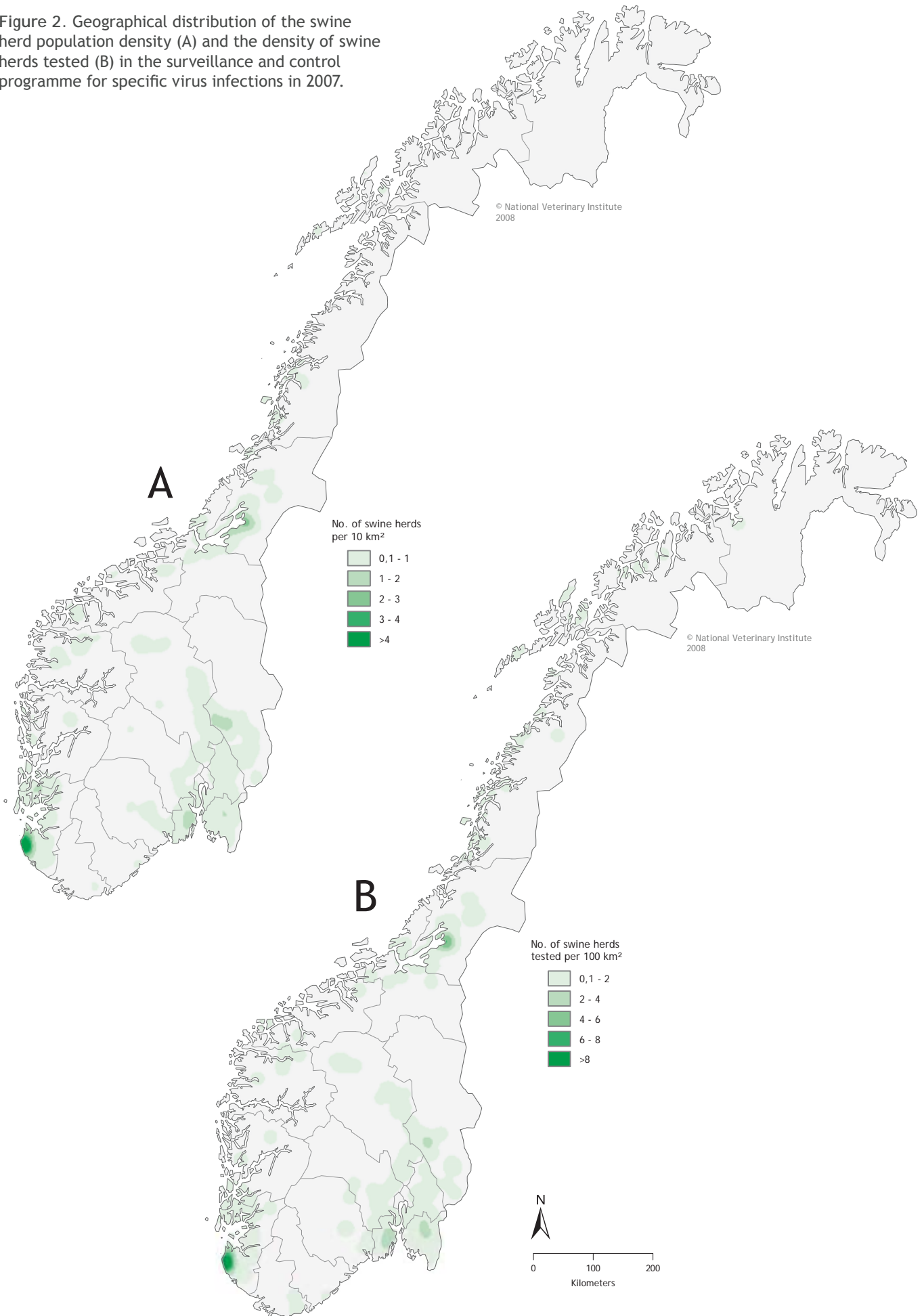
Category	No. of herds tested	Total no. of individual samples collected
Nucleus herds and multiplying herds	142	1,457
Sow pools	10	104
Integrated and piglet-producing herds	246	2,418
Fattening herds	59	590
Total	457	4,569

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Figure 2. Geographical distribution of the swine herd population density (A) and the density of swine herds tested (B) in the surveillance and control programme for specific virus infections in 2007.



Annual report 2007

The surveillance and control programme for chronic wasting disease (CWD) in wild and captive cervids in Norway



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The surveillance and control programme for chronic wasting disease (CWD) in wild and captive cervids in Norway

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Chronic wasting disease (CWD) was not detected in any of the animals tested in 2007.

Introduction

CWD is a transmissible spongiform encephalopathy (TSE) of cervids (1, 2, 3). A few species of the family *Cervidae* are known to be naturally susceptible to the disease: mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), elk (*Cervus elaphus*), and moose (*Alces alces*). CWD was first described as a clinical syndrome termed "chronic wasting disease" in captive mule deer in Colorado, USA in the late 1960s and subsequently identified as a TSE in 1978 (1). In the mid-1980s, the disease was diagnosed in free-ranging elk and deer. At present there is an endemic area for CWD in deer and elk comprised of northern Colorado, southern Wyoming, and western Nebraska. In recent years CWD has also been found in several other U.S. states and in the two Canadian provinces Saskatchewan and Alberta.

The main clinical features of CWD-affected animals are progressive weight loss, changes in behaviour, and depression. In the terminal stages excessive drinking, urination and salivation are common. The clinical course of CWD has a span from a few days to approximately a year, however most animals die within a few weeks to some months. Affected animals are generally older than eighteen months (1, 2).

CWD is, like scrapie in small ruminants and bovine spongiform encephalopathy (BSE) in cattle, characterised by the accumulation of an abnormal form of the prion protein (PrP^{Res} or PrP^{CWD}) in the central nervous system. In most of the CWD-affected animals, PrP^{CWD} is also detectable in the lymphoid tissues (2, 4). The histopathological changes are, like the other TSEs, characterised by vacuolation of the brain tissues (2). The diagnosis CWD relies on the detection of the PrP^{CWD} by immunological methods such as immunohistochemistry, ELISA, or Western Blot.

In Norway, TSEs are restricted to cases of classical and atypical (Nor98) scrapie in sheep and a single case of atypical scrapie in goat in 2006 (5). In addition, a single case of Feline Spongiform Encephalopathy (FSE) was detected in 1994.

Chronic wasting disease is yet to be diagnosed in cervids in Europe. The number of animals tested has been low. However, in 2006 the European Community put a motion that the Member States should carry out a survey for CWD

in cervids (SANCO/960/2006), which was passed according to the Commission decision of 19 March 2007 (document number C(2007) 860). This EC survey shall be completed no later than the end of the 2007 hunting season.

Four cervid species are prevalent in natural populations in Norway: moose, red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), and reindeer (*Rangifer tarandus*). Red deer predominate along the west coast, whereas moose and roe deer mainly inhabit other areas of the country. The wild reindeer live in dispersed populations in separate high mountain areas in southern Norway. The number officially hunted in 2006 (figures for 2007 are not available yet) was: 35,000 moose, 29,200 red deer, 25,100 roe deer, and 5,100 wild reindeer. Additionally, Norway has a semi-domestic reindeer population, mainly kept in the northern parts of the country, presently counting about 200,000 animals.

In Norway, deer farming is not yet a large industry; however the number of herds is rising, with current estimated standing at 50-100 farms. Most of the farms keep red deer, and only a few keep fallow deer (*Dama dama*).

Based on the fact that Norway has large populations of various cervids, a number of them grazing in regions where scrapie is detected, a passive surveillance programme for CWD in Norwegian wild and captive cervids has been running from 2003. Additionally, during 2004-2007 a number of samples from slaughtered semi-domestic reindeer from several regions in the country also have been tested for CWD. A small population (approximately 200) of free-ranging musk ox (*Ovibus moschatus*), inhabits the Dovre high mountain plateau in Mid-Norway. TSE has not been diagnosed in the musk ox, but the species has been included in the programme from 2004.

As an EEA EFTA state, Norway has implemented the EC survey for CWD in cervics (Commission decision 2007/182/EC). The target species relevant for Norway was wild red deer and the survey implied sampling of:

- a) clinical/sick, euthanized animals,
- b) traffic killed animals,
- c) animals found dead, and
- d) healthy animals shot during hunting.

Additionally, for moose, roe deer, reindeer, and farmed deer the categories a) - c) should be sampled. All sampled animals should be over 18 months of age.

Aim

The aim of the programme is to detect the possible occurrence of CWD in the Norwegian cervid population.

Material and methods

Material

As part of the EC survey, samples from adult wild red deer shot during the ordinary hunting season, September–November 2007, were tested. Tested animals also included captive deer and wild cervids older than 18 months that died or were euthanized due to disease or injuries. Additionally, cervids older than one year necropsied at the National Veterinary Institute were subjected to CWD testing. Some semi-domesticated reindeer and one musk ox were also tested. The number and species analysed for CWD in 2007 are given in Table 1.

Laboratory examinations procedures

A rapid test (TeSeE[®] Bio-Rad was used on moose and TeSeE Sheep & Goat[®] ELISA, Bio-Rad on the other species) was used to screen brain samples for detection of the PrP^{CWD}. All the samples were analysed at the National Veterinary Institute in Oslo, which is the National Reference Laboratory for TSEs in Norway.

The National Veterinary Institute is part of the group “Control for Cervids” within the NeuroPrion Network of Excellence aiming at optimising diagnostics tools in Europe for the detection of CWD.

Results

Out of a total of 723 brain samples received for examination for CWD, 720 samples were analysed and three samples were rejected. None of the 720 samples analysed tested positive for CWD in the rapid test (Table 1).

Totally 682 of the tested animals were exclusively examined for CWD and the majority was healthy hunted red deer (Table 1). The remaining 38 animals represent cases received at National Veterinary Institute for routine necropsy.

A total of 40 of the tested animals were captive, including both red deer and fallow deer. All the tested reindeer were semi-domestic animals sampled during slaughter.

Discussion

No animals were detected positive for CWD in 2007. The total number of samples analysed is higher than the previous years due to the EC survey. The majority of the tested animals in 2007 were healthy red deer shot during ordinary hunting. Chronic wasting disease has so far not been diagnosed in cervids in Europe (6–9).

Among the Norwegian cervid species, a higher risk for CWD can be assumed for red deer and moose since these species are among those known to be natural susceptible to the disease (1, 2, 3). Regarding moose, so far, only a few positive CWD cases has been diagnosed in hunted animals in CWD-endemic areas in Colorado, USA (3), thus they

Table 1. The number of cervids tested in the Norwegian surveillance and control programme for chronic wasting disease (CWD) 2007, distributed in reason for submission. Rejected samples are not included.

Species	Routine necropsy		TSE surveillance programme				Total
	Captive	Wild	Hunted	Traffic killed, found dead or euthanized Wild	Found dead or culled Captive	Unspecified	
Moose		20	5	10			35
Fallow deer	1				7		8
Red deer	5	2	548	30	27*		612
Musk ox		1					1
Reindeer						30	30
Roe deer		9	11	14			34
Total	6	32	564	54	34	30	720

* Includes probably some slaughtered captive deer.

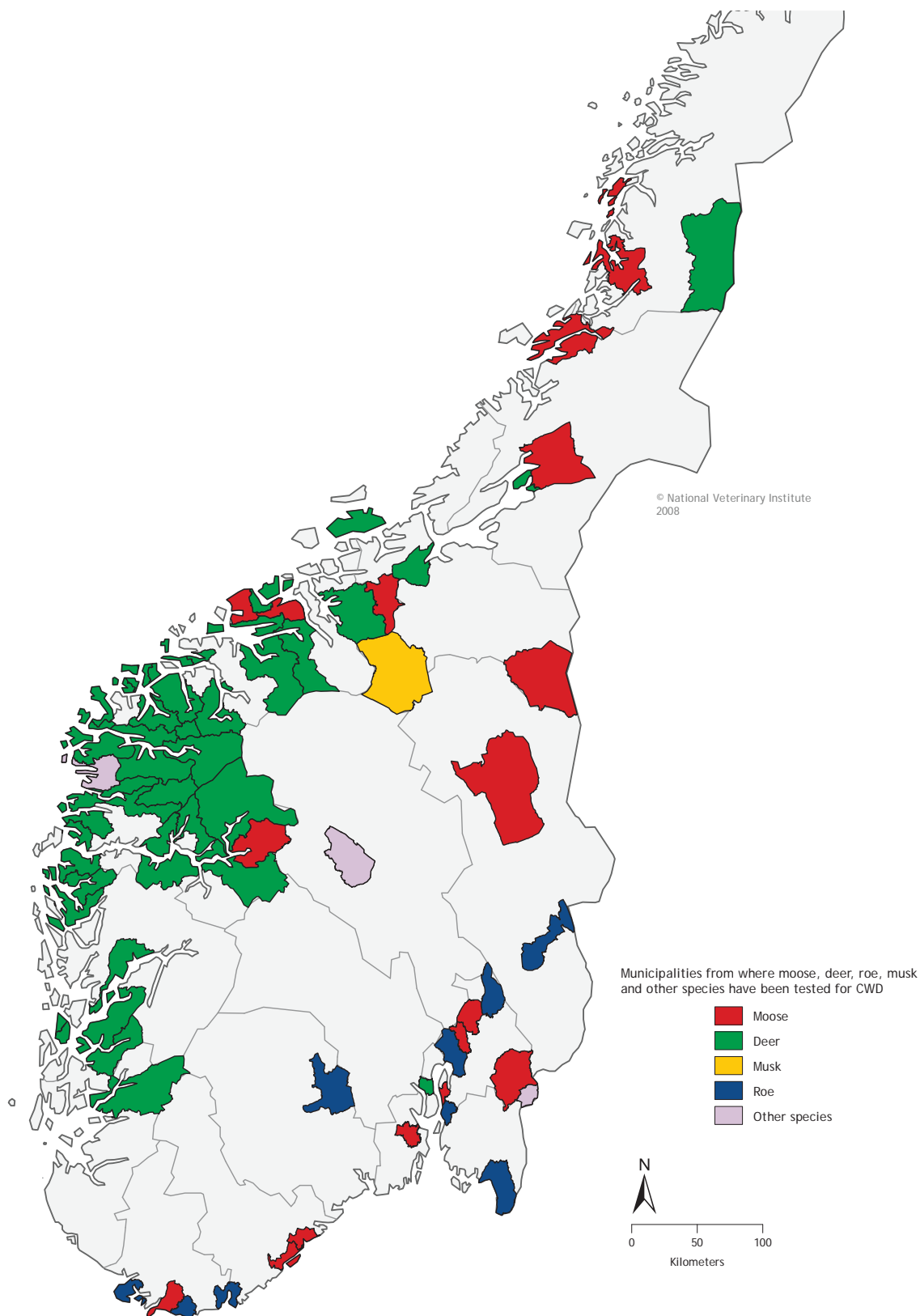


probably represent preclinical CWD. Also, the disease has been transmitted experimentally to moose by oral inoculation of brain tissue from a CWD affected mule deer (10). Roe deer, reindeer and musk ox has so far not been found naturally infected with CWD.

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Figure 1. Municipalities in Norway from which cervids and musk ox were tested for chronic wasting disease (CWD) in 2007.



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The surveillance and control
programme for *Echinococcus*
multilocularis in red foxes
(*Vulpes vulpes*) in Norway

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The surveillance and control programme for *Echinococcus multilocularis* in red foxes (*Vulpes vulpes*) in Norway

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Echinococcus multilocularis was not detected in any of the 811 red foxes (*Vulpes vulpes*) sampled throughout Norway during the licensed hunting seasons between July and April, 2002-2007.

Introduction

The adult stage of the microscopic taeniid tapeworm *Echinococcus multilocularis* lives in the small intestine of wild carnivores, foxes in particular constitute the main reservoir of the parasite (1). Wolves (*Canis lupus*), racoon dogs (*Nyctereutes procyonoides*), and domestic dogs and cats may also be infected. Cats are less susceptible than dogs (2). Rodents act as intermediate hosts of the parasite and become infected through ingestion of eggs shed in faeces of the carnivorous host. In rodents, multiple parasitic cysts (metacestodes) develop in the internal organs. Carnivores are infected through predation on rodents containing these metacestodes. Humans can act as aberrant intermediate hosts when eggs are ingested, and unless treated, infections in humans can be fatal (3). In countries where *Echinococcus multilocularis* is endemic,

serious consideration to human safety has to be given regarding the use of surface water, and the harvesting of berries and mushrooms etc.

Echinococcus multilocularis is endemic in large parts of the northern hemisphere, including eastern and central parts of Europe (1,4). Currently, there is no evidence that this parasite has established in Fennoscandia. However, in 1999, *E. multilocularis* was detected in Denmark (5) and on Svalbard (6).

The opening of the borders in Europe and lifting of travel restrictions on pets between EU countries may facilitate the spread of this parasite into regions previously free from infection. This spread might occur both through infected rodents stowed away in transports or via dogs from endemic areas. The risk of *E. multilocularis* introduction by dogs into Sweden was recently estimated (7). The risk of importing infected dogs, without the current mandatory anthelmintic treatment, was estimated as high whereas the risk of further spread from dogs to wildlife was considered to be moderate to high.

In Norway, compulsory anthelmintic treatment of imported dogs is required. However, according to the EU Directive 998/2003/EC on pet movement, the maintenance of this national regulation post 2008 requires documentation of *E. multilocularis* status within Norway.

The Norwegian Food Safety Authority is responsible for the implementation of a surveillance and control programme for *E. multilocularis* in red foxes. The National Veterinary Institute is responsible for the planning of the program, organizing the collection of samples and performing the tests.

Aims

The aim of the programme is to document the status of *E. multilocularis* in mainland Norway; in order to maintain the national regulation for compulsory anthelmintic treatment of imported dogs, thereby preventing this route of parasite introduction.



Materials and methods

Faecal samples collected from red foxes (*Vulpes vulpes*) shot during the licensed hunting seasons between July and April 2002-2007 were included in the programme. All counties in Norway were represented in the sampling regime.

During 2002-2005, hunters were invited by sending invitation letters to those that had supplied pelts to the Oslo Fur Auction House. For the 2006/07 hunting season, hunters were invited according to the list of registered fox hunters (Statistics Norway). A standard form, that included information on where, when, how and by whom the fox had been killed, as well as the sex (male, female) and presumed age of the animal (juvenile, adult), was filled out by each hunter.

Faecal material collected between 2002 and 2005 was examined at the University of Zürich using copro-ELISA and multiplex PCR methods (8, 9). The methods used for the material collected in hunting season 2006/07 were based upon modified taeniid egg isolation (10,11) and multiplex PCR (8) techniques, as described by Davidson et al. (12).

Results and discussion

In total, 811 red foxes were examined and none of them were found positive for *E. multilocularis*. Significantly more samples came from male foxes (60 %) than female (40 %) and fewer faecal samples were examined from juveniles (40 %) than adults (60 %).

The number and origin of the foxes examined each hunting season are shown in Table 1.

Given the wide geographic area covered in the sampling it appears that *E. multilocularis* has not established in



mainland Norway. However, to confirm the continued absence of this parasite from all regions in Norway prolonged surveillance will be required.

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Table 1. Number and origin of red foxes shot and examined for *Echinococcus multilocularis* in Norway during the licensed hunting periods from July to April, 2002-2007

County	Number of samples examined				Total
	2002/03	2003/04	2004/05	2006/07	
Østfold	4	3	0	18	25
Akershus	17	8	1	54	80
Oslo	2	3	0	10	15
Hedmark	31	9	0	57	97
Oppland	43	25	0	38	106
Buskerud	9	8	0	19	36
Telemark	8	6	0	13	27
Vestfold	4	3	0	19	26
Aust-Agder	0	0	0	11	11
Vest-Agder	0	0	0	9	9
Rogaland	14	6	0	10	30
Hordaland	8	2	0	20	30
Sogn og Fjordane	2	4	0	32	38
Møre og Romsdal	14	10	0	13	37
Sør-Trøndelag	24	11	0	51	86
Nord-Trøndelag	4	2	0	29	35
Nordland	5	2	3	43	53
Troms	8	0	2	25	35
Finnmark	13	5	5	12	35
Total	210	107	11	483	811

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The surveillance and control programme for avian influenza (AI) in wild birds in Norway



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The surveillance and control programme for avian influenza (AI) in wild birds in Norway

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Results were negative for the 2007 surveillance for highly pathogenic avian influenza virus in wild birds.

Introduction

The surveillance also confirmed that mallards, wigeons, gulls, and teals are the most relevant reservoirs of influenza A virus in Norway.

The Norwegian Food Safety Authority is responsible for the implementation of the active surveillance programme for avian influenza (AI) in wild birds. The programme, which was started in 2005, is based on virological investigations in healthy, live or hunted birds. The National Veterinary Institute is responsible for planning, laboratory investigations and reporting components of the programme.

AI is a serious, highly contagious disease of poultry and other captive birds caused by many different subtypes of influenza type A viruses. The level of risks posed by the different subtypes to animal and public health is very variable and, are sometimes unpredictable. This is due to rapid virus mutation and possible re-assortment of the genetic material between different subtypes.

Wild waterfowls are the natural reservoirs for all influenza A virus subtypes. Infected birds do not usually develop clinical disease, but shed large amounts of virus in their faeces (1). The highly pathogenic avian influenza (HPAI) virus H5N1 is primarily shed via the airways (2).

HPAI has never been reported in wild birds of Norway.

Aims

The aim of the national surveillance programme for AI in wild birds is to study and understand the threats posed by wild birds in relation to influenza viruses of avian origin, with special emphasis to H5 and H7 viruses.

Materials and methods

In 2007 the programme for wild birds consisted of molecular screening of cloacal and tracheal swabs from healthy birds shot mainly during the 2007 hunting season. Sampling equipment consisted of a sample tube containing a virus transport medium. Swabs were sent to hunters in the counties of Rogaland (South-Western Norway), Østfold and Hedmark (Eastern Norway), and Sør- and Nord-Trøndelag (Central Norway). Choice of hunters was based on their proficiency during previous hunting seasons. The hunters were also given written instructions on how to sample the animals. They were requested to fill in registration forms for individual birds. The swabs were taken from shot birds, and then placed in the transport medium. The swabs were sent by overnight post to the National Veterinary Institute in Oslo. The samples were frozen at 70 °C upon arrival.



H5/H7

The samples were registered upon arrival and screened using a reverse transcriptase polymerase chain reaction (RT-PCR). The screening RT-PCR used was a pan-influenza A virus RT-PCR that reveals the presence of all subtypes of influenza type A virus. The method does not, however, give information as to which hemagglutinin (H) or neuraminidase (N) subtype is present in influenza positive samples. Therefore, the samples found to be positive in the initial pan-influenza A virus RT-PCR were further subtyped, using RT-PCRs specific for H5 and full-length RT-PCRs for the H and N genes. Samples positive for the pan-influenza A virus RT-PCR were also inoculated in embryonated eggs for virus isolation following the procedures described in the OIE Manual (3), with some minor modifications.

Results

In total, samples from 1,561 birds were received. Of these where 2 samples rejected from examination leaving 1,559 for analysis. Of these, 183 were positive for influenza A virus. None of the samples were positive for HPAI viruses.

Of the bird species sampled, those with the highest prevalence of Influenza A positive results were teal, mallard and wigeon. For complete results of the sampling, see table 1. The prevalence for influenza A virus in waterfowl was 14.2 % (n=913), the prevalence in gulls was 8.7 % (n=601).

None of the samples were H7 positive. Nine mallards and three teals were found to carry H5 subtypes. After sequencing of the H gene identified these viruses as low pathogenic avian influenza (LPAI) viruses.

The subtypes identified included H1N1, H2N6, H3N6, H3N8, H4N2, H4N6, H6N1, H6N2, H9N2, H9N5, H10, H11, H12N2, H12N3, H12N8, H13N2, H13N6, H13N8 and H16N3.

Discussion

In 2007, as in 2005 and 2006, there were samples that tested positive for Influenza A virus from mallards, wigeons and teals (4, 5). But in comparison with the national surveillance programme for AI in wild birds 2006, the general prevalence of AI infection amongst the waterfowl tested in 2007 was much higher. Mallards were found to harbour the highest diversity of H and N subtypes. Low pathogenic avian influenza virus of subtype H5 was found in nine mallards and three teals.

All four gull species tested were positive for influenza A infection. The prevalence of gulls that tested positive for Influenza A in 2007 is seemingly higher than those in 2006, prevalence of 4.4 % (n=594) (5). In contrast to 2006, no lesser black-backed gulls were tested in 2007.



Also sampled were three other species. These birds - cormorant, grey heron and little auk - all tested negative. The low sampling of these species makes it difficult to offer any conclusions as to their importance in their role in the threat of avian influenza.

The findings of this study confirm earlier findings that mallards, wigeons, gulls, and teals are the most relevant reservoirs of influenza A virus in Norway.

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Table 1. Birds examined in 2007 and the results of the examination for influenza virus

Species	No. of examined	Negative	Influenza A	Low pathogenic H5	Low pathogenic H7	High pathogenic H5	High pathogenic H7
<i>Ducks</i>							
Mallard	525	446	79	9	-	-	-
Teal	239	201	38	3	-	-	-
Wigeon	119	107	12	-	-	-	-
Tufted duck	4	4	-	-	-	-	-
Common eider	33	31	2	-	-	-	-
Common scoter	1	1	-	-	-	-	-
Long-tailed duck	4	4	-	-	-	-	-
Goldeneye	5	5	-	-	-	-	-
Red-breasted merganser	1	1	-	-	-	-	-
<i>Gulls</i>							
Herring gull	328	298	30	-	-	-	-
Common gull	210	191	19	-	-	-	-
Great Black-backed gull	64	62	2	-	-	-	-
Black-headed gull	11	10	1	-	-	-	-
Unspecified gull species	1	1	-	-	-	-	-
<i>Other waterfowls</i>							
Little auk	1	1	-	-	-	-	-
Grey heron	1	1	-	-	-	-	-
Cormorant family	1	1	-	-	-	-	-
Species not given	11	10	1	-	-	-	-
Total	1,559	1,375	184	12	0	0	0

Table 2. Birds examined 2006 to 2007 in the program for avian influenza and the results of the examinations

Year	No. of samples	Negative	Influenza A	Low pathogenic H5	Low pathogenic H7	High pathogenic H5	High pathogenic H7
2005	619	539	80	2	0	0	0
2006	1,274	1,189	85	4	0	0	0
2007	1,559	1,375	184	12	0	0	0



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The surveillance and control programme for avian influenza (AI) in poultry in Norway



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The surveillance and control programme for avian influenza (AI) in poultry in Norway

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The 2007 surveillance of avian influenza in poultry and birds in Norway did not detect avian influenza infection.

Introduction

The Norwegian Food Safety Authority is responsible for implementing the surveillance programme for avian influenza (AI) in poultry. The programme, which was started in 2005, is based on serological investigations of poultry. The National Veterinary Institute is responsible for planning, laboratory investigations and reporting components of the programmes.

AI is a serious, highly contagious disease of poultry and other captive birds caused by many different subtypes of influenza type A viruses. The level of risks posed by the different subtypes for animal and public health, is very variable and can be unpredictable. This is due to the rapid virus mutation and possible re-assortment of the genetic material between different subtypes.

Current knowledge indicates that the health risks posed by the so-called Low Pathogenic AI (LPAI) viruses are lower than that posed by Highly Pathogenic AI (HPAI) viruses. The HPAI viruses originate from a mutation of LPAI viruses of either H5 or H7 subtype. HPAI can cause disease in poultry resulting in mortality rate exceeding 90 %.

In general, domestic poultry populations are free from AI viruses. However, wild waterfowl are the natural reservoirs for all influenza A virus subtypes. Infected birds do not usually develop clinical disease, but may shed large amounts of virus in their faeces upon infection (1). A national avian influenza virus surveillance programme in wild waterfowl in Norway was started in 2005. The national surveillance and control programme for AI in poultry was started in 2006 and is modelled on EU's Council Directive 2005/94/EC, also known as the "AI Directive".

AI has never been reported or diagnosed in poultry in Norway.

Aims

The aim of the national surveillance and control programme for AI in poultry is to document that the various poultry populations in Norway are free of influenza A virus of sub-types H5 and H7 and to contribute to the maintenance of this status.

Materials and methods

The programme in 2007 consisted of serological screening of blood samples from poultry. Poultry deemed at risk for exposure to influenza type A were preferentially sampled as outlined in EU's AI Directive Annex I. The basis for sample selection was based upon a risk assessment published by the National Veterinary Institute in February 2006 (2). The sample selection included chickens, turkeys, ducks, geese, quail and ostrich.

In addition to the samples taken from farms on the basis of the risk assessment (2), samples from breeding flocks were also tested for AI. According to the national regulations for certification of poultry breeding farms (Forskrift om sertifisering av fjørfevirksomheter av 18.11.94), blood samples from 60 birds must be taken at least once a year from every breeding flock. These blood samples are to be tested for Newcastle disease, as Norway has the status of a non-vaccinating country. Such samples from chicken, turkey, and duck flocks were included in the national surveillance and control programmes for AI.

Blood samples were collected from all species of poultry from at least 10 birds per holding, with the exception of ducks and geese. If there were more than one shed on the holding, all sheds were sampled. From ducks and geese,

50 samples were to be taken from each selected holding. In those instances where the flock size was less than the number required, all birds in the flock were sampled.

The samples taken from chickens were tested for the presence of antibodies against Influenza A virus. Due to the limitations on the species spectrum of the ELISA for influenza A virus, samples from the remaining species were tested for influenza A virus subtype H5 and subtype H7.

Influenza A

An ELISA kit produced by IDEXX was used for the testing of antibodies against influenza A virus. The test has been demonstrated to detect antibody reactivity to 20 different subtypes of avian influenza including 14 haemagglutinin glycoproteins and the H5N1 subtype.

This test is only validated for use in chickens. If tests were positive, samples were examined further for presence of H5 or H7 with the haemagglutination inhibition test, see below.

H5/H7

All serum samples from species other than chicken were tested for specific antibodies against both H5 and H7 with the haemagglutination inhibition test described in the OIE diagnostic manual (3).

Results

Table 1 shows the number of flocks and birds tested in the different poultry species in the national surveillance and control programmes for AI in 2007. Nine chicken flocks - 3 breeder, 3 commercial and 3 hobby - gave positive or inconclusive results when tested for antibodies against Influenza A virus. Subsequent testing of these samples with haemagglutination inhibition tests however showed no sign of antibodies against either H5 or H7. All other samples were negative.

A number of samples (n=926) taken for the purposes of diagnosing disease, production problems and the control of imported animals were also screened for antibodies against Influenza A virus (approx. 100) or H5/H7 (approx. 850). All were negative.

Discussion

An adequate number of flocks were sampled with respect to Norwegian population of commercial poultry.

Only 11 hobby flocks were sampled in the programme. Conclusions with respect to the adequacy of the sampling of hobby poultry is difficult, as the true population numbers are unknown. The Norwegian Food Safety Authority is working on a voluntary registry for people who keep poultry hobby on a hobby basis. If they succeed, this will be invaluable for future surveillance coverage. It should be noted that the numbers sampled as a part of the programme do not represent the true sampling of such flocks, as a large number of hobby poultry were tested for the purpose of diagnosing disease.

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Table 1. Number of certified breeder flocks, commercial flocks, hobby flocks and birds tested in the surveillance and control programme for AI in poultry in 2007

Species	Certified breeder flocks		Commercial flocks		Hobby flocks		Total
	Flocks	Animals	Flocks	Animals	Flocks	Animals	Animals
Chicken	132	1,400	67	694	10	84	2,178
Turkey	-	-	40	419	-	-	419
Duck	2	99	6	261	1	2	362
Goose	-	-	1	50	-	-	50
Quail	-	-	1	21	-	-	21
Total	124	1,399	125	1,545	11	85	3,029

Annual report 2007

The surveillance and control programme for infectious laryngotracheitis (ILT) and avian rhinotracheitis (ART) in poultry flocks in Norway



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The surveillance and control programme for infectious laryngotracheitis (ILT) and avian rhinotracheitis (ART) in poultry flocks in Norway

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Surveillance in 2007 did not detect infectious laryngotracheitis (ILT) in chicken. The programme for avian rhinotracheitis was not active in 2007.

Introduction

The Norwegian Food Safety Authority is responsible for the implementation of the surveillance and control programmes for infectious laryngotracheitis (ILT) and avian rhinotracheitis (ART) in chicken and turkey flocks, respectively. Started in 1998, these programmes are based on serological investigations. The National Veterinary Institute in Oslo is responsible for the planning, laboratory investigations and the reporting components of the programmes.

ILT is a severe respiratory disease in chickens, and was first described in the USA in the 1920s. Since then, the disease has been seen in most parts of the world, including most European countries (1). However, ILT has not been diagnosed in commercial chicken flocks in Norway since 1971, although clinical outbreaks of ILT have occurred sporadically in Norwegian hobby flocks since 1998 (2). ILT is an OIE listed disease, and in Norway, it is a notifiable list A-disease.

Aims

The aims of the national surveillance and control programme for ILT is to document that the commercial poultry populations in Norway are free of this infection, and to contribute to the maintenance of this status.

Materials and methods

According to the national regulations for certification of poultry breeding farms (3), blood samples from 60 birds must be taken at least once a year from every breeding flock at the farms. These blood samples are to be tested for Newcastle disease, as Norway is a non-vaccinating country. Thirty of the 60 samples from chicken flocks are included in the national surveillance and control programme for ILT.

ILT

An indirect ELISA-test produced by Synbiotics, was used for the testing of antibodies against the ILT-virus.

Results

All 4,318 blood samples analysed in the surveillance programme for ILT were negative.

Table 1 shows the number of farms, flocks and birds tested in the different poultry production types in the national surveillance and control programme for ILT in 2007.

Discussion

Antibodies against ILT are often found in samples from hobby flocks. It is thus of major importance that commercial poultry flocks are kept strictly isolated from hobby birds and backyard poultry flocks. The noncommercial bird populations are complex, and pose a problem for the control of this contagious poultry disease due to the difficulties associated with performing systematic disease surveillance in such bird populations.

Table 1. Number of farms, flocks and birds tested in the surveillance and control programmes for ILT in poultry in 2007

Production	No. of farms tested	No. of flocks tested	Total no. of birds tested	Flocks with seropositive samples
Broiler	77	123	3,749	0
Layer	8	16	569	0*
Total	85	139	4,318	0*

* A sample from one animal was inconclusive

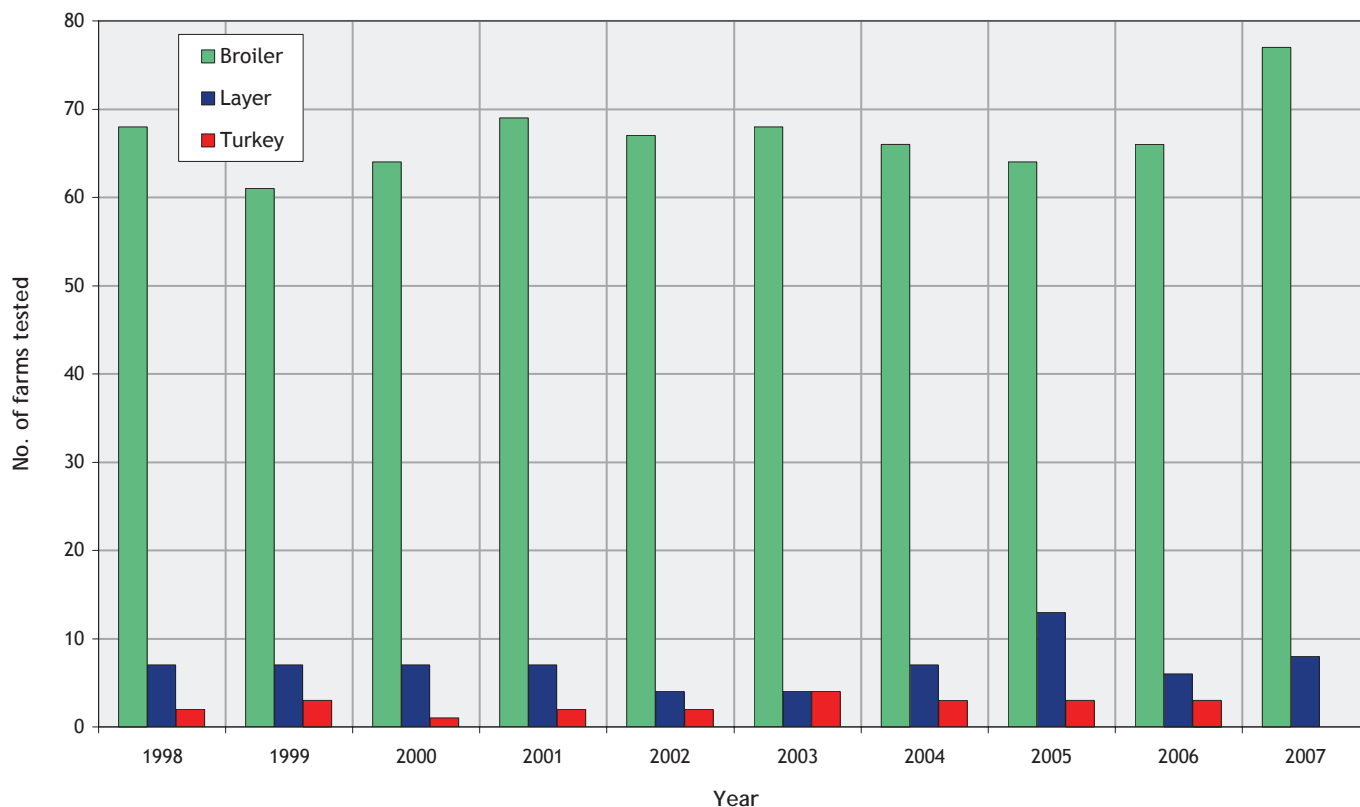


Figure 1. The number of farms tested in the surveillance and control programmes for infectious laryngotracheitis (ILT) in poultry flocks in Norway during the time period 1998-2007.

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The surveillance and control programme for *Campylobacter* in broiler flocks in Norway



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The surveillance and control programme for *Campylobacter* in broiler flocks in Norway

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Campylobacter sp. was detected in 5.7 % of the 4,145 flocks investigated in 2007.

Introduction

Campylobacteriosis is currently the most commonly reported bacterial infectious disease in the Norwegian human population. In almost half of the cases, the infection is acquired in Norway. Consumption of poultry meat purchased raw has been identified as a significant risk factor together with drinking undisinfected water, eating at barbecues, occupational exposure to animals, and eating undercooked pork (1).

The action plan regarding *Campylobacter* in Norwegian broilers has been running since spring 2001 (2, 3, 4). The action plan is a joint effort involving several stakeholder groups from "stable-to-table". The Norwegian Zoonosis Centre at the National Veterinary Institute coordinates the programme, and is responsible for the collection and analyses of data and the communication of results.

The action plan consists of a surveillance programme including all Norwegian broiler flocks and a follow-up advisory service to farms with *Campylobacter* positive flocks. The action plan is updated regularly and the details for 2007 together with other information regarding the action plan, including the results from a product survey performed in 2006-2007 regarding turkey and broiler products can be found at www.vetinst.no.

Aim

The objective is to reduce the human exposure to thermophilic *Campylobacter* through Norwegian broiler meat products.

Materials and methods

Surveillance

All Norwegian broiler flocks that are slaughtered before 50 days of age are sampled pre-slaughter by the owner maximum four days before slaughter. The sample consists of ten pooled swabs from fresh faecal droppings. The samples

are submitted to the National Veterinary Institute's laboratory in Trondheim, where they are analysed by PCR. The carcasses from the positive flocks are either heat treated or frozen for a minimum of three weeks before being marketed. All flocks are tested upon arrival at the slaughter plant by sampling ten caeca per flock at the slaughter line. Contents of the ten caeca are pooled into one sample and analysed by local laboratories. Samples are analysed using the method described in NMKL no. 119, 1990, with minor modifications. Carcasses from flocks which are positive only at the slaughterhouse sampling are not automatically heat treated or frozen.

Follow-up of positive flocks

An advisor from the poultry industry or the Municipal Food Safety Authority should pay a follow-up visit to *Campylobacter* positive broiler farms. The visit should result in measures on the farm to reduce the risk of flocks becoming contaminated with *Campylobacter* in the future.

Results

A total of 4,145 flocks from 555 broiler farms were tested. These flocks were slaughtered in 4,268 batches (a batch is defined as all chickens from one flock slaughtered on the same day). A total of 116 flocks were slaughtered in two or more batches. In addition, one flock was slaughtered at two different slaughterhouses on the same day.

Overall, 237 (5.7 %) flocks (246 (5.8 %) batches) were positive for *Campylobacter* sp. either at pre-slaughter, at slaughter, or at both sampling times. For positive slaughterhouse samples confirmed by the reference laboratory, *C. jejuni* was isolated from 87.7 %, *C. coli* from 11.2 % and *C. lari* from 1.1 %.

Of the 237 positive flocks, 179 (75.5 %) tested positive at pre-slaughter sampling. These carcasses were frozen or heat treated in order to prevent contaminated poultry from reaching the general market as fresh broiler meat. A total of 26 flocks tested positive at pre-slaughter and negative at slaughter.

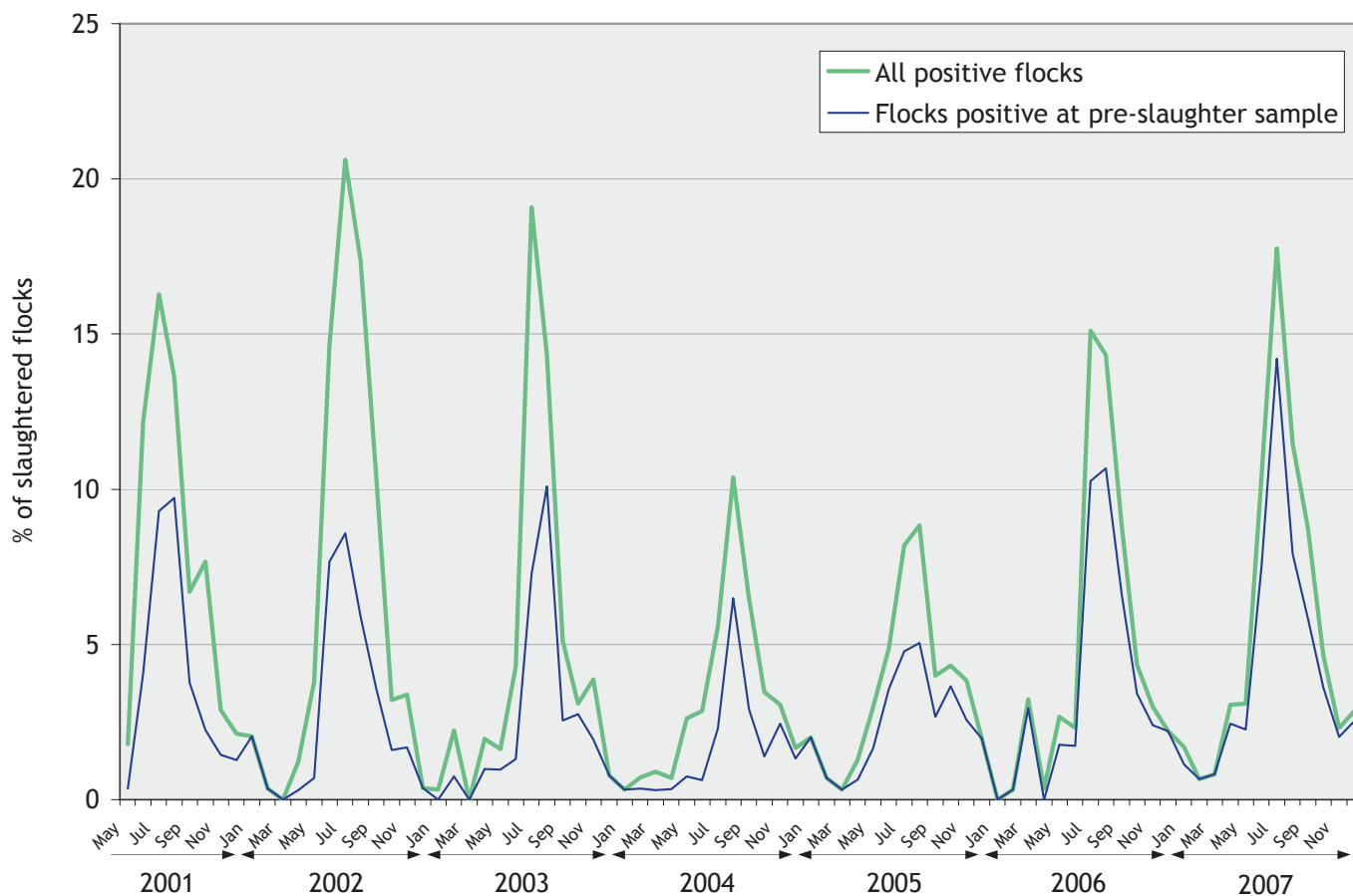


Figure 1. Monthly incidence of *Campylobacter* sp. in slaughtered Norwegian broiler flocks from May 2001 throughout 2007.

The positive flocks came from 154 (27.7 %) of the tested farms. These 154 farms were distributed as follows regarding number of positive events (a positive event is defined as one positive flock or as several parallel positive flocks from different houses):

- A total of 106 had only one positive event (producing 108 (45.6 %) positive flocks).
- A total of 30 had two positive events (producing 66 (27.8 %) positive flocks).
- A total of 14 had three positive events (producing 44 (18.6 %) positive flocks).
- A total of four had four or more positive events (producing 19 (8.0 %) positive flocks).

The 48 farms with two or more positive events in 2007 (8.6 % of all farms) accounted for 54.4 % of all positive flocks.

The proportion of *Campylobacter* positive flocks and the proportion of flocks testing positive already at the pre-slaughter sample has varied substantially since the action plan was launched (Figure 1). Regional differences in the proportions of positive flocks and farms are shown in Table 1 and Figure 2.

In 2007, farms not having distinct flocks but a more or less continuous production were included with monthly samples. A total of 15 out of 17 samples from such farms were positive for *Campylobacter* sp. These results are not included in the summarised data in this report.



Table 1. *Campylobacter* positive farms and flocks by county in Norway 2007

County	Farms			Flocks		
	N	No. positive	%	N	No. positive	%
Østfold	88	19	22.0	729	36	5.0
Akershus	14	5	36.0	102	11	11.0
Hedmark	122	48	39.0	949	74	8.0
Oppland	8	1	13.0	45	1	2.0
Buskerud	12	5	42.0	79	6	8.0
Vestfold	36	11	31.0	249	15	6.0
Telemark	3	0	0	15	0	0
Aust-Agder	3	0	0	21	0	0
Vest-Agder	3	1	33.0	24	3	13.0
Rogaland	99	28	28.0	810	40	5.0
Hordaland	12	0	0	92	0	0
Møre og Romsdal	3	1	33.0	23	1	4.0
Sør-Trøndelag	66	14	21.0	433	20	5.0
Nord-Trøndelag	86	21	24.0	572	30	5.0
Total	555	154	27.7	4,145	237	5.7

Discussion

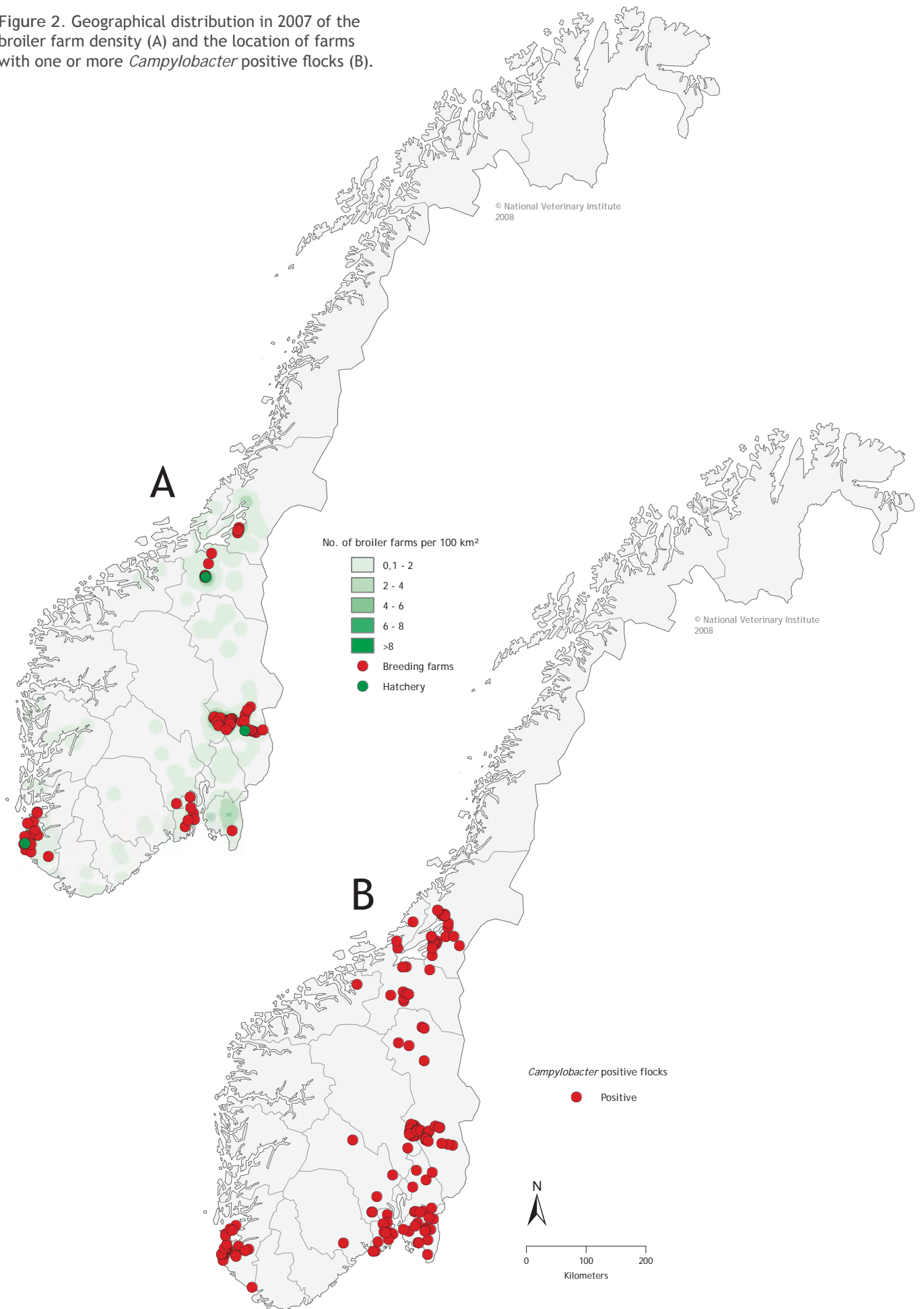
Most farmers are loyal to the guidelines regarding time of pre-slaughter sampling. A total of 260 (6.1 %) slaughter batches for which time of sampling was given were sampled earlier than four days before slaughter, mostly in connection with holidays. In total, less than 2 % of the flocks were not sampled according to the action plan (i.e. sampled only once).

In the first years of the action plan, when the pre-slaughter samples were taken approximately eight days before slaughter, approximately 50 % of the positive flocks were detected only at slaughter. From 1 March 2005 onwards, all flocks had to be sampled maximum four days before slaughter. This contributed to the fact that in 2005, 31.8 % of the positive flocks were detected only at slaughter, in 2006 this was further reduced to 25.3 %, and in 2007 the corresponding figure was 24.5 %. This means that of the more than three million broilers positive for *Campylobacter* in 2007, more than 2.3 millions were heat treated or frozen before going to retail.

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Figure 2. Geographical distribution in 2007 of the broiler farm density (A) and the location of farms with one or more *Campylobacter* positive flocks (B).



Annual report 2007

The surveillance and control programme for viral haemorrhagic septicaemia (VHS) and infectious haematopoietic necrosis (IHN) in Norway

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The surveillance and control programme for viral haemorrhagic septicaemia (VHS) and infectious haematopoietic necrosis (IHN) in Norway

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VHS virus (VHSV) and IHN virus (IHNV) were not detected on any of the sites tested in the 2007 surveillance. However, in November 2007 VHS was diagnosed during investigation of abnormal mortality in rainbow trout in sea cages. The site in question tested negative for VHSV and IHNV in the 2006 surveillance.

Introduction

VHS and IHN are two important rhabdovirus infections in salmonid fish (1). VHS is considered an important disease due to its clinical and economic consequences. VHS occurs in several fish species, but is most frequently recorded in rainbow trout (*Oncorhynchus mykiss*). Based on nucleic acid sequence analysis, four major VHSV genotypes have been identified (1). VHSV genotype III has been isolated from several marine fish species in North European coastal waters (the English Channel, the Baltic Sea, the North Sea, the Norwegian Sea, Skagerak) and from VHS in turbot (*Schophthalmus maximus*) (1, 4). VHSV genotype IV has caused disease in several wild fish species in the Pacific, the Great lakes in North America and in farmed Japanese flounder (*Paralichthys olivaceus*) (2, 3, 5, 6).

IHN has led to serious economic losses in farmed rainbow trout and salmon, and the disease has also had an impact on wild populations of Pacific salmon. The disease was first described in Europe in 1985, in France and Italy. In 2006, IHN was diagnosed in rainbow trout in the Czech Republic and Slovenia. The disease has never been diagnosed in Norway. For more detailed information on VHS and IHN, reference is made to previous reports of the surveillance and control programmes (7, 8).

In 1994, Norway obtained disease free status for VHS and IHN based on health control information and virological examinations carried out in fish farms since 1967 (9). Norway has operated a surveillance programme in accordance with Directive 91/67 EEC (10) since the autumn of 1994. The Norwegian Food Safety Authority is responsible for the programme and for inspection and sampling. The National Veterinary Institute is responsible for laboratory procedures and analyses in accordance with Commission Decision 2001/183/EC (11) and prepares the report.

Aim

The aim of the programme is to document the absence of VHSV and IHN virus (IHNV) in Norwegian fish farms and maintain Norway's approved zone status.

Materials and methods

Sampling

Sampling and inspection is carried out by the District Offices of the Norwegian Food Safety Authority. The yearly sampling schedules covers approximately 50 % of farms (sites) producing susceptible species. According to Directive 91/67/EEC (10) and Decision 2001/183/EC (11), all fish farms producing species susceptible to VHS and/or IHN should be sampled over a two-year period. Inspection and sampling is carried out when the water temperature is below 14 °C. Thirty fish are sampled from each site. Organ samples for virological examination for VHSV and IHNV must contain spleen, anterior kidney and either heart or brain. For brood fish, ovarian fluid can be included. Samples from ten fish may be pooled to form a single sample. For fry (<4 cm), samples must include head and viscera, and five individuals may be pooled to form a single sample. In farms containing rainbow trout, all samples must be collected from this species. In farms without rainbow trout, the samples must be distributed equally among all susceptible species. Samples are collected in transport medium for virological analysis and sent to the National Veterinary Institute for analysis.

Analysis

Samples must arrive at the laboratory within 48 hours of sampling. According to the specifications of Decision 2001/183/EC (11), the samples must be kept cool during transport; the temperature shall not exceed 10 °C. At arrival, samples are homogenised and suspended in the original transport medium and centrifuged at 4 °C. Infectious pancreatic necrosis virus (IPNV) is ubiquitous in Norwegian fish farms. All samples are therefore neutralised with IPNV antiserum prior to inoculation of the cells, since an IPNV infection might mask an infection with VHSV- or IHNV in cell culture. Neutralized homogenate is then inoculated on BF-2 and EPC cells as specified (11). Inoculated cells are incubated at 15 °C for 7 to 10 days and investigated for cytopathic effect (CPE). If CPE is observed, virus is identified as specified by Decision 2001/183/EC and recommendations from EU reference laboratory for fish diseases in Århus, Denmark.

Table 1. Different categories of fish analysed for VHS virus and IHN virus in 2007

	Fry - smolt		On-growing		Brood fish		Total	
	No. sites	No. of fish sampled	No. sites	No. of fish sampled	No. sites	No. of fish sampled	No. sites	No. of fish sampled
Atlantic salmon (<i>Salmo salar</i> L.)	111	3,650	237	7,090	11	330	359	11,070
Rainbow trout (<i>O. mykiss</i>)	12	390	41	1,230	1	30	54	1,650
Brown trout (<i>Salmo trutta</i> L.)	13	520	-	-	-	-	13	520
Sea trout (<i>S. trutta</i> L.)	2	60	-	-	-	-	2	60
Arctic char (<i>Salvelinus alpinus</i> L.)	3	80	1	30	1	30	5	140
Total	140*	4,730	282*	8,470	12*	390	434*	13,590

* The total number of sites may be less than the sum of sites per species as some sites produce more than one species.

Table 2. Number of farms and species analysed for VHS virus and IHN virus during the time period 1995-2007

Farm types	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
<i>Per production type</i>													
Hatcheries	71	169	162	30	27	45	30	32	54	51	125	104	140
On-growing farms	207	340	346	478	527	447	508	414	429	303	280	276	282
Brood stock farms				2	3	7	7	14	2	9	14	15	12
<i>Per species</i>													
Farms with Atlantic salmon	225	425	392	417	462	382	408	372	387	295	345	316	359
Farms with rainbow trout	31	63	69	66	62	83	93	61	74	48	61	49	54
Farms with brown trout	15	13	38	21	27	28	24	23	24	21	8	24	13
Farms with char	1	7	6	5	4	10	8	9	9	5	7	8	5
Farms with turbot	6	1	1		1	1	4		1	1		1	
Farms with sea trout				2	3	2	4	1	2	2	2	2	2
Farms with brook trout				2		1	1	2	1	2			
Farms with relict Atlantic salmon				1						1			5
Total	278	509	506	510	554	494	534	468	498	375	417	392	434

Results

In 2007, a total of 1,369 pooled samples (13,690 individual fish) from 434 sites were examined (Table 1 and 2, Figure 1 and 2). VHSV and IHNV were not detected.

In samples from seventeen submissions, CPE appeared in the BF-2 cell cultures that could not be ascribed to neither IPNV nor VHSV as tested by virus neutralization test and reverse transcription polymerase chain reaction (RT-PCR), respectively. Further investigations of cell cultures exhibiting CPE by immunofluorescence tests and real-time RT-PCR (RRT-PCR) revealed the presence of salmonid alpha virus, the causative agent of pancreas disease (PD). One submission from a site in Hordaland consisted of samples from rainbow trout. The rest consisted of samples from Atlantic salmon, eleven from sites in Hordaland county, two from Sogn & Fjordane and three from Møre & Romsdal. Clinical PD was diagnosed in most of the sites either before or after submission of samples for VHS and IHN surveillance.

Discussion

In 2007, increased mortality was observed in a rainbow trout sea sites in Norway, and clinical signs characteristic of VHS were observed. VHS was diagnosed by histopathology, immunohistochemistry, RT-PCR and cell culture in combination with IFAT and by RT. VHSV genotype III was identified by sequencing of the G-gene. Genotype III previously only isolated from marine species, has thus far been considered nonpathogenic to rainbow trout. At a later stage, VHSV was detected in three additional sites located in close proximity to the site with the primary outbreak. Two of the affected sites were included in the 2007 surveillance programme, but was negatively tested for VHSV. The other two sites had similarly been tested in 2006 without positive VHSV findings. (8). In addition, continuous passive surveillance of Norwegian farmed fish health has not revealed any cases of VHS since 1974. Increased mortality and clinical health problems in farmed fish are always investigated for the presence of notifiable

diseases, including VHS (12). The VHS outbreak in 2007 illustrates the limitations of surveillance programmes, and emphasizes the importance of thorough investigation of clinical disease and increased mortality.

In 2007, 12 pooled samples from 4 sites were rejected, compared to 18 pooled samples from 6 sites in 2006.

The isolation of salmonid alpha virus in samples received for surveillance of VHSV and IHNV may represent a problem for the detection of the two rhabdoviruses. Presently, neutralising antibodies against salmonid alpha virus are not available and it is not known whether replication of salmonid alpha virus will inhibit replication of VHSV in the BF-2 cells (13). Therefore, tissue homogenates of salmonid alpha virus-positive samples are always examined for VHSV by RT-PCR to ensure the absence of this virus. All seventeen sites where salmonid alpha virus was detected are located in the region of Hordaland/Sogn & Fjordane and Møre & Romsdal where PD is now considered endemic. The number of PD outbreaks in Norway has increased yearly, and the disease is spreading along the coast. Thus, it is likely that the problem of salmonid alpha virus interfering with the surveillance of VHS and IHN will persist.

Conclusion

Based on the examinations carried out in the surveillance and control programme for VHS and IHN at the National Veterinary Institute in 2007, no suspected or confirmed cases of VHSV or IHNV were registered. However, due to the outbreak of VHS in 2007, Norway can no longer be considered as one VHS free zone.

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Figure 1. Geographical distribution of the density of tested farms with Atlantic salmon (A) and with rainbow trout (B) in the surveillance and control programme for VHS and IHN in 2007.

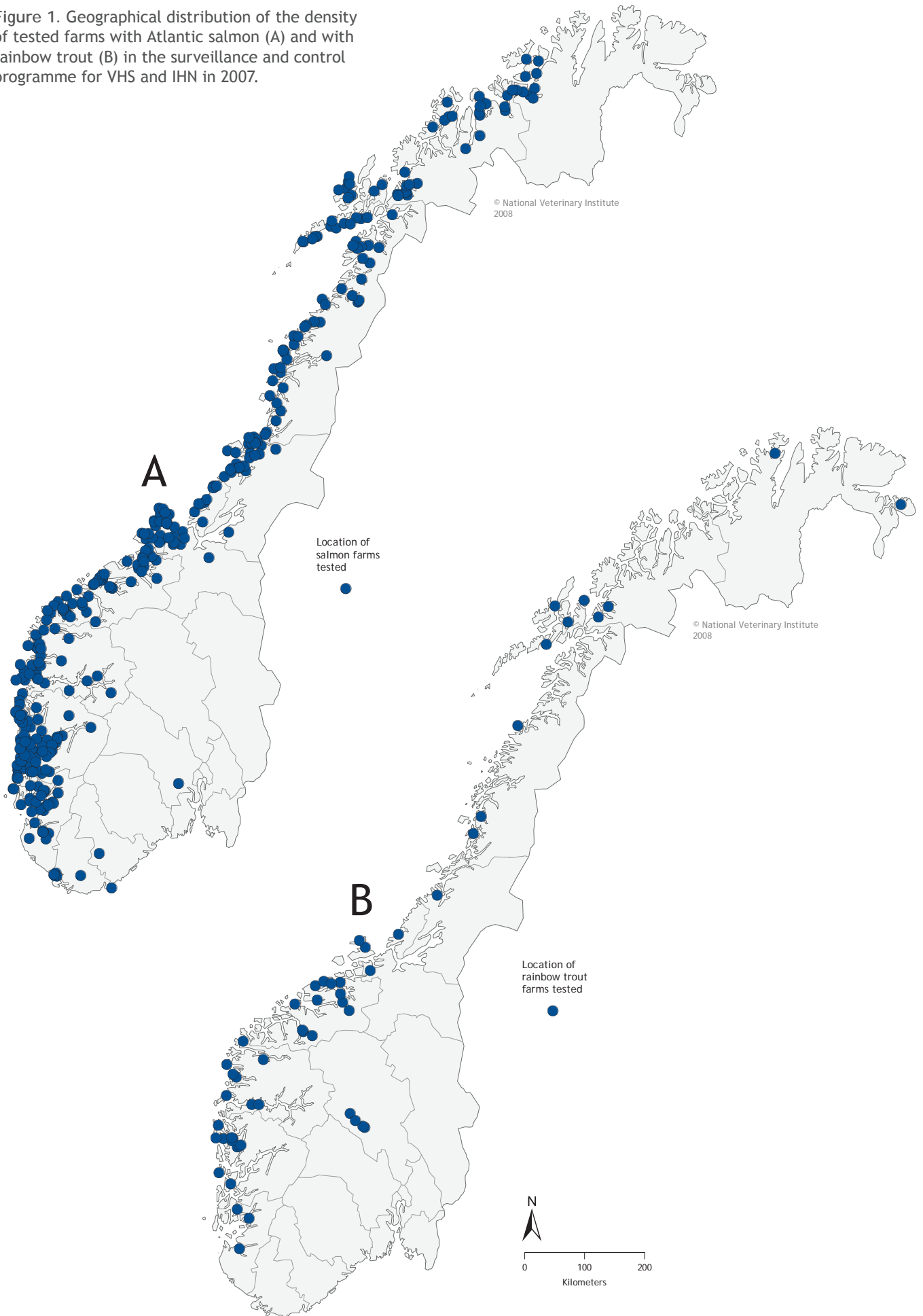
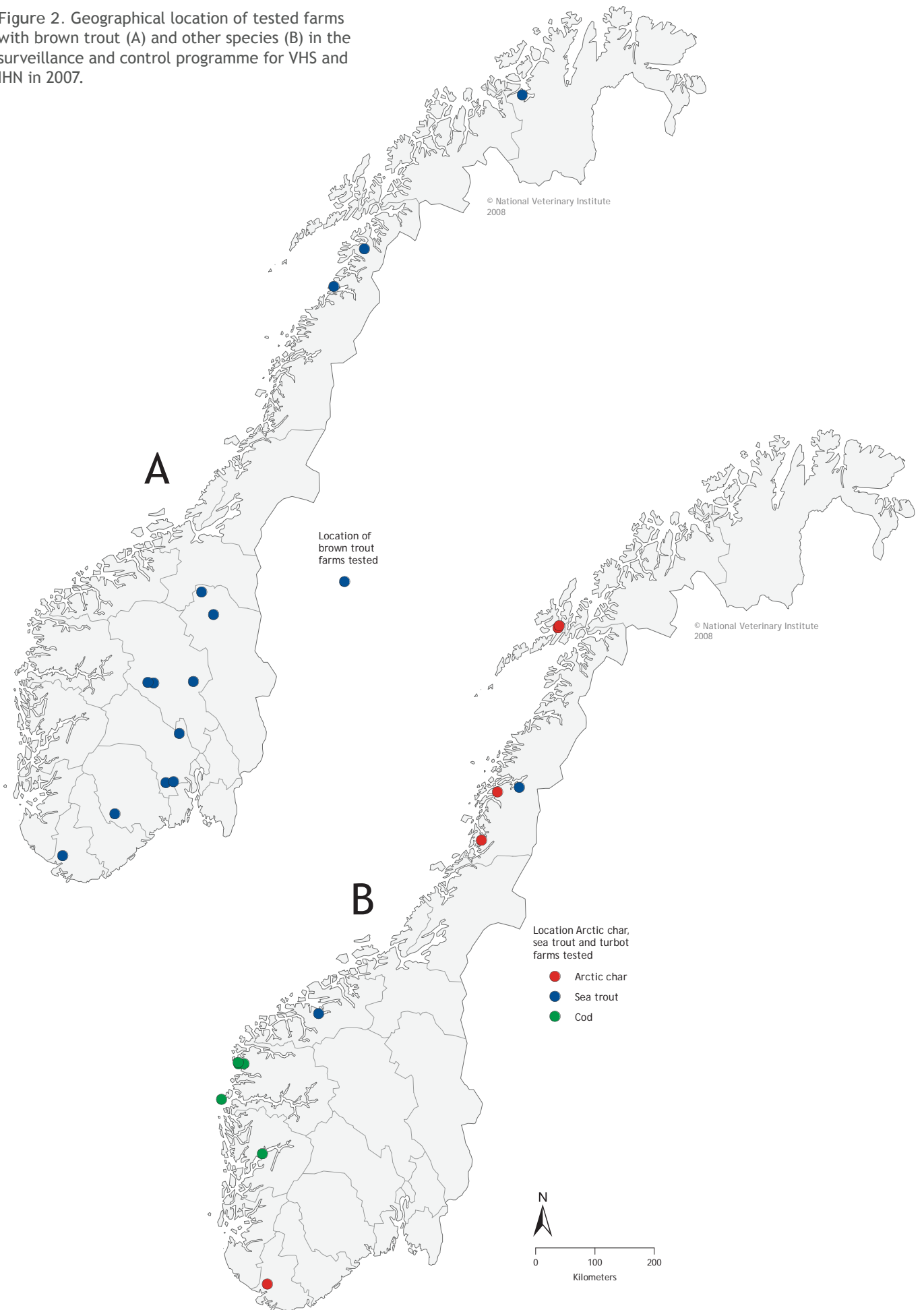


Figure 2. Geographical location of tested farms with brown trout (A) and other species (B) in the surveillance and control programme for VHS and IHN in 2007.



Annual report 2007

The surveillance and control programme for *Gyrodactylus salaris* in Atlantic salmon and rainbow trout in Norway

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Responsible institutions
National Veterinary Institute
Norwegian Food Safety Authority

The surveillance and control programme for *Gyrodactylus salaris* in Atlantic salmon and rainbow trout in Norway

Tor Atle Mo, Kari Norheim, Peder Andreas Jansen

In 2007, Gyrodactylus salaris was not detected in any new rivers or farms with salmon or rainbow trout.

Introduction

During the period of 1975 to 2006, *Gyrodactylus salaris* has been detected in Atlantic salmon fingerlings/parr from 46 rivers, 13 hatcheries/farms with Atlantic salmon parr/smolts and 26 hatcheries/farms with rainbow trout (*Oncorhynchus mykiss*). The policy of the Norwegian Authorities is to eradicate *G. salaris* from infected rivers and farms. In farms, the procedure is to eliminate the hosts (salmon and rainbow trout). By doing so, the parasite is also eliminated because it does not have specialized free-living stages or intermediate hosts. In rivers, acidified aluminium sulphate is now the main chemical used to kill the parasite but not the fish host. By 31 December 2007, *G. salaris* was confirmed to be eradicated from 15 rivers and from all hatcheries/fish farms. The eradication has not yet been confirmed for six additional rivers. The parasite is known or suspected to be present in 25 rivers in Norway.

G. salaris is a notifiable (Group B) disease in Norway. It is listed as "Other significant disease" in the World Organisation for Animal Health (OIE). Surveillance of *G. salaris* has been performed in Norwegian salmon rivers since late 1970s (1, 2, 3, 4, 5, 6). Surveillance is not performed in rivers or farms known to be infected unless measures for eradication of the parasite have just been carried out or other circumstances that justify the need for surveillance.

The Norwegian Food Safety Authority is responsible for sampling rivers and fish farms although County Environmental Departments and other institutions/companies are commissioned to do the actual sampling. The National Veterinary Institute in Oslo (the OIE reference laboratory for the disease) is responsible for examination of samples and taxonomical studies if *Gyrodactylus* is detected.

Aim

The surveillance programme aims to detect and trace any spread of *Gyrodactylus salaris* to new river systems or fish farms (or to rivers and farms cleared of infection).

Materials and methods

At least 30 Atlantic salmon are sampled from each river. Fingerlings/parr/smolts are caught by means of electrical fishing gear. In some of the large rivers, sampling is done at different dates and at different sampling stations. The fish are killed and then preserved as whole in 96 % ethanol. At least 30 Atlantic salmon or 60 rainbow trout are sampled from each farm. Farmed fish are caught by net. The fish are killed, fins (except adipose fin) are cut off and preserved in 96 % ethanol. The samples are sent to the National Veterinary Institute in Harstad where body surface and fins are examined for wild fish while fins only are examined for farmed fish. Samples are examined by a magnifying microscope (10-15 times magnification).

Results

Altogether, 3,675 specimens from 97 rivers and 2,700 specimens from 83 farms were examined in 2007 (Tables 1 and 2). No new infection with *G. salaris* was detected in any river or farm. *G. salaris* reappeared in one river after treatment with a combination of Aluminium Sulphate and rotenone.

Table 1. Rivers examined for *Gyrodactylus salaris* in 2007

County	No. of rivers	Species	No. of fish examined	Detections
Finnmark	7	Atlantic salmon	820	0
Troms	6	Atlantic salmon	195	0
Nordland	9	Atlantic salmon	243	0
Nord-Trøndelag	11	Atlantic salmon	338	0
Sør-Trøndelag	2	Atlantic salmon	63	0
Møre og Romsdal	23	Atlantic salmon	672	0
Sogn og Fjordane ¹	15	Atlantic salmon	552	0
Hordaland	-	Atlantic salmon	-	0
Rogaland	7	Atlantic salmon	241	0
Vest-Agder	5	Atlantic salmon	157	0
Aust-Agder	2	Atlantic salmon	96	0
Telemark	2	Atlantic salmon	16	0
Vestfold	1	Atlantic salmon	66	0
Buskerud	1	Atlantic salmon	31	0
Akershus	3	Atlantic salmon	93	0
Oslo	2	Atlantic salmon	62	0
Østfold	1	Atlantic salmon	30	0
Total	97		3,675	0

¹ 1 reappearance after treatment with a combination of Aluminium Sulphate and rotenone.

Table 2. Fish farms examined for *Gyrodactylus salaris* in 2007

County	No. of farms	Species	No. of fish examined	Detections
Troms	6	Atlantic salmon	180	0
Nordland	11	Atlantic salmon	330	0
Nord-Trøndelag	9	Atlantic salmon, rainbow trout	300	0
Sør-Trøndelag	11	Atlantic salmon, rainbow trout	390	0
Møre og Romsdal	15	Atlantic salmon, rainbow trout	480	0
Sogn og Fjordane	7	Atlantic salmon	210	0
Hordaland	13	Atlantic salmon	390	0
Rogaland	9	Atlantic salmon, rainbow trout	330	0
Vest-Agder	1	Atlantic salmon	30	
Aust-Agder	1	Atlantic salmon	30	
Telemark	-	-	-	-
Buskerud	1	Atlantic salmon	30	0
Total	83		2,700	0

Conclusion

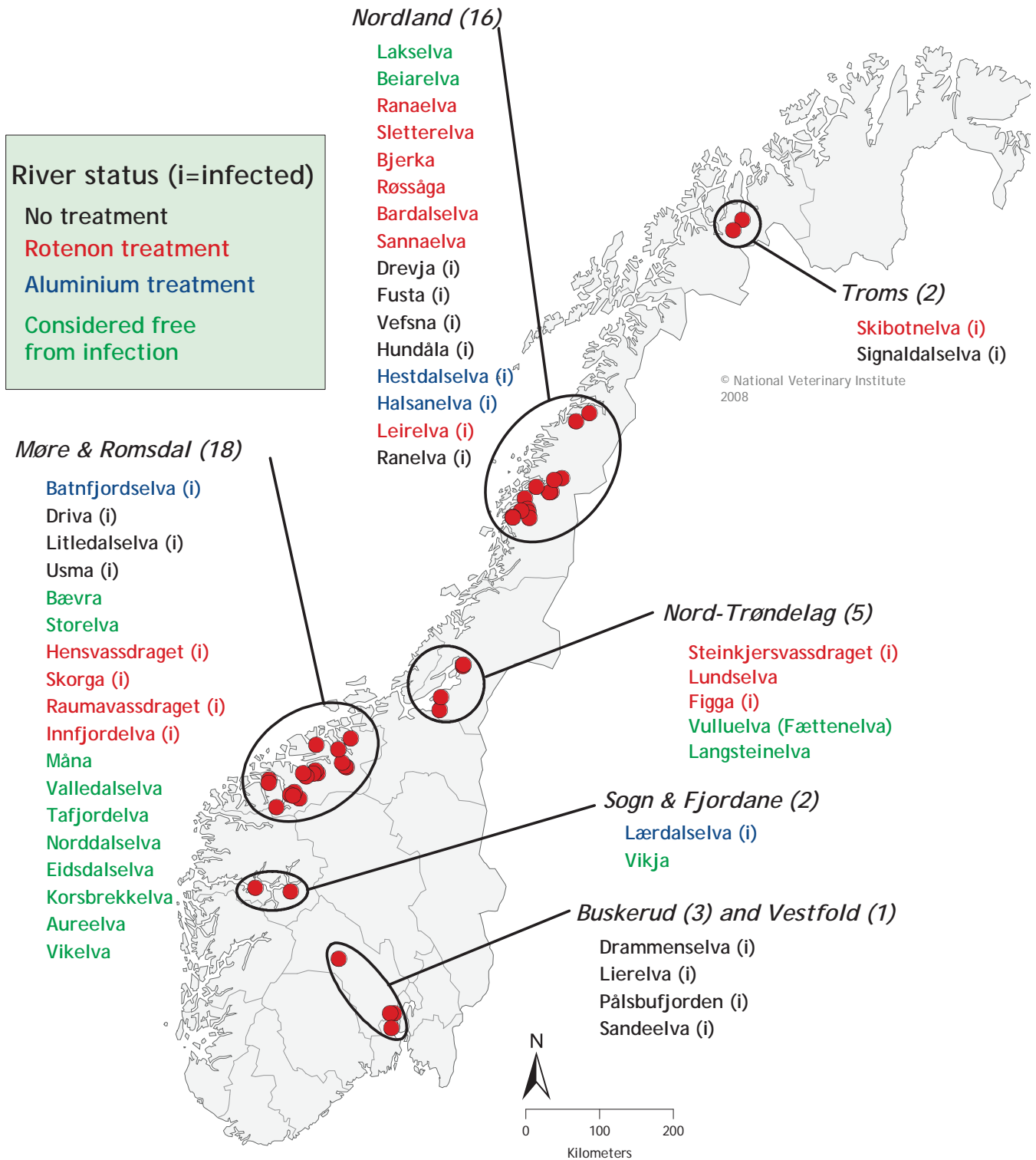
G. salaris did not extend its range to any rivers or fish farms.

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Gyrodactylus salaris detections 1975 - 2007



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The surveillance and control programme for bacterial kidney disease (BKD) in Norway

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Responsible institutions
National Veterinary Institute
Norwegian Food Safety Authority

The surveillance and control programme for bacterial kidney disease (BKD) in Norway

Ole Bendik Dale, Tore Håstein, Liv Jorun Reitan, Randi Faller, Torbjørn Endal, Marianne Heum, Terje Steinum

No BKD positive salmon were detected by the surveillance programme in 2007.

Introduction

Bacterial kidney disease (BKD) is a chronic disease of salmonid fish caused by *Renibacterium salmoninarum*. In 1980 the first five cases of BKD were found in Norway. The National Veterinary Institute has diagnosed altogether 369 outbreaks of BKD from 1980 to 2006 (Figure 1). In the farming industry the number of cases peaked in 1990 when 60 sea water farms had disease outbreaks. Since then, a steady decrease in number of outbreaks has been achieved and for 2006 and 2007, no BKD cases were found.

As no satisfactory treatments or vaccines to control BKD exist, bio-security measures are necessary. As *Renibacterium* can be transmitted vertically from one generation to the next inside the eggs, one of the most essential steps is to keep brood stock free of the infection. In the early 1990'ies populations were selected for breeding after extensive screening by visual inspection on the slaughter of sister groups. Later, systematic disease surveillance of brood fish has resulted in the culling of only two major brood fish populations. A key element to the control BKD at low cost is to perform the internal control of the brood fish populations during spring and summer before sexual maturation in time for replacement of the stock from BKD free populations. Further, smolts positive for BKD have not been allowed to be transferred to sea water, and no movement of fish from sea water farms with BKD, other than for slaughter, has been allowed.

In Norway feral stocks still represent a reservoir of infection which is difficult to eliminate. Fortunately the BKD prevalence in brood fish has been very low as shown by an earlier screening (Table 1). However, even this level has occasionally led to widespread infections in mitigation hatcheries. If fish from such hatcheries are released into the waterways, the BKD situation may deteriorate. To avoid this, screening individual, wild brood fish and checking for overt BKD in the hatchery before release is important in endemic areas.

Aim

The surveillance and control programme started in 2005 and is designed to provide documentation of the BKD situation in Norway in order to establish standards regarding import of live material to Norway.

Materials and methods

The sampling is done by the Food Safety Authority, for the most part in conjunction with the sampling for VHS/IHN. The tissues sampled are predominantly from kidneys with the addition of the other internal organs from fingerlings. Extracts of the tissues are tested individually by a commercially available (BiosChile) ELISA utilising monoclonal antibodies specific for a bacterial surface protein (MSA or p57) (1, 2, 3). This protein is regarded as an important virulence factor. Positive samples in the ELISA are then tested for the presence of the gene coding for this protein by an in-house real-time PCR.

A higher number of samples from small fish have been discarded in 2007 compared to 2005-2006 partly because no pooling of samples has been done.

The routine testing was performed at the National Veterinary Institute, Oslo until august 2007 when it was transferred to the National Veterinary Institute, Bergen. The PCR analysis is still performed at the National Veterinary Institute, Oslo.

Table 1. Brood fish screening for BKD by ELISA 1992-96

Category	Number screened	% pos (n)
Commercial	1,041	0
Feral*	4,048	0,15 (6)

* 87 % Atlantic salmon, 12 % Rainbow trout, 1 % Arctic char.

Table 2. Results from BKD surveillance programme in Norway 2007

Year	No. of sites sampled	No. of samples	Samples discarded*	Negative	Positive
Oppland	7	239	37	202	0
Aust-Agder	2	60	15	45	0
Vest-Agder	3	120	31	89	0
Rogaland	11	351	95	256	0
Hordaland	29	913	127	786	0
Sogn og Fjordane	18	540	42	498	0
Møre og Romsdal	25	962	69	893	0
Sør-Trøndelag	17	514	64	450	0
Nord-Trøndelag	12	360	97	263	0
Nordland	19	689	133	556	0
Troms	6	180	131	49	0
Finnmark	1	15	-	15	0
Total	150	4,943	841	4,102	0

* Samples unfit for testing.

Table 3. Accumulated result from the BKD surveillance programme in Norway 2005-2007

Year	No. of sites sampled	No. of samples	Samples discarded*	Negative	Positive
2005-2006	54	1,994	77	1,887	0
2007	150	4,943	841	4,102	0

* Samples unfit for testing.

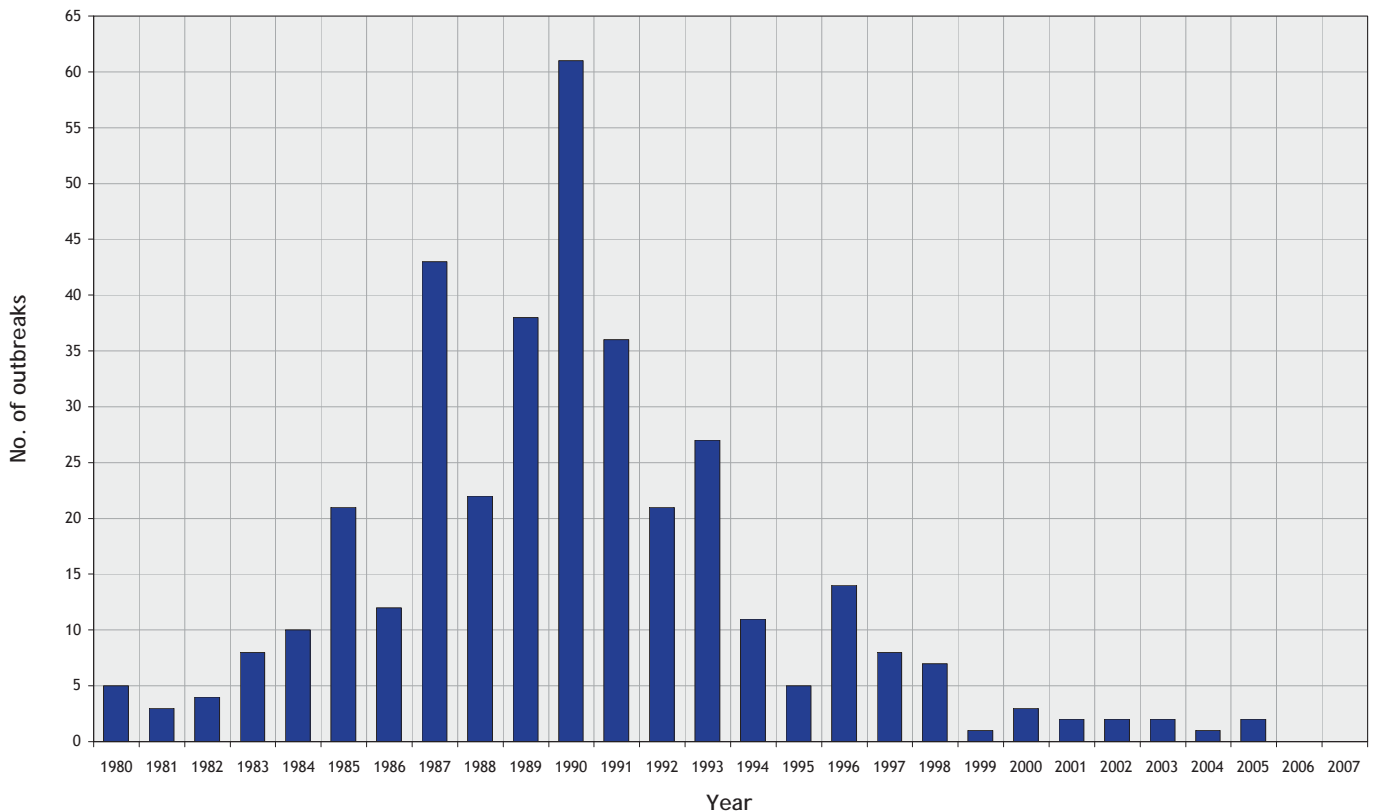


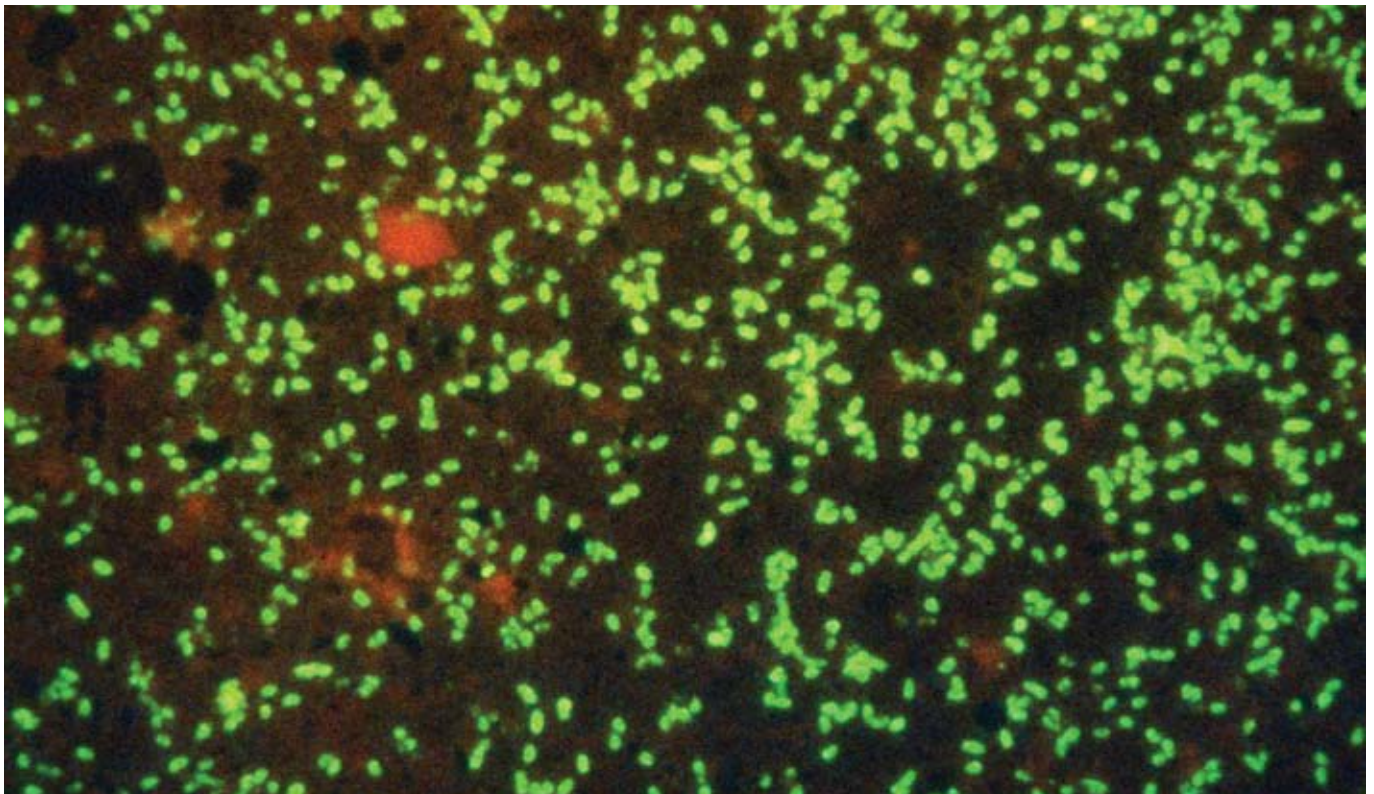
Figure 1. Number of BKD-outbreaks in Norway (feral and farmed populations) during the period 1980-2007.

Results

No BKD positive salmon were detected by the programme in 2007 (Table 2). This result is in keeping with the continuous disease diagnostics performed in the Norwegian aquaculture.

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Immunofluorescence using a monoclonal antibody (4D3) on a kidney smear from a salmon with overt BKD.

Annual report 2007

The surveillance and control
programme for bonamiosis
and marteiliosis in European
flat oysters (*Ostrea
edulis* L.) in Norway

Hege Hellberg
Kristin Aakvik Hopkins

Responsible institutions
National Veterinary Institute
Norwegian Food Safety Authority



The surveillance and control programme for bonamiosis and marteiliosis in European flat oysters (*Ostrea edulis* L.) in Norway

Hege Hellberg, Kristin Aakvik Hopkins

Bonamia sp. or Marteilia refringens were not observed in any of the samples tested in 2007.

Introduction

Notifiable diseases of European flat oyster (*Ostrea edulis* L.) population have not been reported so far in Norwegian waters (1, 2). This is in contrast to the situation in most other oyster producing European countries, where infectious diseases cause great losses in previously highly productive flat oyster populations (3). The protozoan parasites *Bonamia ostreae* and *Marteilia refringens* are identified as the main disease-causing organisms (4, 5) and bonamiosis has caused a collapse in flat oyster production in affected regions. *B. ostreae* has been detected as far north as Denmark. Bonamiosis was diagnosed in Limfjorden in 1980 but appears to have been successfully eradicated. In June 2006, *B. ostreae* was detected for the first time in Scotland and Wales. This led to the formation of two new surveillance zones. Bonamiosis and marteiliosis are classified as notifiable diseases by the OIE and as group A diseases in Norway.

In 2004 the entire coastline of Norway was recognized as an approved zone with regard to *Bonamia ostreae* and *Marteilia refringens* (6). The decision is based on the results of the surveillance and control programme for bonamiosis and marteiliosis which was initiated in the fall of 1995. The programme is based on directions given by the Commission Decision of November 6 2002 (7) referring to the current edition of OIE (World Organisation for Animal Health) "Manual of Diagnostic Tests for Aquatic Animals" (8), describing procedures for sampling and analysis of European flat oysters for bonamiosis and marteiliosis. The European flat oyster is found up to latitude 65°N in Norway, and wild populations are small and geographically limited due to climatic conditions. Since 1995, altogether 11 sites along the Norwegian coast have been included in the surveillance programme. However, not all sites have been included each year and selection of sampling sites has been based on the size of the wild populations and the structure of the oyster industry. In 2006, the sample sites were revised to ensure a more risk based approach. Two sites with no/very low activity were excluded, and a site with many previous transfers was included (sample site 11). Analysis of samples from this site will be prioritized. In 2007 a total of 5 sites were sampled.

The Norwegian Food Safety Authority is responsible for the programme, which involves inspection and sampling. The National Veterinary Institute in Bergen is responsible for laboratory procedures and analysis in accordance with the EU Decision, and also prepares the reports.

Aim

The aim of the programme is to document the absence of *Bonamia ostreae* and *Marteilia refringens* in Norwegian flat oysters and maintain Norway's approved zone status.

Materials and methods

Sampling

The sites are inspected, and 30 oysters are sampled per site during spring and autumn by the Food Safety Authority District Offices, or by persons appointed by the District Offices. Live oysters are shipped to the National Veterinary Institute in Bergen.

Table 1. Number of oysters per sample site tested for bonamiosis and marteiliosis in 2007

Sample site	Spring 2007	Autumn 2007	Total 2007
2	-	30	30
3	30	30	60
6	28	30	58
7*	-	-	-
9	30	30	60
11	30	-	30
Total: 6	118	120	238

Sites no 1, 4, 5 and 8 are no longer included.
* Site 7 could not be sampled as planned in 2007.

Analysis

Oyster shipments arrive at the laboratory within 24 hours of sampling. The oysters are prepared for histological examination according to the current edition of OIE "Manual of Diagnostic Tests for Aquatic Animals" (8). A cross section, containing gills, mantle, and digestive gland, is cut from the specimen and fixed in Davidson's fixative. Fixed samples are processed for histology, sectioned and stained with Haematoxylin-Eosin.

Bonamia sp. are normally found in the gills, mantle and in the connective tissue surrounding the digestive gland. *Marteilia refringens* is normally found in the epithelium of the digestive gland and tubula.

Results

During 2007, the National Veterinary Institute in Bergen received a total of 238 oysters from five sites (Table 1). All samples were examined. *Bonamia* sp. or *Marteilia refringens* were not observed. However, in some oysters from a wild population (sample site 3) small spherical or ovoid structures (2-5 µm wide) were observed within haemocytes. Paraffin embedded blocks and frozen gill tissue were sent to the "Community Reference Laboratory For Diseases of Bivalve Molluscs" (IFREMER) in France for additional testing. In Situ Hybridization and PCR was performed on the material in accordance with Commission Decision of November 6 2002 (7). *B. ostreae* was not diagnosed. No observations of abnormal mortality have been reported for 2007.

Discussion

The results from the initial two-year period provide support for freedom from bonamiosis and marteiliosis in the Norwegian flat oyster population (9). A sample size of 30 gives a 95 % probability for detecting a prevalence of at least 10 % in an infected population under the assumption of a 100 % sensitive test.

The present sampling programme covers the geographical area in which commercial production and harvesting is possible. The sampling procedure aims to be representative and the results from continuous surveillance support the findings that *Bonamia ostreae* and *Marteilia refringens* are not present in the Norwegian flat oyster population. Due to the findings of *Bonamia*-like structures in some

specimens from site 3, the sample size may be increased to 150 oysters, if the wild population can support additional sampling.

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Surveillance and control programmes in Norway

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