



**SURVEILLANCE OF ZOOBOTIC  
AND OTHER ANIMAL DISEASE  
AGENTS IN SWEDEN 2010**

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ANSTALT

# Introduction

The 2010 report, Surveillance of zoonotic and other animal disease agents in Sweden, describes active and passive surveillance on zoonotic, epizootic and other animal disease agents of current interest. The vast majority of diseases covered by the report are notifiable according to Swedish legislation, to be reported to either the Swedish Board of Agriculture, the National Food Administration or to the Swedish Institute for Communicable Disease Control.

Sweden has a very good situation with regard to infectious diseases in animals and is to date free from all relevant serious contagious diseases in food producing animals. Also, compared to most countries, the prevalence of *Salmonella* is low in food producing animals.

This favourable situation in food producing animals is probably due to several factors. The government in co-operation with a well organised animal industry and strong farmers associations has made it possible to control or eliminate diseases through surveillance and control programmes. Also, the geographical location of the country and the limited import of live animals have minimised the risk of introduction of serious infectious diseases.

However, this situation can change rapidly. The increase in tourism and trade as well as a new agricultural structure with bigger farms make future surveillance even more important in order to meet and manage any incursion that may occur. Likewise, it is of great importance to improve the surveillance systems for diseases already present in the country taking into account new approaches such as risk based or syndromic surveillance.



# The livestock population

Demographic data show that most farms are located in the southern and central parts of Sweden and animal husbandry is the major line of production. In the northern part of Sweden there are mostly small farms. During the last decades the number of holdings with livestock has decreased, whereas those remaining have increased in size. Most of the data below relates to the situation in June 2010. Maps 1-3 and Figure 1 give an overview of the livestock population in Sweden.

## CATTLE

There are 56,600 herds with a total number of 1,536,700 cattle (including dairy and suckler cows, heifers, bulls, steers and calves younger than one year) in Sweden (Map 1).

The number of dairy cows has decreased over a long period of time. In June 2010 there were 348,100 cows in 5,600 dairy herds with an average of 62 cows per herd. The number of suckler cows

has increased somewhat since 2007 and was 197,100 in June 2010. The average herd size was 16 cows. In total, approximately 424,000 adult cattle and 26,600 calves were slaughtered during 2010, which is a decrease compared to 2009.

## PIGS

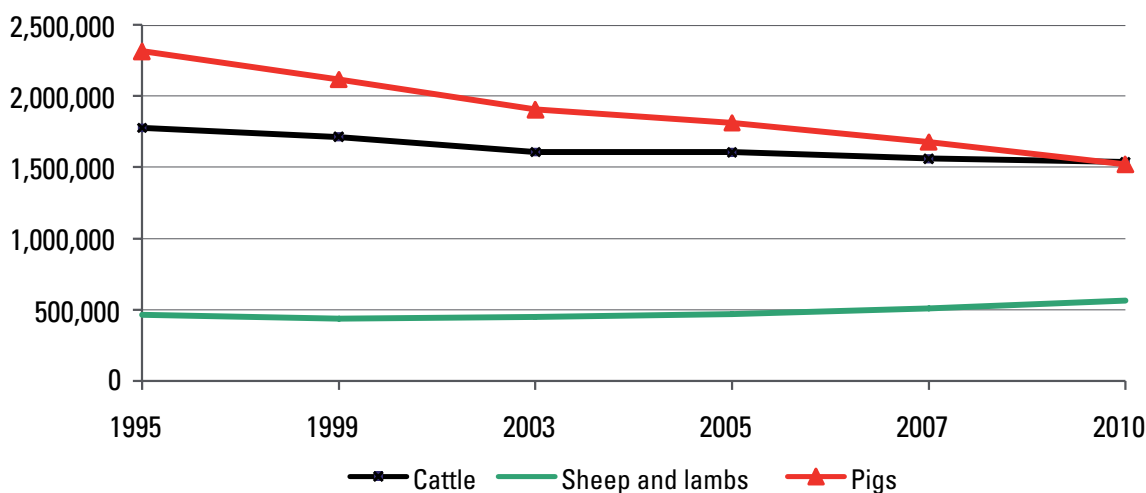
The number of boars and sows was 156,000 in June 2010, a decrease with 36% since 1995. The total number of pigs was 1,519,000 (Map 2). The number of herds with boars and sows was 1,000 in June 2010 and the average herd size 156. The farrowing interval was 2.2 times and artificial insemination was used in over 90% of the matings. The number of fattening pigs was 936,900 in 1,400 herds.

About 2.9 million pigs were slaughtered at an age of six to seven months during 2010.

## SHEEP

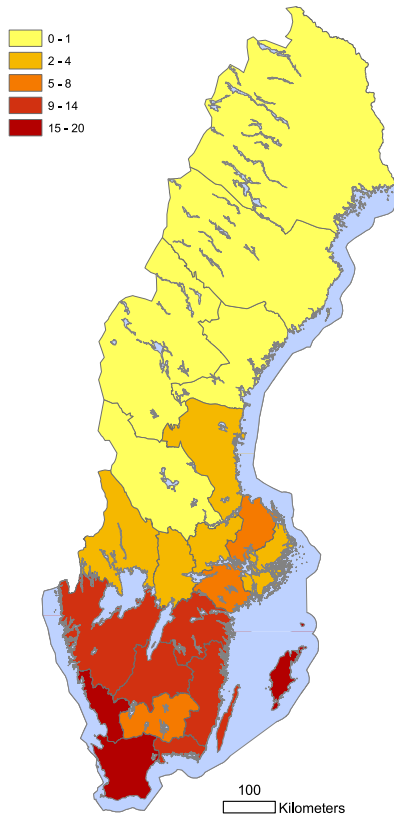
In 2010, there were 8,700 sheep holdings with a total of 273,100 ewes and rams, and 7,400 holdings with 291,800 lambs (Map 3). The number of ewes and rams has increased with about 40% since 1995. Sheep farms in Sweden are usually small-scale

Figure 1. Number of livestock 1995-2010.

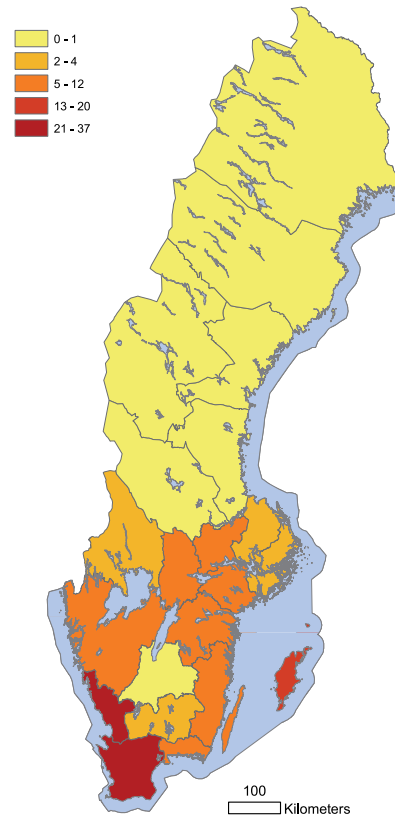


# SURVEILLANCE 2010

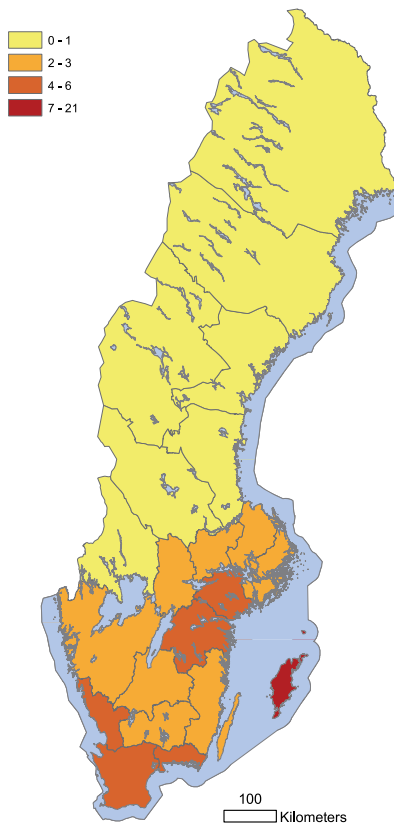
Map 1. Number of cattle per km<sup>2</sup> in 21 Swedish counties as of June 2010.



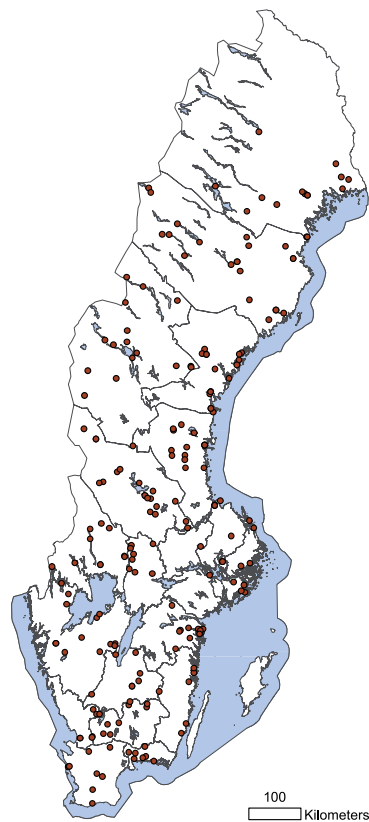
Map 2. Number of pigs per km<sup>2</sup> in 21 Swedish counties as of June 2010.



Map 3. Number of sheep per km<sup>2</sup> in 21 Swedish counties as of June 2010.



Map 4. Geographical distribution of fish farms, including places for caught of feral broodfish, in Sweden 2010.





enterprises but the herd size has been increasing in later years. The average number of adult sheep was 32 per herd.

Approximately 222,000 lambs were slaughtered in 2010.

## GOATS

In 2010 the reported number of goats and goat holders in Sweden were 11,135 and 1,659, respectively. Most holders only have a few goats and the number of holdings with  $\geq 10$  goats were 121.

## POULTRY

The number of holdings with broiler production is slowly decreasing. In 2010 there were 181 holdings. About 78.5 million chicken were sent for slaughter during the year.

There were approximately 6 million hens ( $\geq 20$  wks) in 3,700 holdings. The egg production was 86.2 million kilos during 2010 which is an increase compared to 2009. Note that for 2010 an estimate of 22.6% of sold quantity did not go through the whole sale trade.

There were between 100,000 and 130,000 turkeys in June 2010 on 100 holdings.

The production of geese and ducks is very small. Less than 10,000 geese and ducks were slaughtered during 2010.

## FISH AND MOLLUSKS

Sweden is a very small producer when it comes to aqua culture. The farms are evenly distributed over the country with a slight predominance to the middle and south parts, (Map 4). Rainbow trout is

the most frequently farmed fish followed by salmon, brown trout and char; salmon and brown trout mainly for restocking feral populations. Eels are imported from Severn in the UK through quarantine procedures for the restocking of feral populations. A minor part is farming of pike-perch and perch. The main tonnage is produced in the continental zone. Many of the farms are quite small compared to European standard, but there is a trend towards bigger units. During the last five to ten years there has been an increased foreign ownership, mainly Finnish.

Since 2009 there has been an increasing interest for aquaculture of mollusks. The dominating species, blue mussel, is farmed for consumption and for improving environmental conditions. Swedish oysters have been discovered in Europe as a high quality product and consequentially farming and harvesting of natural banks have grown in interest.

### Trade in live animals

In 2010, 262 pigs were brought into Sweden (from Norway and UK only), 42 cattle (from Denmark and Germany), 182 sheep (from Denmark) and 95 sheep from Finland (for slaughter).

The number of animals leaving the country during 2010 consisted of 526 cattle, 20,894 pigs of which 20,812 were sent for slaughter to Germany and 32 sheep were sent to Estonia.

Regarding the trade in poultry no figures are available.

### Animal databases

The Central Register of Holdings

The Swedish Board of Agriculture is responsible

for the Central Register of Holdings. Each holding is allocated a unique identification number (holding number). The register contains information concerning the holding of bovine animals, pigs, sheep, goats, laying hens and poultry with details on holding number, visiting address, type of production, capacity and the geographical coordinates (for pigs, sheep and goats) of the holding as well as the name, address and telephone number of the keeper. Concerning the laying hens, all egg producers with a capacity of at least 350 laying hens and all those selling eggs for consumption shall be registered. The register contains specific information about production method, capacity and the number of houses and sections on the holding.

### The central Database of movement

The Swedish Board of Agriculture is responsible for the Central Database of movements. It contains data on all holdings with pigs, sheep and goats and their movements between holdings. The data encompasses address and the holding number of the holding as well as name and telephone number of the keeper. The database contains information from the keeper and slaughterhouses. Keepers may register movements in the database via the Internet, or in paper form. Animals are registered in groups in the database when moved. Concerning sheep and goats both the keeper who dispatches the animals, and the keeper who receives the animals, are responsible for reporting to the database, not later than seven days after the movement.

### The Central Database for Bovine animals

The Swedish Board of Agriculture is responsible for the Central Database for Bovine animals (CDB), to which all bovine births, deaths and movements shall be reported. The keeper is responsible to report any changes within seven days of the occurrence. The purpose of the register is to allow swift and efficient tracing of a contagious disease, verification of the country of origin of a meat product, as well as control and administration of cross compliance. The system enables the scanning of animal disease forms into the data system.

### The Slaughter Register

The Slaughter Register (SLAKT) is administrated by the Swedish Board of Agriculture. The slaughterhouses are responsible for reporting all slaugh-

tered animals including wild game. The producer's organization number or personal code number must be reported for all species except wild game. The holding number of the supplier is compulsory information for all species except horses and wild game. Reports shall be made every week.

### The database for dairy herds

The Swedish Dairy Association is responsible for the database for dairy herds (Ko-databas). The database include milk recordings, fertility results and disease recordings for all animals at the dairy farm. It forms the bases for the development of different management tools used by the farmers, advisors and veterinarians. It is also a valuable tool for research concerning feeding, animal health, genetics etc. Approximately 90% of all dairy cows in Sweden are included in this recording program.

### Register at the Swedish Animal Health Service

The Swedish Animal Health Service is responsible for different control and monitoring programs. Relevant information about holdings with cattle, sheep, pigs and farmed deer that are affiliated to these programs is kept in computerised registers.

### The animal health database

The animal health database (vet@) is used by the veterinary services for the documentation of the health situation on farms, including details about health status, treatment and vaccinations of individual animals. It is based on reports from practitioners to the Swedish Board of Agriculture. All veterinarians are obliged to report their various practice activities. It is mandatory for all veterinarians to report continuously as concerns production animals. The purpose is to monitor the animal health situation in Sweden and use it as a base for preventive measures.

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# Institutions, organisations and laboratories involved in monitoring

## Swedish Board of Agriculture

The Swedish Board of Agriculture, SBA, is the Government's expert authority in the field of agricultural and food policy, and is responsible for agriculture and horticulture. This includes monitoring, analyzing and reporting to the Government on developments in these areas, and implementing policy decisions within its designated field of activities.

The SBA promotes animal health by strict animal welfare requirements and by combating and preventing the spread of contagious animal diseases and is also the chief authority for the Swedish district veterinarians.

## National Veterinary Institute

The Swedish National Veterinary Institute, SVA, is a Government expert authority within the field of risk assessments, prevention, diagnostics and the control of contagious and other serious infectious diseases including zoonotic agents.

Diagnostic capacity for the most feared contagious animal diseases is available at SVA. Antimicrobial resistance in bacteria from animals and from food of animal origin is monitored regularly and several control- and monitoring programs are being conducted in cooperation with stakeholder organisations and relevant authorities. Research and development are other important tasks for SVA.

## Swedish Institute for Communicable Disease Control

The Swedish Institute for Communicable Disease Control (SMI) is a governmental expert agency with the mission to monitor the epidemiological situation for infectious diseases in humans. Central to SMI operations is to, with the help of reports received, efficiently trace, analyze and combat infectious diseases. Preparedness is at a high level at SMI as concerns outbreaks of severe infectious

diseases, both inside and outside the country's borders. SMI carries out diagnostic analyses of different bacteria, viruses, parasites and fungi, as well as water and environmental analyses. SMI's research and development is closely connected to its other preventative measures, as well as to the current public health situation.

## National Food Administration

The National Food Administration, NFA, is the central supervisory authority for matters relating to food, including drinking-water and has a direct responsibility to the Government.

The NFA has the task of protecting the interests of the consumer by working for safe food of good quality, fair practices in the food trade, and healthy eating habits. Fair practices in the food trade imply that the consumer can rely on the labelling as regards, for example, the composition, weight, keeping qualities and origin of the food. The NFA also performs risk assessments and chemical and microbiological analyses of food and water.

## County Administrative Board

Sweden is divided into 21 counties, each of which has its own County Administration and County Governor. The County Administrative Board is a government authority that exists in close proximity to the people in each county. The County Administrative Board is an important link between the people and the municipal authorities on the one hand and the government, parliament and central authorities on the other. The County administrations have important coordinating functions regarding prevention, surveillance and eradication of contagious diseases.

## The Swedish Dairy Association

The Swedish Dairy Association is the national industry organization for Swedish dairy farmers



and the Swedish dairy industry. The Swedish Dairy Association works on behalf of its owners, who are the seven largest dairy companies (jointly representing more than 99% of Swedish milk production), seven livestock cooperatives, two semen-producing companies, and nine breeder societies. The Swedish Dairy Association gathers, develops and communicates knowledge relating to the entire chain from cow to consumer, including issues concerning animal health. The Swedish Dairy Association is further organizing the surveillance programs regarding bovine leucosis and infectious bovine rhinotracheitis. It is also organizing the eradication program for bovine virus diarrhoea virus and a control program for salmonellosis in bovines.

### Swedish Animal Health Service

The Swedish Animal Health Service AB (SvDhv) is a veterinary consulting company which business ideas originate from the 1960's. SvDhv is mainly engaged in animal health and animal welfare issues concerning the rearing of pigs, cattle (for meat production) and sheep. The goal is healthy animals for profitable farming and the customers are farmers, the industry and the government. The services provided by SvDhv are open to all farmers. SvDhv is owned by the main meat producing companies in Sweden and is officially responsible for general animal health programs for pigs, cattle and sheep. In addition, SvDhv is officially responsible for specific disease control programs, monitoring of resistance in pathogenic bacteria and the routine autopsy activity in farm animals. Research and development are also performed.

### Swedish Poultry Meat Association

Swedish Poultry Meat Association (SPMA) represents 98% of the poultry meat production of chicken, turkey, goose and duck in Sweden, with members from the entire production-chain. The members are obliged to participate in the animal health programs, administered by SPMA such as control for *Salmonella*, *Campylobacter*, coccidiosis and clostridiosis.

Out of 78.5 million approved chickens produced during 2010, the members of SPMA produced 77.3 million. SPMA is multi functional; the major task is the work associated with economic and political industry related matters important to its members. SPMA is receiving legislative referrals from the Swedish public authority and the EU's institutions.

The organization also initiates and economically supports research.

### The Swedish Egg and Poultry Association

The Swedish Egg and Poultry Association is the national organization for Swedish egg producers, hatcheries, rearing pullet companies, egg packing stations and pullet feeding companies.

The Swedish Egg and Poultry Association is responsible for the organization of surveillance programs regarding animal health and welfare and the voluntary salmonella control program. The objective is to further support a sound egg production, with a high standard of animal welfare and food hygiene /safety on an economically competitive basis.

### Swedish Fish Health Control Program

The main objectives of the Swedish Fish Health Control Program are to prevent the occurrence of and to stop the spread of serious and contagious fish diseases to fish farms and to wild populations of fishes. The services are open to all fish farmers. The Swedish Fish Health Control Program is owned by the main fish farming companies in Sweden and is officially responsible for general animal health programs for farmed fish and also farmed crayfish.

Important parts of the fish health control program are breeding program for good fish health, participation in control program for virus and bacterial infections as well as vaccination program. In addition extensive information, advice and training services are offered to our associated fish farming companies.

Since 1990 the Swedish Fish Health Control Program has worked with a voluntary control program aimed at national control and eradication of renibacteriosis (BKD). The program has resulted in a decrease in the number of new BKD cases and the disease is now unusual in Swedish fish farms.

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# Atrophic rhinitis

## BACKGROUND

Atrophic rhinitis (AR) is caused by toxin producing strains of *Pasteurella multocida* (PMT). Since PMT is a secondary invader not capable of penetrating an intact mucosa it is dependant on other infections. Traditionally *Bordetella bronchiseptica* has been considered the most important precursor for PMT, but also other bacteria and virus may precede PMT.

AR used to be a common disease in pig enterprises, but as improvements in rearing and disease preventing measures have been made the disease have gradually faded away. The Swedish Animal Health Service effectuates a control program since 1995.

## DISEASE

When PMT penetrate the nasal mucosa the nose mussels are destroyed and inhaled air will reach the respiratory organs without being sealed or warmed, which in turn increases the risk for other infections. Further, the bone building process is affected and the snout may become obliquely in young pigs. Affected pigs will also show a retarded growth.

## LEGISLATION

Atrophic rhinitis is a notifiable disease according to SJVFS 2002:16 (with amendments).

## SURVEILLANCE

The purpose of the control program is to declare herds selling breeding stock free from infections with PMT, and thereby decrease the incidence of AR in all herd categories. Eradication of PMT is not realistic since it is an ubiquitous bacterium that can affect all mammals.

Nucleus and multiplying herds are controlled for presence of PMT at an annual basis. Anytime AR is suspected in a herd, it should be controlled for presence of PMT. If PMT is demonstrated the

health declaration is withdrawn and restrictions on sale of pigs are effectuated until the herd is sanitised and declared free from the disease. Diagnostic tools developed by DAKO (Copenhagen, Denmark) and evaluated at SVA during the late 80ies and early 90ies offered a possibility to combat AR in an effective way. Nasal swabs are cultivated on special media overnight. The entire microbial growth is harvested and diluted into water and the toxin of PMT is demonstrated by an ELISA system.

## RESULTS AND DISCUSSION

AR used to be a rather common disease, but due to efforts made in the early 90ies and to the control program initiated in 1995 the disease is now very rare. The last Swedish herd was diagnosed with AR in 2005 (Table 1). In 2009, PMT was demonstrated in 10 out of 34 imported Norwegian boars in a quarantine. These boars were isolated and found negative for PMT at resampling and thereafter installed at a boar station as intended.



Table 1. The total number of samples and the outcome of nasal swabs analyzed for PMT. The samples have been collected in all nucleus and multiplying herds, as well as in production herds suspected for AR.

| Year | Samples | Positive samples | Diagnosed herds |
|------|---------|------------------|-----------------|
| 2005 | 2,413   | 29               | 2               |
| 2006 | 1,836   | 2                | 0               |
| 2007 | 1,878   | 1                | 0               |
| 2008 | 462     | 0                | 0               |
| 2009 | 1,724   | 10               | 1               |
| 2010 | 1,523   | 0                | 0               |



# Aujeszky's disease

## BACKGROUND

Aujeszky's disease (AD) virus is a herpes virus with capacity to infect several species but the pig is the natural host. AD is an important disease in the swine production worldwide although many countries have controlled the disease, at least in the domestic swine population. Wild boars are reported to develop clinical signs of disease but their role as reservoirs or in transmitting the disease is debated. Other species that are infected, including cattle, sheep, goat, dog and cat, develop clinical signs but are not considered important for

the transmission of the disease. A few cases of human infection have been reported but AD is not considered a zoonotic disease.

Sweden has been officially free from AD since 1996 (Commission Decision 96/725/EU with amendments). This status was achieved following a national, government supported control program operated by the Swedish Animal Health Service that was introduced in 1991. Swedish Animal Health Service is also responsible for the ongoing active surveillance program and reports to the Swedish Board of Agriculture.





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### DISEASE

The clinical manifestation of AD is different depending on the age of the infected animal. The most severe clinical signs develop in newborn or very young piglets in which infection leads to neurological signs and nearly 100% mortality, whereas adult pigs show only mild respiratory signs and inappetence. In addition to the mild clinical signs, pregnant sows can abort as a consequence of the infection.

### LEGISLATION

The disease is included in the Swedish Act of Epizootic Diseases (SFS 1999:657 with amendments) and thereby notifiable on clinical suspicion for all clinicians and farmers. Sweden has been granted certain additional guarantees by the European Commission regarding AD, to protect the Swedish swine health status.

### SURVEILLANCE

The purpose of the surveillance is to document continued freedom from the disease. Samples are analyzed for antibodies against AD virus using a blocking ELISA (Svanovir™, PRV-gB-Ab ELISA, Svanova) and in the case of clinical suspicion also for virus or virus genome. All analyses are performed at the National Veterinary Institute (SVA).

#### Passive surveillance

As AD is notifiable on clinical suspicion for both veterinarians and farmers, cases with suspect clinical signs will be investigated following notification to the Swedish Board of Agriculture. The following investigation includes, in addition to restrictions on the farm during investigation, sampling of sick or dead animals and examination of the herd for prevalence of clinical signs and production results. Ongoing testing of animals for export and at breeding centers adds to the passive disease surveillance.

#### Active surveillance

The active surveillance program comprises sampling of sows and gilts at breeding units and fatteners at slaughter. The samples used for the surveillance originate from the PRRS surveillance program and comprises sampling in all Swedish nucleus herds, multiplying herds and sow pools

twice a year and randomly selected production herds at slaughter once a year. In nucleus herds, multiplying herds and sow pools eight samples per herd are analyzed at each sampling occasion and at slaughter three samples per herd are analyzed.

### RESULTS

#### Passive surveillance

During 2010 three clinical suspicions of AD were investigated. The main clinical symptom in two of these herds was reproductive failure and in the third respiratory disease in weaners was the main symptom. In all three cases other diseases included in the Act of Epizootic Diseases were included in the investigation. Following investigation including sampling, all three herds were declared negative for AD.

Samples originating from pre-testing for export and at breeding centers, approximately 1800 samples, were all negative regarding AD.

#### Active surveillance

In 2010, 1,070 samples from nucleus herds, multiplying herds and sow pools and 4,371 samples from fatteners originating from approximately 1,457 herds taken at slaughter were analyzed within the active surveillance program. All these samples were negative regarding antibodies to AD virus.

### DISCUSSION

The purpose of the surveillance is to document freedom from the disease and to contribute to the maintenance of this situation by detection of an introduction of the disease before it is widely spread in the swine population. The effect of changing the sampling scheme from solely sampling boars and sows at slaughter to the present scheme in which sows and gilts are sampled at breeding units and fatteners at slaughter has been that a larger number of samples have been analyzed for AD antibodies than previous years.

# Avian Influenza surveillance programs in poultry and wild birds

## BACKGROUND

Avian influenza (AI) is caused by Influenza A viruses. The viruses belong to different antigenic subtypes based on hemagglutinin (H1-H16) and neuraminidase (N1-N9) surface structures. The disease is highly contagious and is spread both directly and indirectly. Wild birds are reservoir for low pathogenic viruses (LPAIV), which may mutate and become highly pathogenic (HPAIV) if introduced in poultry flocks. Since 2005 highly pathogenic H5N1 virus has affected and been spread by wild birds in Asia, Europe and Africa. In early spring 2006 highly pathogenic avian influenza (HPAI) of subtype H5N1 was detected in wild birds for the first time in Sweden. One infected farmed mallard was also detected in a game bird holding.

In 2010 in the European Union there were two outbreaks of HPAI H5N1 in two farms with backyard poultry in Romania and 13 outbreaks of LPAI of different subtypes in Germany (n=1), Denmark (2), Netherlands (1) and Italy (9). One HPAI H5N1 infected fallen common buzzard was detected in Bulgaria.

## Animals

Morbidity may be as high as 100%, but depends on species affected, co-infections, virulence in the virus and other factors. In general gallinaceous birds including turkeys and chicken suffer a more severe disease than waterfowl as ducks and geese, which may only express minor clinical signs, if any. LPAIV infections most often cause asymptomatic infections or mild respiratory disease. HPAIV infections cause variable clinical signs like cyanosis, respiratory distress, diarrhea, nervous signs,

depression, decreased food and water intake, decreased egg production with altered egg quality. In some cases the only sign is sudden death of large numbers of birds.

## LEGISLATION

High pathogenic avian influenza of all subtypes as well as low pathogenic avian influenza of H5 and H7 subtypes are included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and are notifiable on suspicion. If AI is suspected or confirmed on a farm, measures will be taken to combat the disease and to prevent further spread according to Council Directive 2005/94/EC.

## SURVEILLANCE

The Avian Influenza surveillance programs in Sweden in poultry and wild birds were in 2010 based on Council directive 2005/94/EC and Commission decision 2007/268/EC. The latter determines the general and specific requirements and criteria about sampling, target populations, survey design, laboratory testing, reporting etc. for both poultry and wild birds.

The aim of the survey in poultry is to detect infections of avian influenza virus subtype H5 and H7 in different species of poultry. The survey in wild birds shall contribute to the knowledge of avian influenza ecology and the threats from wildlife to animal health as well as to serve as an early warning system of avian influenza strains that may be introduced into poultry flocks from wild birds.

The survey programs have been carried out on a yearly basis in all member states since 2002 to

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determine the prevalence of avian influenza, in particular avian influenza virus subtypes H5 and H7. The aim and the requirements for the surveillance programs will be changed as from 2011.

### Poultry

The serological analyses were performed at the National Veterinary Institute (SVA). All poultry were sampled at slaughter except for breeders, game birds and backyard flocks. The breeders were bled late in their production period within the Poultry Health Control Program. The game birds and the backyard flocks were bled at the holding. The samples were analyzed using a haemagglutination-inhibition test described in the diagnostic manual for avian influenza as provided for in Council Directive 2005/94/EC.

Within the program sampling has been performed in game birds (mallard ducks and pheasants), layers, turkeys, breeders, geese, ducks, ratites, small-scale broiler production and some backyard flocks with geese and ducks. Ten blood samples from each holding were collected except for holdings with geese, ducks and mallard ducks where 40 samples from each flock were collected. In flocks with less than 10 and 40 birds respectively, all birds were sampled. In total 2,613 samples were taken. Table 2 gives an overview of all poultry flocks sampled in 2004 to 2010.

In addition to the surveillance program, samples taken on suspicions, including clinical suspicions for Newcastle disease, are analyzed for AIV.

### Wild birds

The survey in wild birds consists of both active surveillance on living birds and passive surveillance on birds found dead or diseased. The surveillance was primarily targeting high risk species in accordance with Commission decision 2007/268/EC, Annex II. In total 2,354 birds were sampled, 353 of them were sampled within the passive surveillance which was carried out by SVA.

The active surveillance was performed from April until November by Kalmar Bioscience in cooperation with SVA at two different wild bird habitats in Sweden. Birds of 17 different species were sampled of which 80% were mallard ducks (*Anas platyrhynchos*). The birds were sampled with cloacal and oropharyngeal swabs.

From dead birds that were autopsied, swab samples (mostly both cloacal and tracheal) were used for PCR analyses. The samples were analyzed for the detection of avian influenza virus genome by using an M-gene realtime PCR. Positive samples were further analyzed for detection and identification of H5 and H7 viruses, including virus pathotyping by amplicon sequencing.

From the birds sampled within the surveillance performed by Kalmar Bioscience two swabs were

Table 2. Number of flocks of different poultry categories sampled in 2004-2010.

|                                       | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---------------------------------------|------|------|------|------|------|------|------|
| <b>Laying hens</b>                    | 60   | 60   | 60   | 60   | 65   | 61   | 62   |
| <b>Turkeys</b>                        | 26   | 35   | 26   | 23   | 23   | 17   | 21   |
| <b>Ducks</b>                          | 21   | 16   | 2    | 3    | 8    | 3    | 4    |
| <b>Geese</b>                          | 25   | 22   | 28   | 16   | 30   | 13   | 11   |
| <b>Broilers<sup>1</sup></b>           | 0    | 0    | 7    | 17   | 28   | 27   | 24   |
| <b>Ratites</b>                        | 11   | 7    | 15   | 10   | 10   | 6    | 4    |
| <b>Breeding hens (parents)</b>        | 40   | 40   | 40   | 40   | 42   | 33   | 34   |
| <b>Breeding turkeys (parents)</b>     | 0    | 5    | 4    | 4    | 2    | 4    | 3    |
| <b>Game birds (mallards)</b>          | 0    | 0    | 0    | 7    | 6    | 6    | 7    |
| <b>Game birds (pheasants)</b>         | 0    | 0    | 0    | 23   | 23   | 20   | 17   |
| <b>Backyard flocks (geese, ducks)</b> | 0    | 0    | 0    | 0    | 0    | 6    | 0    |

<sup>1</sup> Small-scale production.

## DISEASE SURVEILLANCE 2010

always taken. One swab was analyzed for the detection of avian influenza virus genome by using an M-gene real-time PCR at the Kalmar Bioscience. If the sample was positive the other swab from the same bird was sent to the Department of Virology, Immunobiology and Parasitology at SVA for further testing.

### RESULTS

#### Poultry

All samples analyzed were negative regarding antibodies to avian influenza virus subtype H5 and H7 except for in total 21 samples from four holdings which were positive for H5. The four holdings, all game farms with mallards, were further investigated by swab sampling. No influenza A virus genome was detected in samples from two of the holdings. In samples from the other two holdings influenza A virus genome was detected in the M-gene realtime PCR. Further analyses of these samples including both PCR for H5 and H7 as well as virus isolation attempts were however negative.

#### Wild birds

Within the passive surveillance 353 birds of 59 different species were sampled and two birds, one whooper swan (*Cygnus cygnus*) and one Great Black-backed Gull (*Larus marinus*) were PCR positive for Influenza A viruses, but no virus could be isolated. No other samples from dead wild birds were positive for influenza A viruses.

Within the active surveillance 2,001 birds were sampled and no HPAIV positive birds were detected. Six common teal (*Anas crecca*) and 64 mallards were positive for low pathogenic avian influenza virus subtype H5. Eight mallards were positive for low pathogenic avian influenza virus subtype H7. The majority of the positive birds were sampled in August or later. In addition samples from 423 birds (mostly mallards) were positive for avian influenza virus, but none for avian influenza subtypes H5 or H7. The actual subtypes were not determined in these cases.

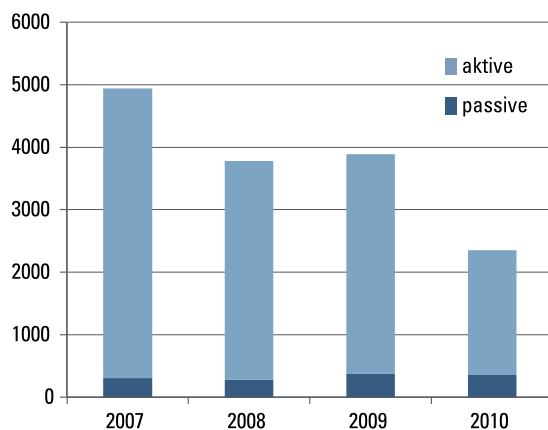
### DISCUSSION

In May 2005 the first large outbreak of HPAI among wild birds was reported from China. Ever since, infected wild birds have been detected in Europe. Although there has not been any great

mortality in wild birds, they pose a risk for domestic birds since the virus is directly pathogenic in poultry. Preventive measures in Sweden and the rest of Europe have been focused on increased biosecurity in poultry holdings to prevent the introduction of the virus from wild birds. These measures are still very important but once introduced to poultry the virus is more likely to be spread in between poultry flocks via infected live animals, contaminated vehicles and products etc. When combating the disease focus should thus be on preventive measures in order to reduce transmission of virus between poultry flocks.

The number of wild birds sampled have gradually decreased (Figure 2) as the situation, when it comes to HPAI H5N1, has stabilized. Most findings of highly pathogenic avian influenza have been made within the passive surveillance, while most of the low pathogenic strains have been detected within the active surveillance. As a consequence of this the surveillance program in wild birds will change as from 2011 and the European commission will no longer economically support active surveillance in wild birds. The Swedish surveillance program in wild birds will change in this direction.

Figure 2. Number of wild birds sampled within active and passive surveillance in 2007-2010.





# Bluetongue

## BACKGROUND

Bluetongue is a vector borne disease of ruminants and camelids caused by any of 24 serotypes of bluetongue virus (BTV). The virus is transmitted by haematophagous midges (*Culicoides* spp).

Until 1998 bluetongue had not been detected in any European country but since then, outbreaks have been detected in several Mediterranean countries. In August 2006 BTV-8 appeared in the Netherlands. During 2006 and 2007 this outbreak spread to a large number of countries in northern and Western Europe. In 2008, further cases were reported and vaccination campaigns were launched in most of EU as soon as inactivated vaccines became available. In September 2008 the first case of BTV-8 infection in Sweden was confirmed. A vaccination campaign and intensive surveillance activities were initiated nationally, with focus on the southern part of the country. Following the detection of more infected animals over a larger area, the zones were adjusted accordingly. Vaccination and surveillance activities continued in 2009. In the first quarter of 2009 transplacental infection was detected in three newborn calves, all three cases originating from infections of their dams in autumn 2008.

In December 2010, Sweden was declared free from BTV-8.

## DISEASE

BTV causes clinical disease in ruminants, mainly in sheep. The different serotypes appear to vary in their ability to cause clinical signs in different animal species and also in the severity of clinical signs in the same species. The signs include fever, lesions in the mucous membranes of the mouth and nostrils, inflammation of the coronary band, swollen head and oedema in various body tissues.

## LEGISLATION

The control, monitoring, surveillance and restrictions on movements of certain animals of suscep-

tible species are governed by Regulation 1266/2007 with amendments. Bluetongue is a notifiable disease and is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments).

## SURVEILLANCE

All diagnostic testing as outlined below was performed at the National Veterinary Institute (SVA). Serum samples were analyzed with a competitive ELISA (ID Screen® Bluetongue Competition ELISA) and milk samples were analyzed with an indirect ELISA (ID Screen® Bluetongue Milk). Organs and blood were analyzed with a real-time pan-PCR detecting all 24 serotypes.

A positive case is defined as an animal giving rise to a positive PCR-product or an unvaccinated animal without remaining maternal antibodies giving a significant antibody titre.

### Passive surveillance

In addition to clinical surveillance, serological testing for Bluetongue prior to import and export, before movements of animals out of the restriction zone, and at breeding centres was performed until the declaration of freedom in December 2010.

### Active surveillance

#### *Vector surveillance*

The vector surveillance, initiated in 2007 in order to document the activity of relevant *Culicoides* spp. throughout the different seasons of the year, was continued in 2010. Light traps were placed on farms geographically spread over the country. Vector data are shown in Table 3.

#### *National surveillance in cattle*

Bulk milk testing was performed once monthly during June-November. To detect a herd level seroconversion of 0.5% a random sample of 162 herds were tested every month of vector activity.

## DISEASE SURVEILLANCE 2010

Table 3. First and last detection of  $\geq 5$  parous *Culicoides* in traps in Sweden during 2007-2010.

| Trap ID | 2007<br>(DD-MM)                        | 2008<br>(DD-MM)                        |                                       | 2009 (DD-MM)                           |                                       | 2010 (DD-MM)                           |                                       |
|---------|--|--|---------------------------------------|--|---------------------------------------|--|---------------------------------------|
|         | Last detection of $\geq 5$ par. C/t/n* | First detection of $\geq 5$ par. C/t/n | Last detection of $\geq 5$ par. C/t/n | First detection of $\geq 5$ par. C/t/n | Last detection of $\geq 5$ par. C/t/n | First detection of $\geq 5$ par. C/t/n | Last detection of $\geq 5$ par. C/t/n |
| 1       | NA                                     | 30/5                                   | 1/8                                   | NA                                     | NA                                    | NA                                     | NA                                    |
| 2       | 16/10                                  | 10/6                                   | 28/8                                  | NC                                     | NC                                    | NC                                     | NC                                    |
| 3       | NA                                     | 14/5                                   | 1/8 <sup>†</sup>                      | NA                                     | NA                                    | NA                                     | NA                                    |
| 4       | 10/10                                  | 4/6                                    | 2/10                                  | 5/5                                    | 10/8                                  | NA                                     | NA                                    |
| 5       | 15/10                                  | 6/6                                    | 28/9                                  | 17/5                                   | 31/8                                  | 15/6                                   | 3/9                                   |
| 6       | 27/10                                  | 17/5 <sup>†</sup>                      | 15/10                                 | 20/5                                   | 20/9                                  | 3/6                                    | 9/10                                  |
| 7       | 17/9                                   | NA                                     | NA                                    | NA                                     | 4/10 <sup>†</sup>                     | 7/6                                    | NA                                    |
| 8       | 23/8                                   | 26/6                                   | 8/9                                   | 26/8                                   | 26/8                                  | NA                                     | NA                                    |
| 9       | 26/9                                   | 5/6                                    | 7/9                                   | NC                                     | NC                                    | NC                                     | NC                                    |
| 10      | 3/11                                   | 13/6                                   | 20/8                                  | 1/5 <sup>†</sup>                       | 25/9                                  | 2/6                                    | 25/9                                  |
| 11      | 23/8                                   | 1/6                                    | 29/8                                  | 30/6                                   | 6/8                                   | 30/6                                   | 8/9                                   |
| 12      | 1/10                                   | NA                                     | NA                                    | NA                                     | NA                                    | NA                                     | NA                                    |
| 13      | 9/10                                   | NA                                     | 25/9                                  | 9/7                                    | 21/9                                  | 29/6                                   | 6/9                                   |
| 14      | NA                                     | NA                                     | NA                                    | 5/8                                    | 23/9                                  | NA                                     | NA                                    |
| 15      | NA                                     | NA                                     | 28/9                                  | 4/8                                    | 4/8                                   | 30/7                                   | 26/8                                  |
| 16      | NA                                     | NA                                     | 27/9                                  | 30/5                                   | 26/9                                  | 17/6                                   | 5/9                                   |
| 17      | NA                                     | NA                                     | 23/8                                  | 7/8                                    | 7/8                                   | 22/8                                   | 22/8                                  |
| 18      | NA                                     | NA                                     | NV                                    | NV                                     | NV                                    | NV                                     | NV                                    |

\*C/t/n = *Culicoides*/trap/night

<sup>†</sup> First/last collection made inside stable

NA = Trap not operated

NC = No collections of  $\geq 5$  parous female C/t/n that year.

NV = No vector species

<sup>†</sup>Trap removed

### Targeted risk based monitoring in dairy herds

Bulk milk testing of all dairy herds was also performed in the area just outside the vaccination area, once in February and once in September. There were approximately 1,000 dairy farms in the restriction area outside the vaccination zone. The first survey aimed to detect infection in heifers kept on pasture during 2009 and that started to contribute to the bulk milk in the vector free period. These heifers typically graze on the most distant

fields until they approach calving. The second survey was to detect any new virus circulation, just after the peak of vector activity.

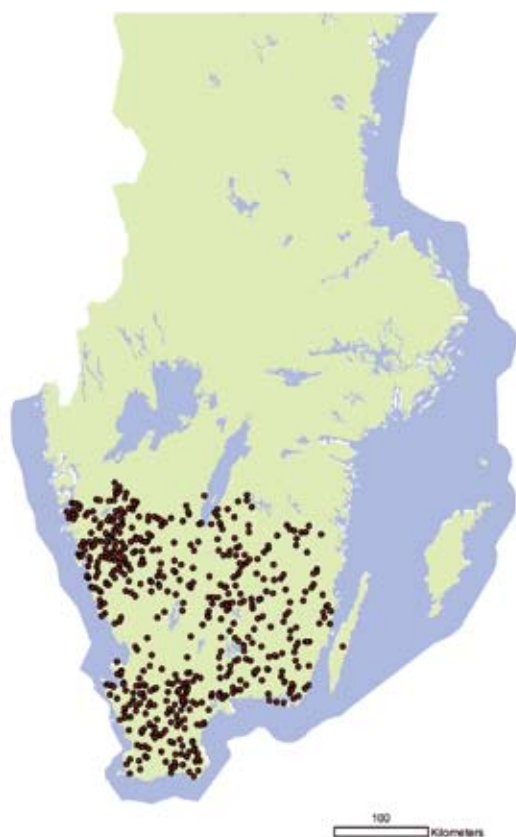
### Survey to detect any remaining infection

This testing addressed the area in which two full years of vaccination was done. Small herds where no vaccination was done in 2008-2010 were chosen for PCR testing in order to detect any virus circulation. As these herds were never vaccinated they may have been exposed to virus during the peak of prevalence in 2008, and some animals could have seroconverted during that period. Thus, it was decided to use PCR as the method of detection and test all animals during the period when it was most

likely that they would be PCR positive, i.e. just after the peak of vector activity. The number of tested herds was sufficient to detect 1% prevalence with 95% confidence. All animals in each selected herd were sampled, as the herds were comparatively small and to compensate for any naturally seropositive (and thereby protected) animals. Map 5 shows the distribution of the tested herds in the vaccination area. In all, 1,158 cattle in 308 herds and 1,606 sheep in 266 herds were tested.

About 50% of the samples were taken in October when vector activity had ceased in all but one site. About 25% of the herds and animals included in the survey were sampled 9th -29th of October, when vectors were last collected from the last active site (Table 3).

Map 5. Geographical distribution of the bovine and sheep herds tested in September and October 2010.



## RESULTS

Vector data relevant for the vector free period are demonstrated in Table 3.

12 clinically suspect cases were tested but none were found positive.

4 positive bulk milk tests were further investigated; none of them were concluded to be caused by BTV infection. No PCR test was positive.

## DISCUSSION

In summary, no clinical suspicions of bluetongue were confirmed nor was there any indication of viral circulation during 2009 and 2010. This was the basis for the declaration of freedom from BTV-8 in December 2010.

Competent vectors are present in Sweden and may spread the infection. Introduction of the virus to Sweden may occur by infected animals, infected vector or other yet unidentified means.

At present, there are no indications of BTV-8 circulation in neighbouring countries and the EU situation appears favourable. However, as new serotypes emerge in the Mediterranean region or start circulating worldwide, this situation may rapidly change. Moreover, when national vaccination campaigns are finalised and the prevalence of seropositive animals decline, the population will again become susceptible to BTV-8. Therefore, new introductions of this serotype, or any remaining foci in previously infected countries, could pose a threat. It is clear from the experiences of the past years that BTV may spread and take hold in livestock populations in Northern Europe.

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# Bovine spongiform encephalopathy

## BACKGROUND

Classical Bovine Spongiform Encephalopathy (BSE) belongs to the group of diseases called Transmissible Spongiform Encephalopathies (TSE) and was first described in cattle in the UK in 1986. The current theory about the causative agent is the prion-only hypothesis. This theory assumes that misfolded prions (small proteins) induce the same pathological structure in normal proteins in the body of the host, resulting in accumulation of prions and cellular damage without involvement of any microorganism. Classical BSE has primarily spread through contaminated meat and bone meal (MBM), i.e. MBM containing parts of animals infected with BSE. However, the primary source of the epidemic has not been established.

In 1996 the disease became a public health concern, after the detection of a new variant of Creutzfeldt-Jacob Disease in humans (vCJD), likely to be linked to classical BSE in cattle. This resulted in actions taken to prevent transmission to humans

through removal of Specified Risk Material (such as brain and spinal cord) at slaughter, restrictions related to feed to avoid recycling of infectious material to ruminants through infected MBM and when rapid test became available also an intensified surveillance.

In recent years, strains of BSE which show diagnostic dissimilarities with classical BSE have been described. The possible spontaneous occurrence of these cases is being discussed, as well as possible links to classical BSE and potential zoonotic aspects.

Sweden has historically had a low risk of introduction of classical BSE and a low risk of recirculation of the disease if it had been introduced. This has been assessed through the Geographical Bovine spongiform encephalopathy Risk (GBR) by the Scientific Steering Committee and by the European Food Safety Authority (EFSA), and later by the OIE Scientific Commission. Sweden is currently, through a resolution adopted by the



## DISEASE SURVEILLANCE 2010

OIE International Committee, recognized as having negligible BSE risk.

One case of BSE has been detected in cattle in Sweden. This was in 2006 in a beef cow born in 1994. This case was confirmed to be of H-type, i.e. not classical BSE.

### DISEASE

The incubation period is long, from a couple up to several years. Symptoms are related to the neurological system and include altered behaviour and sensation as well as affected movement and posture. Clinical symptoms can last for weeks. The disease is progressive and always fatal.

### LEGISLATION

Surveillance and control is regulated through the Regulation (EC) No 999/2001 of the European Parliament and of the Council of 22 May 2001, on national level the sampling is regulated by SJVFS 2010:9. BSE is a notifiable disease under the Swedish Act of Epizootic diseases (SFS 1999:657, with amendments) and there is a scheme to compensate farmers for losses due to eradication measures.

### SURVEILLANCE

#### Feed

In order to survey compliance with the feed bans, samples are collected at feed-mills, of imported raw material for feed production and at farm level and analyzed for the presence of MBM using microscopy, Regulation (EC) 152/2009. The Swedish Board of Agriculture and the County Boards are responsible for this surveillance.

#### Animals

The Swedish Board of Agriculture is responsible for the surveillance program, which is carried out in cooperation with the National Veterinary Institute (SVA). SVA is appointed National Reference Laboratory, NRL (Regulation (EC) 999/2001). Samples from animals in passive surveillance and risk categories are analyzed at the SVA, and healthy slaughtered animals are examined at a private laboratory in Sweden.

#### *Passive surveillance*

All suspicions of BSE (bovine animals not responding to treatment, with clinical signs that are

compatible with BSE symptoms) must be reported to the authorities. The obligation to report applies for animal owners, veterinarians and everyone else who is responsible for the animals. Samples are analyzed with Bio-Rad TeSeE short assay protocol (SAP) in combination with Bio-Rad TeSeE Western Blot.

#### *Active surveillance*

The design is in accordance with Regulation (EC) No 999/2001 Annex III and Sweden applies derogation in accordance with Commission Decision 2008/908.

The following categories were sampled in the active surveillance in 2010:

- All healthy slaughtered cattle over 48 months of age
- All healthy slaughtered cattle over 30 months of age if they origin in a country not included in the list in Commission Decision 2008/908
- All emergency slaughtered cattle above 48 months of age, including slaughter used for feed to large carnivores.
- All fallen stock (animals dead or killed on farm but not slaughtered for human consumption) above 48 months of age. The animals are sampled at the rendering plants or at autopsy. Sweden applies derogation (Regulation (EC) 999/2001) for remote areas with a low cattle density, where no collection of dead animals is organised. The cattle population in these areas does not exceed 10% of the total bovine population in Sweden.

The samples from fallen stock, emergency slaughter, and some samples from normal slaughter at small slaughterhouses were examined with Bio-Rad TeSeE short assay protocol (SAP). In case of positive or inconclusive results the material was prepared and examined by Bio-Rad TeSeE Western Blot.

The large majority of the samples from healthy slaughtered animals were examined with rapid tests at a private laboratory. The samples were tested with Bio-Rad TeSeE short assay protocol (SAP). In case of positive or inconclusive results the material was prepared and examined by Bio-Rad TeSeE Western Blot at the SVA.

## DISEASE SURVEILLANCE 2010

### RESULTS

#### Feed

In 2010, 111 feed were sampled at feed-mills and 35 imported raw materials were sampled. Two samples were taken from each, thus resulting in 222 feed samples at feed-mills, and 70 samples of imported raw material. Moreover, 198 samples were collected in the primary production at farm level at 197 different farms. Out of these samples one sample at farm level, one sample from a feed-mill, and one sample from imported raw material were positive for fish meal, all were negative for meat- and bone meal.

#### Animals

##### *Passive surveillance*

In 2010 three cattle were examined due to clinical suspicion, all with negative results.

##### *Active surveillance*

In 2010, in total 120,697 samples were examined for BSE and all samples were negative. Of these, 12,719 were from fallen stock and 10 from emergency slaughter.

### DISCUSSION

No positive BSE cases were detected. Preventive measures have been in place for many years and the fact that no cases were detected support that these measures have been effective. The low number of clinical suspicions may be an indication of a lower degree of awareness among farmers and veterinarians compared to 5-10 years ago.

Reports of prion transmission studies including several passages in different species have shown that prion strains do not always remain stable through these passages. The source of the large epidemic of classical BSE has not been determined and atypical cases cannot be excluded as the source. Thus, the atypical cases may be a potential source of a new epidemic. As the number of cases of classical BSE is decreasing within the European Union, surveillance is decreasing and moreover voices are being raised for allowing the use of MBM in feed. If the bans are to be relaxed it is of uttermost importance to remember that unintentional cross-contamination at feed mills was sufficient to keep the epidemic going and this was the reason for the total feed ban in 2001. Relaxations of the total feed ban could potentially result

in a new epidemic. Strict separation and sufficient bans must be kept in place to avoid any possibility of recirculation of BSE if it would enter the system again. Moreover, resources and focus must be relocated to survey the feed chain to enable early detection of cross contamination.

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# Bovine viral diarrhoea

## BACKGROUND

Bovine viral diarrhoea (BVD) is caused by bovine viral diarrhoea virus (BVDV), which is classified in the genus Pestivirus in the family Flaviviridae. Cattle are the primary host of BVDV, but most even-toed ungulates are probably susceptible to the disease. Cattle that are persistently infected serve as a natural reservoir for virus. The virus may be spread between animals via direct or indirect routes.

A voluntary surveillance and control program with the objective to eradicate BVD without vaccination was launched by the Swedish Dairy Association in 1993. The government and the farmers share the costs for sampling and testing. Since June 1, 2001, there is also a compulsory control program requiring all cattle herds to be tested for BVDV on a regular basis.

## DISEASE

BVDV may induce disease of varying severity, duration and symptoms after an incubation period of 6-12 days. Fever, depression, respiratory symptoms and diarrhoea are typical signs of acute BVD. In pregnant cattle, infection may result in reproductive failure such as abortion and stillbirth or the birth of calves that may be persistently infected with the virus. A more uncommon form of BVD is mucosal disease that may occur in acute or chronic form in persistently infected animals.

## LEGISLATION

BVD is a notifiable disease (SJVFS 2002:16 with amendments). The voluntary control is regulated in SJVFS 1993:42 and the compulsory in SJVFS 2002:31.

## SURVEILLANCE

A risk-based surveillance scheme was introduced in January 2010 when the country was divided in regions depending on their BVD-status. In free regions sampling is mainly directed towards herds buying/selling live animals. In regions not free from BVD all herds are sampled annually. Surveillance of dairy herds is performed by sampling bulk tank milk while surveillance of beef herds is performed by sampling at slaughter. In the latter herds live animals can also be sampled. Herds that are infected are screened and persistently infected virus carriers are identified and removed. Another important part of the program is creating a positive attitude to biosecurity in the farming community and to protect the free herds from introducing BVDV.

Diagnostic testing is performed at the National Veterinary Institute (SVA), Uppsala, Sweden. For screening, an indirect antibody ELISA (Svanovir<sup>®</sup> BVDV-Ab ELISA) for serum, milk and bulk milk samples is used.

## RESULTS

In 2010, the total number of herds affiliated to the voluntary program was 17,270 and at the end of the year 17,250 herds were certified as free from the disease. Of the remaining herds, 12 are considered to still be infected. The other herds only have to be tested further before becoming certified free from the disease. Two herds were discovered to be newly infected by the virus during 2010.

## DISCUSSION

All herds in Sweden were affiliated to the voluntary or compulsory programs during 2010. At the end of 2010, 99.9% of the herds were certified BVD-free and 0.1% or less was infected by BVD-virus. The control program has been successful, and the goal is to eradicate the disease during 2012.

# Brucellosis

## BACKGROUND

Brucellosis is caused by zoonotic, gram-negative bacteria belonging to the genus *Brucella*. Most human cases are caused by four species, each having a preferred animal host. *Brucella melitensis* occurs mainly in sheep and goats, *B. suis* in pigs, *B. abortus* in cattle and *B. canis* in dogs. The infection is transmitted by contact with the placenta, foetus, foetal fluids and vaginal discharges from infected animals and may also be found in milk, urine, semen and feces. *In utero* infections occur, however venereal transmission seems to be uncommon. Humans are normally infected through contact with infected animals or contaminated animal products such as cheese made of unpasteurized milk.

Brucellosis was eradicated from the Swedish cattle population during the first half of the last century. The last Swedish bovine case was recorded in 1957. Brucellosis in humans has been a notifiable disease in Sweden since 2004. No more than 10 annual cases have been reported. All patients have acquired the infection outside Sweden.

## DISEASE

### Animals

In animals brucellosis mainly causes reproductive disorders such as abortions, orchitis and epididymitis. Arthritis is occasionally seen in both sexes. Systemic signs and deaths are rare, except in the foetus or newborn. The period between infection and abortion or other reproductive signs is variable. Infected asymptomatic females may shed the organism in milk and uterine discharges.

## HUMANS

*B. melitensis* is considered to be the most severe human pathogen in the genus. Brucellosis in humans can be asymptomatic, but the course of the illness is extremely variable and the clinical signs may appear insidiously or abruptly. Typically,

brucellosis begins as an acute febrile illness with nonspecific flu-like signs such as fever, headache, malaise, back pain, myalgia and generalized aches. Some patients recover spontaneously, while others develop persistent symptoms that typically wax and wane. Genitourinary involvement is noticed in 2-20% of the human cases. The mortality rate is low, around 2%.

## LEGISLATION

### Animals

Brucellosis in food-producing animals is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments). Vaccination is prohibited and notification of suspect cases is mandatory. Sweden's bovine brucellosis free status is officially stated in EU legislation since 1994, Decision 2003/467/EC last amended by Decision 2005/764/EC. Ovine brucellosis is encompassed by Directive 91/68/EEC, Sweden was declared officially free of brucellosis in sheep and goats in 1995 (Decision 94/972/EC).

Current surveillance standards for bovine and ovine brucellosis are given in the EU legislation, Directive 64/432/EEC and Directive 91/68/EEC, respectively.

### Humans

Brucellosis has been a notifiable disease since 2004 according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

All diagnostic testing as outlined below is performed at the National Veterinary Institute (SVA). A positive case is defined as an animal from which *Brucella* spp. has been isolated, or an animal with a confirmed positive serological reaction.



## DISEASE SURVEILLANCE 2010

### Passive surveillance

Suspicion based on clinical signs in food producing animals must be reported to the Swedish Board of Agriculture and subsequently investigated.

In addition to the passive surveillance, serological testing for brucellosis is performed prior to import and export of all susceptible species, and in bulls and boars at semen collection centres.

### Active surveillance

Screening for *B. abortus* has been conducted regularly in Sweden since 1988, for *B. melitensis* since 1995 and for *B. suis* since 1996. The purpose of the surveillance is to document freedom from bovine and ovine brucellosis in Sweden in accordance with the EU legislation and to further document freedom from the disease in the Swedish pig population. The Swedish Board of Agriculture finances the surveillance, which is planned and executed by the National Veterinary Institute (SVA). Since the start of the screenings, no samples have been confirmed positive. In addition to the screenings described per species below, surveillance is performed by post mortem examination and culture of aborted foetuses.

In 2010, 5 alpaca, 65 ovine, 6 caprine, 64 bovine and 55 porcine foetuses were examined by culture.

### Surveillance for brucellosis in cattle

From 1997 and onwards, approximately 3,000 samples (bulk milk and/or serum samples) have been tested each year. During 2010, bulk tank milk samples from 3,000 dairy herds were analyzed for antibodies against *B. abortus*. The samples were collected within the surveillance programs for bovine virus diarrhoea and enzootic bovine leucosis and were obtained from those samples by convenience sampling (in other words not strictly random), evenly distributed throughout the sampling period. The diagnostic tests used were an indirect ELISA (SVANOVIR® Brucella-Ab I-ELISA, Svanova, Biotech, Uppsala, Sweden). For confirmation, the complement fixation test was used.

### Surveillance for brucellosis in sheep and goats

Since 1995 approximately 10,000 samples have been tested each year, representing approximately 5% of the sheep population. During 2010, 7,000 serum samples were analyzed for *B. melitensis*. The serum samples were collected within the surveil-



## DISEASE SURVEILLANCE 2010

lance program for Maedi/Visna (sheep) and the Caprine Arthritis Encephalitis program (goats). The samples were obtained from those samples by convenience sampling (in other words not strictly random). The diagnostic test used was the Rose Bengal Test (RBT), with the complement fixation test for confirmation.

Surveillance for brucellosis in pigs and wild boar  
From 1996 and onwards, approximately 3,000 serum samples from pigs have been tested for antibodies against *B. suis* each year. In 2010, no samples were taken from pigs and wild boar.

### Humans

The surveillance in humans is passive. Diagnosis of human cases is made by detection of *Brucella* species in blood, bone marrow or urine or by detection of antibodies in blood. The bacteria are isolated by culture of clinical samples, and identified by real-time PCR of colonies.

## RESULTS

### Animals

During 2010 clinically suspect cases were reported from three bovine herds. Serum samples were taken from affected individuals, all samples were negative. No clinical suspicion was seen in any other animal species.

Surveillance samples from four animals in one sheep herd were positive. There were no clinical signs in the herd and after further testing infection was ruled out.

All other samples from active as well as passive surveillance were negative.

### Humans

For years, no domestic cases have been reported and Sweden is considered free from brucellosis. In 2010, however, one domestic case was reported. This person is not considered to be infected by a Swedish product but had consumed dried milk powder imported from Afghanistan after returning back to Sweden.

In 2010, 12 cases were reported, 7 men and 5 women in the age groups between 20-74 years. Except for the case reported as domestic the country of infection was Iraq for 7 cases, Syria and Somalia for 1 case respectively and for 2 cases country of infection was unknown.

## DISCUSSION

In summary, no herd or any individual animal was diagnosed with *Brucella* infection during 2010. One human case was reported as domestic but the source of the infection was considered an imported food vehicle. The long standing and rather extensive serological screenings performed without finding any infection and the very low number of human cases (none of which have been domestically acquired) confirms that no brucellosis is present in food-producing animals in Sweden.

Imported dogs might harbour *Brucella canis*. Occasionally dogs are tested for brucellosis but no positive case has yet been confirmed. As infected dogs only shed the agent in semen and placental fluids the risk of getting brucellosis from infected castrated dogs is considered small.

The active surveillance in aborted fetuses from food-producing animals is an important part of the surveillance system. Other means of risk-based surveillance for brucellosis may be discussed.

# Campylobacteriosis

## BACKGROUND

Thermophilic *Campylobacter* spp., curved gram negative rods, are the most common causes of human bacterial gastroenteritis in many countries. *Campylobacter* were for the first time isolated from human diarrhoea in 1972 although spiral bacteria had been seen microscopically in human stool samples in earlier decades. Most human infections are caused by *C. jejuni*, followed by *C. coli* and a few by other *Campylobacter* species.

Birds are considered the principal reservoir although *Campylobacter* can colonise the intestinal tract of many other animal species. The bacteria are excreted in faeces. *Campylobacter* are fragile organisms but are able to survive in water for longer periods. The infectious dose in human infection is low. A seasonal peak in the summer months is observed in most European countries. Most human infections are sporadic, which makes identifying the source of infection difficult. Risk factors for infection include consumption of or handling undercooked contaminated meat

products (especially poultry), consuming contaminated unpasteurized milk and other dairy products, drinking water from contaminated supplies, travelling abroad and contact with farm animals and pets.

The number of reported human cases in Sweden during the last decade has varied between approximately 6,000 and 8,600 (Figure 3). Of these, approximately 1,800-3,100 (20-40%) have been reported as domestic.

## DISEASE

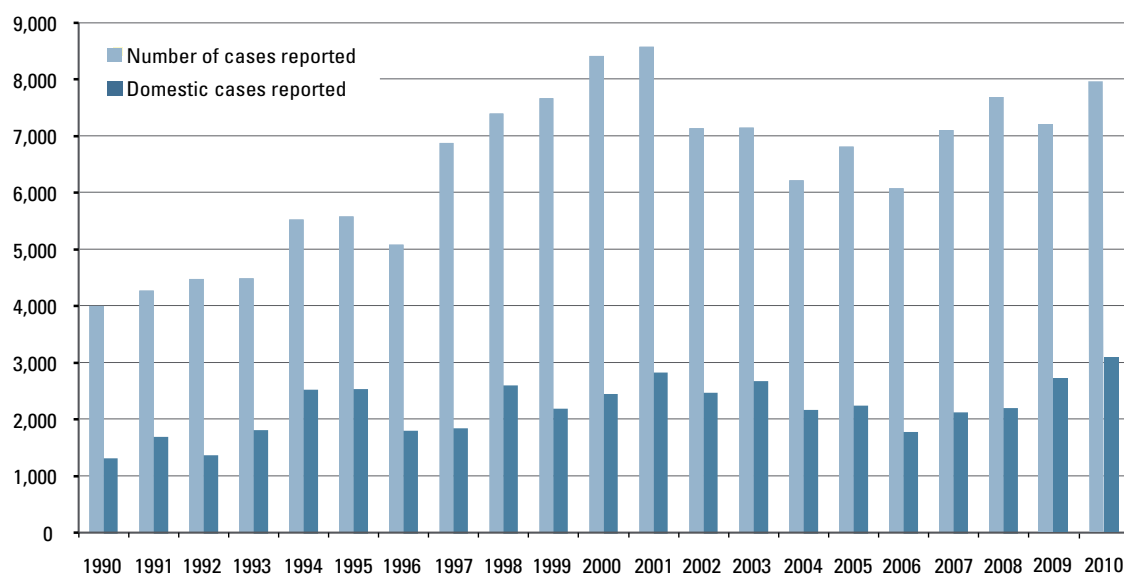
### Animals

Asymptomatic carriers of thermophilic *Campylobacter* are common in several animal species.

### Humans

Campylobacteriosis is an acute usually self-limiting enteric disease that resolves within a week. In some individuals the symptoms may last longer. The symptoms are mild to severe: diarrhoea, fever,

Figure 3. Number of notified cases of campylobacteriosis in humans in Sweden 1990-2010.



## DISEASE SURVEILLANCE 2010

abdominal pain, nausea and malaise. The infection can be complicated by reactive arthritis, irritable bowel syndrome and a neurological disorder, Guillain-Barré syndrome.

### LEGISLATION

#### Animals

Thermophilic *Campylobacter* are not notifiable in animals. Currently, only *Campylobacter fetus* sp. *venerealis*, which causes bovine genital campylobacteriosis, is notifiable in Sweden.

#### Food

Detection of *Campylobacter* spp. in food is not notifiable.

#### Humans

Infection with *Campylobacter* is notifiable according to the Communicable Disease Act (SFS 2004:168).

### SURVEILLANCE

#### Animals

A surveillance program for broilers has been operated by the industry (Swedish Poultry Meat Association) since 1991. Since 2006, sampling is performed by collecting intact caeca from 10 birds from every slaughter batch at the major slaughterhouses. The caeca are pooled into one composite sample per batch. The program covers 99% of broilers slaughtered in Sweden. Samples are analyzed according to accredited methods.

#### Food

Monitoring is based on in-house control in the companies and sampling by the authorities.

#### Humans

There is no active surveillance in humans.

### RESULTS

#### Animals

In 2010, thermophilic *Campylobacter* were detected in 444 (13.2%) of the 3,357 slaughter batches in the national *Campylobacter* program (Figure 4). As in previous years, the prevalence of *Campylobacter* in broilers was lowest (2.7%) in February and highest (38.7%) in August.

#### Humans

In 2010, 8,001 cases of campylobacteriosis were notified. Of these, 39.2% (3,143) were domestic. The incidence in domestic cases (33.4/100,000 inhabitants) increased with 16% compared to the year before and was the highest during the last decade. As a result, the slight downward trend reported 1997-2009 was discontinued and as a consequence, a trend analysis 2010 demonstrated no significant trend in domestic cases since 1997. Also in summer, the number of notified cases was higher than previous years beginning already in May and continuing until September.

#### Food

The local health authorities reported 55 samples during the year. Of these 46 were taken as part of follow up of complaints or outbreak investigations. No positive samples were reported.

### DISCUSSION

During the last fifteen years, the number of notified human cases of campylobacteriosis has remained at a high level. The prevalence of *Campylobacter* in slaughter batches of broilers decreased in the beginning of the last decade but has remained at 12-13% in recent years (Figure 4).

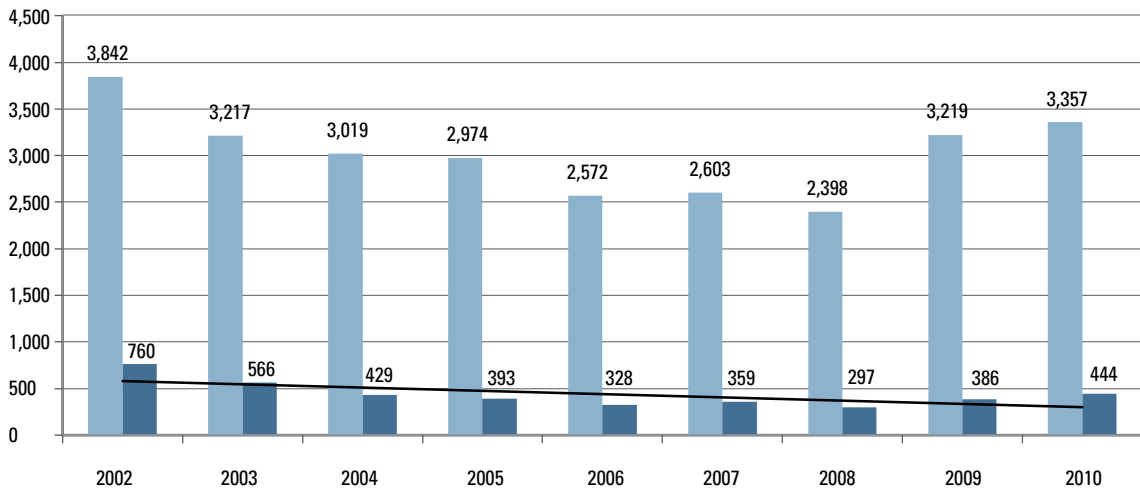
Reducing *Campylobacter* prevalence at farm level decreases the risk of human infection. Applying strict biosecurity measures has decreased the number of *Campylobacter* positive broiler slaughter batches in Sweden. Still, 12-13% producers often deliver *Campylobacter* positive slaughter batches accounting for 40% of the *Campylobacter* load of domestic poultry. Thus, more effective measures to control infection in these animals would be needed. Since flies have been associated with spread of the infection a fly control program has been introduced in some broiler houses. Also, several other control measures to reduce flock prevalence are under investigation.

Carcasses are easily contaminated at slaughter and at secondary processing which necessitates application of good hygienic practises. Furthermore *Campylobacter* negative birds can be contaminated at slaughter. This can be prevented by slaughtering flocks tested positive or flocks from operators often delivering positive birds separately from *Campylobacter* free flocks. Also, freezing *Campylobacter* positive carcasses or scheduling them to heat-treatment would reduce the risk for consumers.



## DISEASE SURVEILLANCE 2010

Figure 4. Incidence of *Campylobacter* in Swedish broiler batches. Broilers delivered from members of Swedish Poultry Meat Association.



Strict hygiene in the kitchen to avoid cross-contamination between possible contaminated food and food that will not be heated i.e. raw vegetables is essential. Likewise good hygiene is important when preparing food at barbecues. Most domestic cases were reported during the summer period beginning already in May.

### REFERENCES

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Lindqvist R, Lindblad M. Quantitative risk assessment of thermophilic *Campylobacter* spp. and cross-contamination during handling of raw broiler chickens evaluating strategies at the producer level to reduce human campylobacteriosis in Sweden. *Int J Food Microbiol.* 2008; 121:41-52.

# Coccidiosis and clostridiosis in broilers

## BACKGROUND

Coccidiosis and clostridiosis are intestinal diseases that commonly affect broiler chickens around the world. Both diseases are major causes of economic losses and reduced welfare.

## DISEASE

Coccidiosis is caused by microscopic parasites (genus *Eimeria*) that invade the intestinal epithelium. *Eimeria* spp. are ubiquitous, resilient and host-specific parasites that are easily transmitted between birds by the faecal-oral route, especially when birds are kept on litter at high stocking density. The severity of the intestinal lesions is influenced by parasite and host factors, such as parasite species, infectious dose, host age and level of immunity. Generally, young broiler chickens are highly susceptible.

Clostridiosis is a multifactorial disease and the pathogenesis is not well understood. Clostridiosis is associated with proliferation of the bacterium *Clostridium perfringens* type A, which together with managerial factors and loss of mucosal integrity cause lesions in the intestines (necrotic enteritis) and liver (cholangiohepatitis).

Clinical signs of coccidiosis and clostridiosis range from severe outbreaks with high mortality rates to mild or subclinical forms, which are associated with reduced weight gain and impaired feed conversion. Clostridiosis is also a cause of condemnation at slaughter due to liver lesions. Both diseases may be prevented by in-feed ionophorous anticoccidials.

## LEGISLATION

The health control program regarding coccidiosis and clostridiosis in broilers is regulated in Swedish legislation (SJVFS 1998:131) and is administered by the Swedish Poultry Meat Association.

## SURVEILLANCE

The purposes of the surveillance are to document that the anticoccidials efficiently protect broilers from disease and to supervise the amount and type of anticoccidials used. Also, the long-term goal is to replace anticoccidials by other preventive measures.

Field control of anticoccidial efficacy is performed by a lesion scoring method in five 22-34 days old broiler chickens each from 20 farms from the different feed areas twice a year. The farms are selected based on previous (average) production results. If the lesion score of an individual flock exceeds a certain level (2.5) an analysis of the feed regarding the concentration of anticoccidial is performed and an on-farm investigation concerning management and general health status is carried out. The occurrence of hepatic and intestinal lesions is surveilled at slaughter houses, and if more than 0.5% of the birds in a flock are affected samples are sent for histological examination to SVA. Further, data are compiled on a quarterly basis from all slaughterhouses on the overall level of condemnations due to liver lesions.

## RESULTS AND DISCUSSION

In 2010, lesions scores of >2.5 were not found in any of 26 investigated broiler flocks. However, the number of investigated flocks was lower than expected because of reorganization of official veterinarians from the National Food Administration who perform the lesion scoring. Samples for histological examination were submitted from slaughterhouses from 26 broiler flocks with >0.5% condemnation due to intestinal and/or liver lesions. Lesions consistent with clostridiosis (cholangiohepatitis) were observed in 22 flocks and inclusion body hepatitis (an adenovirus infection) was diagnosed in two flocks. All eight slaughterhouses reported condemnation levels exceeding 0.1% caused by liver disease on at least one occasion during 2010. It was



concluded that there are currently no indications of reduced efficacy of anticoccidials in Sweden. No long-term trends towards reduced anticoccidial efficacy or increased prevalence of coccidiosis and/or clostridiosis were observed.

#### REFERENCES

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# Echinococcosis

## BACKGROUND

Echinococcosis is caused by tapeworms belonging to the genus of *Echinococcus*. Although the genus contains several species, only the species of *E. granulosus* and *multilocularis* exist in Europe.

The life cycles of these parasites are completely different but both require two hosts: a definitive and an intermediate host. Humans are dead-end hosts of these parasites and may become infected by accidental ingestion of the eggs.



Photo: Gunilla Hallgren

# Alveolar echinococcosis

## BACKGROUND

*Echinococcus multilocularis* is endemic in large parts of Europe and has been increasingly reported in animals from countries near Sweden, such as Latvia and Estonia. Although a rare disease in humans, alveolar echinococcosis is of considerable public health concern due to its high mortality if untreated as well as high treatment costs. The definitive hosts of this parasite are mainly foxes but also raccoon dogs, dogs, cats, coyotes and wolves can act as definitive hosts. Small rodents and voles serve as intermediate hosts. The main host, the fox, contracts *E. multilocularis* from eating infected rodents.

## History

Prior to 2010, *E. multilocularis* had never been detected in Sweden and no case of alveolar echinococcosis had been reported in Sweden. As a response to the finding of *E. multilocularis* in Denmark in foxes and intermediate hosts, an active monitoring program of the red fox (*Vulpes vulpes*) was implemented in Sweden in 2000.

## DISEASE

### Animals

In the definitive animal host, the infection is asymptomatic. The main intermediate hosts,



## DISEASE SURVEILLANCE 2010

rodents, will usually die of the infection if not previously captured by a predator.

### Humans

In humans, alveolar echinococcosis may develop into a serious, potentially fatal disease characterized by tumour-like lesions in the affected organ. Because of the long incubation period the disease is most frequently seen in adults. The most common site of localization is the liver but other organs can also be affected. Symptoms depend on the site and size of the lesion. The incubation period for developing alveolar echinococcosis in humans is assumed to be between 5 and 15 years.

### LEGISLATION

#### Animals

Detection of the parasite is notifiable according to Swedish legislation (SJVFS 2002:16 with amendments).

Since 2004, all dogs and cats entering Sweden from other countries (except for certain countries) have to be treated with praziquantel before entering Sweden as a preventive measure. The EU Regulation 998/2003 gives a transitional period for Sweden to maintain these rules until 31 December 2011.

#### Humans

Alveolar echinococcosis has been a notifiable disease since 2004 according to the Communicable Disease Act (SFS 2004:168).

### SURVEILLANCE

#### Animals

From 2000 to 2009, a total of 2,962 red foxes (*Vulpes vulpes*), 68 raccoon dogs (*Nyctereutes procyonoides*) and 35 wolves (*Canis lupus*) were examined for *E. multilocularis*: all with negative results. Samples from most foxes (n=2,675) were examined by ELISA (CoproAntigen ELISA) at the Institute for Parasitology, Zurich University, for the presence of the *E. multilocularis* coproantigen and the rest, plus those from which samples were ELISA positive, were examined using the sedimentation and counting technique (SCT) (n=726). The raccoon dogs and wolves were examined by SCT.

#### Humans

The surveillance in humans is passive.

### RESULTS

#### Animals

During 2010, 304 foxes were examined for *E. multilocularis*. A total of 103 were tested by SCT and 201 by egg PCR. One fox, a young female, shot in December 2010 in Västra Götaland county, in south-west Sweden was found to be positive. This fox was analyzed with egg-PCR. The result was confirmed by conventional PCR followed by sequencing. Furthermore, the intestine of the fox was examined by SCT and the parasites present were identified as *E. multilocularis*, both morphologically and by detection of parasite DNA by PCR and sequencing.

#### Humans

No cases of alveolar echinococcosis were reported in Sweden in 2010.

### DISCUSSION

Before 2010, *E. multilocularis* had never been detected in Sweden. Due to the finding of this parasite, an increased surveillance of foxes has been initiated to clarify the distribution of the parasite in Sweden. An increased surveillance of rodents to identify the intermediate host will also be initiated. If *E. multilocularis* is not spread over the country, there is a need to clarify if it is possible and cost effective to eradicate the parasite. The EU Regulation 998/2003 gives a transitional period for Sweden to require deworming of pets entering Sweden until 31 December 2011.

Although it is not known how *E. multilocularis* was introduced to Sweden, it is considered that infected dogs introduced to the country without proper deworming is the most probable way of introduction. The finding of *E. multilocularis* in Sweden will probably affect the way people handle dogs and cats. The risk of humans ingesting eggs from the environment is unclear and needs future attention.

### REFERENCES

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# Cystic echinococcosis

## BACKGROUND

Cystic echinococcosis is caused by *Echinococcus granulosus*. Domestic dog and wolves are the most frequent main hosts. Eggs of the parasite are excreted in faeces and thus to the environment where they can infect intermediate hosts such as cattle, horses and wild ruminants. The eggs develop into the larval stage (hydatid cyst) mainly in the liver and occasionally in other organs of the intermediate host. The main hosts get the infection when consuming organs containing larval cysts.

## History

Echinococcosis was earlier quite common in the northern parts of Scandinavia, where it had a connection to the possession of reindeers. In the 1990's *E. granulosus* was sporadically detected in moose and reindeer in Sweden.

## DISEASE

### Animals

In animals, the infection is usually asymptomatic.

### Humans

In humans, the main site of localization of cystic echinococcosis is the liver. However, other organs might also be involved, such as the lungs, heart or brain tissue. Infected patients may remain asymptomatic for years or permanently. Clinical signs of disease depend on the number of cysts, their localization and pressure exerted on surrounding organs or tissues. The incubation period for developing cystic echinococcosis ranges between several months to years.

## LEGISLATION

### Animals

Detection of the parasite is notifiable in all animals according to SJVFS 2002:16.

### Humans

Echinococcosis has been notifiable according to the Communicable Disease Act since 2004 (SFS 2004:168).

## SURVEILLANCE

### Animals

All animals are inspected for cysts during routine meat inspection.

### Humans

The surveillance in humans is passive.

## RESULTS

### Animals

*E. granulosus* was not detected in any animals in 2010.

### Humans

In 2010, 30 cases of echinococcosis were reported, which is double the number of cases compared to 2009. The increase was probably due to refugees coming to Sweden from areas where the disease is relatively common, but this connection is difficult to interpret because of the long incubation period. Other explanations for the increase may be a greater awareness of the disease, which has led to more cases being discovered and reporting might also have improved. Of the total number of reported cases 20 were women and 10 men aged 16 to 79 years (median age 39.5 years). They probably had been infected in areas where the parasite is endemic and the most frequently specified countries of infection were Iraq (11 cases), parts of former Yugoslavia (6 cases) and Syria (4 cases).

## DISCUSSION

*E. granulosus* has not been detected in Sweden in animals since the late 1990's, when it was reported in reindeer in the northernmost regions of Sweden, bordering on Norway and Finland. The parasite is prevalent in several European countries. In Finland it has occurred in wildlife (wolves, elk and reindeer); in other European countries mainly in a cycle of dogs-farm animals.

# Enzootic Bovine Leucosis

## BACKGROUND

Enzootic bovine leucosis (EBL) is caused by bovine leukemia virus, which is an oncovirus in the family Retroviridae. Infection occurs by transfer of infected lymphocytes for example via contact with contaminated biological material from an infected animal.

Sweden was declared officially free from enzootic bovine leucosis (EBL) by the European Union (EU) in January 2001 (former Decision 2001/28/EC, currently Decision 2003/467/EC last amended by Decision 2005/764/EC). Before this, a voluntary control program had started in 1990 and a mandatory eradication program had been running since the autumn of 1995.

## DISEASE

EBL is characterized by multiple cases of multicentric lymphosarcoma in adult cattle within a herd after an incubation period of 4-5 years. The tumors can develop rapidly in many sites, which may cause variable clinical signs depending on the site. Persistent lymphocytosis without clinical signs occurs earlier but rarely before 2 years of age.

## LEGISLATION

EBL is included in the Swedish legislation regarding notifiable diseases (SJVFS 2002:16). EBL is also on the OIE list of infectious diseases and current surveillance standards are given in EU legislation, Directive 64/432/EEC.

## SURVEILLANCE

The purpose of the surveillance is to document freedom from EBL in accordance to Directive 64/432/EEC. The Swedish Dairy Association is responsible for this surveillance, which is approved and financed by the Swedish Board of Agriculture.

From 2010 surveillance in dairy herds is performed by random sampling of at least 1,700 herds every year. Milk samples are collected within the quality control programs of the dairies. The surveillance in beef herds is performed by random sampling of at least 2,900 herds every year. Serum is collected from slaughtered cattle above 2 years of age in sampled herds.

Diagnostic testing is performed at the National Veterinary Institute (SVA), Uppsala, Sweden. Both milk and sera are analyzed using an antibody ELISA (Svanovir BLV GP-51 ELISA).

## RESULTS

During 2010, no herd was diagnosed with EBL.

## DISCUSSION

As no herd was diagnosed with EBL 2010 Sweden has now been declared free from EBL for 10 years indicating a very stable disease-free situation.





# Footrot

### BACKGROUND

Footrot is a world-wide contagious disease in sheep and goats. The causative agent is *Dichelobacter nodosus* (*D nodosus*), in conjunction with *Fusobacterium necrophorum*. Predisposing factors are humid and warm weather conditions, and inter-digital dermatitis is a precursor to footrot. The severity of footrot depends on the strain of *D nodosus* and the environmental conditions.

The first case of footrot in Swedish sheep was diagnosed in 2004. Data from all affected flocks have been documented since 2004. A prevalence study on slaughter lambs was performed in 2009. A voluntary control program was launched by the Swedish Animal Health Service in 2009.

### DISEASE

The clinical signs are typical foot lesions, and lameness due to the painful lesions. Lameness is, however, not a consistent clinical sign in all affected sheep. Footrot may vary in severity from inflammation of the interdigital skin to complete underrunning of hoof horn.

### LEGISLATION

Footrot is a notifiable disease (SJVFS 2002:16 with amendments).

### SURVEILLANCE

The aim of the control program is to eliminate footrot from affected sheep flocks and to provide certificate for footrot-free sheep trade. Another important part of the program is training for veterinary practitioners and non veterinary staff to perform clinical inspection and footrot scoring.

The program is based on foot bathing, moving to clean pastures and culling of chronically infected sheep. Feet are inspected by veterinarians and sheep farmers on an annual basis. The inspections are performed during August to October, when the risk for footrot increases due to weather

conditions. If no signs of footrot are detected, the flock is certified (F-status). Flocks with a history of footrot can be certified a year after elimination of the infection.

Diagnostic testing is performed at the National Veterinary Institute (SVA), Uppsala, Sweden. Development of additional diagnostic tools are also linked to the control program.

### RESULTS

In 2010, 92 sheep flocks have been certified free from footrot. Another 63 flocks are in process of being certified.

### DISCUSSION

Good collaboration between authorities, the sheep farming community and individual sheep farmers has resulted in a cost-effective control program.

### REFERENCE

U König, A-K J Nyman, K de Verdier: Prevalence of footrot in Swedish slaughter lambs. *Acta Veterinaria Scandinavica* 2011, 53:27.

# Infectious Bovine Rhinotracheitis

## BACKGROUND

Infectious bovine rhinotracheitis (IBR) is caused by Bovine herpes virus 1. The same virus can affect different organ systems causing respiratory, abortive, genital or conjunctival disease. Transmission is mainly by aerosol for the respiratory form and by venereal transmission for the genital form.

Examination of Swedish bulk milk samples during the early nineties showed the presence of a small number of seropositive herds. No signs of clinical disease were present in these herds. An eradication program was initiated in 1994 and the last seropositive animal was found in 1995.

## DISEASE

The incubation period for IBR is 3-21 days, but virus can be silently present in the host animal and be reactivated by stress or immunosuppression. The clinical picture varies with the subtype of the virus but also with the environmental and surrounding factors. Several manifestations of the disease can be present in the same outbreak in the same herd, the symptoms being concentrated either to the respiratory tract, reproductive organs or the eyes.

## LEGISLATION

The Swedish IBR eradication program was approved in 1994 (Decision 73/94/ COL and Decision 95/71/EC). Sweden was allowed additional guarantees relating to IBR in 1995 (Decision 95/109/EC) and was officially declared free from IBR in 1998 (former Decision 98/362/ EC, current Decision 2004/558/EC). Since 2004, all neighbouring Nordic countries have additional guarantees relating to this disease (Decision 74/94/ COL and Decision 95/71/EC). IBR is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments). Vaccination is prohibited and notification on clinical suspicion is mandatory.

## SURVEILLANCE

All diagnostic testing as outlined below was performed at the National Veterinary Institute (SVA). Milk and sera were analyzed for presence of antibodies using an indirect ELISA (SVANO-VIRTM IBR-ab, SvanovaR). A blocking-ELISA IBR/BHV-1 gB Ab ELISA kit (IDEXX) was used for confirmatory testing. Semen and organ samples were tested with a real time PCR. A positive case is defined as an animal with a positive PCR result or a confirmed positive serological reaction.

### Passive surveillance

Suspicious based on clinical signs must be reported to the Swedish Board of Agriculture and subsequently investigated.

In addition to the clinical surveillance, bulls are tested at semen collection centres. Bovine animals are also tested at export or import, including the more exotic species such as buffalo, visent and yak.

### Active surveillance

The purpose of the surveillance is to document freedom from IBR. The Swedish Board of Agriculture is responsible for the surveillance, which is coordinated by the Swedish Dairy Association. Within the surveillance program dairy herds are tested with bulk milk samples, in farms with more than 50 cows pooled milk samples are used. The sampling is conducted twice yearly within the Dairy association's quality control program and synchronized with the programs for bovine viral diarrhoea and enzootic bovine leucosis and thus not strictly random. The surveillance also includes serum samples from beef cattle. In 2010 1,702 bulk milk samples and 5,796 serum samples from beef cattle were examined.

## DISEASE SURVEILLANCE 2010

### RESULTS

In 2010 eight cases were investigated with serology and/or PCR, due to clinical suspicion of IBR. The diagnostic testing ruled out the suspicions.

All other samples tested in 2010 were also negative.

### DISCUSSION

In summary no herd or individual animal were diagnosed with IBR infection during 2010. This supports Sweden's IBR free status.



Photo: Gunilla Hallgren

# Influenza (pig)

## BACKGROUND

Influenza is a viral disease affecting both birds and mammals, including humans. The cause is a RNA-virus of the family Orthomyxoviridae that is highly inclined to change over time and new strains are created both through mutations (“antigenic drift”) and through mixing of existing strains (“reassortment”). Influenza viruses are classified into subtypes based on their surface antigens, hemagglutinin (H) and neuraminidase (N). The main mode of transmission of influenza virus is by aerosols containing virus from the airways of infected individuals of the same species. Occasionally influenza virus can be transmitted from one species to another (like in the case with avian influenza infecting humans), but the main rule is that each species has their own influenza viruses.

The most common swine influenza virus subtypes internationally are H1N1, H1N2 and H3N2. Of these, the H1N1 swine influenza virus was reported to infect pigs in North America already in 1918.

During 2009 a new pandemic type of H1N1, possibly of partly porcine origin, began circulating in people and this virus has occasionally infected swine by transmission from humans in a number of countries including Norway, Denmark and Finland.

## History

Influenza H1N1 was isolated from Swedish pigs for the first time in 1982. The clinical signs were severe in the previously naive pig population but got milder over time. The H1N1 virus is since 1982 established in the country and has become endemic. Influenza H3N2 is also present in the Swedish pig population. Antibodies to H3N2 were first detected in a serologic screening performed in 1999. Since the clinical signs were not as evident as when H1N1 was introduced and the H3N2 was detected in screening of apparently healthy animals it is less clear when this subtype was introduced.



However, H3N2 has since 1999 occasionally been correlated to severe respiratory illness.

Another porcine influenza A type (H1N2) that has been spread through Europe, was diagnosed for the first time in Sweden in a large multisite unit with respiratory disease in growers during the winter 2009.

There has been no regular monitoring for influenza in pigs in Sweden, but SVA has managed to run serological screenings during 1999, 2002 and 2006 for the presence of serum antibodies in 1,000 porcine sera. The screening in 2006 also included analyses for antibodies to H5 and H7.

## Disease

Infection with influenza virus can produce clinical respiratory disease manifested as dyspnoea, sometimes with nasal discharge and cough, accompanied by fever, inappetence and inactivity. The disease can affect pigs of varying age and the severity of clinical sign varies from severe respiratory disease to subclinical infection. The morbidity of affected herds is generally high whereas mortality is low.

## LEGISLATION

Influenza in pigs is not regulated in the Swedish legislation.

## SURVEILLANCE

### Passive surveillance

During 2009 and 2010, samples from pig herds with respiratory signs that could be associated with influenza were collected with the aim to analyze the samples for presence of the pandemic influenza A (H1N1) virus using a polymerase chain reaction (PCR)-method. From each affected herd 5-10 nasal swab samples were collected and analyzed in a stepwise mode; samples positive for swine influenza A were further analyzed for pandemic influenza A (H1N1). Collection of samples and investigation of



## DISEASE SURVEILLANCE 2010

the herds have been performed by the Swedish Animal Health Service. Furthermore, these samples were also investigated regarding other influenza A types.

### Active surveillance

The surveillance made in 2010, included 1,008 porcine sera collected at slaughter. These sera were randomly selected from the PRRS control program and included a maximum of four sera per herd and sampling occasion. These sera were monitored for antibodies to Swine influenza types H1N1, H1N2 and H3N2 using HI-tests. HI-titers  $\geq 1:64$  were regarded to reflect significant levels of serum antibodies. Regarding the recently demonstrated influenza H1N2-virus, two HI-tests were carried out, one using a traditional strain and one based on the strain isolated in Sweden (the 9706-strain).

## RESULTS

### Passive surveillance

Samples from totally twelve herds with respiratory signs were analyzed for swine influenza virus in 2009 and 2010. In three of these herds influenza A virus was detected, but in no case was pandemic influenza A (H1N1) virus found.

### Active surveillance

The surveillance made in 2010, revealed low frequencies of pigs with significant levels of antibodies to Swine influenza types H1N1, H1N2 and H3N2 using HI-tests (Table 4). It is however notable that the prevalence of pigs with significant

levels of antibodies to H1N2 increased somewhat when the analysis was based on the recent Swedish isolate of the strain.

## DISCUSSION

The results indicate presence of, but no large impact of Swine Influenza in the Swedish pig population. In the serological screening carried out in 2010, the incidence of influenza was low with respect to H1N1 and H3N2. The prevalences of pigs with significant levels of serum antibodies were lower during 2010 than in 2006. Also the prevalence of pigs with significant levels of serum antibodies to H1N2 was low, regardless of the origin of viral strain used for the analysis. The reactions defined as low rather indicated unspecific reactions than true antibodies to the the influenza strains analyzed for. Still the difference in results depending on H1N2-viral strain used for analysing indicate the necessity to include relevant influenza strains (Table 4). The new pandemic form of H1N1 affecting pigs internationally has not yet been detected in pigs in Sweden.

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Table 4. Reactors from the serosurveys performed 1999 to 2010. The table shows the prevalence of significant seroreactors to the three porcine adapted strains of influenza present in the country. The table also shows the prevalences with low reaction in the HI-tests. Note the difference in prevalences depending on strain used for antibody detection for H1N2 in 2010.

| Seropositive samples                             | H1N1  | H3N2  | H1N2-standard | H1N2 new (9706strain) |
|--|-------|-------|---------------|-----------------------|
| Significant levels of antibodies ( $\geq 1:64$ ) |       |       |               |                       |
| 2006... (n = 999)                                | 33.0% | 6.7%  | 0,6%          | -                     |
| 2010 (n = 1,008)                                 | 0.6%  | 3.7%  | 0.1%          | 0.9%                  |
| Low levels of antibodies ( $\leq 1:32$ )         |       |       |               |                       |
| 2006 (n = 999)                                   | 15.1% | 18.8% | 7.0%          | -                     |
| 2010 (n = 1,008)                                 | 2.3%  | 9.6%  | 1.3%          | 5.1%                  |

# Leptospirosis

## BACKGROUND

Several species of the spirochetal bacteria of *Leptospira* can cause leptospirosis. The disease is associated with reproductive losses in cattle and significant economic costs worldwide, but may also cause disease in humans. Many countries in Europe have screening programs for *Leptospira interrogans* serovar *hardjo* (*Leptospira hardjo*).

*Leptospira* may be transmitted directly between animals or indirectly in the environment. The bacteria do not multiply outside the host, but may survive for long periods in the environment.

The results from the surveillance of *Leptospira pomona* in pigs are presented under the heading “Surveillance for a selection of infectious diseases in pig herds”.

## DISEASE

### Animals

*L. hardjo* is one of several pathogenic serovars and is associated with disease in cattle, sheep, goats and horses. Infections may be acute or chronic, asymptomatic, mild or severe. Acute disease is more often seen in calves. Disease in adult cows may go unnoticed as early symptoms as fever and depression often are transient and mild. Infected herds may have problem with abortions, decreased fertility and decreased milk yield as well as increased mortality in calves. The symptoms in sheep and goats are similar to those in cows. Sheep and cattle can act as reservoir hosts if having asymptomatic disease.

### Humans

*Leptospirosis* in humans ranges from asymptomatic or mild, influenza-like illness to a severe infection with renal and hepatic failure, pulmonary distress, and death.

## LEGISLATION

### Animals

Since 2004, leptospirosis is a notifiable disease in Sweden (SJVFS 2002:16, with amendments).

### Humans

Leptospirosis in humans is notifiable according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

From 1994 to 2006, approximately 3,000 samples (bulk milk and/or serum samples) have been tested for *Leptospira hardjo* in bovines each year. Since 2006 sampling and testing for antibodies to *L. hardjo* is not performed every year. In 2010 both bulk milk samples as well as blood samples were included in the program. A total of 2,496 blood samples were randomly selected at several slaughterhouses within the surveillance program for bovine virus diarrhea (BVD) and evenly distributed throughout the sampling period. In addition 750 bulk milk samples were selected by systematic random sampling from the surveillance program for BVD.

Diagnostic test used for both blood samples and bulk milk samples was an indirect ELISA (Prio-CHECK *L. hardjo*, Antibody detection ELISA, Lelystad, Holland). Positive blood samples confirms with MAT (Microscopic agglutination test). Positive or doubtful ELISA results on bulk milk samples confirms by investigation in the herd including additional sampling of individuals

Regarding surveillance for *Leptospira pomona* in pigs, see chapter on Surveillance for a selection of infectious diseases in pig herds.

### Humans

The surveillance in humans is passive.



### RESULTS

#### Animals

All samples but one were negative for antibodies to *L. bardjo* within the screening program in 2010. The result from one bulk milk sample was doubtful. However, the dairy herd was investigated and individual sampling of five dairy cows was performed as well as collection of a new bulk milk sample. There was no clinical signs suggesting *L. bardjo* infection in the herd and all samples turned out to be serologically negative.

#### Humans

Four cases of leptospirosis were reported. They were all infected when travelling in South East Asia.

### DISCUSSION

Leptospirosis occurs worldwide, but the predominant serovars vary by geographic region. The disease is associated with reproductive losses in cattle and significant economic costs worldwide. Some *Leptospira* serovars may be present in Sweden. However, the surveillance of *L. bardjo* that has been in place since 1994 suggest that this serovar is not present in the country. Since 2006 the surveillance program in cattle is no longer performed each year. The reason for this is that the serological screening of *L. bardjo* is considered of less importance compared to screening programs of other contagious animal diseases and as human infections are mainly travel-associated. The Swedish Board of Agriculture can decide on epidemiological investigation in case of clinical disease suggesting leptospirosis.



# Listeriosis

## BACKGROUND

The genus *Listeria* contains several species but the only zoonotic species, *Listeria monocytogenes* was first described in 1926. Previously, sporadic cases of listeriosis were reported, often in employees in contact with diseased animals but since the 1980's outbreaks of listeriosis have been traced to food products.

*Listeria* bacteria are widely distributed in the environment, such as in soil, silage and water. They can survive for long periods in the environment and tolerate disinfection and also grow at refrigeration temperatures. These properties make elimination of *L. monocytogenes* difficult. The main sources of human listeriosis are contaminated food products, such as smoked or marinated vacuum-packaged fishery products, meat products and soft cheeses or other ready-to-eat foods with long shelf-life. The infection can also be transmitted

from infected animals to humans or via person-to-person contact. The environment and animals serve as important reservoirs of the pathogen.

*L. monocytogenes* is destroyed by heating (pasteurization and cooking). The bacterium is able to grow in vacuum-packed food, at refrigeration temperatures and in modified atmospheres.

*L. monocytogenes* is destroyed by heating (pasteurization and cooking). *L. monocytogenes* is often found as an environmental contaminant in food premises.

In Sweden, during the last ten years approximately 40-60 cases have been reported annually. Outbreaks have been associated with vacuum-packaged fish (1995-1996) and with cheese made of raw goat milk (2001). During the later years, an increasing trend for cases of listeriosis has been noted both in Sweden and internationally. In 2009, the highest number of cases ever was reported (73 cases).





## DISEASE SURVEILLANCE 2010

### DISEASE

#### Animals

*L. monocytogenes* can infect a wide range of animal species, both domestic and wild. Animals may be asymptomatic carriers and shed the organism but especially sheep may develop clinical disease, such as neurological symptoms, abortions, mastitis or septicemia.

#### Humans

Listeriosis can be manifested either as a milder non-invasive form or as a severe invasive disease. The non-invasive form is mainly febrile gastroenteritis. A severe form mostly occurs in immunocompromised persons, the newborn, pregnant women and elderly people. Symptoms for the invasive listeriosis are septicaemia, meningitis and meningoencephalitis. For those with severe infection, the fatality rate is high (20-40%). The infection can lead to miscarriage, premature delivery or neonatal death. The incubation period of listeriosis varies from 3-70 days, the average being about 21 days.

### LEGISLATION

#### Animals

Listeriosis is notifiable in animals according to (SJVFS 2002:16 with amendments).

#### Food

Criteria for *L. monocytogenes* in foods are specified in EU-regulation on microbiological criteria (EC 2073/2005). Food business operators shall ensure that foodstuffs are in compliance with the regulation. Different criteria apply for ready-to-eat (RTE) foods in which growth of *L. monocytogenes* can occur and in RTE foods in which growth of *L. monocytogenes* will not occur during their shelf-life.

#### Humans

Listeriosis has been a notifiable disease in Sweden since 1960. It is notifiable in humans for both clinicians and laboratories according to the Communicable Disease Act (SFS 2004:168).

### SURVEILLANCE

#### Animals

There is no active surveillance system. Notifications are based on clinical cases and laboratory

analyses. The diagnosis can be based on histological or macroscopical findings at necropsy or by detection of the organism by cultivation methods using enrichment in selective broth followed by culture on selective and non-selective agar. Identification is made by biochemical methods. The Swedish Board of Agriculture can decide on epidemiological investigations if needed.

#### Food

No official control program exists. Sampling is performed by national and local authorities, mainly at retail level but also at production units. Sampling performed by the industry is not normally reported to the authorities. Analysis is based on cultivation methods according to EN/ISO 11290-1 and 11290-2 or NMKL 136.

#### Humans

The surveillance in humans is passive.

Isolates from human cases are sent to SMI for typing using the method provided by the *Listeria* reference laboratory in Paris.

### RESULTS

#### Animals

In 2010, listeriosis was reported in 31 sheep, three cattle, one goat, one dog and in one monkey.

#### Food

In 2010 a nationwide project was run in cooperation between the National Food Administration and the local health authorities. In all 1,379 samples (439 samples of meat products, 455 samples of soft and semi-soft cheeses and 485 samples of fish and fishery products) were analyzed both qualitatively and quantitatively. Of these, seven samples (1.6%) of meat products, two cheese samples (0.4%) and 52 samples of fish and fishery products (10.7%) were positive for *L. monocytogenes*. In three samples of fish and fishery products the counts of the pathogen were between 2-2.9 log cfu/gram. In one cheese sample (blue-mould soft cheese) more than 4 log cfu/gram were detected. In all other positive samples the counts of *L. monocytogenes* were < 100 cfu/g and in 77% of these, the concentration was < 10 cfu/gram.

Separate from this project, the local health authorities reported 127 other samples of various food products that were analyzed qualitatively. *L. monocytogenes* was detected in three of these samples.

## DISEASE SURVEILLANCE 2010

### Humans

In 2010, 63 cases of listeriosis were reported (incidence 0.7 cases per 100,000 inhabitants). This is a decrease with 14% from the very high number the year before (73 cases), but is still a high incidence (Figure 5). In accordance with the nationwide project on *Listeria* in ready-to-eat foods, the Swedish Institute for Communicable Disease Control has collected all human isolates for subtyping and comparison with the food isolates found in the project.

During the year, listeriosis was reported in seven pregnant women and unfortunately two of the new-born babies died of sepsis and meningitis. The number of pregnant women with listeriosis was the highest since 1992. The Swedish Institute for Communicable Disease Control investigated these cases and published a report with the purpose of spreading information to prevent future cases. The report is available in Swedish via [www.smi.se](http://www.smi.se).

A majority of the cases were elderly people. The age group 80–89 years was the most common with 20% of the cases. The gender distribution was even. The counties Gotland (incidence 1.8), Kronoberg (1.6) and Västmanland (1.6) had the highest incidences in 2010.

Listeriosis is most often a domestic infection.

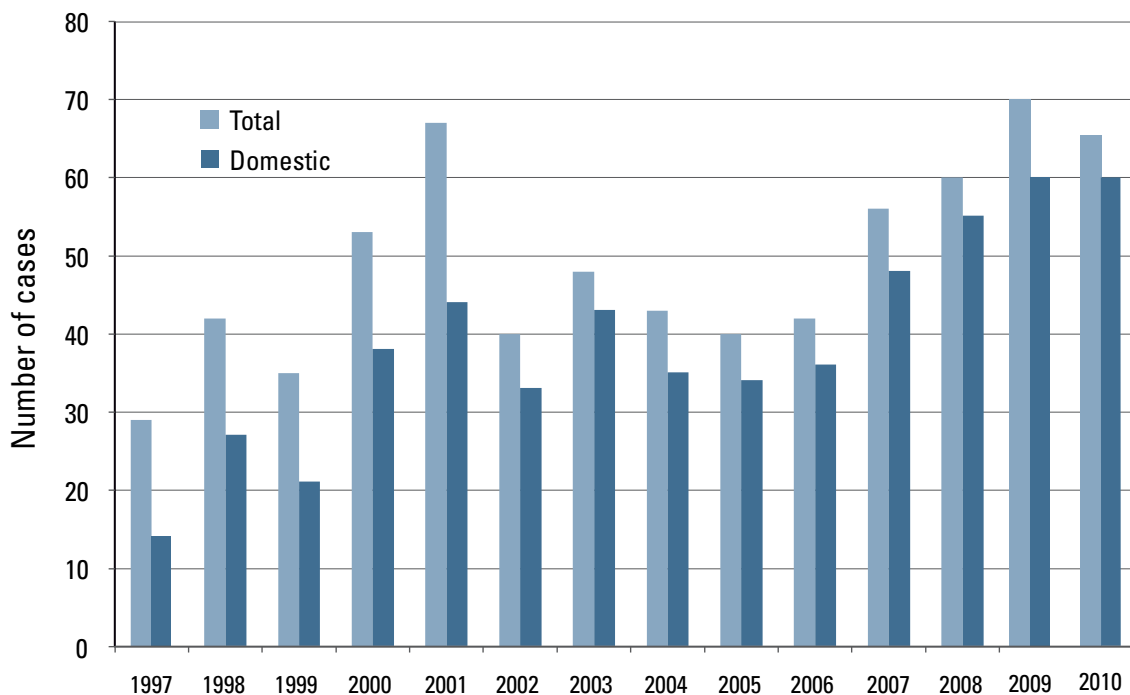
During 2010, 58 cases were reported with Sweden as country of infection. Two cases were infected abroad and 3 cases had missing information about country of infection.

Due to the nationwide project, almost all (62/63) isolates were serotyped and the distribution was as follows: 1/2a 77%, 4b 16% and 1/2b 6%. All strains were subtyped with PFGE to follow the development of certain increasing strains in 2009. As in 2009, certain clusters made up for a large proportion of the cases. One of these was especially observed in 2010 as well as in 2009 and investigations are ongoing in 2011. No larger outbreaks were reported in 2010.

### DISCUSSION

An increasing trend of reported human cases of listeriosis is seen in several European countries, Sweden included. The reasons for this increase remain unclear and should be elucidated because of the severity of the infection. The increase in the notified incidence may be attributed to changes in consumer habits, in the food chain or in legislative changes.

Figure 5. Number of notified human cases of listeriosis in Sweden, 1997-2010.



The case-fatality rate of listeriosis is high. One third of the patients died within three months but since most of them suffered from severe underlying diseases the impact of listeriosis is difficult to estimate. Usually, one to two pregnant women are diagnosed with listeriosis each year but in 2010 a higher number was reported which was of concern. A majority of these women had difficulties with the Swedish language, an important observation which is further discussed in the report given.

The microbiological criteria on *L. monocytogenes*, set in 2005 decide the standard the industry has to achieve for their products to be considered safe for consumers. The results from the nationwide project show that the fish industry still has problems with *L. monocytogenes* and the results indicate this to be a problem primarily for cold-smoked and marinated salmon. Relevant control measures are being discussed with the industry. The result of the ongoing subtyping comparison between human and food isolates will be useful for understanding the sources of infection for human cases and how these could be prevented.

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# Maedi/Visna

## BACKGROUND

The causative agent of maedi/visna (M/V) is a lentivirus in the Retrovirus family. Transmission between animals occurs most commonly via the oral route (e.g. via milk), but may also occur via inhalation of infected aerosol droplets. The incubation period is long indicated by the name lenti meaning slow.

In Sweden M/V was diagnosed in 1974 by post mortem examination at slaughter. A serological screening performed at seven Swedish abattoirs in 1989 demonstrated 8.2% seropositive flocks. A voluntary control program for M/V was launched by the Swedish Animal Health Service in 1993. The conditions applying to this program are stated in the Swedish legislation (SJVFS 1999:25). A second M/V program for sheep and goats that is not regulated within the Swedish legislation and does not require the same obligations from the farmers, started by the Swedish Animal Health Service at the end of 2005. The two M/V programs are running in parallel.

Since 1993 more than 600 flocks have been diagnosed with M/V of which 270 flocks with close to 15,000 sheep have been culled and in a majority of the flocks measures to eliminate the infection have been taken.

## DISEASE

In most cases clinical signs such as wasting, respiratory distress, arthritis and staggering, do not occur until the sheep are 3-4 years old or more. However, it can be an underpinning cause of other infection manifestations.

## LEGISLATION

Decision 1991/0068/EEC encompasses M/V. M/V is included in the Swedish legislation regarding notifiable diseases (SJVFS 2002:16) stating that the disease shall be reported when it has been diagnosed.

## SURVEILLANCE

The initial goal of the control program was to create a pool of M/V free breeding stock. This goal was reached some years ago, and in the second phase the aim is to eradicate M/V from the Swedish sheep population.

Farmers joining the initial program sign a contract where they agree that all animals have to be individually identified and the farmers have to keep a record of the flock. Blood samples are collected from all sheep older than 12 months of age. If the serology is negative, the flock gets an M1-status. 12-16 months later, a second sampling of all individuals older than 24 months is performed and if all samples are negative for M/V antibodies M2-status is granted. This procedure is repeated 12-16 months later and a negative result grants M3-status, which means that the flock is declared free of M/V. Farmers within the program are only allowed to bring in animals from flocks with the same or higher M/V status. In flocks where antibodies are detected, depending on the prevalence of positive animals, either a whole herd cull or eradication measures including selective slaughter is performed.

At the end of 2010, 2,940 flocks with a total of 125,146 sheep were enrolled in the initial program. Approximately 23,000 samples were analyzed within the programs during the year.

Diagnostic testing was performed at the National Veterinary Institute (SVA). Sera were analyzed using an AGID-test (agar gel immune diffusion) for which the antigen was purchased from VLA or with an ELISA-test (Synbiotic's Elitest MVV/CAEV).





### RESULTS

M/V antibodies were detected in 13 flocks. A total of 130 flocks reached M3- from M2-status during the year, making the number of flocks with M3-status (i.e. declared M/V free) 2,597 at the end of the year, with a total of 113,391 sheep.

### DISCUSSION

It is estimated that more than 200,000 sheep are controlled in the programs, which is more than 80% of the Swedish sheep population. There is still, however, a significant number of small flocks that is not included in the control programs. Efforts to contact and enroll new flocks will continue. The proportion of M/V positive among the not affiliated flocks is decreasing.

# Nephropathia epidemica

## BACKGROUND

Nephropathia epidemica (NE) is caused by Puumala virus, a member of Hantavirus genus in the Bunyaviridae family. Hantaviruses are the cause of rodent-borne haemorrhagic fevers with renal syndrome (HFRS) and hantavirus pulmonary syndrome (HPS). Puumala virus is likely the most prevalent hantavirus in Europe. The virus is excreted from its natural reservoir, the bank vole by saliva, urine and faeces. Puumala virus can remain infectious in bank vole cage beddings for two weeks. Transmission to humans often occurs in an aerosolized form. Humans may be exposed to virus aerosols during occupational or recreational activities, such as working with hay, cleaning barns or summer cottages, cutting wood and entering buildings contaminated with rodent excretions. NE was first described by two Swedish physicians independently in 1934. The linkage to its natural reservoir, the bank vole, was suggested many years later. The virus was first isolated in 1982 in Puumala, a municipality in south-eastern Finland.

In Sweden, between 100 and 600 cases are reported each season with a considerable inter-annual variation coupled to the 3-4 year population cycle of the bank vole. During the seasons 2006-2007 and 2007-2008 the annual number of notified cases rose to 1,400.

## DISEASE

### Animals

In bank vole, the infection is as far as we understand subclinical.

### Humans

The clinical picture is characterized by a sudden onset with high fever, headache, backache and abdominal pain. The symptoms range from sub-clinical to renal failure requiring intensive care and dialysis, but fatal cases are rare. The incubation period varies from 2 to 6 weeks.

## LEGISLATION

### Animals

Hantaviruses are not notifiable in animals.

### Humans

Nephropathia epidemica has been notifiable since 1989 according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

There is no surveillance in animals.

### Humans

The surveillance in humans is passive.

## RESULTS

### Humans

In 2010, 416 NE cases were reported, which was almost eight times more than in 2009 (Figure 6). The great increase was due to the bank vole population being in the growth phase of its cycle and thus there were many infected animals which could spread the disease.

Most reported NE cases were in the age between 40 and 70 years and the incidence was highest in the age span of 60-69 years. The majority of reported cases were men (58%). The reason for the difference between genders is not clear.

Almost all cases acquired their infection in Sweden. Four cases reported having been infected in Finland, where NE is also common.

Like in previous years, most of the cases (81%) were reported from the four northernmost counties in Sweden. Västerbotten county showed the highest incidence with 51 cases per 100,000 inhabitants.

The number of reported cases decreased during spring and summer, but the characteristic increase of the autumn started already in July, which is unusually early. Nearly three-quarters of the cases



Photo: Lena Renström

were reported in the second half of the year, with a peak of 70 cases in November reflecting the growth of the bank vole population during the summer and the voles probably starting to find their way indoors to human habitations when it gets colder outside.

### DISCUSSION

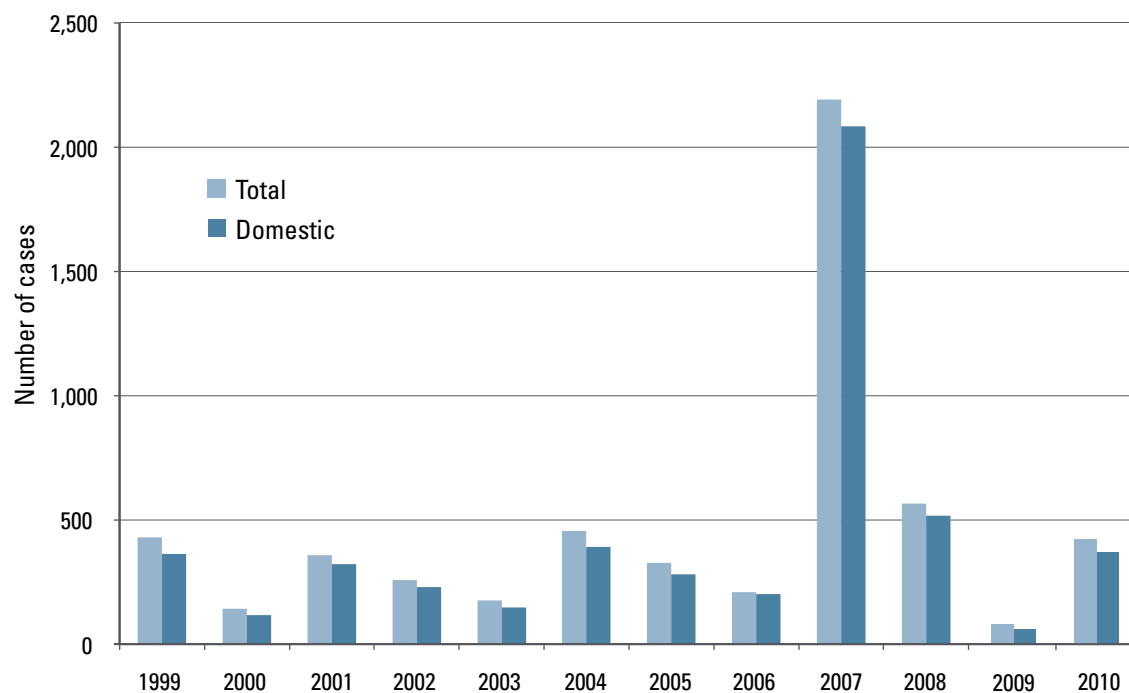
Peaks in the bank vole population coincide with increased number of human cases of Puumala virus infections which was evident during the last years. In 2010, the bank vole population was in the growth phase of its cycle resulting in an increase of

human NE cases. Except from the 3-4 year natural population cycle, variations in the climatic conditions also have an impact on rodent populations.

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Figure 6. Notified human cases of Nephropathia epidemica in Sweden in 1997-2010.





# Paratuberculosis

## BACKGROUND

Paratuberculosis is a common disease in most countries in the world, the Swedish situation with an extremely low prevalence is unique. However, sporadic cases in beef cattle, all of them connected directly or indirectly to imported animals have occurred, most recently in 2005. Paratuberculosis has never been detected in dairy cattle, other ruminants or wildlife in Sweden. The overall purpose of the surveillance and the control program in beef herds is to document freedom from bovine paratuberculosis and to prevent possible spread by early detection of the infection.

Previous active surveillances

- Tracings and several screenings in cattle after detection of a positive beef cow in 1993.
- Screening of 200 dairy herds each year in the years 2000, 2003 and 2005.
- Since 2004, all ruminants above one year of age, submitted for necropsy are sampled for *Mycobacterium avium* subsp. *paratuberculosis* (MAP) culture.
- Screening of sheep herds since 1993.

## DISEASE

Paratuberculosis, also called Johne's disease, is an intestinal infection in ruminants caused by MAP. MAP can be excreted in the faeces from infected animals and the transmission route is fecal to oral. It causes chronic diarrhea and emaciation resulting in animal suffering and death. To the farmer it causes great economic losses due to reduced milk production and reduced lifetime of affected animals. The incubation period is several years, in areas with endemic infection clinical disease is most commonly seen at the age of 2-5 years. There is no reliable method to detect the infection during the incubation period.

The zoonotic potential of MAP cannot be ignored, there are ongoing discussions about MAP

as one possible cause for Crohn's disease in humans. In countries with high prevalence of the disease, MAP has been demonstrated to occur in animal products such as milk and meat by which humans can be exposed to the bacteria.

## LEGISLATION

Paratuberculosis (Johne's disease) is included in the Swedish Act of Epizootic diseases since 1952 (SFS 1999:657 with amendments). Vaccination is according to this law prohibited and notification of the infection is mandatory based on clinical suspicion. Whole-herd slaughter is performed if MAP is detected in a herd.

## SURVEILLANCE

Diagnostic tests

In 2010 culture was used for all surveillances. After pre-treatment with NaOH and oxalic acid, samples were cultured on modified Lowenstein-Jensen medium supplemented with mycobactin and on Herrolds Egg Yolk medium for up to 4 months. Faecal samples from sheep were cultured for up to 6 months, on both modified L-J with mycobactin and modified Middlebrook 7H10 with mycobactin. Direct PCR on a new preparation from the stored sample was performed on samples within the control program that had moldy overgrowth in the culture.

Samples collected on clinical suspicion were analyzed with both direct PCR and culture. All tests for MAP were performed at the National Veterinary Institute, SVA.

Passive surveillance

Sampling and diagnostic work up is mandatory in animals of any ruminant species showing symptoms that lead to clinical suspicion of paratuberculosis. Sampling includes fecal samples from live animals and post-mortem samples from dead or culled animals. The latter include samples from the



ileal wall, ileal content and ileocaecal lymph nodes as well as any macroscopic lesions in the intestines. Wildlife is sampled when MAP is suspected at necropsy.

In 2010, clinical suspicions were raised in six herds with sampling of nine individuals (five cattle herds and one jak herd). One more investigation was performed due to cattle testing positive for antibodies previous to export. The number of clinical suspicions the last five years has been between three and nine.

### Active surveillance

#### *Control program in beef cattle*

In the control program, the target population is beef herds that sell animals for breeding. The control program is managed by the Swedish Animal Health Service and financed by the Swedish Board of Agriculture. In total, the control program for bovine paratuberculosis encompassed 519 herds during 2010 including all main breeding beef herds and a smaller number of dairy herds (Map 6). In affiliated herds, yearly faecal samples

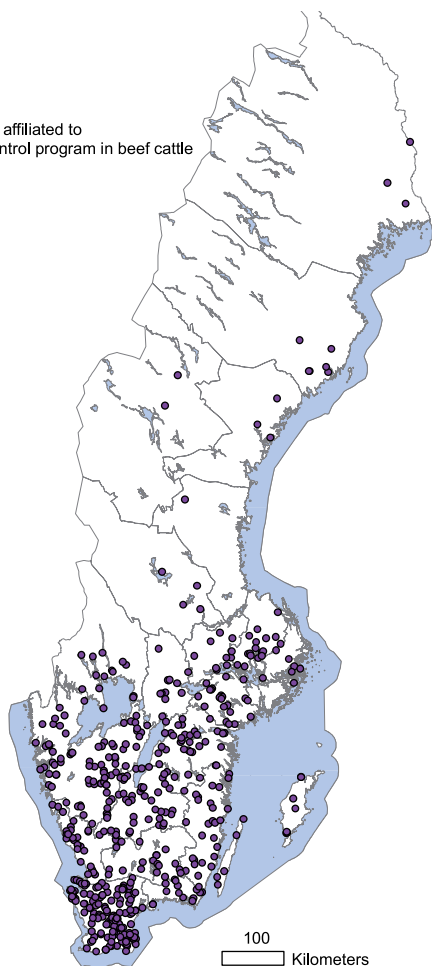
are collected from all cattle from two years of age and all purchased animals from one year of age. After five years of negative results, sampling is reduced to faecal sampling of 20% of the animals in the herd, or a minimum of ten animals, every second year. The samples are pooled five and five, except for imported animals that are cultured individually. In 2010 the number of sampled herds within the control program was 107 encompassing samples from 1,733 cattle. Changes in the program have been discussed during 2010 and will be put in place in 2011.

#### *Screening of beef herds with imported cattle*

This screening encompasses all beef herds that have imported animals during 1990-2005. In total 187 herds were identified (Map 7). After exclusion of herds being sampled within the control program 66 herds qualified for sampling. At the end of 2010 1,190 animals within 63 herds had been sampled for fecal culture. All imported individuals were sampled, and when imported animals were not alive their offspring and animals older than two

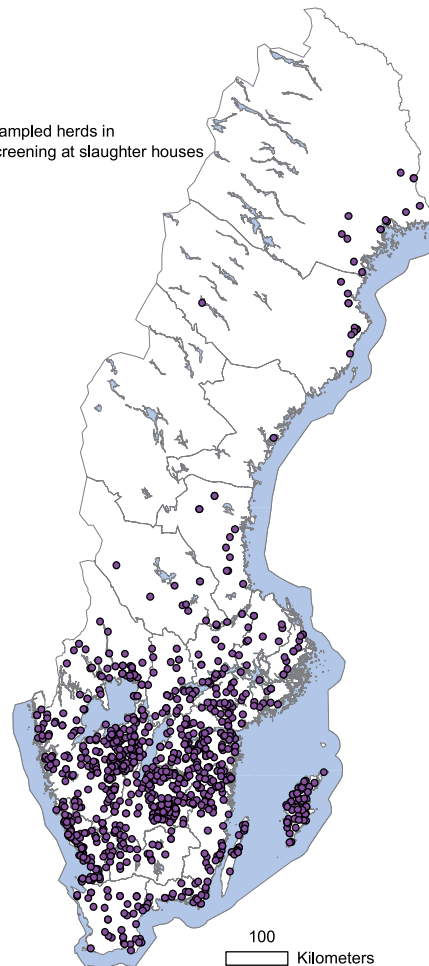
Map 6.

● Herds affiliated to the control program in beef cattle



Map 7.

● Sampled herds in screening at slaughter houses



## DISEASE SURVEILLANCE 2010

years within the same herd where sampled. Three herds did not voluntarily participate and will be handled by the Swedish Board of Agriculture. The screening was managed by the Swedish Animal Health Service and financed by the Swedish Board of Agriculture.

### *Screening of older cows at slaughterhouses*

The active surveillance in slaughterhouses, 2008 - 2010, was managed by the Swedish Animal Health Service and financed by the Swedish Board of Agriculture.

Samples from the ileal wall, ileal content and ileocaecal lymph nodes were collected for culture from cows older than six years with signs of weight loss. The sampling took place at eight different slaughterhouses. 189 cows were sampled in 2010, with the total number of sampled cows adding up to 1,211 since the start of this screening in 2008.

### *Post mortem examinations*

Sampling was performed on ruminants above one year of age submitted to post mortem examinations. Samples were taken as described for the screening of older cows at slaughterhouses (Map 8). In 2010, 391 animals were sampled (221 cattle, 165 sheep, 2 goats, 1 alpaca, 1 bison and one vicent).

### *Screening of sheep*

Ten of the older animals within 72 sheep herds where sampled for fecal culture during 2010 (Map 9). These were herds sampled within the Maedi-Visna program and they were selected by convenience.

## RESULTS

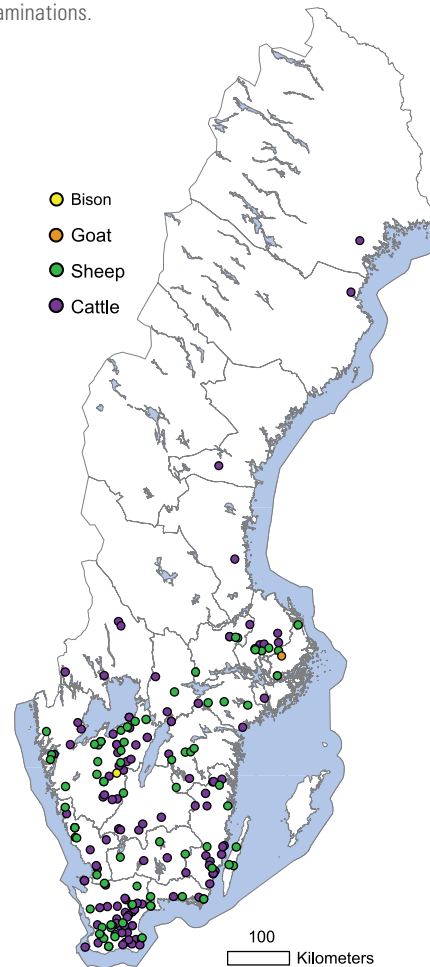
MAP was not detected in any of the examinations carried out in 2010 (Tables 5 and 6).

## DISCUSSION

The investigations undertaken show that the prevalence of MAP in Swedish ruminants remains at a very low level.

The screening of beef herds with imported cattle was aiming for the highest risk group of animals for MAP in Sweden; MAP has been detected in no other breeds or species than beef cattle and all cases have been connected to imported animals. Screening of older cows at slaughterhouses was also

Map 8. Sampled ruminants submitted to post mortem examinations.



Footnote: For the alpaca and vicent no coordinates were available.

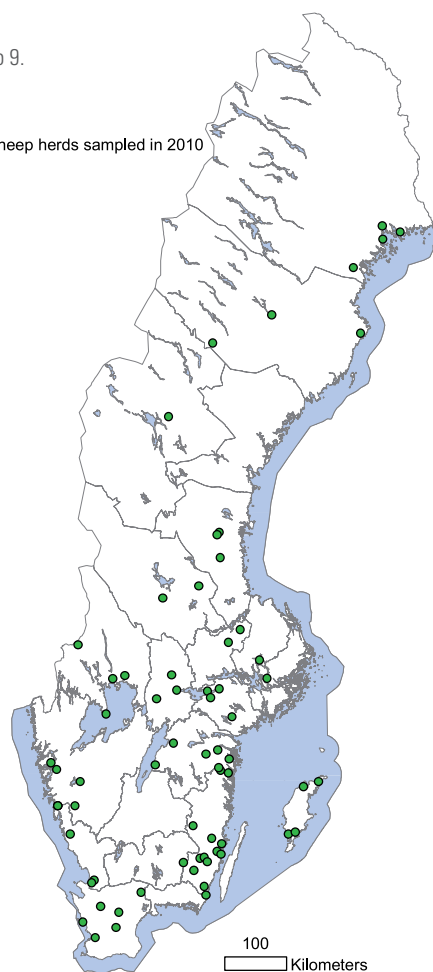
a screening aiming at a risk group of animals; cows older than six years with signs of weight loss. Approximately 50,000 cows older than six years are slaughtered yearly, and it is estimated that roughly 20% of these show signs of weight loss resulting in 10,000 cows available for sampling each year. The screening has been ongoing for approximately two years resulting in 1,211 sampled cows. As none of these samples were positive there is a 95% certainty that the prevalence of MAP infection within this group of animals is less than 0,35% (calculations performed in Freecalc with se (sensitivity) 0,8 and sp (specificity) 1,00).

Fallen stock is also considered a risk category for MAP and therefore all ruminants older than one year of age, submitted for post mortem examination, are sampled for MAP. In addition to the present sampling, all herds affiliated to the control program will have to send in fallen stock for post mortem examination in 2011, which will result in

## DISEASE SURVEILLANCE 2010

Map 9.

● Sheep herds sampled in 2010



increased numbers of cattle being sampled for MAP at post mortem examinations. The sampling at post mortem examination also includes sampling from other susceptible species, like alpacas, bisons and vicents which often are kept in herds with animals imported from countries where MAP is frequently occurring.

Work is in progress aiming at demonstrating freedom of paratuberculosis in Swedish cattle using multiple complex datasources. This investigation is based on results from surveillances performed during 2005-2008. Results from this study (finished in 2011), will be important in supporting the need for continued investigations of animals being imported, as imports of susceptible species possess the greatest risk of introduction of MAP to the Swedish cattle population.

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Rockström, U. 2011. Slutrapport; Undersökning avseende paratuberkulos i nötkreatursbesättningar som varit sista besättning till djur, vilka importerats till Sverige under 1990 till 2005. Jordbruksverkets diariernr 33-4861/11.

Table 5. Screening of sheep.

| Surveillance             | No of sampled sheep | No of sampled herds |
|--------------------------|---------------------|---------------------|
| Screening of sheep       | 719                 | 72                  |
| Post mortem examinations | 165                 | 77                  |
| <b>TOTAL in 2010</b>     | <b>884</b>          | <b>149</b>          |

Table 6. Screening of cattle.

| Surveillance                               | No of sampled cattle | No of sampled herds | Timespan for collection of samples |
|--|----------------------|---------------------|------------------------------------|
| Control program in beef cattle             | 1,733                | 107                 | 2010                               |
| Screening of herds with imported cattle    | 1,190                | 63                  | 2006-2010                          |
| Screening of older cows at slaughterhouses | 1,211                | 1,015               | 2008-2010                          |
| Post mortem examinations                   | 221                  | 118                 | 2010                               |
| <b>TOTAL in 2010</b>                       | <b>4,355</b>         | <b>1,303</b>        |                                    |

# Porcine Reproductive and Respiratory Syndrome

## BACKGROUND

Porcine Reproductive and Respiratory Syndrome (PRRS) is caused by an enveloped RNA-virus belonging to the family *Arteriviridae* and the disease affects domestic swine. PRRS is a highly contagious disease transmitted between swine both through direct and indirect contact.

Seropositive feral pigs and wild boars have been described but there is no evidence of wild boar being a reservoir for PRRS. The disease was first described in USA in 1987 and the virus was subsequently identified in 1991. Since then PRRS has spread to be endemic in most of the swine populations of the world and is now considered to be one of the most economically important viral diseases in swine production. In 2006, an atypical variant of PRRS virus was reported from Asia. This variant causes more severe clinical signs and higher mortality than the previously described variants of the virus.

In 1998 the Swedish Animal Health Service launched a surveillance program in which the Animal Health Service does the sampling and the National Veterinary Institute performs the analyses. The first case of PRRS in Sweden was confirmed in July 2007. Until then Sweden was one of few countries that declared themselves free of PRRS. The outbreak was detected through routine sampling within the surveillance program. Since the disease was not widespread at the time of detection a decision was made to control the outbreak through a modified stamping out procedure. The actions taken to eradicate the disease proved to be effective and following extensive surveillance sampling during the fall of 2007 it was possible to declare Sweden free from the disease with high probability in the beginning of 2008. Despite extensive investigation the source of the outbreak could not be established.

After the outbreak in 2007 the surveillance program has been revised in order to enable an

even earlier detection of a new introduction of the disease.

## DISEASE

As indicated by the name, infection with PRRS virus causes varying clinical signs depending on age of the infected animals. The incubation period is 2-7 days (usually 2-3 days) and in adult swine the clinical signs are usually mild, consisting of increased body temperature and inappetence for a few days. The devastating effect of PRRS infection in this category of animals is that it might lead to reproductive failure including late abortions, mummified fetuses, small litters and increased frequency of non pregnant sows. In fattening pigs the infection mainly causes respiratory signs.

The new atypical variant of PRRS may cause high fever, discolouration of the skin and mortality rates up to 100% in all age groups.

## LEGISLATION

The disease was included in the Swedish Act of Epizootic Diseases in 1999 (SFS 1999:657 with amendments) meaning that any suspicion of PRRS is compulsory notifiable and notification will lead to investigation.

## SURVEILLANCE

The purpose of the surveillance is to document freedom from PRRS and to detect introduction of the disease before it has been widely spread in the population. Both sampling for detection of virus genome and antibodies against PRRS virus are used in the surveillance. To detect antibodies against PRRS virus a commercial ELISA-method (HerdChek® PRRS X3 Antibody ELISA, Idexx Laboratories) is used and presence of virus genome is analyzed using a polymerase chain reaction (PCR)-method. Samples positive for PRRS virus





antibodies in the ELISA-test are analyzed in an immunoperoxidase monolayer assay (IPMA) for confirmation.

Regarding surveillance for other pig diseases, see chapter on Surveillance for a selection of infectious diseases in pig herds.

#### Passive surveillance

As PRRS is notifiable on clinical suspicion for both veterinarians and farmers, cases with suspect clinical signs will be investigated following notification to the Swedish Board of Agriculture. The investigation includes, in addition to restrictions on the farm during investigation, sampling of sick or dead animals and examination of the herd for presence of clinical signs and analyses of production results.

Ongoing testing of animals for export and at breeding centers adds to the passive disease surveillance.

#### Active surveillance

The revised active surveillance program implemented in 2007 comprises sampling in all Swedish nucleus herds, multiplying herds and sow pools twice a year and randomly selected production herds at slaughter once a year. In nucleus herds, multiplying herds and sow pools eight samples per herd are analyzed at each sampling occasion and at slaughter three samples per herd are analyzed.

In addition, analyses for PRRS virus genome with PCR are included in the active surveillance of aborted fetuses from sows.

## RESULTS

#### Passive surveillance

Six investigations following clinical suspicion of PRRS was undertaken during 2010. In four of these, reproductive failure was the main clinical manifestation. Following sampling the herds could

be declared negative for PRRS.

Samples originating from pre-testing for export and at breeding centers were all negative regarding PRRS.

#### Active surveillance

In 2010, 2,012 samples from nucleus herds, multiplying herds and sow pools and 4,424 samples originating from approximately 1,475 herds taken at slaughter were analyzed. All samples were tested for the presence of antibodies to PRRS. In five samples antibodies against PRRS virus were detected and confirmed whereupon investigations were initiated. These investigations concluded the positive samples to be single reactors not due to infection with PRRS in the herds.

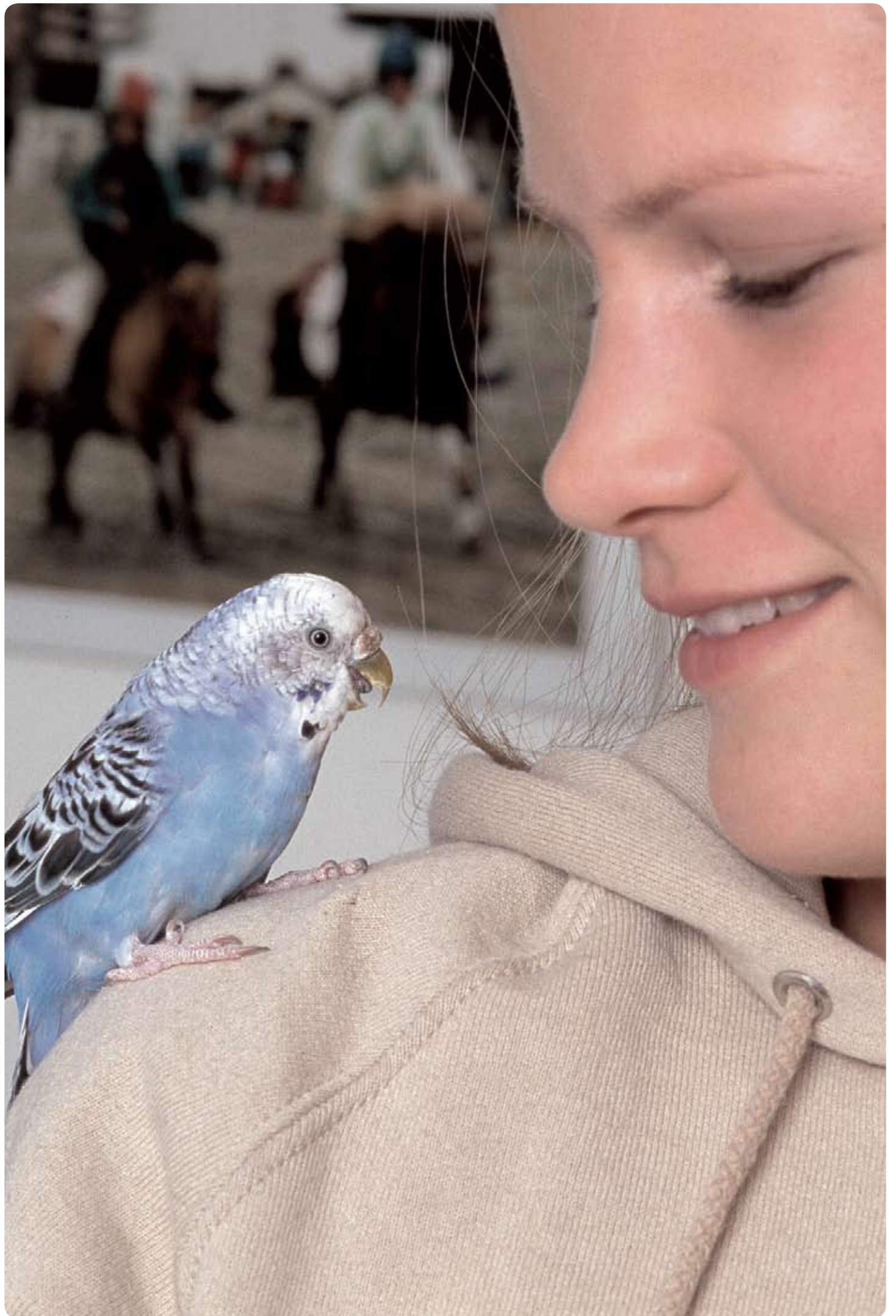
Within the surveillance of aborted fetuses, 61 fetuses from 29 herds were examined for PRRS virus genome and all samples were negative regarding PRRS.

## DISCUSSION

Following the outbreak of PRRS in 2007, the active surveillance program was further developed for even earlier detection of PRRS introduction into the country. The program is based on a calculated sample volume of approximately 7,000 samples. As the Swedish pig population has decreased with approximately 10% 2007-2010, the number of samples analyzed 2010 (approximately 6500) could be considered an adequate sample volume and thus the results of the surveillance program 2010 provides a basis for documentation of freedom of disease.

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# Psittacosis

## BACKGROUND

Psittacosis is caused by *Chlamydophila psittaci*, an intracellular bacterium. In 1879, psittacosis was described for the first time when an outbreak of pneumonia associated with exposure to tropical pet birds was detected among Swiss patients. The organism was identified in the 1930's. Since then, outbreaks have been described worldwide.

The main reservoir is in birds and the organism is excreted in faeces and nasal discharges. Birds may become carriers of the organism and shed it for years without any symptoms. People acquire the infection mainly via inhalation of contaminated dust or through contact with infected birds. In birds, the infection is transmitted via contact or via ectoparasites or via contaminated equipment. *C. psittaci* may persist in dry faecal secrete for months.

Control of psittacosis is very difficult. As the organism exists in both domestic and wild birds, eradication is impossible.

## DISEASE

### Animals

Birds commonly develop symptoms when stressed or immune system is depressed. Symptoms in birds range from an asymptomatic infection to conjunctivitis, sneezing, pneumonia and generalized infection. Adult birds recover from the infection whereas mortality can be up to 90% among young birds.

### Humans

In humans the symptoms often include fever, headache, rash, myalgia, chills and upper or lower respiratory tract infection. The disease is usually mild or moderate, but can be severe especially in untreated elderly persons. The incubation period is usually between 5 and 14 days.

## LEGISLATION

### Animals

*C. psittaci* is notifiable in animals according to (SJVFS 2002:16 with amendments).

### Humans

Psittacosis has been a notifiable disease since 1969 according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

No active surveillance exists. Notifications are mainly based on detection of the organism by PCR.

### Humans

The surveillance in humans is passive.

For laboratory verification of the infection serology and PCR are the methods used.

## RESULTS

### Animals

No cases were reported in animals in 2010.

### Humans

In 2010, five cases of psittacosis were reported and all of them were infected in Sweden. All the cases, except one 10-year old boy, were in their 60s. Three cases were men and two women. In the majority of case reports, no way of transmission was stated. Some had probably been infected while feeding wild birds or cleaning birdfeeders.

## DISCUSSION

In the 1980'ies around 100 cases were reported each year. During the last decade, between two and 24 cases have been notified yearly. There is no obvious explanation to this decrease in number of cases, but one possible cause could be that there is less sampling of ill persons. Surveys performed in other countries suggest that the number of human cases of psittacosis is underestimated. Detection methods are not sensitive enough.

At present, *C. psittaci* does not occur in Swedish poultry. The organism is occasionally reported in cage birds but psittacosis is considered common in both cage birds and wild birds.

# Q fever

## BACKGROUND

Q fever is a zoonotic disease caused by the bacterium *Coxiella burnetii*. Because of its tolerance to heat, dryness and many disinfectants, the organism is difficult to eradicate. Cattle, sheep and goats are considered to be the main reservoirs of the organism, but pets such as dogs and cats may also become infected. The agent is shed through several routes, such as milk, fetal and vaginal fluids, feces, urine and semen. *C. burnetii* has also been isolated from ticks.

Transmission to humans is mainly considered to be through inhalation of contaminated aerosols and dust. Therefore, contact with dusty animal products and -environments, such as wool, hay and bedding material may pose a risk. Also, consumption of unpasteurized raw milk may constitute a risk to susceptible individuals. In humans, immunosuppression, predisposing valvular heart disease and pregnancy may increase susceptibility to Q fever.

Larger outbreaks of Q fever, when reported, are principally always associated with small ruminants, whereas cattle more appear to be a possible source of sporadic cases. In many countries, Q fever is seen as an occupational hazard for professionals in contact with domestic ruminants and their environments, such as farmers, veterinarians and abattoir workers.

The presence of *C. burnetii* in domestic animal populations in Sweden is known since the early 1990's, when the bacterium was first isolated from a sheep placenta in a herd on the isle of Gotland. In 1993, a survey on Swedish sheep and cattle showed a low seroprevalence (0.3% in sheep (n=1001) and 1.3% in cattle (n=784).

In 2008/2009, a national survey on dairy cattle herds was performed showing that 8% of the herds were antibody positive in bulk milk. There were large regional differences, with highest prevalence on the isles of Gotland and Öland (59 and 35%, respectively).

In humans, only two domestic cases were reported in the 1980's and 90's. During the same period, a serosurvey in humans identified 28% of sheep farmers and 13% of veterinarians to be antibody positive, indicating a larger extent of the exposure. However, a prospective study on cases of endocarditis showed that only one of 329 patients had antibodies to *C. burnetii* indicating that the chronic Q fever endocarditis is rare. Since Q-fever became notifiable in humans in 2004, one to three cases have been reported annually until 2008, when an increase could be observed. Only one case was classified as domestic during the period 2004-2009. As for several other diseases, the incidence of the disease in humans seems to be underestimated.

## DISEASE

### Animals

Q fever in animals is usually asymptomatic but can also lead to reproductive failures such as abortions or still-/weakborn offspring. In herds where the agent has been proven to be present it should be ascertained whether any reproductive problems are due to Q fever or if there are, in fact, other causes.

### Humans

In humans the infection can vary from asymptomatic or flu-like illness to acute pneumonia. Liver complications and abortions occur. Most patients recover but some may develop a chronic illness. Incubation period varies depending on the number of organisms inhaled but is usually 2-3 weeks.

## LEGISLATION

### Animals

Q fever is a notifiable disease according to (SJVFS 2002:16 with amendments). Notification of a primary case of Q fever in animals is based on detection of the agent or increased antibody levels in paired samples.





### Humans

Q-fever has been notifiable according to the Communicable Disease Act since 2004 (SFS 2004:168).

### SURVEILLANCE

#### Animals

In 2010, national surveys in dairy goats and sheep were performed. Pooled milk samples from 58 dairy goat herds (corresponding to 63% of the target population) were investigated for antibodies by two indirect ELISA:s (CHEKIT Q-fever, Idexx and ELISACox, LSI) and for detection of the agent by RT-PCR (in-house protocol). In addition, pooled serum samples (10 individuals per pool) from 518 sheep herds were tested within the national maedi-visna program and analyzed by the same two ELISA kits for detection of antibodies.

Also, a regional bulk milk survey of antibodies to *C. burnetii* (the first of three in a longitudinal study in 2010/2011) was carried out on the isle of

Gotland, involving 114 dairy cattle herds (approximately 50% of all dairy herds on the island). Also in this survey, the two ELISA:s were run in parallel.

Twenty-four samples from sixteen bulls were submitted for export testing and investigated for antibodies by ELISA (CHEKIT Q-fever). In addition, 129 samples from cattle (n=54), sheep (n=60), goats (n=7) and alpaca (n=8) were investigated by RT-PCR in conjunction with surveillance for *Brucella* ssp. in aborted material.

#### Humans

The surveillance in humans is passive. For laboratory verification of the infection serology and PCR are the methods used.

### RESULTS

#### Animals

*C. burnetii* was not detected in bulk milk from any of the investigated dairy goat herds. Also, all herds

were antibody negative in the CHEKIT Q fever ELISA kit, whereas one herd, located in Västerbotten county, showed a reaction in the ELISACox kit from LSI. This corresponds to an antibody prevalence of 1.7% (95% CI 0.04-9.2) based on the ELISACox test.

Antibodies were detected in three out of 518 sheep herds (0.6%, (95% CI 0.1-1.7%)), by one or both ELISA tests (one positive in both (n=1), positive in ELISACox (n=1), grey zone result in CHEKIT Q fever (n=1)). The herds were located in Gotland, Uppsala and Jönköping counties.

The regional bulk milk survey on the isle of Gotland showed a prevalence of antibody positive dairy cattle herds of 61% (95% CI 52-70%) in the CHEKIT Q fever ELISA, and 54% (44-63%) in the ELISACox assay.

The samples submitted for export testing and the samples of aborted material were all negative for *C. burnetii*.

### Humans

Since the 1980s, there have only been occasional domestically acquired Q fever cases reported each respective decade. Most reported cases have been infected abroad, mainly in the Mediterranean countries. In 2010, the epidemiological situation changed as eight of the totally 11 reported cases claimed having been infected in Sweden. All these domestic cases were linked to a farm in southern Sweden which was included in the national survey on dairy herds mentioned above and where the bulk milk from the cows was shown to be antibody positive for *C. burnetii*. The human infection was detected when a person with connection to the farm was suspected of being infected with Q fever. An investigation was launched and a further seven people who lived and/or worked at the farm were found to be positive for *C. burnetii*. It was impossible to determine whether they had only had asymptomatic infections or whether their infections were clinical, as colds and fatigue were common during that time of the year. Anyhow, no one was seriously ill or showed signs of chronic Q fever disease.

Except one boy, all reported Q fever cases in 2010 were in the age group 30-70 years and all but one were male. During the time period when Q fever has been a notifiable disease, only about 20% of the reported cases have been women. A similar difference in gender distribution has been

described from other countries, but the cause of it is not clear.

The cases acquired abroad in 2010 had been infected in Cyprus, Turkey and Tanzania.

### DISCUSSION

In 2010, Swedish goats were for the first time subject to Q fever investigations. The results suggest that *C. burnetii* is a rare pathogen in this population. The same holds for sheep. In contrast, the survey in Gotland dairy cattle confirmed the results from 2008/2009, that this region has a high prevalence of cattle herds exposed to the agent.

The reason for using two parallel assays in the investigations conducted was the known difficulties associated with serological diagnosis of Q fever in small ruminants and recent suggestions that the use of assays based on ruminant antigen rather than tick antigen may be more sensitive. However, this was not the fact under Swedish conditions, where the two tests performed in a similar manner in sheep and goats, and where the kit with ruminant antigen was, if anything, less sensitive in Swedish cattle.

Swedish dairy goat herds are largely located in the northern part of the country, i.e. where there is a low prevalence of *C. burnetii* in cattle. To find a low degree of exposure in this population was therefore logical. In contrast, there is an ambiguity in the fact that *C. burnetii* was first cultured from sheep in Sweden and the low prevalence of antibodies to the bacterium found in the national screening. With the known difficulties involved in small ruminant serology, it is also desirable to screen sheep for the agent itself. Therefore, in 2011, the serological survey in sheep is being followed up by a survey based on vaginal swab sampling aimed at detection of the agent by RT-PCR

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# Rabies

## BACKGROUND

Rabies is caused by a rhabdovirus belonging to a family of Lyssaviruses. Rabies can infect all warm-blooded animals. Rabies occurs worldwide with some free areas. Rabies is transmitted through contact with saliva, typically via animal bites. Most human cases are caused by infected dog bites. The reservoir animal species of rabies in endemic countries are wild carnivores or stray dogs. In Europe the reservoir species are red fox and raccoon dogs. Bats in Europe may carry another type of rabies virus called European Bat Lyssa virus (EBLV), but never classical rabies. Since 1886 Sweden has been free from animal rabies. EBLV has never been isolated from bats in Sweden.

## DISEASE

### Humans and animals

Rabies virus infects the central nervous system of humans and mammals. Early symptoms of rabies are nonspecific, consisting of fever, headache, and general malaise. As the disease progresses, neurological symptoms appear and may include insomnia, anxiety, confusion, slight or partial paralysis, excitation, hallucinations, agitation, hypersalivation and difficulty swallowing. The incubation period of rabies is usually 3-6 weeks, but may vary from five days to one year.

Not much is known about symptoms in EBLV infected bats. They may express weight loss, disorientation, lack of coordination and muscle spasms and aggression, but some infected bats may be normal in behavior.

## LEGISLATION

### Animals

Rabies is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and is notifiable on suspicion. If rabies is suspected or confirmed measures will be taken to combat the disease and to prevent further spread.



Photo: Anders Lindström

To prevent the introduction of rabies, dogs and cats have to fulfill certain provisions before entering Sweden. Depending on the country of origin they either have to be placed in quarantine or have to be rabies vaccinated and have their antibody titer tested. The rules are set in the EU Regulation 998/2003 and Sweden may keep these rules until 31 December 2011.

### Humans

Rabies in humans is notifiable according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

Since 1998, a passive surveillance program has been in place where dead bats have been examined for the presence of rabies virus. Annual information about the survey has been sent to different interested parties with an appeal to send in bats and with instructions how to handle the dead bats to reduce the risk of rabies infection. In addition, since 2008 an active surveillance program has been performed in Sweden.

### Passive surveillance

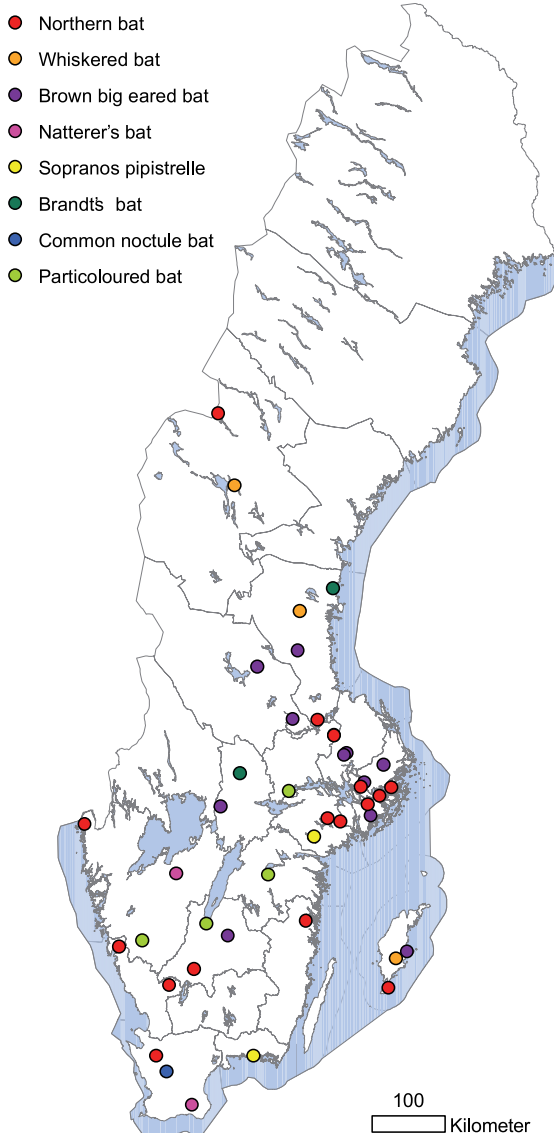
During 2010, five dogs, two squirrels, one cat, one

## DISEASE SURVEILLANCE 2010

red fox and one European otter were examined for rabies due to clinical suspicion. The diagnostic method used was based on the detection of antigens in brain tissue by use of a fluorescent antibody test, FAT.

71 dead or wounded and euthanized bats were sent to the National Veterinary Institute (SVA) for rabies examination (Map 10). The contributors were mostly private persons. The diagnostic method used was FAT. Of these, 31 bats were in no condition to be examined for rabies, mostly due to decomposition. The bats were sent to The Swedish Museum of Natural History, Stockholm, to determine the species.

Map 10. Distribution of bats tested for rabies in passive surveillance during 2010.



### Active surveillance

86 Daubenton's bats (*Myotis daubentonii*) were caught in the County of Uppsala by using mist nets. Blood samples and oral swabs were taken and the species and age were determined. After sampling the bats were released.

For serology the FAVN-method with EBLV-1 virus was used. The swabs were analyzed by real-time PCR for the detection of EBLV 1 and 2 and classical rabiesvirus.

### Humans

The surveillance in humans is passive.

## RESULTS

### Animals

All animals tested negative for rabies.

### Humans

No human cases were reported during the year.

## DISCUSSION

During the last decades, two persons have been hospitalized for rabies in Sweden. In 1974, a Swedish man fell ill after having been infected in India and in 2000 a woman fell ill after a visit in Thailand. Both patients had most probably been infected by rabid dogs. Since Sweden has been free from classical rabies, the risk of acquiring the disease from Swedish animals is negligible. There has been an increasing problem with illegal importation of pets since 2004, mostly dogs. Illegally imported dogs are probably the greatest threat to the rabies free status of Sweden even though the risk of introducing rabies is rather low.

During 2009 both Northern Bats and Daubenton's bats have been especially investigated for EBLV and the results suggest that EBLV is present in Sweden. There are 18 different species of bats in Sweden, all insectivorous belonging to the family of Vespertilionidae. Daubenton's bat (*Myotis daubentonii*), associated with EBLV-2 infections, is common and may be found from the south up to the county of Ångermanland in the north. Six other *Myotis* species may also be found in Sweden. The Serotine Bat (*Eptesicus serotinus*), associated with findings of EBLV-1 in Europe, is found in certain habitats in the south of Sweden. The Northern Bat (*Eptesicus Nilsonii*), which is related to the Serotine Bat, is the most common in Sweden, and may be found all over the country.



# Salmonellosis



## BACKGROUND

*Salmonella* infection is one of the most important bacterial zoonoses. The genus is divided into two species: *S. enterica* and *S. bongori*. Most *Salmonella* belong to *S. enterica* subspecies *enterica*. More than 2,500 different serovars belonging to this subspecies have been described. *Salmonella* can infect reptiles, all warm-blooded animals as well as humans. Humans are infected by contaminated food products of various ranges, through contact with infected animals, via person-to-person transmission or via a contaminated environment.

A severe domestic outbreak of *S. Typhimurium* in 1953 that involved more than 9,000 people prompted the need for a control program for *Salmonella*. Since then, the strategy for control has been to prevent *Salmonella* in any part of the production chain, from feed to food of animal origin. When Sweden joined the European Union in 1995, the Swedish *Salmonella* control program was accepted.

Around 3,000-4,000 human cases of salmonellosis are reported every year to the Swedish Institute for Communicable Disease Control (SMI). A majority of these (around 80-85%) are infected abroad. The low proportion of domestic infections is unique for Sweden compared to many other countries. Few larger outbreaks are reported and the source is more often imported food than domestic.

## DISEASE

### Animals

Infection in animals is often asymptomatic. However, *Salmonella* can cause clinical illness with symptoms of diarrhoea, abortions and fever, and lead to death. In Sweden clinical signs are frequently seen in cattle herds, but only rarely in swine herds and poultry flocks.

### Humans

*Salmonella* infects the gastrointestinal tract and causes an acute gastrointestinal illness. The symptoms can range from asymptomatic and mild to severe. The incubation period is often between 1 and 3 days but can vary from 6 hours to 10 days

Most patients recover from the illness spontaneously but sequelae such as reactive arthritis occurs in approximately 1-15% of the patients. Moreover, prolonged symptomless excretion of the pathogen is common.

## LEGISLATION

### Feed

Control of animal feed is an integrated and essential part of the control program for *Salmonella* at farm level. The manufacturer is responsible for producing *Salmonella*-free feed. Poultry feed has to be heat treated according to the legislation. The major part of cattle and swine feed is also heat

## DISEASE SURVEILLANCE 2010

treated. The control of feed is supervised by the Swedish Board of Agriculture which also carries out unannounced inspections at feed mills.

*Salmonella* in feed is regulated in national legislation (SJVFS 2006:81) as well as in an EU regulation (EU 142/2011).

### Animals

Investigation is required on clinical suspicion of *Salmonella* and any finding of *Salmonella*, irrespective of serovar, is notifiable and action is taken to eliminate the infection or contamination. Vaccination is not used in Sweden. The *Salmonella* Control Program is governed by the Swedish Act on Zoonosis (SFS 1999:658) and its regulations. The aim of the program is that animals sent for slaughter and animal products should be free from *Salmonella*.

### Food

Any finding of *Salmonella* in food is notifiable and a contaminated food product is considered unfit for human consumption.

### Humans

Salmonellosis in humans is notifiable according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Feed

In the control program for feed the emphasis is on control of feed raw materials, the heat treatment process and preventive measures regarding recontamination of heat treated feed. Also, suspected feed-borne infections are carefully investigated.

#### *Monitoring of feed raw materials*

Raw materials are the most important risk factor in feed production. According to domestic legislation feed materials are classified according to the empirical risk they present, and those feed materials classified as a risk have to be tested negative for *Salmonella* contamination before being used for feed production.

All consignments of imported feed materials classified as a risk have to be sampled for salmonella according to a sampling plan. The sampling plan is designed to detect a *Salmonella* contamination in 5% of the batch with 95% probability.

#### *Monitoring feed mills*

The purpose of the monitoring is to ensure the absence of *Salmonella* in the production lines as well as in the feed mill environment.

A safety management system shall be applied, i.e. the critical steps have to be identified in the processing line according to HACCP (Hazard Analysis and Critical Control Points). The management system covers a number of specific GMP (Good Manufacturing Practises) requirements, according to Swedish legislation.

A minimum of five samples from feed mills manufacturing compound feeding stuff for poultry and a minimum of two samples from those manufacturing compound feeding stuff for other food-producing animals must be collected at specified places in the processing line on a weekly basis. These samples are analyzed at the SVA (using the NMKL nr 71:1999 5th edition method) and any finding of *Salmonella* is reported to the Swedish Board of Agriculture. The manufacturers take additional samples from the processing line and the feed mill environment. Adequate measures shall be performed in case of positive findings of *Salmonella*.

### Food

Control of *Salmonella* is an important part of in-house control programs in most food enterprises in Sweden. All findings shall be reported to the competent authority. Sampling at retail level is also frequent even if the number of samples has decreased from previous very high numbers. Food samples are analyzed using the NMKL (nr 71:1999 5th edition) method.

#### Surveillance at slaughterhouses

According to the Swedish *Salmonella* control program samples from intestinal lymph nodes and swabs from carcasses are taken from cattle and swine and neck skin samples from slaughtered poultry. Sampling is proportional to slaughtering capacity. Altogether approximately 28,000 samples from cattle, adult swine, fattening pigs and poultry are collected annually.

At red meat cutting plants, approximately 3,000 samples are taken annually from crushed meat and meat scrapings and approximately 1,200 samples are taken in white meat cutting plants. The samples are analyzed by regional laboratories using the NMKL (nr 71:1999 5th edition) method.

## Control in Food-producing Animals

### *Control in poultry*

The program comprises a compulsory part and a voluntary part. All poultry species are included in the compulsory part, which gives the rules for obligatory sampling.

### *Compulsory program – poultry*

All breeding flocks having more than 250 birds are tested (Table 7). Grandparents of *Gallus gallus* broilers are imported as day-old chicken. Laying hens, turkeys, geese and ducks are imported as parents. Samples consist of boot swabs taken from all parts of the house where the birds are kept. From rearing flocks two pairs of sock samples are taken and pooled into one, five pairs pooled to two are taken from production flocks.

All holdings selling eggs for consumption are sampled (Table 7). All poultry flocks having more than 500 birds, irrespective of species, are tested 1-2 weeks before slaughter. The results must be available before slaughter.

The producers pay the costs for laboratory analyses and the visits to the holdings. Only accredited laboratories are allowed to perform the analyses. The laboratory sends the test results to the County Veterinary Officer on a quarterly basis. According to the regulations the County Veterinary Officer has to send a report on the test results of all poultry holdings to the Swedish Board of Agriculture once a year.

### *Voluntary program – poultry*

A preventive voluntary program includes all-in

all-out production, hygienic measures and certain standard of poultry houses, such as hygienic barriers between the clean and unclean part. Purchase of animals is only allowed from holdings affiliated to the voluntary program. Only heat-treated feed is allowed. The poultry houses must be cleaned and disinfected before introduction of a new flock. The broiler producer has to make an application to be accepted in the voluntary program. An official veterinarian controls the housing regularly. The producers affiliated to the voluntary program are allowed higher compensation in case of *Salmonella*. All broiler producers belonging to the Swedish Poultry Association are affiliated to the voluntary program (approximately 99% of the slaughtered broilers). The voluntary program has been in place for more than 40 years. All broiler flocks are analyzed for *Salmonella* before slaughter. Positive flocks are destroyed.

### *Control in cattle and pig herds*

The program comprises a compulsory and a voluntary part.

The compulsory part consists of faecal sampling annually from breeding pig herds and gilt-producing herds and twice a year from sow pools. At necropsy, all calves younger than six months are tested for *Salmonella*. *Salmonella* is tested at other post-mortem investigations if an infection of *Salmonella* is suspected on the basis of the macroscopic findings. All imported animals are sampled. On clinical suspicion, herds or single animals should be tested for *Salmonella*.

The voluntary program is a preventive hygienic

Table 7. Sampling scheme for *Salmonella* in poultry.

| Category of poultry                       | Sampling frequency                               | Sample type                                      | Sampling before slaughter | Official veterinarian    |
|---|--|--|---------------------------|--------------------------|
| Breeders in rearing                       | 1 d, 4 weeks, 2 weeks prior to rearing or moving | 2 pairs sock samples                             | 14 d before slaughter     | Once a year              |
| Breeders in production                    | every 2nd week                                   | 5 pairs sock samples                             | 14 d before slaughter     | 3 times under production |
| Layers in rearing                         | 2 weeks prior to moving                          | 2 pairs sock samples or 2 faecal samples of 75 g | 14 d before slaughter     | Once a year              |
| Layers in production                      | every 15th week (start at 22-26 weeks)           | 2 pairs sock samples or 2 faecal samples of 75 g | 14 d before slaughter     | Once a year              |
| Poultry for meat production (all species) |  | 2 pairs sock samples or 2 faecal samples of 75 g | 14 d before slaughter     | Once a year              |



program aiming at decreasing the risk of *Salmonella*. Holdings affiliated to the program get higher compensation in case of positive findings. The majority of all breeding holdings and many of the large dairy herds are affiliated to the program. In addition, affiliated holdings can apply for a commercial *Salmonella* insurance.

### *Control in other animals*

Animals are tested for *Salmonella* at suspicion or trace-back. Wild animals necropsied at the SVA are tested for *Salmonella*.

All samples from animals (poultry, cattle and pigs and other animals) are analyzed using the MSRV (EN-ISO 6579:2002/A1: 2007: Amendment 1: Annex D) method.

### *Humans*

*Salmonella* infection is notifiable in humans. All reported domestic cases are traced for the source of infection. All isolates sent to the Swedish Institute for Communicable Disease Control are analyzed according to the guidelines of the WHO Collaborating Centre for Reference and Research on *Salmonella*. Institute Pasteur, Paris, France Grimont, P. A. D. and Weill, F-X, 2007.

## MEASURES IN CASE OF POSITIVE FINDINGS

All suspected primary isolates of *Salmonella* from non-human sources are sent to the SVA for confirmation, resistance testing, serotyping and further typing. Primary isolates of *Salmonella* from humans are sent to Swedish Institute for Communicable Disease Control for serotyping and further molecular typing.

### Feed

Findings of *Salmonella* in imported feed materials and compound feeds are reported within the Rapid Alert System for Food and Feed (RASFF).

Measures are always taken when *Salmonella* is detected in feed samples. *Salmonella* positive feed materials are usually treated with organic acids. After acid treatment the feed material has to be re-tested with negative result before using it in feed production. Manufactured feed containing *Salmonella* has to be withdrawn from the market.

A larger sampling is made in the production line if *Salmonella* is detected in the weekly monitoring and several measures are then undertaken. If *Salmonella* is found before heat treatment the contaminated part of the production line is thoroughly cleaned and disinfected, usually by dry cleaning, followed by disinfection. If *Salmonella* is found after heat treatment, the feed mill has to be thoroughly cleaned and disinfected. Environmental sampling must show negative results before production is resumed.

### Animals

If *Salmonella* is suspected in an animal, a veterinarian is always obliged to take samples and prevent further transmission. When *Salmonella* is isolated at a laboratory the laboratory has to notify the Swedish Board of Agriculture and the County Veterinary Officer. The County Veterinary Officer informs the official veterinarian at the abattoir and others needing the information before confirmation. The isolate is sent to SVA for confirmation and further typing.

When *Salmonella* is confirmed on a farm, the holding is put under restrictive measures and an epidemiological investigation is always performed and a plan to eradicate *Salmonella* from the holding is designed. Animal movements to and from the holding are forbidden.

All *Salmonella* positive poultry flocks are euthanized irrespective of serotype. The poultry



stable and all possible contaminated areas are thoroughly cleaned and disinfected. Before introduction of new birds, all environmental samples must be negative for *Salmonella*.

In pigs and cattle, a combination of stamping out of groups of animals and hygienic measures controlled by repeated sampling is usually practiced. Hygienic measures can include reducing the number of animals, control of animal, feed and manure movements on the farm and reduction of *Salmonella* in the environment by cleaning and disinfection. No *Salmonella* positive animals should enter the cleaned and disinfected parts of the stable. Negatively tested animals, when considered at low risk of being infected, may be slaughtered under certain conditions with extra hygienic measures and sampling of each carcass. The restrictions are lifted when the cleaning and disinfection have been completed and *Salmonella* cannot be detected from two whole-herd samplings for culture performed four weeks apart.

If *Salmonella* is detected in companion animals advice is given to the owners. If *Salmonella* is detected in horses, the stables and or the paddocks at risk are put under restrictions and the horse is followed up.

### Food

Food products contaminated with *Salmonella* are considered unfit for human consumption. Products released on the market will be withdrawn and contaminated products will be destroyed or sent for special treatment to eliminate the *Salmonella* bacteria.

Findings in imported consignments are reported in the RASFF-system and the consignments will be returned to the country of origin, destroyed or sent for special treatment as applicable. RASFF is also used for informing about contaminated Swedish food products released on the EU-market.

In food businesses where *Salmonella* has been detected follow-up measures including careful cleaning and disinfection and environmental sampling will be applied.

## RESULTS

### Feed

Thirteen major feed mills produce approximately 95% of all feed consumed. In the monitoring of feed mills, 8,617 samples were taken. *Salmonella* was detected in 41 samples (0.48%). Ten serotypes

were detected; *S. Typhimurium* was the most common (n=19) (Table 8).

In addition, *Salmonella* was detected in 32 (0.9%) of 3,615 samples from feed materials of vegetable origin. The most common serotype was *S. Mbandaka* (n=5). No *Salmonella* was detected in environmental samples from domestic rapeseed processing plants. *Salmonella* was detected in 5 (0.5%) of 1,020 samples from feed materials of animal origin and from pet food.

### Animals

#### Poultry

*Salmonella* Typhimurium was detected in 17 (0.5%) of 3,702 broiler flocks (Table 9). Broilers in 15 flocks (nine holdings) were delivered by the same hatchery. However, in spite of intensive tracing the source of the outbreak could not be identified. No *Salmonella* infection was detected in the hatchery or in any breeder parent flock. One holding suffered from re-infection in two flocks.

*S. Livingstone* was detected in one flock of laying hens at slaughter and in another flock in routine farm sampling. *Salmonella* was not detected from any breeding flocks, neither from turkeys. Moreover, one flock with ostriches and one flock with geese were found infected with *S. Senftenberg* and *S. Typhimurium*, respectively.

#### Cattle

In 2010, 23 cattle herds were under restrictions due to infections of *Salmonella* and at the end of the year 13 cattle herds remained under restrictive measures. Seven of the herds were detected during 2010 (Table 10);

- 3 herds were detected by tracings from human infections.
- 2 herds were detected by sampling of calves at post mortem examinations.
- 1 herd was sampled due to clinical disease.
- 1 herd was sampled due to detection of *Salmonella* in a poultry flock of the holding.

No herd with *S. Dublin* was detected in 2010, which is the most commonly occurring serotype in Swedish cattle herds. However, when no serological screening is performed, detection of *S. Dublin* largely depends on sampling in herds with clinical disease or sending calves for post mortem examinations.

## DISEASE SURVEILLANCE 2010

Table 8. *Salmonella* serotypes isolated in feed control in 2010.

| Serotype  | Feed material of animal origin <sup>A</sup> | Pet food         | Feed material of oil seed origin <sup>B</sup> | Feed material of cereal grain origin | Process control feed mills       | Rape seed (environmental) |
|---|---|------------------|---|--------------------------------------|----------------------------------|---------------------------|
| <i>S. Aarhus</i>                                  |   |                  |   |                                      | 1                                |                           |
| <i>S. Agona</i>                                   |   |                  | 2   |                                      |                                  |                           |
| <i>S. Cubana</i>                                  |   |                  | 4   |                                      | 1                                |                           |
| <i>S. enterica</i> subspecies <i>enterica</i> (I) |   |                  | 5   |                                      | 1                                |                           |
| <i>S. Give</i>                                    |   | 1                |   |                                      |                                  |                           |
| <i>S. Glostrup</i>                                |   |                  | 1   |                                      |                                  |                           |
| <i>S. Havana</i>                                  |   |                  | 1   |                                      |                                  |                           |
| <i>S. Infantis</i>                                |   |                  | 2   |                                      | 1                                |                           |
| <i>S. Isangi</i>                                  |   |                  | 1   |                                      |                                  |                           |
| <i>S. Livingstone</i>                             | 1   |                  | 2   |                                      |                                  |                           |
| <i>S. Mbandaka</i>                                |   |                  | 5   |                                      | 7                                |                           |
| <i>S. Montevideo</i>                              |   |                  |   |                                      | 1                                |                           |
| <i>S. Newport</i>                                 | 1   |                  | 1   |                                      |                                  |                           |
| <i>S. Ohio</i>                                    |   |                  | 1   |                                      |                                  |                           |
| <i>S. Ouakam</i>                                  |   |                  |   |                                      | 2                                |                           |
| <i>S. Putten</i>                                  |   |                  |   |                                      | 1                                |                           |
| <i>S. Ruiru</i>                                   |   |                  | 2   |                                      |                                  |                           |
| <i>S. Senftenberg</i>                             |   | 1                | 2   |                                      | 6                                |                           |
| <i>S. Stratford</i>                               |   |                  | 1   |                                      |                                  |                           |
| <i>S. Tennessee</i>                               |   |                  | 1   |                                      | 3                                |                           |
| <i>S. Typhimurium</i>                             |   |                  | 1   |                                      |                                  |                           |
| <i>S. Typhimurium</i> Phagetype 120               |   |                  |   |                                      | 17                               |                           |
| <i>S. Typhimurium</i> Phagetype RDNC              |   |                  |   |                                      | 1                                |                           |
| <i>S. Typhimurium</i> Phagetype RDNC              |   |                  |   |                                      | 1                                |                           |
| <i>S. Vejle</i>                                   | 1   |                  |   |                                      |                                  |                           |
| <b>TOTAL</b><br>(total number of samples)         | <b>3</b><br>(959)                           | <b>2</b><br>(61) | <b>32</b><br>(3,481)                          | <b>0</b><br>(77)                     | <b>43<sup>C</sup></b><br>(8,617) | <b>0</b><br>(545)         |

A - Meat and bone meal, fish meal, greaves, bone meal, meat meal, milk products, and poultry offal meal.

B - Derived from palm kernel, rape seed, soya bean, sunflower seed, groundnut and linseed.

C - 41 positive samples, two different serotypes in two different samples.

## DISEASE SURVEILLANCE 2010

Table 9. Results from the *Salmonella* control programme in poultry flocks 2010.

| Animal species | Production type | Production stage   | No. flocks | No. positives | Percentage | Serotype                                       |
|----------------|-----------------|--------------------|------------|---------------|------------|--|
| Gallus gallus  | Meat production | Adult Grand Parent | 11         | 0             | 0.00%      |  |
| Gallus gallus  | Meat production | Adult Parent       | 121        | 0             | 0.00%      |  |
| Gallus gallus  | Meat production | Production         | 3,702      | 17            | 0.46%      | <i>S. Typhimurium</i> RDNC (n=16), DT120 (n=1) |
| Turkeys        | Meat production | Adult Parent       | 4          | 0             | 0.00%      |  |
| Turkeys        | Meat production | Production         | 155        | 0             | 0.00%      |  |
| Gallus gallus  | Egg production  | Adult Parent       | 23         | 0             | 0.00%      |  |
| Gallus gallus  | Egg production  | Production         | 614        | 2             | 0.33%      | <i>S. Livingstone</i>                          |
| Geese          | Meat production | Production         | 27         | 1             | 3.70%      | <i>S. Typhimurium</i> NT                       |
| Ducks          | Meat production | Production         | 11         | 0             | 0.00%      |  |

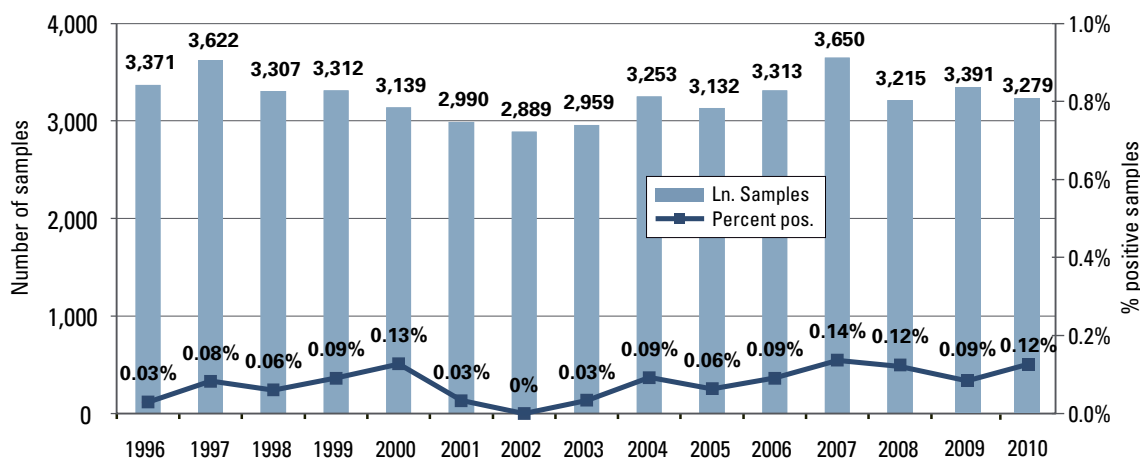
*S. Senftenberg* was detected in one flock of ostriches.

Three herds have been under restrictions due to a monophasic *Salmonella* (*S. enterica* sp. *enterica* 1,4,5,12:i:-). One of these herds was most likely infected via use of water from a contaminated water stream and another of these herds had bought calves from this herd. The third herd had no

epidemiological connection to the two previous herds; it was in another geographical area and also of a different subtype (MLVA).

Six herds in the county of Skåne were under restriction due to *S. Reading* during 2010 and at the end of the year four of these herds were still

Figure 7. *Salmonella* in cattle lymph nodes sampled at major slaughterhouses.



## DISEASE SURVEILLANCE 2010

Table 10. Cattle and swine herds infected with *Salmonella* in 2010.

| Primary serotype       | Species       | Phagetype           | Restricted since | Restrictions lifted | Reason for sampling                              |
|------------------------|---------------|---------------------|------------------|---------------------|--|
| S. Derby               | swine         | <i>not relevant</i> | 2010             | not                 | Trace-back after isolation at abattoir sampling  |
| S. Derby               | swine         | not relevant        | 2010             | 2010                | Trace-back after isolation at abattoir sampling  |
| S. Dublin              | cattle        | not relevant        | 2007             | 2010                | Abattoir sampling                                |
| S. Dublin              | cattle        | not relevant        | 2008             | not                 | Trace-back                                       |
| S. Dublin              | cattle        | not relevant        | 2008             | not                 | Necropsy   |
| S. Dublin              | cattle        | not relevant        | 2009             | 2010                | Screening survey                                 |
| S. Dublin              | cattle        | not relevant        | 2009             | 2010                | Screening survey                                 |
| S. Dublin              | cattle        | not relevant        | 2009             | 2010                | Screening survey                                 |
| S. Dublin              | cattle        | not relevant        | 2009             | not                 | Screening survey                                 |
| S. Dublin              | cattle        | not relevant        | 2009             | 2010                | Trace-back                                       |
| S. enterica 4,5,12:i:- | cattle        | not relevant        | 2009             | not                 | Trace-back                                       |
| S. enterica 4,5,12:i:- | cattle        | not relevant        | 2009             | not                 | Trace-back                                       |
| S. enterica 4,5,12:i:- | cattle        | NT                  | 2010             | not                 | Necropsy   |
| S. enterica 4:i-       | swine         | not relevant        | 2010             | not                 | Abattoir sampling control programme              |
| S. Reading             | cattle        | not relevant        | 2007             | not                 | Abattoir sampling control programme              |
| S. Reading             | cattle        | not relevant        | 2008             | 2010                | Necropsy   |
| S. Reading             | cattle        | not relevant        | 2008             | not                 | Clinical symptoms in cattle                      |
| S. Reading             | cattle        | not relevant        | 2009             | 2010                | Trace-back                                       |
| S. Reading             | cattle        | not relevant        | 2009             | not                 | Trace-back                                       |
| S. Reading             | cattle, swine | not relevant        | 2010             | not                 | Clinical symptoms                                |
| S. Typhimurium         | cattle        | 120                 | 2009             | 2010                | Abattoir sampling control programme              |
| S. Typhimurium         | cattle        | RDNC                | 2009             | 2010                | Abattoir sampling control programme              |
| S. Typhimurium         | cattle        | DT 120              | 2010             | not                 | Trace-back                                       |
| S. Typhimurium         | cattle        | PT 146              | 2010             | not                 | Human infection                                  |
| S. Typhimurium         | cattle        | RDNC                | 2010             | not                 | Human infection                                  |
| S. Typhimurium         | cattle        | DT 120              | 2010             | not                 | Human infection                                  |
| S. Typhimurium         | cattle        | PT 39               | 2010             | 2010                | Necropsy   |
| S. Typhimurium         | swine         | 104                 | 2007             | 2010                | Trace-back & abattoir sampling control programme |
| S. Typhimurium         | swine         | 120                 | 2009             | partly lifted       | Abattoir sampling control programme              |
| S. Typhimurium         | swine         | 120                 | 2009             | not                 | Trace-forward                                    |

NT= non typable

RDNC=reacts but does not conform



Table 11. Results from the *Salmonella* control programme at slaughterhouses and cutting places in 2010

| Animal species   | Abattoir | Sample type    | No. samples | Positive | Percentage (%) | Serotype  |
|------------------|----------|----------------|-------------|----------|----------------|---|
| Cattle           | Major    | Lymph node     | 3,279       | 4        | 0.12%          | <i>S. Enteritidis</i> PT15a, Teshie, Typhimurium DT125*, RDNC   |
|                  | Small    | Lymph node     | 243         | 1        | 0.41%          | <i>S. Derby</i>   |
|                  | Major    | Carcass swab   | 3,365       | 2        | 0.06%          | <i>S. Saintpaul</i> , Typhimurium PT1   |
|                  | Small    | Carcass swab   | 245         | 0        | 0.00%          |   |
| Breeding swine   | Major    | Lymph node     | 2,367       | 3        | 0.13%          | <i>S. Enteritidis</i> PT4, RDNC, <i>S. Oranienburg</i>  |
|                  | Small    | Lymph node     | 29          | 0        | 0.00%          |   |
|                  | Major    | Carcass swab   | 2,368       | 0        | 0.00%          |   |
|                  | Small    | Carcass swab   | 27          | 0        | 0.00%          |   |
|                  | Major    | Lymph node     | 3,531       | 6        | 0.17%          | <i>S. Thompson</i> , <i>S. Typhimurium</i> U277, RDNC (n=3), <i>S. enterica</i> sp. <i>enterica</i> O4:i- |
|                  | Small    | Lymph node     | 31          | 0        | 0.00%          |   |
| Slaughter swine  | Major    | Carcass swab   | 3,478       | 0        | 0.00%          |   |
|                  | Small    | Carcass swab   | 33          | 0        | 0.00%          |   |
| Cattle and swine |          | Meat scrapings | 4,236       | 0        | 0.00%          |   |
| Poultry          | Major    | Neck skin      | 5,713       | 1        | 0.02%          | <i>S. Livingstone</i>   |
|                  | Small    | Neck skin      | 33          | 0        | 0.00%          |   |
|                  |          | Meat scrapings | 1,405       | 1        | 0.07%          | <i>S. Paratyphi</i> B Java  |

\* Typhimurium PT 41 was detected in the pooled sample

under restrictions. One of these herds was detected early in 2010 and introduction was suspected to be via large groups of wild birds that had eaten from corn silage at the farm shortly before clinical signs appeared in the animals. This outbreak with *S. Reading* has now been going on for three and a half years.

*Salmonella* was isolated from 5 of 3,522 lymph nodes analyzed (Table 11, Figure 7). Four of these animals were slaughtered at high-capacity and one at a smaller abattoir. *Salmonella* was not detected in the whole-herd samplings in the originating herds. *S. Derby* was isolated from a cattle lymph node at a smaller abattoir. In the trace-back *Salmonella* was not detected in the cattle herd but from two swine herds delivering animals to the slaughterhouse.

*Salmonella* was also isolated from two individual cases at necropsy, in addition to the two mentioned

above, but in these two cases *Salmonella* could not be detected in the herds of origin on whole-herd sampling.

### Pigs

In 2010, *Salmonella* was detected in four new pig herds (Table 10). In two of these, *S. Derby* was detected in a trace-back after isolation of *Salmonella* from a cattle lymph node. In one farm a monophasic *Salmonella* (*S. enterica* sp. *enterica* 1,4,5,12:i:-) was detected and the source of the infection was most likely live pigs from an infected farm (detected in 2011). Three additional herds were under restrictive measures due to an infection of *S. Typhimurium* detected in 2007 or 2009.

*Salmonella* was detected from 3 of 2,396 lymph node samples taken from adult pigs (Table 11, Figure 8) and from 6 of 3,562 lymph node samples

## DISEASE SURVEILLANCE 2010

Figure 8. *Salmonella* in lymph nodes of adult pigs, sampled at major slaughterhouses.

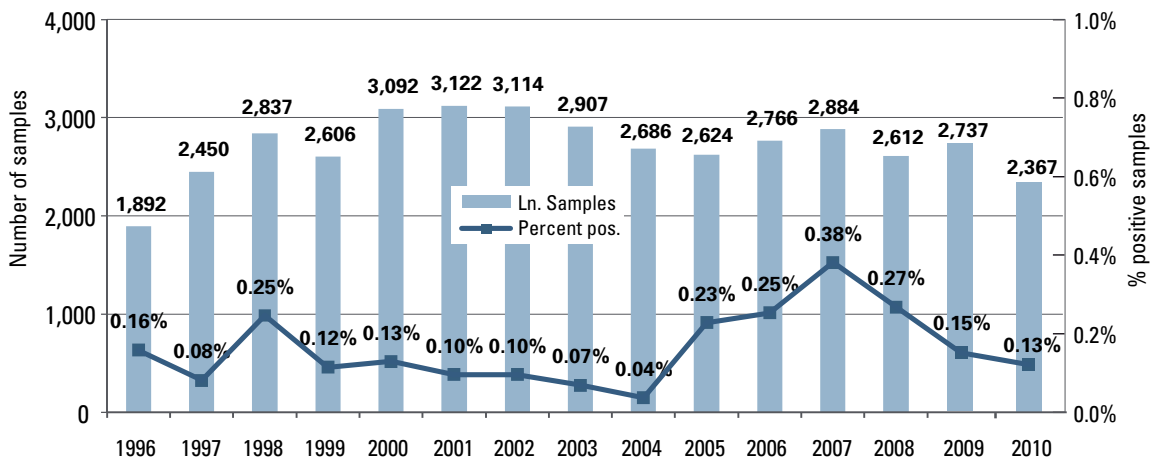
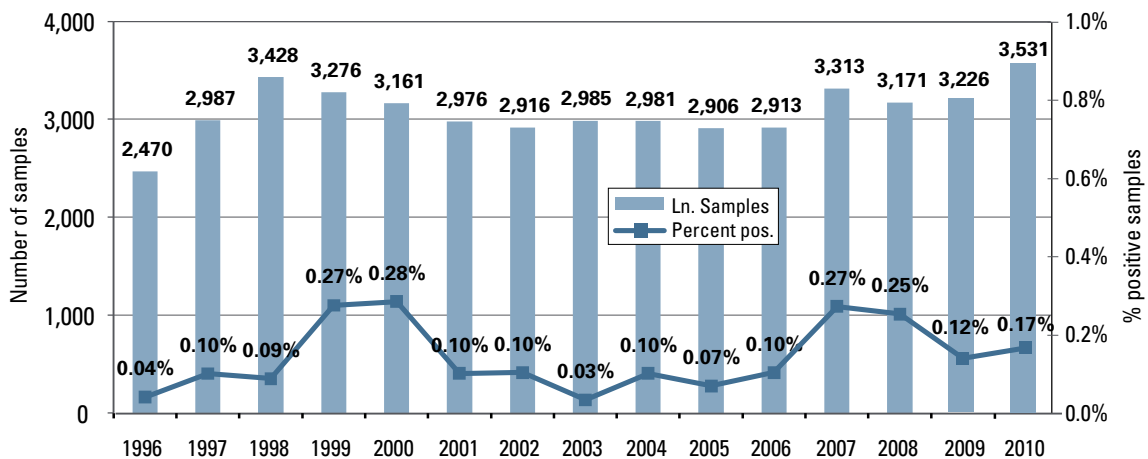


Figure 9. *Salmonella* in lymph nodes of fattening pigs, sampled at major slaughterhouses.



of fattening pigs (Figure 9). All findings were from high-capacity abattoirs. In one of these cases, *Salmonella* could be isolated in the following whole-herd sampling (monophasic *Salmonella*). This is the same farm as previously mentioned.

### Other animals

*Salmonella* was detected in two sheep herds, one dog, one horse, and 9 reptile pets. *Salmonella* was further detected in 14 wild birds as well as a monophasic and aphasic *Salmonella* in a wild boar and fox, respectively. In contrary to previous years, *Salmonella* was reported in only nine cats (Table 12).

## FOOD

In the Swedish *Salmonella* control program,

*Salmonella* was detected in 1 of the 5,746 poultry neck skin samples (Table 11, Figure 10) and in two of 3,365 cattle carcasses. No positive swine carcasses were detected in 5,906 samples. *Salmonella* was isolated from 1 of altogether 5,641 samples from cutting plants.

The local health authorities reported 2,516 samples of which 7 were found positive. Two of these positive samples were from fresh meat, the other 5 were from different ready-to-eat foods.

### Humans

During 2010 a total of 3,609 cases were reported with *Salmonella* infection (Figure 11), which is an increase from the lower number reported the year before (3,504 cases). The number of domestic cases

## DISEASE SURVEILLANCE 2010

Table 12. Reported cases of *Salmonella* in cats, dogs, horses, sheep, reptiles, wild birds and other wild animals in 2010.

| Serotype   | Phagetype      | Cat      | Dog      | Horse    | Sheep    | Reptiles* | Wild birds | Other wild animals |
|--|----------------|----------|----------|----------|----------|-----------|------------|--------------------|
| S. Aarhus  | not relevant   |          |          |          |          |           | 1          |                    |
| S. Abony   | not relevant   |          |          |          |          | 1         |            |                    |
| S. Benin   |                |          |          |          |          | 1         |            |                    |
| S. Brandenburg   |                |          |          |          |          |           | 2          |                    |
| S. Enteritidis   | not phagetyped |          |          |          |          |           | 1          |                    |
| S. Hadar   |                |          |          |          |          |           | 1          |                    |
| S. Istanbul  | not relevant   |          |          |          |          |           | 1          |                    |
| S. Kisarawe  |                |          |          |          |          | 3         |            |                    |
| S. Oranienburg   |                |          |          |          |          | 1         |            |                    |
| <i>S. diarizonae</i>                                     | not relevant   |          |          |          | 2        | 1         |            |                    |
| S. Salamae   | not relevant   |          |          |          |          | 1         |            |                    |
| <i>Salmonella sp</i> l=6,8:-:-                           |                |          |          |          |          |           |            | 1                  |
| <i>Salmonella enterica sp enterica (II)</i> Sl=4,5:-:1,5 |                |          |          |          |          |           |            | 1                  |
| S. Reading   |                | 1        | 1        |          |          |           | 1          |                    |
| S. Tennessee   |                |          |          |          |          | 1         |            |                    |
| S. Typhimurium   | PT 1           | 1        |          |          |          |           |            |                    |
| S. Typhimurium   | PT 41          |          |          | 1        |          |           | 1          |                    |
| S. Typhimurium   | U277           | 2        |          |          |          |           |            |                    |
| S. Typhimurium   | RDNC           | 1        |          |          |          |           |            |                    |
| S. Typhimurium   | NT             |          |          |          |          |           | 1          |                    |
| S. Typhimurium   | not phagetyped | 4        |          |          |          |           | 5          |                    |
| <b>Total</b>   |                | <b>9</b> | <b>1</b> | <b>1</b> | <b>2</b> | <b>9</b>  | <b>14</b>  | <b>2</b>           |

\*Two serotypes: Abony and Oranienburg were isolated from one reptile

increased with 39% to 830 cases in 2010, an incidence of 8.8 cases per 100,000 inhabitants, due to several domestic outbreaks in 2010. Travel-associated infections increased slightly in 2010 with 13% to 2,712 cases, which can be explained by an increase in the number of international travels in 2010.

Among the domestic cases, 47% were adults in the age group 30–69 years. Children aged 0–9 years accounted for 17% of the domestic cases. More adults were reported as travel-associated cases compared to domestic cases. The gender distribution was even.

As for previous years, most cases were reported from the three largest counties in Sweden. The counties with larger outbreaks during 2010 had the highest incidences; Dalarna (26.3), Kalmar (22.3) and Skåne (11.4).

A majority of the *Salmonella* cases are infected abroad (77% in 2010). As in previous years, the infection was most commonly acquired in Thailand (715 cases) followed by Turkey (n=405), Egypt (n=318) and Tunisia (n=145) in 2010.

Among the domestic cases, 94% were serotyped compared to 18% for the travel-associated cases. *S. Typhimurium* dominated (29% of the typed

## DISEASE SURVEILLANCE 2010

Figure 10. *Salmonella* in neck skin samples of poultry at major slaughterhouses.

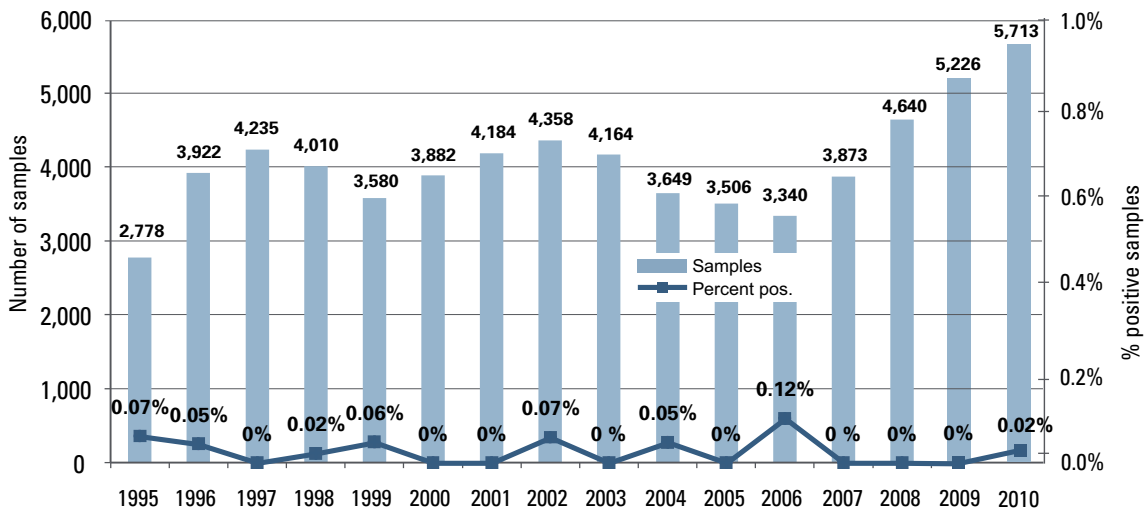
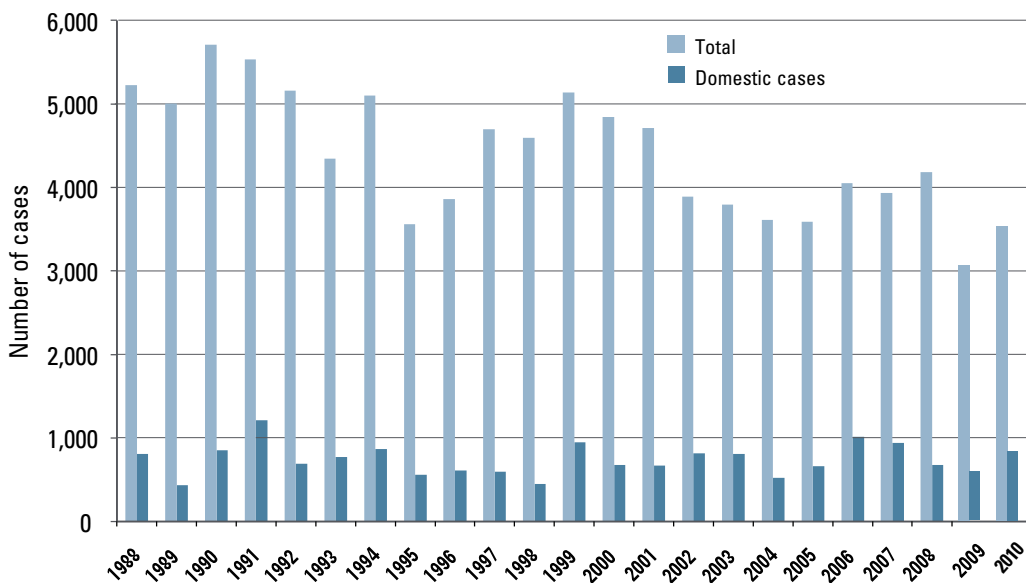


Figure 11. Notified human cases of salmonellosis in Sweden in 1988 -2010.



isolates) among domestic cases and *S. Enteritidis* among the travel-associated cases. The phagetypes NT (Non Typable), 120 and 104 were most common for domestic *S. Typhimurium*. *S. Typhimurium* was followed by *S. Enteritidis* (12%) and monophasic *Typhimurium* (*S. enterica* sp. *enterica* 1,4,5,12:i:-) (11%). A study to characterize monophasic *Typhimurium* isolates in Sweden was running during 2010 and will continue in 2011.

*Salmonella* cases are reported with a clear seasonal variation with most cases during the warmer months May to September. Most travel-

associated cases are reported during January to March when travelling to warmer destinations take place.

During 2010, 17 domestic *Salmonella* outbreaks were notified with 224 reported cases, which is a clear increase from previous year. Several outbreaks were caused by poor food hygiene in restaurants. In the largest outbreak at least 42 cases were infected with *Salmonella Typhimurium* NT after eating in the same restaurant in Kalmar County. *Salmonella* was detected both in several of the kitchen personnel as well as in food items and the cause of



the outbreak was poor food hygiene. Two different restaurant outbreaks were reported in Dalarna. One was connected to a thai-chinese restaurant with 18 cases infected with biochemically variant monophasic *Salmonella* (*S. enterica* sp. *enterica* 1,4,5,12,b:i:-), d-tartrate positive). The other outbreak occurred in a pizzeria with a prolonged contamination of *S. Enteritidis* PT 2 that caused two clusters with 20 cases before cleaning and disinfection stopped the spread of the infection. In Skåne, 18 cases of *S. Infantis* were matched with genetical subtyping, PFGE, to an indistinguishable *Salmonella* isolate in falafel from a restaurant. Also, an outbreak of *S. Senftenberg* among mainly older women lead to larger investigations. A temporarily contaminated batch of linseeds was suspected to be the source of the outbreak, but in spite of an extensive sampling, the contamination could never be proved and the outbreak has not been solved. The prolonged outbreak of *S. Reading* since 2007 involved five new cases in 2010. All had connections to infected farms.

### DISCUSSION

The low proportion of domestic human infections is unique for Sweden, Norway and Finland compared to most European countries. In order to trace and control the sources of infection it is therefore important to report domestic incidence figures of human cases and not only total incidence figures in an international context. The total notified incidence in 2010, 38.4 cases per 100,000 inhabitants is higher compared to the domestic figure of 8.8 cases per 100,000 inhabitants. The Swedish situation with few domestic human cases reflects the good *Salmonella* situation in domestic animals and food. The *Salmonella* situation in domestic animals has been very favourable for many decades (Figures 12-15).

In the feed sector, data from 2010 showed the same picture as the previous year with *S. Typhimurium* as the most frequently isolated serotype in feed mills, mainly depending on that one major feed mill still had problems with a salmonella contamination.

The number of cattle herds (n=6) detected with *Salmonella* in 2010 was less than the number of herds detected in 2008 (n=21) and 2009 (n=19) (Figure 15). However, no bulk milk screening has been performed the last year which might be a reason for detection of fewer herds, rather than a

true decrease of the number of cattle herds with *Salmonella*.

During 2010, *S. Derby* was detected in two swine herds with outdoor rearing management. This serovar has not been detected in pigs in Sweden since the late 1990's (Figure 14). The source of the infection in the present cases has not been revealed.

Reported human cases of *Salmonella* vary from year to year depending on the number of outbreaks. According to a trend analysis the total number of notified human cases has significantly decreased between the years 1997-2009, but a trend could not be identified for the domestic cases. An increase in 2010 might shift the trend, but that is too early to say.

For outbreaks the trend has been changing from large meat outbreaks towards smaller outbreaks with vegetable sources. (Figure 16).

An increased awareness regarding the risk of *Salmonella* in untraditional sources such as leafy green vegetables is needed as these products are commonly not cooked or heated prior to eating as compared to meat products and especially imported leafy greens have quite frequently been found to be contaminated with *Salmonella*. Routine subtyping of isolates from humans and comparison with isolates from animals, food, feed and the environment by MLVA has proved to be a useful tool to detect clusters and outbreaks. PFGE is another useful tool to identify sources in outbreaks as with the falafel outbreak in Skåne.

Monophasic *Salmonella* (*S. enterica* sp. *enterica* 1,4,5,12:i:-) has increased in recent years in Sweden and in other European countries which has led to ongoing investigations. In order to understand this emerging type a joint national project between human and veterinary institutes started in 2010.

# DISEASE SURVEILLANCE 2010

Figure 12. Notified incidence of *Salmonella* in Swedish layer holdings during 1968-2010.

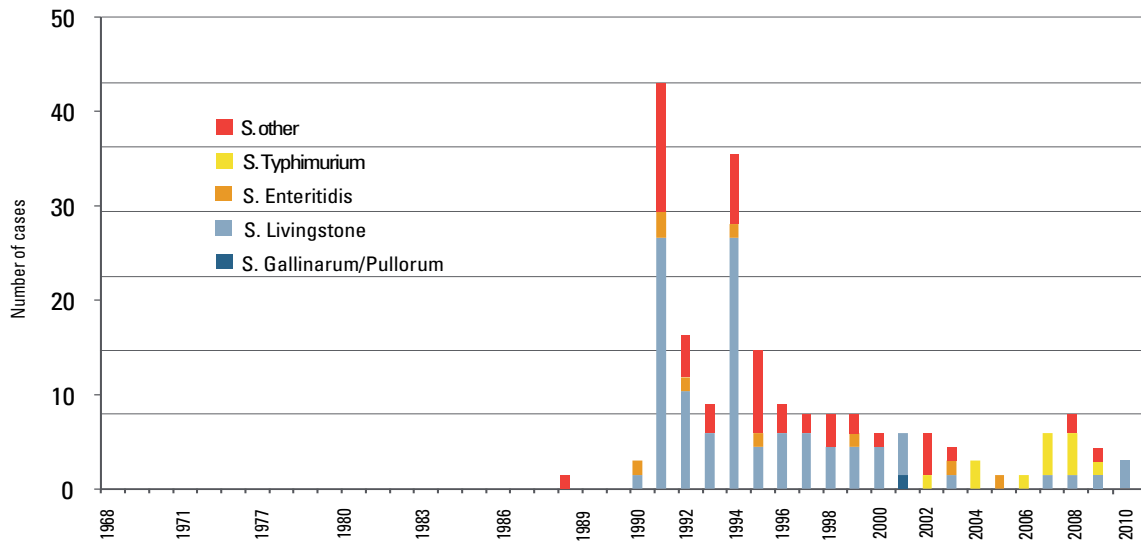
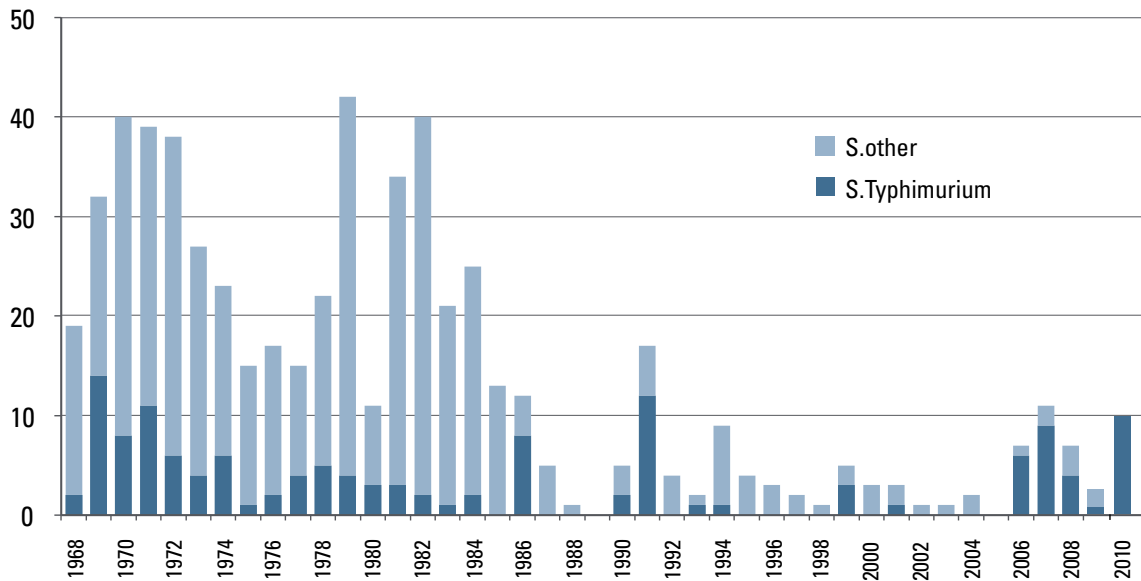


Figure 13. Notified incidence of *Salmonella* in Swedish broiler holdings during 1968-2010, breeding flocks included.



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# DISEASE SURVEILLANCE 2010

Figure 14. Notified incidence of *Salmonella* in Swedish pig herds during 1968-2010.

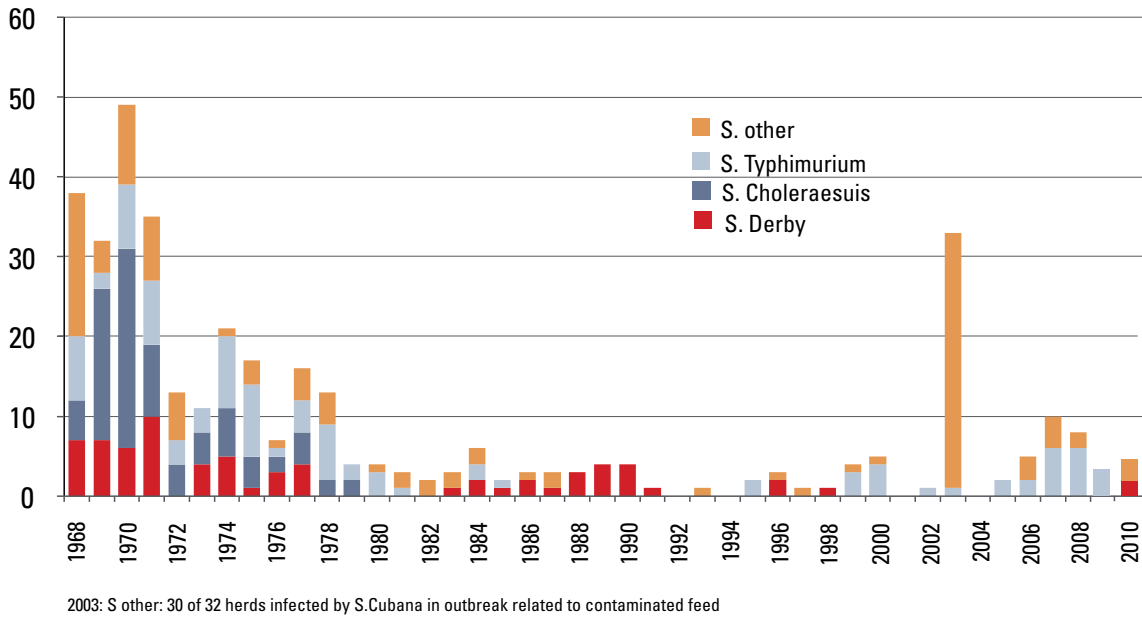


Figure 15. Notified incidence of *Salmonella* in Swedish cattle herds during 1968-2010.

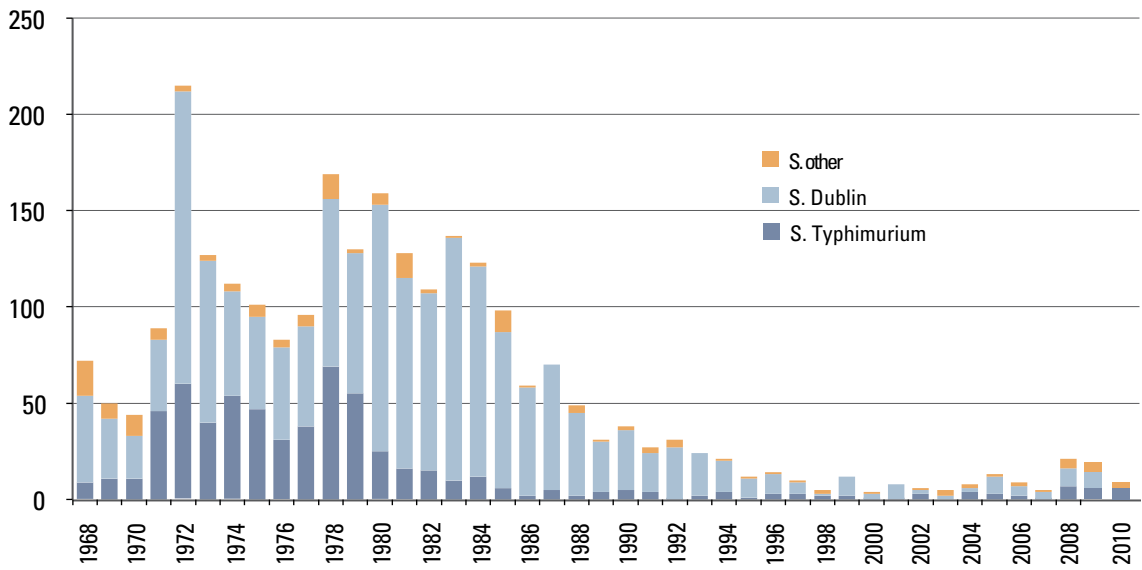
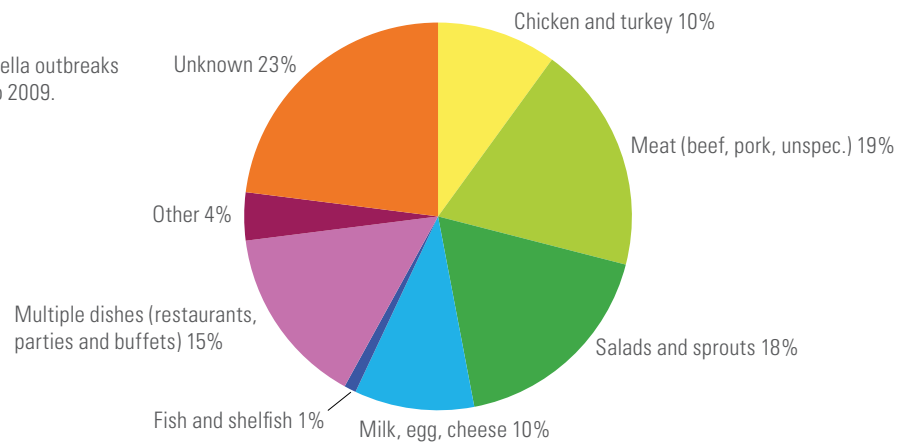


Figure 16. Sources of *Salmonella* outbreaks in humans in Sweden 1980 to 2009.



# Scrapie

## BACKGROUND

Scrapie belongs to the group of diseases called Transmissible Spongiform Encephalopathies (TSE) and was first described more than 250 years ago. The current theory about causative agent is the prion-only hypothesis. This theory assumes that misfolded prions (small proteins) induce the same pathological structure in normal proteins of the host resulting in accumulation of prions and cellular damage without involvement of any microorganism. Susceptibility to scrapie is genetically related. All routes of transmission have not been established, however, it is clear that spread can occur related to lambing.

After classical BSE became a disease of public health concern (see further chapter on BSE), and existence of BSE in small ruminants was suspected, both surveillance and control of TSE in small ruminants was increased within the European Union in 2002.

Classical scrapie has been detected in Sweden once, in a single flock in 1986. The whole flock was culled and the origin of the disease was never established.

In 1998 an atypical variant of scrapie was detected in Norway. The first Swedish case was detected in 2003, and since then a number of cases have been detected. Although atypical scrapie is experimentally transmissible, epidemiological studies on European level indicate that atypical scrapie may be a spontaneously occurring disease.

## DISEASE

The incubation period is long, up to several years. Symptoms of classical scrapie are related to the neurological system and include altered behaviour and sensation, affected movement and posture, as well as pruritus and skin lesions. The disease is progressive and always fatal.

## LEGISLATION

Surveillance and control is regulated through the Regulation (EC) 999/2001 of the European Parliament and of the Council of 22 May 2001. On national level surveillance and control is also regulated by the national scrapie control program and Sweden has since 2003 additional guarantees related to trade within the union (Commission Regulation (EC) 546/2006). Moreover sampling on national level is regulated by SJVFS 2010:9. Furthermore, scrapie is a notifiable disease under the Swedish Act of Epizootic diseases (SFS 1999:657, with amendments) and there is a scheme to compensate farmers for losses due to eradication measures.

## SURVEILLANCE

The Swedish Board of Agriculture is responsible for the surveillance program, which is carried out in cooperation with the National Veterinary Institute (SVA). SVA is appointed National Reference Laboratory, NRL (Regulation (EC) 999/2001. Samples are analyzed at the SVA.

### Passive surveillance

All suspicions of scrapie must be reported to the authorities. The obligation to report applies for animal owners, veterinarians and everyone else who is responsible for the animals. Samples from animals with clinical suspicion of scrapie are examined with Bio-Rad TeSeE short assay protocol (SAP) in combination with Bio-Rad TeSeE Western Blot.

### Active surveillance

The design of the surveillance program is in accordance with Regulation (EC) 999/2001 Annex III and the Swedish national control program. Within the program, all dead sheep and goats over 18 months of age which are not slaughtered for human consumption should be sampled. The



## DISEASE SURVEILLANCE 2010

carcasses are sampled at rendering plants and at autopsy. In remote areas where there is no collection of carcasses, the farmers shall send the whole skull to the SVA. Farms with confirmed cases of atypical scrapie are obliged to have increased surveillance in the herd during two years. In addition to fallen stock, healthy slaughtered animals above 18 months of age should be examined from these flocks.

The samples from active surveillance were examined Bio-Rad TeSeE short assay protocol (SAP) at SVA in accordance with Regulation (EC) 999/2001. In case of positive or inconclusive results the material was prepared and examined by Bio-Rad TeSeE Western Blot.

### RESULTS

#### Passive surveillance

In 2010 one goat was examined due to clinical suspicion of scrapie. The goat was negative for both classical and atypical scrapie.

#### Active surveillance

##### *Sheep*

In 2010 SVA examined 6,500 sheep from fallen stock for scrapie. Out of these, all samples were negative for classical scrapie and four were positive for atypical scrapie Nor98.

##### *Goats*

In 2010 SVA examined 25 goats from fallen stock for scrapie. All were negative both for classical scrapie and for atypical scrapie.

### DISCUSSION

#### Classical scrapie

Since the start of the active surveillance in 2002, more than 50,000 sheep have been tested without any positive cases detected. There is no central register for individual sheep and thus the number of dead animals cannot be compared to the number of sampled animals. Although not all sheep are collected, and although some of them are too autolysed to be sampled during the warmest summer months, the animals tested in 2010 still constitute approximately 2.6% of the population of adult sheep. The results support the freedom, or very low prevalence of classical scrapie in the country.

Sweden has additional guarantees related to scrapie when farmers import sheep or goats. However, illegal imports which are not detected could pose a potential threat to the current scrapie status in the Swedish sheep and goat population.

#### Atypical scrapie

Since the first case of atypical scrapie was detected in Sweden in 2003, in total 23 cases have been detected until the end of 2010. Out of these, two were detected through passive surveillance and the rest through active surveillance. Currently the flocks are put under intensified monitoring in accordance with the regulation (EC) 999/2001. No additional cases of atypical scrapie have been found in the positive flocks. On European level, two epidemiological studies have concluded that the prevalence is similar in different countries and that the prevalence in positive flocks does not differ from the prevalence in the rest of the sampled population. This pattern differs from the way contagious disease are normally distributed in the population and support the hypothesis that atypical scrapie is spontaneously occurring. However, transmission studies have shown that atypical scrapie can be transmitted to sheep and other species under experimental conditions. Although potential within flock transmission directly between animals seem to be very low (if it all exists) other routes of spread and the potential zoonotic aspect are being discussed.

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# Tick-borne encephalitis (TBE)

## BACKGROUND

Tick-borne encephalitis virus (TBEV) belongs to the genus flavivirus in the family Flaviviridae. TBE virus is endemic in an area ranging from northern China and Japan, through far-eastern Russia to Europe. The virus causes a neurological infection which may lead to long-term sequelae in the affected patients. The virus is spread by ticks (*Ixodes ricinus* and *I. persulcatus*), which are infected when they take their blood meals from infected rodents. The virus is also circulating in the tick-vector population (transovarial transmission) without any influence of vertebrate hosts. Larger mammals, predominantly ungulates, are important to feed the adult ticks, thereby leading to larger tick populations. Humans mainly get the infection via infected ticks although unpasteurized milk and other milk products have also been reported as sources. Vaccination of persons living, visiting or working in endemic areas is recommended.

Three virus sub-types of TBEV are described: the Western, Siberian and Far eastern subtypes. In Sweden, only the first one has been found.

The first TBE case in Sweden was reported in 1954 and during the following three decades, there were 10-40 annual cases reported annually. From the mid-1980's a clearly increasing trend has been observed. The last years about 200 cases have been reported annually. With a few exceptions all the cases are infected in Sweden. Most of them have acquired their infection in eastern coastal line close to the capital area. The age distribution is wide but most of the cases are between 30 and 70 years. There is a slight overrepresentation of men. About 80% of the patients are diagnosed in July to October.

## DISEASE

### Animals

Animals do not develop a disease.

### Humans

In humans, a biphasic course of the disease is common. The first, viremic phase lasts for about four days. After a free interval of about a week, a meningoencephalitic phase appears in about one third of the patients. The symptoms may then include fever, headache, nausea, cognitive dysfunctions or spinal paresis, etc. The mortality is low, about 0.5%. The incubation period of TBE is usually between 7 and 14 days.

## LEGISLATION

### Animals

TBE virus is not notifiable in animals.

### Humans

TBE in humans is notifiable as a viral meningoencephalitis since 2004 according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

There is no surveillance in animals.

### Humans

The surveillance is passive in humans.

## RESULTS

### Humans

In 2010, 174 cases of TBE were reported, which is a decrease of 17% in comparison to 2009. The decrease might partly be due to the hot and dry weather in the end of June and beginning of July, which made the ticks shelter in the ground.

As usual, more men than women were reported as TBE cases. In 2010 this difference between the sexes was exceptionally large, with about two thirds of the cases being men. Most cases were in the age 30 to 60 years. There were relatively few reported TBE infections in people under the age of 30.

## DISEASE SURVEILLANCE 2010

A majority of the TBE cases (98%) had acquired their infection in Sweden. Other sites of infection were Åland and the archipelago of Finland. The TBE season of 2010 started quite late with the first cases falling ill in the beginning of May. The number of cases peaked in September, which is later than the average year (Figure 17). This fact can probably be explained by the weather during the summer.

The spread of cases was mainly as the years before with a concentration of cases in the coastal areas of Stockholm, Södermanland and Uppsala counties, both along the lake of Mälaren and the Baltic Sea (Map 11). Both Örebro and Gävleborg counties reported their first cases ever.

### DISCUSSION

Although a slight decrease in the number of reported TBE cases was observed in 2010, an overall increasing trend in Sweden has been noted as in other European countries. The number of reported cases is probably affected by a combination of several factors as the number of infected ticks as well as infected vertebrate hosts, the behaviour of humans, the observance of the TBE infection in the health care or the weather conditions.

Map 11. Place of infection of reported TBE cases in 2010.

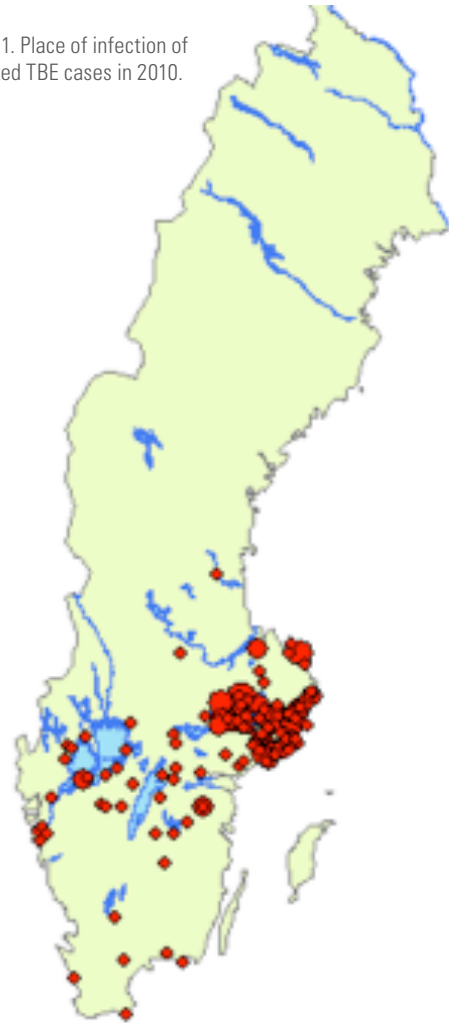
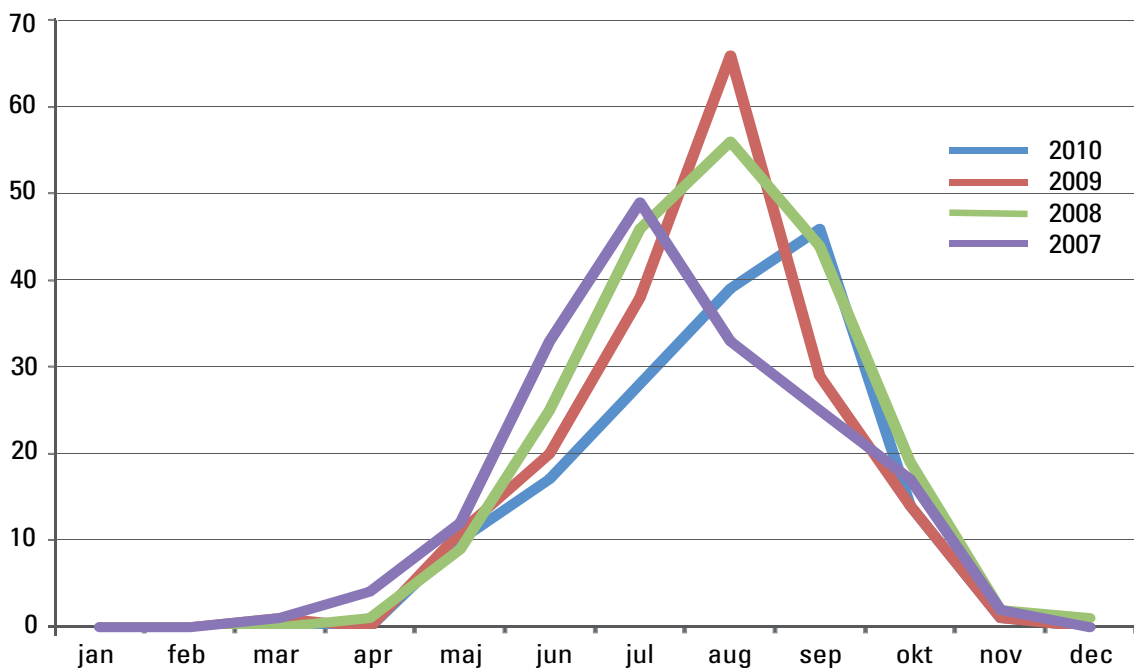


Figure 17. Seasonal variation in date of falling ill for TBE cases in 2007-2010.





# Trichinellosis

## BACKGROUND

Trichinellosis is caused by parasitic nematodes of the genus *Trichinella*. Several species are included in the genus. In Europe, *T. spiralis*, *T. britovi* and *T. nativa* are the dominant causes of human infections. The parasites can be hosted by different mammals, such as domestic pigs and horses but the main reservoirs are wild carnivores and omnivores. Humans mainly acquire the infection by eating raw or inadequately heated contaminated meat and meat products, typically cold-smoked, fermented sausages. In Sweden, the species detected include the aforementioned three as well as *T. pseudospiralis*. In the gut *Trichinella* larvae, develop into adults and mate. After mating, the female releases larvae which penetrate the intestinal mucosa and travel via the bloodstream to various organs and muscles. In striated muscles the larvae may survive for years.

In Sweden, *Trichinella* has been inspected at slaughter in domestic pig since the 20th century. During 1970-1990 sporadic cases were detected in domestic pig, but since 1994 there have been no cases. The parasite is endemic in Swedish wildlife.

The disease is extremely rare in Sweden and detected human cases are infected abroad. The most recent reported case (in 2007) had consumed wild boar sausage brought in privately from Spain. The preceding case occurred in 2003 after consumption of cold-smoked ham in the Balkans. Before that there had not been a case since 1997, which also was travel-associated.

## DISEASE

### Animals

Animals rarely develop a clinical infection.

### Humans

The disease can range from subclinical infection to fatal disease. The incubation period varies from 5-15 days. Symptoms initially involve diarrhoea and abdominal pain and later muscle pain, fever, oedema of the upper eyelids and photosensitivity. Early stages of the disease respond well to treatment. Cardiac and neurological complications may occur 3-6 weeks post infection. Trichinellosis is not transmitted between humans.



## DISEASE SURVEILLANCE 2010

### LEGISLATION

#### Animals

*Trichinella* is notifiable in animals according to SJVFS 2002:16 with amendments.

#### Humans

Trichinellosis is notifiable according to the Communicable Disease Act (SFS 2004:168).

### SURVEILLANCE

#### Animals

All slaughtered domestic pigs and wild boar as well as horses and hunted wild boars and bears are tested for *Trichinella* by the digestion method. In addition, several species of wild animals are tested for *Trichinella*, including e.g. fox, lynx, wolves, badgers, birds and wolverines. *Trichinella*-free regions have not been created in Sweden.

#### Humans

The surveillance is passive.

### RESULTS

#### Animals

In 2010, all slaughtered domestic swine (3,021,322) and horses (3,281) were tested for *Trichinella*.

*Trichinella* was not detected in domestic pigs or horses. *Trichinella* spp. was detected from four of 50,014 (0.01%) wild boar samples. *Trichinella* was detected from 7 lynxes and 8 wolves, (Table 13).

#### Humans

No human cases of *Trichinella* were reported in 2010.

### DISCUSSION

Trichinellosis is extremely rare in Swedish food-producing animals and detected human cases in the last decades were infected abroad. The *Trichinella* situation in Swedish animal population seems to be stable. *Trichinella* occurs in wild carnivores but the risk of getting *Trichinella* from domestic pigs and horses is negligible. Establishing *Trichinella* -free regions may be considered.

Table 13. Findings of *Trichinella* in wild animals 2010.

| Animal species       | No. Samples | No. Positives | Percentage (%) | <i>T. britovi</i> | <i>T. nativa</i> | <i>T. spiralis</i> | <i>T. pseudospiralis</i> | <i>T. spp.</i> |
|----------------------|-------------|---------------|----------------|-------------------|------------------|--------------------|--------------------------|----------------|
| Arctic fox           | 2           | 0             | 0.00%          |                   |                  |                    |                          |                |
| Badgers              | 3           | 0             | 0.00%          |                   |                  |                    |                          |                |
| Bears                | 250         | 0             | 0.00%          |                   |                  |                    |                          |                |
| European Pine Marten | 1           | 0             | 0.00%          |                   |                  |                    |                          |                |
| Grey seals           | 1           | 0             | 0.00%          |                   |                  |                    |                          |                |
| Lynxes               | 136         | 7             | 5.15%          | 2                 | 4                |                    |                          | 1              |
| Otters               | 6           | 0             | 0.00%          |                   |                  |                    |                          |                |
| Raccoon dogs         | 17          | 0             | 0.00%          |                   |                  |                    |                          |                |
| Red foxes            | 308         | 0             | 0.00%          |                   |                  |                    |                          |                |
| Wild birds           | 38          | 0             | 0.00%          |                   |                  |                    |                          |                |
| Wild boars           | 50,014      | 4             | 0.01%          | 1                 |                  | 1                  | 2                        |                |
| Wolverines           | 11          | 0             | 0.00%          |                   |                  |                    |                          |                |
| Wolves               | 60          | 8             | 13.33%         | 1                 | 7                |                    |                          |                |

# Tuberculosis

## BACKGROUND

Tuberculosis (TB) is a serious disease in humans and animals caused by bacteria included in the *Mycobacterium tuberculosis* complex. *Mycobacterium bovis* causes bovine tuberculosis in several animal species as well as in humans. Historically, the reservoir has been cattle but many other wild and domestic species can also maintain the infection. Wildlife reservoirs in e.g. badgers, deer and wild boar cause persistent problems in some countries. Humans usually acquire *M. bovis* infection via unpasteurized milk or via inhalation. The predominant cause of human tuberculosis is however *Mycobacterium tuberculosis*. In countries where human tuberculosis caused by *M. tuberculosis* is common, this bacterium is also frequently isolated from various species of animals.

Sweden was declared officially free from bovine tuberculosis in 1958. Since then, sporadic cases have occurred in cattle, the most recent in 1978. Compulsory tuberculin testing of all cattle was abolished in 1970 and the national tuberculosis control in cattle is based on meat inspection and passive clinical surveillance.

When Sweden joined the European Union in 1995, the status of OTF (officially tuberculosis free) was obtained (former Decision 95/63/EC, Commission Decision 03/046/EG).

In 1987, *M. bovis* infection was introduced into the farmed deer population. A control program for tuberculosis in farmed deer was introduced in 1994 and made compulsory in 2003. The last case of tuberculosis in farmed deer was identified in 1997.

The yearly incidence among humans in Sweden in the early 1940's was above 300/100,000 inhabitants. This was followed by a rapid decline, beginning even before effective treatment was available in the early 1950's. Currently, the yearly incidence is about 6/100,000 inhabitants, which is among the lowest in the world. The vast majority of the cases occur in immigrants originating from countries that still have a high incidence of tuberculosis.

## DISEASE

The symptoms caused by tuberculosis in both humans and animals depend largely on the localisation of the infection. The disease progresses slowly and symptoms may take a long time to develop, even in cases with substantial lesions. Weight loss and sometimes coughing (in cases with respiratory tract infection), ascites (due to infection in intestinal lymph nodes or liver) or mastitis (mainly in cattle with udder infection) can be seen. The incubation period varies from weeks to years.

## LEGISLATION

### Animals

Suspect cases of infection with *Mycobacterium bovis*, *M. tuberculosis*, or other mycobacteria in the *M. tuberculosis*-complex, is notifiable in all animal species according to the Swedish Act of Epizootic diseases (SFS 1999:657, with amendments)..

### Humans

Tuberculosis in humans is a notifiable disease according to the Communicable Disease Act (SFS 2004:168). Contact tracing is compulsory and the treatment is free of charge. Refusing treatment if the patient is contagious can lead to detention.

## SURVEILLANCE

### Animals

From suspect cases in animals, lymph nodes from five different areas (retropharyngeal, submandibular, mediastinal, mesenterial and inguinal) and organs with macroscopic lesions are collected. Histology and direct smears are performed on all materials. If TB cannot be ruled out by histology or if direct smears are positive, culture is performed. Cultures are performed on solid media (Löwenstein-Jensen, Stonebrink's, Modified Middlebrook) according to the accredited method at the National Veterinary Institute (SVA) for up to eight weeks. Microscopy of all suspect colonies is performed and bacteria in the *M. tuberculosis*-



complex are identified with a specific genetic probe. Positive isolates are further subtyped.

Skin fold tuberculin tests are performed according to EC 1226/2002 (amending annex B of EC 64/432) and SJVFS 2003:33, K62. The comparative intradermal test is used, mostly at the neck site except for camelids where the auxiliary site is used. In case of a positive tuberculin test, the animal is culled and sampled as stated above. Culture is performed on all samples.

#### Humans

In humans sputum smear is the standard test when pulmonary tuberculosis is suspected. Otherwise culture from urine, feces, blood or liquor is also a possibility or biopsies from suspected site of infection.

### PASSIVE SURVEILLANCE

#### Animals

As TB is notifiable on clinical suspicion, clinical symptoms in animals or lesions detected at necropsy of an animal, prompt official investigations including sampling for bacteriology, tuberculin testing of contact animals and epidemiological investigation, are carried out.

In addition, an investigation is performed if there is reason to suspect exposure of animals to bacteria of the *M. tuberculosis*-complex.

Furthermore, tuberculin tests are performed at artificial insemination centres and at export/import of animals as required according to EU-legislation (Council Directive 64/432/EEC).

#### Humans

The surveillance in humans is passive.

#### Active surveillance

##### *Animals*

Monitoring is performed by meat inspections at slaughter of food producing animals. Veterinary officers of the National Food Administration perform the inspections. Suspect lesions are sent to the SVA for histology and bacteriology.

The control program in farmed deer is based on regular whole-herd tuberculin testing, or whole-herd slaughter and meat inspection. Deer may only be sold for direct slaughter unless they originate from a herd that have undergone three consecutive herd tests and continue to test regularly.



### RESULTS

#### Animals

The number of animals investigated by histology and, if relevant, bacteriology, due to lesions detected at slaughter were 102 pigs, 11 deer, 35 cows, 14 sheep, 4 horses, one moose and one wild boar. From these samples, bacteria from the *Mycobacterium avium/intracellulare*-complex were isolated in 16 cases (all pigs). No other samples yielded any mycobacteria.

The total number of registered holdings for farmed deer was close to 600. However, a large proportion of these do not keep deer after obtaining TB free status. The number of herds that were considered active, i.e. kept deer and had obtained TB free status were 339. A total of 16 herds were still exempted from testing and allowed to perform meat inspections and necropsies for 15 years to obtain free status. Another three herds will be depopulated due to their application of exemption from testing being rejected. No TB was detected in any tested deer herds.

Due to clinical suspicions, samples from one alpaca and one sheep were investigated. TB could be ruled out by histological examination. One sputum sample from a dog was examined by direct smear. No mycobacteria could be detected in the sample.

#### Humans

Two cases of *M. bovis* were reported in humans in 2010. Both cases originated from TB endemic countries most likely infected before arrival in Sweden.

### DISCUSSION

#### Animals

No cases of TB were detected in Swedish animals during 2010. Although the surveillance is mainly dependent on inspections of slaughtered animals, this is regarded as sufficient for monitoring. However, the submission rates of lesions from slaughtered ruminants should be improved. Passive surveillance based on clinical suspicions and necropsy findings will always be of low sensitivity as clinical symptoms and massive lesions are mainly seen in late stages of the infection.

The eradication efforts in farmed deer have been successful and the probability that Swedish farmed deer are TB free is high. It is important that the

remaining herds are dealt with so that all registered herds can be declared officially free.

The broad host range, long incubation period and low sensitivity of tests for tuberculosis means that introduction of live animals from endemic regions poses a constant risk.

#### Humans

The rapid decline of tuberculosis in humans in the 1940's coincided with the eradication of tuberculosis in cattle and started before the introduction of effective treatment in the 1950's. A much larger part of the population lived in close contact with domestic animals then and it's likely to be more than a coincidence. Today Sweden has one of the lowest incidences of human tuberculosis in the world.

The officially free status as regards bovine tuberculosis has been maintained during 2010. The overall TB situation in animals and humans remains favourable.

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# Tularaemia

## BACKGROUND

Bacterium *Francisella tularensis* is the causative agent of tularaemia, a disease affecting humans and several animal species. *F. tularensis* comprises several subspecies which show differences in virulence. *F. tularensis* subsp. *holarctica* (type B) is the main subspecies responsible for human and animal infection in Europe.

*F. tularensis* is capable of surviving for weeks at low temperatures in water, moist soil, or decaying plant and animal matter. Although many different animal species can be infected, tularaemia is typically found in hares and rodents.

Humans become infected through a variety of mechanisms such as handling infected or dead animals, bites of infected insects or other arthropods, ingesting contaminated food or water, and inhaling aerosols of bacteria. Clinical disease is variable and dependent on the route of transmission. The infection is more often reported in men than in women, which might be attributed to their leisure and professional activities. The age group of 30-65 years is the most affected in both genders. Tularaemia might spread during the whole year, but it is most frequent during late summers.

Sweden has reported cases of endemic tularaemia since 1931. Ever since the first Swedish tularaemia case was reported an endemic area has been identified in northern and central Sweden.

The mountain hare is the animal species in which tularaemia has most frequently been identified in endemic areas in the past. However, in recent years, tularaemia has been detected in the European brown hare in new geographic areas.

The yearly numbers of notified human cases range from a few cases to more than 2,700 cases in 1967.

## DISEASE

*F. tularensis* is highly infectious, as few as 10–50 colony forming units may cause infection. The incubation period is usually 3–5 days. Tularaemia can be manifested in different forms depending on

the route of transmission and on the virulence of the organism. These forms are: ulceroglandular, oculoglandular, pneumonic, oropharyngeal, gastrointestinal, and typhoidal.

### Animals

In Swedish hares and in many rodent species that die of tularaemia, the pathological presentation of the disease is a disseminated multi-organ septicemic form.

### Humans

The ulceroglandular form is the most common form; the respiratory, oculoglandular and oropharyngeal forms being less common. In the ulceroglandular form, a local ulcer usually appears at the site of infection and the adjacent lymph nodes are enlarged. The general symptoms of tularaemia are high fever, headache and nausea.

## LEGISLATION

### Animals

Tularaemia is notifiable in animals (SJVFS 2002:16 with amendments).

### Humans

Tularaemia has been a notifiable disease since 1970 according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

No active surveillance is performed in animals. Surveillance is based on voluntary submission of animals found dead or euthanized by hunters and the general public. The detection is based on direct immunofluorescence of the sample.

### Humans

The surveillance is passive. For laboratory verification of the infection both serology, PCR and isolation of the bacteria could be used.



## RESULTS

### Animals

*F. tularensis* was detected from five animals: two brown hares, two yellow-necked mice and one mountain hare. Four of these animals were from counties south of the capital Stockholm, outside the former endemic area.

### Humans

In 2010, 484 cases of tularaemia were reported, which is almost a doubling of the number of cases from 2009. The cause of this increase is unclear, but sharp fluctuations in the number of tularaemia cases are not unusual. The peak in 2010 was the highest since 2003, when 698 cases were notified (Figure 18).

As in previous years, more men (64%) than women were reported. Most infected individuals were aged 40 to 70 years. The general increase in the number of cases reported in 2010 was distributed somewhat unevenly across age groups with a disproportionate increase in people in the age group 60–80 years. A majority of cases (98%) was domestically acquired according to the reports.

Most cases were reported from the counties of Jämtland, Örebro and Stockholm. Jämtland county presented by far the highest incidence (62 cases per 100,000 inhabitants). In 2010, the tularaemia cases were scattered over large parts of central and northern Sweden.

The infection can spread throughout the year, but it is most common during the late summer and

autumn months (Figure 19). In 2010, a negligible number of cases (2%) were reported during the first six months. The case reports began to increase in number during July and reached its peak in October. The peak in number of reported cases occurred one month later than usual, but what caused this delay in time is unclear. Presumably, the weather might have had some impact.

## DISCUSSION

Tularaemia has been endemic in northern and central Sweden at least since the early 20th century with a marked variation in the number of cases between different years. Years with high numbers of cases are often followed by periods when the disease is virtually absent. There is no obvious explanation for these fluctuations since the epidemiology is not well-known. The reservoir for the bacterium between outbreaks has not been clearly elucidated. During the last decade, the epidemiology of tularaemia has changed and the number of reported cases in humans and animals infected south of the previous endemic region has increased. In animals, outbreaks of tularaemia have been associated with rises in rodent and hare populations, but this has not been confirmed in Sweden. It is possible that the European brown hare has become an important carrier of *F. tularensis* in many areas, but its epidemiological role remains unclear.

## DISEASE SURVEILLANCE 2010

Figure 18. Notified cases of tularaemia in humans in Sweden during 1999-2010.

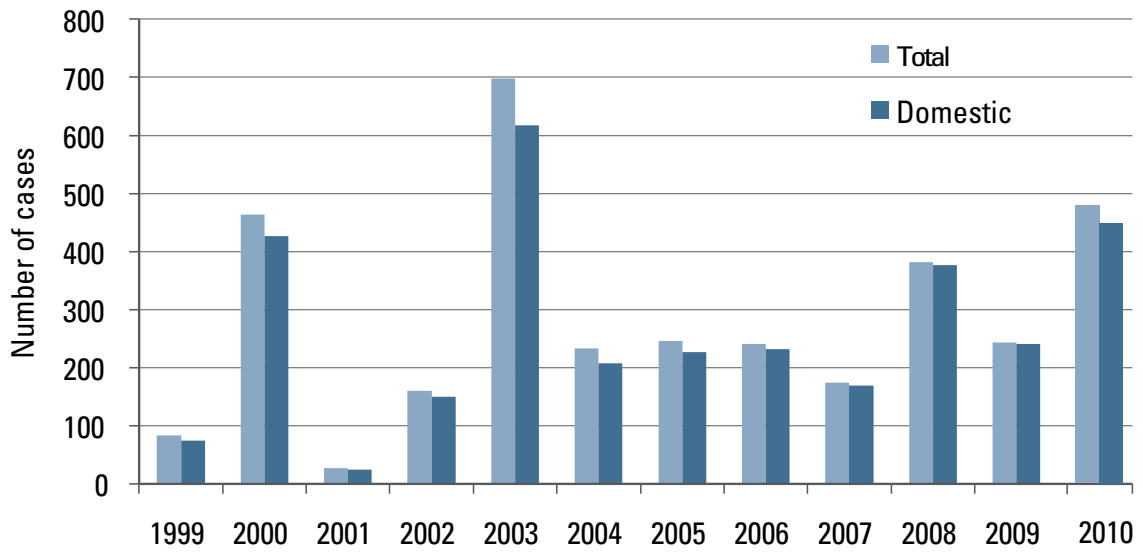
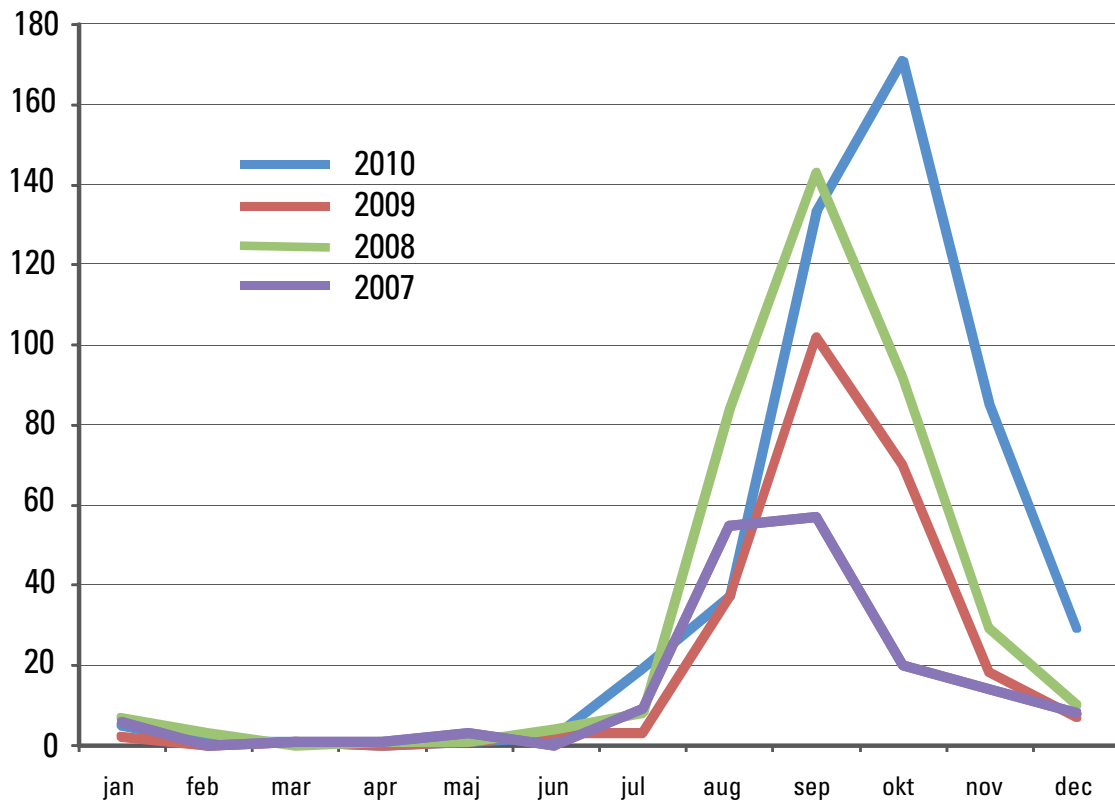


Figure 19. Seasonal distribution of the notified human cases of tularaemia in Sweden during 2007-2010.



# Vero-Toxin producing *Escherichia coli* (VTEC)

## BACKGROUND

Verocytotoxin producing *Escherichia coli* (VTEC) are causative agents of serious intestinal infections in humans. These bacteria often cause hemorrhagic diarrhoea; they are then called EHEC (enterohaemorrhagic *E. coli*). More than 380 different VTEC serotypes have been associated with human illness but most outbreaks and severe disease are caused by serotype O157:H7. Other common serotypes causing gastrointestinal illness are O26, O103, O111 and O145. Cattle are the main reservoir of VTEC associated with human disease although other animal species also may acquire the organisms. The infectious dose is low, probably just a few bacterial cells. Not only foods of bovine origin but also vegetable food items and drinking water have been implicated in outbreaks. The infection can also be transmitted through direct or indirect animal contact, via environment or person-to-person transmission. VTEC was only sporadically detected in Sweden until 1995 when 114 human cases of VTEC O157:H7 were notified. In 1996, VTEC O157 was isolated in Swedish cattle for the first time and human *E. coli* O157 infection was traced to a cattle herd. In 2002 an outbreak of VTEC O157:H7 in the county of Skåne affecting 30 persons was caused by consumption of cold smoked fermented sausage. The biggest Swedish outbreak so far occurred in the summer of 2005 when 135 cases, including 11 (8%) HUS (haemolytic uraemic syndrome) cases were infected with O157:H7 after eating contaminated fresh lettuce sprayed with water positive for verocytotoxin 2 at the time of harvest. Indistinguishable isolates from humans and cattle faeces from a farm upstream confirmed the implicated source and control measures that lead to the termination of the outbreak were implemented.

Around 250-350 cases of EHEC are reported annually, of which 50 -65% are domestically

acquired. Most of the cases are reported during the period July to September.

National guidelines were established in 1997 and were revised in 2008. The aim is to minimize the spread of VTEC to humans and animals. A risk profile was produced by the responsible authorities in 2007.

## DISEASE

### Animals

Animals usually do not develop a clinical disease.

### Humans

The clinical picture may vary from asymptomatic infection to non-haemorrhagic or haemorrhagic diarrhoea associated with abdominal cramps. Most patients recover fully. Approximately 7-10% develop HUS, which is characterised by acute renal failure, thrombocytopenia, and microangiopathic haemolytic anaemia. A large proportion of the patients are young children and severe complications are most common in this age group and among elderly people. HUS may lead to renal failure or death.

## LEGISLATION

### Animals

Since 1999 VTEC O157 findings in animals are only notifiable when associated with human VTEC infection (SJVFS 2002:16 with amendments).

### Humans

EHEC O157 has been notifiable for both clinicians and laboratories under the Swedish Communicable Disease Act since 1996. All EHEC serotypes pathogenic to humans are notifiable since 1 July 2004 (SFS 2004:168).



## DISEASE SURVEILLANCE 2010

### SURVEILLANCE

#### Active surveillance

##### *Animals*

If a County Medical Officer suspects an association with a human VTEC infection to a farm, the county veterinary officer will be informed. A request to the Swedish Board of Agriculture will be made for trace back investigation and sampling of suspected animals.

#### Surveys

##### *Animals*

Between 1997 and 2002 annual prevalence studies of VTEC in slaughter cattle were conducted. Since 2002, prevalence studies have been performed every third year. The aim is to detect a prevalence of 0.1% with a 90% confidence level. In each study, about 2000 cattle faecal samples were randomly selected from abattoirs representing about 90% of slaughtered cattle. A baseline study on cattle carcasses was done in 2006-2007 and a prevalence study in sheep was done at nine slaughterhouses in 2007-2008.

### RESULTS

#### Animals

##### *Active surveillance*

During 2010 eight cattle farms, one sheep farm and one horse were epidemiologically investigated as suspected sources for human infection. VTEC O157 was isolated from two cattle farms, all other investigations were negative.

##### *Monitoring*

VTEC O157 was detected in 9 (1.8%) of 492 faecal and 2 (1.9%) of 105 ear samples from sheep in a survey performed in 2007-2008. In cattle, surveys during 1997-2002 showed a prevalence of approximately 1%. In the study done in 2005-2006, VTEC O157 was detected in 3.4% of faecal samples. In the abattoir survey conducted in 2008-2009 VTEC O157 was detected in 3.3% of 1,993 faecal and 8.2% of 500 ear samples (Map 12). In these studies, VTEC O157:H7 has predominantly been isolated from cattle in the south of Sweden whereas very seldom from the northern two thirds of the country. However, in the latest survey, VTEC O157:H7 was isolated from one ear sample from Luleå in the northern part of Sweden. This is the most northern isolate in the Swedish slaughterhouse surveys performed.

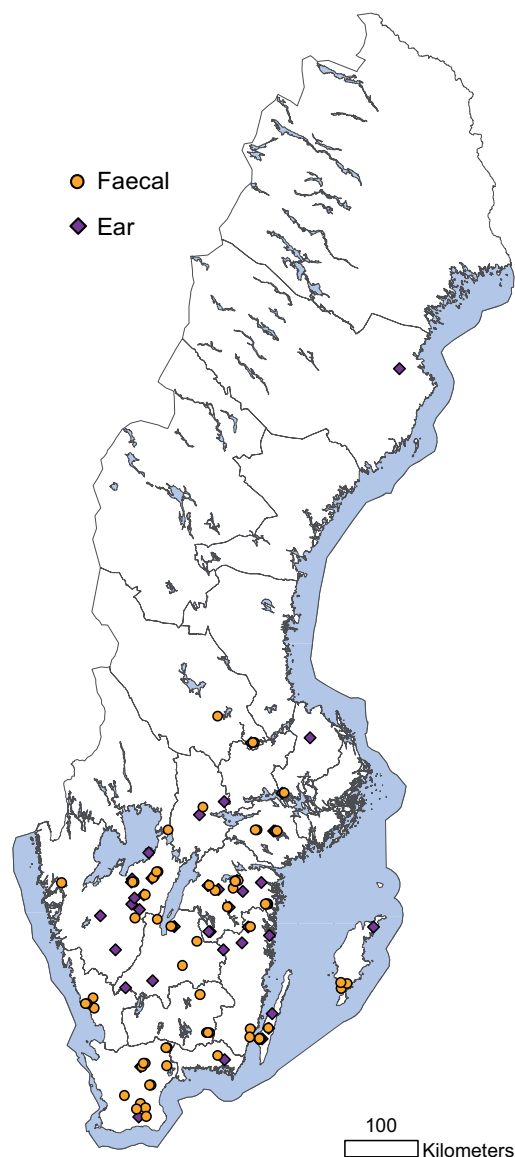
#### Food

Very few samples were reported from the responsible authorities.

#### Humans

In 2010, 334 human cases were reported which is an increase from 2009 (228 cases). The increase was mainly seen for the domestic cases. In 2010 194 domestic cases were reported (59% of the total number, incidence 2,1 cases per 100,000 inhabitants). The decreasing trend from last years thus shifted in 2010 (Figure 20).

Map 12. Geographical distribution of VTEC O157 positive faecal and ear samples collected at slaughter at the major slaughterhouses in a survey conducted during 2008/2009 in Sweden.



## DISEASE SURVEILLANCE 2010

Children under 10 years accounted for almost half (48%) of the domestic cases also in 2010. One third (34%) of the domestic cases were under 5 years.

The domestic incidence was the highest in Gotland (14,0) followed by Halland (4,7) and Jönköping (4,7).

41% of the cases were infected abroad and Egypt was the most common country of infection. In 2010 the highest number ever of EHEC cases from Egypt were reported (40 cases).

EHEC has a seasonal variation with most cases reported during the summer months. In 2010 57% of the domestic cases were reported in June to September.

During 2010, 59% of the domestic cases were serotyped and 38% of the cases were infected abroad. O157:H7 was the most common serotype with 34% of the domestic cases and 25% of the

cases infected abroad. After O157, O26 (13%), O103 (10%), O Non Typable (9%), O145 (7%), O153 (4%) and O121 (4%) were the most common serotypes among the domestic cases. The number of domestic O157 cases (39 cases) increased from 2009 (22 cases). The distribution of O157 and non-O157 has changed the last years. In 2010 two thirds were non-O157 and one third O157. In the earlier years, O157 was more common than non-O157 (Figure 21).

The largest outbreak of 2010 took place during autumn in a kindergarten in Västra Götaland. In total 12 persons fell ill; 7 children and 4 of their family members and one staff. Several cases had to receive hospital care and two of the children developed HUS. The serotype was the rare O153. An extensive investigation was performed at the kindergarten but no suspected source was found.

Figure 20. Notified domestic incidence of human EHEC infection in 2006-2010.

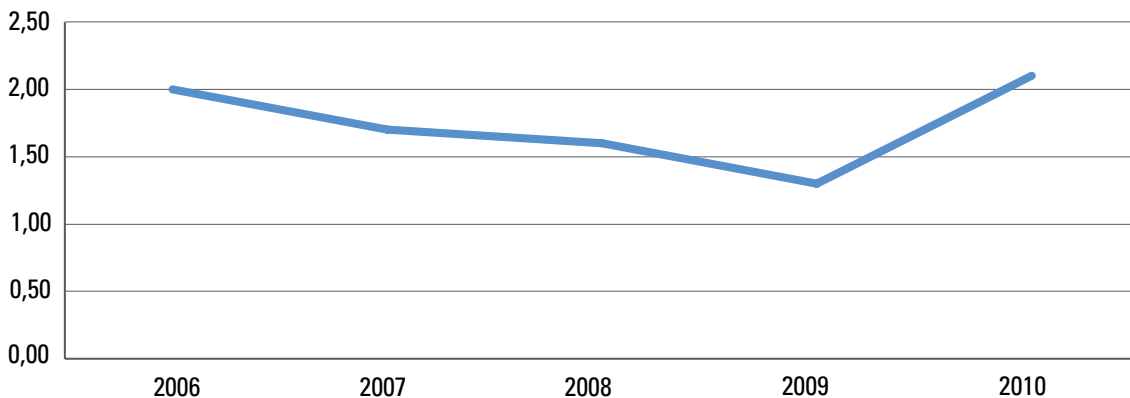
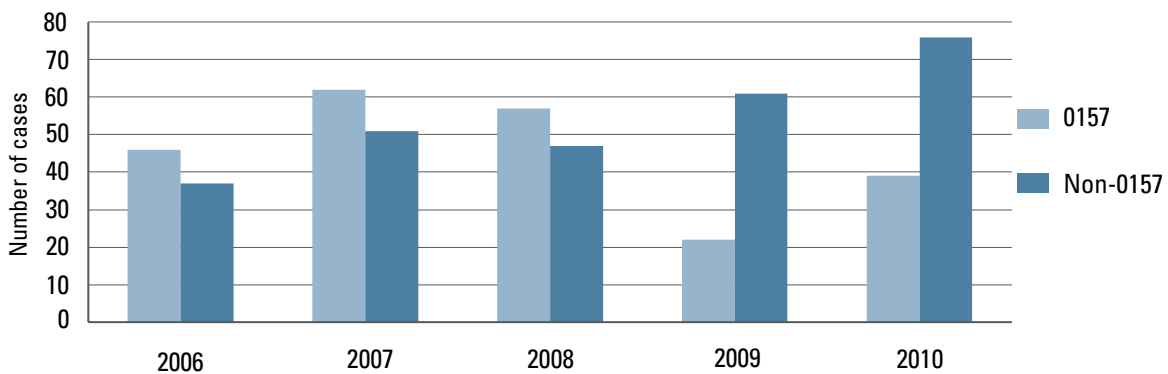


Figure 21. Notified domestic human cases of *E. coli* O157 and non-O157 from 2006 to 2010.



Four cattle farms in the area with some connection to the kindergarten were sampled, but all were negative for O153. The source of the outbreak was not found, but proper hygiene measures stopped the spread of the infection.

### DISCUSSION

A decreasing trend in domestic EHEC infections has been observed during the later years. In 2010, however, the number of domestic cases increased to the levels of 2005 when a salad outbreak occurred. The increase in 2010 was generally seen during the summer months. Several investigations were performed on suspected contaminated wells at summer cottages and connections to farms were investigated. The highest notification rates in humans are in counties with higher cattle-density, i.e. in southern Sweden but in the summer of 2010 cases were also reported in other counties. It is still too early to predict if the sudden trend shift is stable and what caused the increase in 2010.

Because of modifications of the detection methods, the results of the different prevalence surveys cannot be directly compared. Therefore it is difficult to determine whether the observed increase in animal prevalence from one to three percent is true or merely an effect of improved detection methods. Measures to decrease the animal prevalence are being investigated.

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# Yersiniosis

## BACKGROUND

The genus *Yersinia* has been associated with human and animal diseases for centuries. Two enteropathogenic species of the bacterial genus of *Yersinia* are zoonotic, namely *Yersinia enterocolitica* and *Yersinia pseudotuberculosis*. Pigs are considered the main reservoir of *Y. enterocolitica*. *Yersinia* bacteria are widespread in nature but nonpathogenic strains are common. The most common human pathogenic variant is *Y. enterocolitica* 4/O: 3.

Wild animals, especially rodents and birds are considered the principal reservoir of *Y. pseudotuberculosis*. Both *Y. enterocolitica* and *Y. pseudotuberculosis* are frequently found in pig tonsils and intestinal contents. Infections caused by *Y. enterocolitica* are thought to be food-borne. The sources and vehicles of *Y. pseudotuberculosis* infections in humans remain obscure but infections caused by consumption of contaminated carrots and iceberg lettuce have been described. *Yersinia* bacteria are destroyed by heating (pasteurization and cooking) but are able to grow at low temperatures and can therefore grow in food that is kept cool.

*Y. pseudotuberculosis* was isolated from diseased guinea pigs in the 1880's. Mainly sporadic cases of yersiniosis were reported in humans until a large outbreak of *Y. enterocolitica* associated with chocolate milk occurred in the USA in 1976. The first food- and waterborne outbreaks of *Y. pseudotuberculosis* were reported in 1980's.

## DISEASE

### Animals

Pigs are asymptomatic intestinal carriers of pathogenic *Y. enterocolitica* and *Y. pseudotuberculosis*. Infection with *Y. pseudotuberculosis* in other animals may vary from asymptomatic to severe mesenteric lymphadenitis and lead to septicaemia and death.

*Y. enterocolitica* has occasionally been isolated from cats and dogs with diarrhoea.

### Humans

*Y. enterocolitica* causes gastrointestinal symptoms in humans ranging from mild self-limiting diarrhea to acute mesenteric lymphadenitis, which might be difficult to differentiate from appendicitis. Long-time sequelae including reactive arthritis, uveitis and glomerulonephritis occur sometimes. Prolonged carriage has been reported in children as well as in adults.

## LEGISLATION

### Animals

*Y. enterocolitica* and *pseudotuberculosis* are not notifiable in animals.

### Food

*Y. enterocolitica* and *pseudotuberculosis* are not notifiable in food.

### Humans

Yersiniosis is notifiable according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

### Animals

There is no active surveillance in animals.

### Food

There is no active surveillance in food.

### Humans

The surveillance is passive in humans.

## RESULTS

### Animals

*Y. pseudotuberculosis* was isolated from one bird tested at the SVA.



### Food

Hardly any samples were reported from official sampling.

### Humans

In 2010, 282 cases were reported and 219 of them were domestic. Since 2004, when a total of 594 persons were reported, there has been a decrease in cases and in 2010 the lowest number of cases was reported since 1997 (Figure 22). However, in May 2010, an outbreak among 120-130 students was caused by eating undercooked meat at a party. At least 69 of the attendants had gastrointestinal symptoms as well as joint ache and skin lesions. Only one of the cases was verified as *Y. enterocolitica* but eight had antibodies against *Yersinia*.

Usually more men than women are reported but in 2010 the domestic cases were equally distributed according to sex (111 men and 108 women).

Children are more often infected than adults and children between 1-6 included 31% of the domestic cases in 2010.

A majority of the cases are reported as domestic. Of the 43 persons infected abroad 8 were reported from Spain, 4 from Egypt, Thailand and Turkey respectively and from other countries a few cases per country.

### DISCUSSION

Yersiniosis is one of the most notified zoonoses in Sweden. However, since 2004, the number of notified yersiniosis cases in humans has decreased with 49%. This decrease has occurred without any active measures in the food chain.

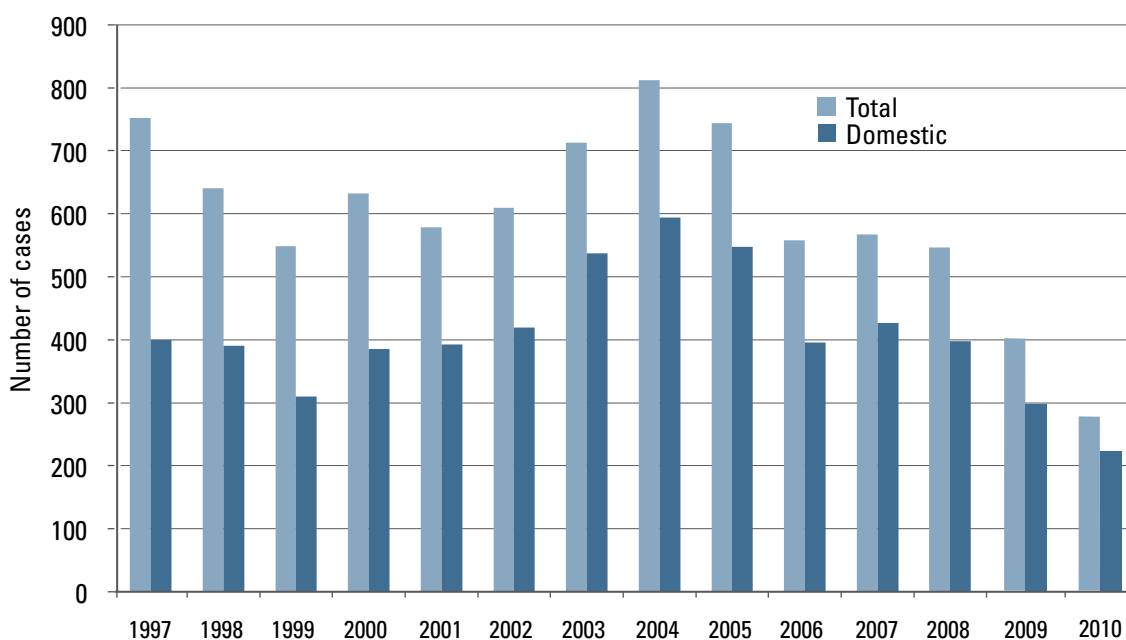
Yersiniosis in humans is considered foodborne. Outbreaks are rare and most infections seem to be sporadic but under-reporting may be considerable. Approximately 70% of the infected cases are domestic. Case-control studies suggest consumption of pork products as a risk factor. Good slaughtering hygiene and avoiding long storage times of ready-to-eat food items are essential in controlling *Yersinia*.

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Figure 22. Notified cases of yersiniosis in humans in Sweden during 1997-2010.



# Poultry Health Control Program

## BACKGROUND

The Poultry Health Control Program is based on provisions issued by the Swedish Board of Agriculture. During the year 2010 the provisions (SJVFS 1995:123) were amended leading among other things to changes in the sampling and testing schemes from 1 October 2010 (SJVFS 2010:58). The program is mandatory for all hatcheries producing more than 50,000 day-old chickens per year and all breeding establishments (grandparent and parent flocks of layers, broilers and turkeys) delivering hatching eggs to these hatcheries. In addition to serological sampling for several infectious diseases the program consists of rules on biosecurity, standard of the houses, management, clinical surveillance etc.

## LEGISLATION AND DISEASE

All diseases in the program are notifiable according to provisions issued by the Swedish Board of Agriculture (SJVFS 2002:16 with amendments). The diseases included in the program during 2010 are briefly described below.

- *Salmonella* Gallinarum (causing Fowl typhoid) and *Salmonella* Pullorum (causing Pullorum disease) are specially adapted to poultry. Both serotypes are included in the Swedish zoonosis legislation as well as in the European legislation on trade in poultry and hatching eggs (Council Directive 2009/158/EC). These two salmonella serotypes were eradicated from the Swedish commercial poultry population in the beginning of the 1960's. *S. Gallinarum* has not been detected in Swedish poultry since 1984 when a backyard flock was found to be infected. *S. Pullorum* was last detected in two backyard flocks in 2001. Both serotypes are important vertical infections in addition to the common horizontal spread. *S. Gallinarum* commonly infects and causes disease (diarrhoea, inappetence, production losses and mortality) in older birds. *Pullorum* disease mainly affects foetuses and chickens up to 3 weeks of age.

- *Mycoplasma gallisepticum* and *Mycoplasma meleagridis* are important poultry pathogens, *M. meleagridis* is however only pathogenic for turkeys. These two mycoplasmas are able to spread both horizontally and vertically. They mainly cause respiratory disease and egg production losses. *M. gallisepticum* may also cause arthritis and is present in the backyard poultry population in Sweden. Testing of breeding flocks for *M. gallisepticum* and *M. meleagridis* (only turkey flocks) is included in the European legislation on trade in poultry and hatching eggs (Council Directive 2009/158/EC).
- Paramyxovirus type 1 may cause outbreaks of Newcastle Disease, with egg production losses, increased mortality, nervous signs and respiratory symptoms, the severity of the disease may however vary. The virus is transmitted through direct and indirect contacts with infected birds and for shorter distances also with the wind. Wild birds are an important reservoir. Since 1995, nine outbreaks of Newcastle Disease have occurred in Sweden. The disease is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments). Since all outbreaks have been successfully eradicated Sweden is keeping its status as a Newcastle free country without vaccination according to Commission Decision 95/98/EEC.
- Egg drop syndrome - virus is a naturally occurring adenovirus in water fowl (including the wild population) in which it does not cause any symptoms. In chickens, symptoms are only seen during the production period as decreased egg production in an otherwise clinically healthy flock. The virus is able to spread both vertically and horizontally. The Swedish breeding population is free from the disease.

During the first three quarters of 2010, as in previous years, testing for *Mycoplasma synoviae*, avian pneumovirus and infectious laryngo-tracheitis-virus were also included in the Poultry Health Control Program. These three agents are however not included in the revised program that came into force on the 1st of October 2010.

## ADDITIONAL SURVEILLANCES 2010

### SURVEILLANCE

The serological screening within the program is administered by SVA and financed by the Swedish Board of Agriculture and the participating companies. In 2010 nine different breeding companies participated in the program; four broiler-, four laying hen- and one turkey breeding company. In accordance with the provisions, sixty blood samples were taken from the breeding flocks included in the program, once during the rearing period and several times during the production period. The blood samples were sent by mail to the National Veterinary Institute (SVA) where serological tests were performed. The sampling and testing schemes from 1 October 2010 are presented in Tables 14 and 15.

### RESULTS

Table 16 gives an overview of all samples taken in breeding flocks of chickens and turkeys, and the laboratory methods used, during 2010. All analyzed samples tested negative for *Salmonella Gallinarum*, *Salmonella Pullorum*, *Mycoplasma meleagridis*, Paramyxovirus type 1, Avian pneumovirus and Infectious laryngotracheitis.

During 2010, one flock (turkey parents), two flocks (chicken grandparents) and eight flocks (chicken grandparents and parents) were further investigated due to a few positive samples for *Mycoplasma synoviae*, *Mycoplasma gallisepticum* and Egg drop syndrome, respectively. No clinical signs were seen in these flocks and after testing new samples in the flocks, the previous positive samples were considered as unspecific serological reactions.

### DISCUSSION

The aim of the Poultry Health Control program is to document freedom from the diseases included, to stop the introduction and possible further spread of diseases and to allow trade from the participating companies.

The results from the serological screening in the Poultry Health Control Program support the status of freedom from these infections in the Swedish breeding poultry population. The clinical surveillance in the poultry breeding population is also of utmost importance.

Table 14. Sampling schedule for chicken grandparent and parent flocks from 1st October 2010. Number of blood samples tested at different weeks of age.

| Agent \ Age in weeks                      | 16 | 24 | 36 | 48 | 60 |
|---|----|----|----|----|----|
| <i>S. Pullorum</i> / <i>S. Gallinarum</i> |    | 60 |    |    |    |
| <i>Mycoplasma gallisepticum</i>           | 60 | 60 | 60 | 60 | 60 |
| Paramyxovirus type 1                      |    |    |    | 60 |    |
| Egg drop syndrome-virus                   |    | 30 |    |    |    |

## ADDITIONAL SURVEILLANCES 2010

Table 15. Sampling schedule for turkey parent flocks from 1st October 2010. Number of blood samples tested at different weeks of age.

| Agent                           | Age in weeks                              | 20 | 32 | 44 | 56 |
|---------------------------------|---|----|----|----|----|
|                                 | <i>S. Pullorum</i> / <i>S. Gallinarum</i> |    |    | 60 |    |
| <i>Mycoplasma gallisepticum</i> |   | 60 | 60 | 60 | 60 |
| <i>Mycoplasma meleagridis</i>   |   | 60 | 60 | 60 | 60 |
| Paramyxovirus type 1            |   |    |    |    | 60 |

Table 16. Number of sampling occasions for grandparent (GP) and parent (P) flocks of chickens and turkeys and total number of samples tested.

| Disease                                      | No of sampling occasions |     |         | No of samples |        |         | Method                                    |
|--|--------------------------|-----|---------|---------------|--------|---------|---|
|  | Chickens                 |     | Turkeys | Chickens      |        | Turkeys |   |
|  | GP                       | P   | P       | GP            | P      | P       |   |
| <i>S. Pullorum</i> /<br><i>S. Gallinarum</i> | 9                        | 84  | 4       | 540           | 5,010  | 240     | Rapid plate agglutination                 |
| <i>Mycoplasma gallisepticum</i>              | 48                       | 425 | 15      | 2,880         | 25,470 | 900     | ELISA Svanovir MG antibody test, SVANOVA  |
| <i>Mycoplasma synoviae</i>                   | 26                       | 124 | 6       | 1,560         | 7,440  | 360     | ELISA Svanovir MS antibody test, SVANOVA  |
| <i>Mycoplasma meleagridis</i>                | 0                        | 0   | 15      | 0             | 0      | 900     | Rapid plate agglutination                 |
| Paramyxovirus type 1                         | 6                        | 87  | 4       | 360           | 5,190  | 240     | ELISA Svanovir NDV antibody test, SVANOVA |
| Egg Drop Syndrome-virus                      | 15                       | 84  | 0       | 450           | 2,520  | 0       | Haemagglutination inhibition test         |
| Avian pneumovirus                            | 0                        | 40  | 3       | 0             | 2,370  | 180     | ELISA Svanovir APV antibody test, SVANOVA |
| Infectious laryngo-tracheitisvirus           | 6                        | 65  | 0       | 120           | 1,310  | 0       | ELISA ILT antibody test kit, Biochek      |



# Surveillance for a selection of infectious diseases in pig herds

## BACKGROUND

The surveillance included under this heading is performed either yearly, every second or third year or on an irregular basis depending on the disease. At present, the surveillance for classical swine fever (CSF) and brucellosis is performed yearly, whereas swine vesicular disease (SVD) and transmissible gastroenteritis (TGE) are investigated every second year (latest surveillance 2009 and 2008, respectively) and leptospirosis (*Leptospira pomona*) every third year (latest surveillance 2007). Influenza in pigs is investigated on an irregular basis, the latest surveillance was carried out in 2006.

During 2010 active surveillances were performed regarding classical swine fever (CSF), transmissible gastroenteritis (TGE), leptospirosis (*Leptospira pomona*) and brucellosis. The results of the PRRS and the brucellosis surveillance as well as the situation regarding influenza in pigs are presented elsewhere in this report.

## CSF

CSF is a dreaded disease of pigs caused by a pestivirus closely related to bovine virus diarrhoea virus and border disease virus. It is considered one of the most important and devastating pig diseases worldwide. During 1997-98 there was an extensive outbreak in Holland, Germany, Belgium and Spain. Since then outbreaks in Europe have been confined to more limited geographic regions. CSF is present in the European wild boar population and some countries in Eastern Europe have difficulties in controlling CSF in backyard and feral pigs although the situation has improved during recent years. The disease is also present in Asia and South America. CSF has not been diagnosed in Sweden since 1944.

CSF is a highly contagious disease that is transmitted by direct and indirect contact between animals. Feeding pigs infected swill is considered

the main means of spreading the disease to new areas. Due to this, swill feeding of pigs is prohibited in the European Union.

## TGE

TGE is caused by a coronavirus and is widely spread in swine producing regions worldwide. It causes severe losses due to piglet mortality in seronegative herds. In the 1980s a mutant of TGEV, porcine respiratory coronavirus (PRCV), appeared. It caused mild disease and infection protected from severe disease caused by TGEV. Neither TGE nor infection with PRCV has been diagnosed in Sweden.

## Leptospirosis (*Leptospira pomona*)

All mammals are susceptible to one or several *Leptospira* serovars and pig is considered the reservoir host for *Leptospira pomona*. Leptospirosis occurs worldwide but dominating serovars vary with geographic region. Very occasional cases of pigs serologically positive to *Leptospira spp* (other than *L. pomona*) are diagnosed in Sweden.

## DISEASE

### CSF

CSF appears in different clinical forms; acute, chronic and a mild form with reproductive disturbances as the main clinical manifestation. The incubation period is 2-14 days and in the acute form of the disease high fever (42°C), shivering, weak hind legs, purple discoloring of the skin and diarrhoea is seen. Chronically infected animals exhibit a more diffuse clinical picture with intermittent fever, anorexia and stunted growth. In the mild form abortions is the main clinical sign.



## TGE

TGEV causes severe diarrhoea and up to 100% mortality in piglets younger than 5 weeks, but affects all age groups in a seronegative herd. A previous infection with PRCV, which in itself only gives rise to mild infection, leads to a milder clinical manifestation of TGEV and thus has changed the importance of TGEV-infection to some extent.

### Leptospirosis (*Leptospira pomona*)

*Leptospira* infections in swine may be asymptomatic or give rise to reproductive failure. In piglets fever, gastrointestinal disorders and jaundice may be present,

## LEGISLATION

CSF is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and the control of this disease is regulated in detail through EU-directives. TGE and leptospirosis are notifiable diseases (SJVFS 2002:16, with amendments).

## SURVEILLANCE

The purpose of the surveillance activities is to document freedom from these diseases in the Swedish pig population and to contribute to the maintenance of this situation. The National Veterinary Institute (SVA) has been responsible for collection, sample analysis and reporting to the Swedish Board of Agriculture.

The serological analyses of CSF, TGE and leptospirosis (*Leptospira pomona*) and analyses for CSF virus genome and CSF virus culturing were performed at the National Veterinary Institute (SVA). CSF serology was done using a commercial kit (IDEXX® HerdChek CSFV Antibody Test Kit) and in case of positive ELISA results a confirming neutralization peroxidase-linked assay (NPLA) for detection of antibodies against CSFV was performed. TGE/PRCV antibodies were analyzed using an ELISA-method (Svanovir® TGEV/PRCV-Ab ELISA) and for *Leptospira pomona*-antibodies a microscopic agglutination test (MAT) was used.

## ADDITIONAL SURVEILLANCES 2010

### Passive surveillance

As CSF is notifiable on clinical suspicion for both veterinarians and farmers, cases with suspect clinical signs will be investigated following notification to the Swedish Board of Agriculture. The following investigation includes, in addition to restrictions on the farm during investigation, sampling of sick or dead animals and examination of the herd for prevalence of clinical signs and production results.

TGE and leptospirosis are notifiable on laboratory diagnosis and thus a confirmed presence of either of these diseases in the country would be known.

Ongoing testing of animals for export and at breeding centers adds to the passive disease surveillance.

### Active surveillance

In 2010, sera for the active surveillance were collected by systematic random sampling from the surveillance carried out by the Swedish Animal Health Service for porcine respiratory and reproductive syndrome (PRRS).

In addition, analyzes for CSF virus genome with PCR is included in the active surveillance of aborted fetuses from sows.

## RESULTS

### Passive surveillance

Nine investigations following clinical suspicion of CSF were carried out during 2010. In four of these, reproductive failure was the main clinical manifestation. Following investigation including sampling the herds could be declared negative for CSF.

Samples originating from sampling for export and at breeding centers were all negative regarding CSF and TGE, whereas samples positive for leptospirosis (*Leptospira sejiro*) were found in one group of animals sampled for export (eight out of ten animals). These ten animals were all negative regarding *Leptospira pomona*.

### Active surveillance

#### CSF

Serum samples from 2,922 pigs were analyzed regarding antibodies to CSF. In none of these samples antibodies to CSFV could be demonstrated.

Within the surveillance of aborted fetuses, 61 fetuses were examined for CSF virus genome and all samples were negative.

#### TGE

Serum samples from 2,898 pigs were analyzed for antibodies to PRCV/TGEV and all of these were negative.

#### Leptospirosis (*Leptospira pomona*)

All 2,873 serum samples analyzed were negative regarding antibodies to *Leptospira pomona*.

## DISCUSSION

The results from the surveillance in Sweden regarding CSF, TGE and *Leptospira pomona* during 2010 give additional documentation of freedom from these infections in the Swedish commercial pig population.

The present CSF situation in EU member countries in Eastern Europe and the diverse clinical picture of CSF with a spectrum of clinical signs from very severe to very mild or subclinical emphasizes the need for both passive and active surveillance for CSF.

# Wild boars, surveillance for certain infections

## BACKGROUND

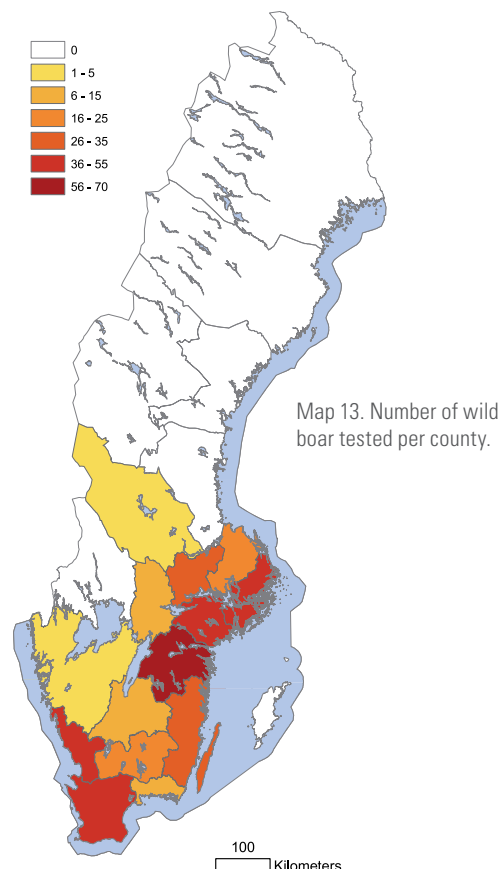
Contagious pig diseases in general and classical swine fever in particular can affect and be spread by the wild boar population. This is the situation in several European countries. The wild boar population is increasing in Sweden and is estimated by the Swedish environmental protection agency to be more than 100,000 heads. Since year 2000 more than 2,000 dead hunted wild boars from different parts of the country have been bled in connection with slaughter. The samples were sent to National Veterinary Institute (SVA) for analysis for antibodies to certain infections.

### Legislation

The infections in the wild boar surveillance program 2010 are all included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and are notifiable on suspicion. If any of them are suspected or confirmed, measures will be taken to combat the disease and to prevent further spread.

## SURVEILLANCE

In 2010 394 blood samples from wild boars from different parts of Sweden were analyzed for antibodies to Aujeszky's disease (AD), porcine reproductive and respiratory syndrome (PRRS), African swine fever (ASF) and classical swine fever (CSF) (Map 13). The samples were analyzed for antibodies to ADV and PRRSV using the methods described under the respective disease headings in this report. Antibodies to CSF and ASF were analyzed using commercial ELISA-methods (IDEXX® HerdChek CSFV Antibody Test Kit, IDEXX, Sweden and Ingezim PPA COMPAC 11.PPA.K.3, Inenasa, Spain, respectively)



## RESULTS

All samples tested were serologically negative.

## DISCUSSION

The Swedish wild boar population is growing and the boundaries for its presence in the Swedish fauna moves further north. In areas where wild boars already are present the population becomes denser, which increases the risk of direct or indirect contact between wild boars and domestic pigs. With the increasing population, hunting wild boar becomes more popular and foreign hunters come to Sweden to hunt and Swedish hunters go abroad. These hunting travels may pose an increased risk of introducing exotic diseases into Sweden as people have direct or indirect contacts with wild animals that may be infected.

There have been cases of African swine fever in Russia very close to the EU-border, but not yet within the union. The situation is of course of concern as wild boars are present in most of the outbreak areas and may become infected and be a factor in spreading the disease. There is no vaccine available.

## REFERENCES

Ruiz-Fons, F, Segalés, J and Gortazár, C, 2008. A review of viral diseases of the European wild boar: Effects of population dynamics and reservoir role. *Vet J* 176:158-169



# Fish and shellfish, surveillance for a selection of infectious diseases

## BACKGROUND

Sweden has a very good level of health in both aquaculture as well as in wild populations. None of the serious diseases that occur through Europe are found in Sweden. The diseases that occur are of lower importance and occur at low frequencies. The reason for this is to be found in Sweden's restrictive approach to the importation of live fish for restocking/farming and an early introduction of health-control in farms. To maintain this good state of health, a comprehensive epidemiological thinking is required as fish and shellfish are included in several multifaceted activities related to the risk of spreading disease and disease control. Other considerations such as ballast water, shipping, sport fishing, ornamental aquarium fish and migrating wild fish plays a significant role in the assessment and management of the health protection for the animal species.

The major part of the Swedish rivers have dams in their reaches due to hydropower stations. These are very effective migrations barrier for feral fish and are of a great help to protect the continental zone from existing and emerging coastal diseases. This gives a different health situation at the coast compared to the continental zone. All transport of live fish from the coastal to the continental zone is forbidden. Due to the migration barriers Sweden has a national conservatory program for salmonids. Migrating brood fish are caught at the first barrier and kept until ready to spawn. In connection with stripping, the fish are sampled for virus and BKD. After fertilization and disinfection the eggs are placed in quarantine and kept there until the results from the tests are available. The quarantines are supplied with water from the continental zone and outlets are made to the coastal. All eggs from positively tested parents are destroyed. After hatching and rearing, in freshwater emanating from the continental zone, the offspring's are released to the coastal zone.

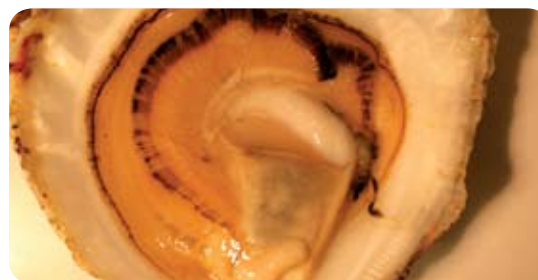


Photo: Anders Alfjorden

Sweden has approved disease free zone status (2002/308/EC) for Viral hemorrhagic septicemia (VHS) and Infectious haematopoietic necrosis (IHN) and received additional guaranties (2004/453/EC) for Infectious pancreatic necrosis (IPN) and Spring viraemia of carp (SVC). For the disease Renibacterios (BKD) Sweden has an by EUan accepted control program for the continental zone. Sampling and diagnostics for these diseases have encompassed all Swedish fish farms since the late 80ies, and since 1994 according to EU directive 92/532 (2001/183).

## DISEASE

Infectious hematopoietic necrosis (IHN) and viral haemorrhagic septicemia (VHS)

Both diseases are caused by rhabdovirus and occur frequently in Europe. They are both transferred horizontally, and a vertically transmission cannot be completely ruled out for IHN. VHS is found in a marine form, why a spread through wild populations cannot be excluded.

Both diseases have greatest impact in aqua culture of rainbow trout (*Oncorhynchus mykiss*) in freshwater, but has been detected in several other species. For both diseases the fish exhibit behavioral changes, lethargy and abnormal swimming (whirling). The fish are anemic with varying degrees of bleeding in multiple organs. Therapy and vaccines are lacking.

## ADDITIONAL SURVEILLANCES 2010

### Infectious pancreatic necrosis (IPN)

IPN is caused by a virus associated to the group Birnaviridae. The virus is highly infectious to juvenile salmonids and the sensitivity declines with increasing age. Fish that survived the virus infection are asymptomatic virus carriers. In addition to the salmonids virus has been detected in several species. Infection can be transmitted both horizontally and vertically. The disease is considered as one of the most economically costly in several European countries.

The disease mostly get notice in the form of sudden high mortality in young fish. The fish exhibit external symptoms such as darkening and abdominal distension. Corkscrew swimming is characteristic. Bleeding in the abdominal fat and internal organs are the most dominant findings. Mortality rates can vary between 10-90%.

### Renibacterioses

(BKD/*Renibacterium salmoninarum*)

BKD is caused by a gram positive, small rod bacterium *Renibacterium salmoninarum*.

The infection can be transmitted both horizontally and vertically. The disease is favored by low water temperatures, which is why outbreaks occur mainly during spring and fall at temperatures between 7-15 degrees.

In rainbow trout the disease can be characterized as chronic and provide a continuous low mortality of about 50-10%. Infected fish may have an impaired growth and disease can result in a deterioration of quality of fish for human consumption. Salmon and arctic char, however, are more susceptible to BKD, especially in terms of stress, and mortality can reach up to 80%.

### Spring viremia of carp (SVC)

SVC is caused by a rhabdovirus. The disease occurs in Asia and several European countries. The virus has been detected in several fish species in the family cyprinids. The disease is transmitted only horizontally.

The symptoms of the disease are usually general, such as darkening, exophthalmia and a slow breathing. The fish swim lazily by sporadic periods of hyperactivity. Common findings are also pale gills, a distended abdomen with ascites and small haemorrhages in the skin and gills. Internally bleeding is found in organs including muscle, swim bladder and brain.

### Marteiliosis

Marteiliosis is caused by a unicellular parasitic animal (*Marteilia refringens*). The parasite need a crustacean (*Paracartia grani*) as an intermediate host, a species considered not to exist in Sweden due to the climate. The disease cause reduced fitness, an impaired growth and resorption of the gonads and hence reduced reproductive capacity. When the animals' weaken it will have difficulties to keep the shell halves closed. The parasite are considered to exist in two forms the "o" and "m" form, whereby the first-mentioned is demonstrated in the oyster and the latter in blue mussels.

### The crayfish plague

Crayfish plague is caused by an aquatic fungus parasite, (*Aphanomyces astaci*), which in late 1800 spread to Europe from the U.S. with live crayfish. The disease occurs throughout Europe and North America. The parasitic fungus reproduces by spores spread by water. When the spores find a crayfish they grow through the skin and attack the underlying tissues.

The signal crayfish - exhibit black (melaninise-rade) areas adjacent to fungal contaminated areas of the skin. The spots will disappear in the shedding of the shell, but may gradually come back.

The noble crayfish - the first sign is a high mortality in the crayfish populations. Crayfish exhibit mainly behavioral symptoms such as moving during daytime, reduced coordination and balance difficulties.

In connection with investigations relating to crayfish plague, an examination for white spot disease (WSD) is performed.

## LEGISLATION

All the diseases except crayfish plague are included in the Swedish legislation regarding notifiable diseases (SJVFS 2007:090) and the control is specifically regulated in SJVFS 2006:015. Further, IHN, VHS, IPN other than serotype ab and SVC are included in the Swedish Act of epizootic diseases (SFS 1999:657, with amendments). Crayfish plague is regulated by the Board of Fishery (FIFS 2001:3).

## SURVEILLANCE

Sweden has two control programs, the national compulsory and the voluntary.

## ADDITIONAL SURVEILLANCES 2010

The aim of the programs is to document freedom from IHN, VHS, IPN, BKD and SVD in the Swedish fish population and to contribute to the maintenance of this situation. The programs also provide an opportunity for early detection of new, exotic diseases, thereby improving the conditions of control.

The national compulsory program is regulated by EU directive 2006/88 and the Swedish Board of Agriculture. Practically it is performed by the Swedish Fish Health Control. It prescribes inspections and sampling for virus and renibacterios (BKD/*Renibacterium salmoninarum*) based on the risk for a farm to obtain infection, its dissemination and impact of infection. For each farm a risk analysis is done, forming the basis for classification and hence the number of visits and samples to be performed in the farm. The inspections are to be performed at a water temperature that is optimum for searched agent.

The voluntary program prescribes an additional inspection at a water temperature of over 14°C, and a yearly sampling for BKD in farms with breeding program.

The National Board of Fisheries implements the control of crayfish for cray fish plague (*Aphanomyces astaci*). White spot syndrome (WSS) has been considerable debated during 2009, above all due to the risks of transmission to wild populations of Crustacea primarily through angling. The disease is not included as an active target in the Swedish control program.

As well as during 2009, Sweden also conducted a screening of (*Marteilia refringens*) in blue mussels during 2010. The study was conducted at the Swedish west coast in both farms and wild populations.

All analyses are performed at the Swedish reference laboratory, the National Veterinary Institute (SVA) and testing for virus are performed by cell culture techniques and for BKD by ELISA.

All analysis are performed according to recommendation by EU or OIE.

Virus are tested on organ material (spleen, kidney, heart/brain) by a cell culturing method. A pool consists of organs from up to ten fishes, cultivated in live cellines and identified by serum neutralisation, ELISA or in some cases PCR.

BKD is demonstrated by an ELISA or cultivating and verified by PCR.

For crayfish, plague are demonstrated by light microscopy, cultivating and verified by PCR.

## RESULTS

Viral haemorrhagic septicemia (VHS), Infectious hematopoietic necrosis (IHN), Infectious pancreatic necrosis (IPN)

During 2010, 522 pools of samples were tested, equal to approximately 6,000 individuals from both continental and coastal zone.

Spring Viremia of Carp (SVC)

In 2010, 12 pools, equal to approximately 80-120 individuals.

Bacterial Kidney Disease (BKD)

Kidneys from 2,391 fish were tested.

*Marteilia refringens*

120 samples of oysters (*Ostrea edulis*) and 210 of blue mussel (*Mytilus edulis*) from farms and wild populations on the Swedish west coast were tested.

Crayfish plague

The disease was investigated in 16 cases from 16 different locations.

No case of the here mentionend epizootic viruses was detected, neither any case of BKD. Marteiliosis was found in one farm and two natural populations of bluemussel, none in oyster.

Disease-causing agents in general, detected during 2010 were two cases of perch rhabdoviruses and parasitic kidney disease in four cases of wild fish.

## DISCUSSION

A continued good level of health in Swedish aquaculture requires that the risk analysis prescribed by the EU as a basis for health monitoring of aquaculture, are implemented carefully and with respect to all the parameters that may be important for the protection against infections. A mistake in the early stage of the implementation may result in irreversible damage. Also the assessments across countries, in these matters, need to be similar for similar questions to make trade safer regarding infections. The term "species susceptible to the disease" and "mechanical vector" need to be further investigated for the major part of the diseases and fishspecies, in order to give reasonable confidence in decision making in aquaculture matters.

# Post mortem examinations in food producing animals

## BACKGROUND

Early detection of infectious diseases is of outmost importance in order to mitigate negative effects. For diseases with severe clinical signs the first line of defense is the detection of disease by animal owners, field veterinarians or pathologists. International experiences as well as practical examples from Sweden shows that post mortem examinations remains a vital part in disease control and that emerging diseases many times have been detected at post mortem examinations. This was for example the case when PMWS was introduced to Sweden in 2003, and in 2008 when anthrax was diagnosed for the first time since 1981.

As post mortem examinations are considered an important part in the early detection and national surveillance for infectious and emerging disease, after decades of decreasing numbers of post mortem examinations in food producing animals, a specific program for encouraging such examinations by financial means started in the early nineties. The Swedish Board of Agriculture finances the program and the Swedish Animal Health Services (SvDHSV) is responsible for the organization.

## PROGRAM

The program finances post mortem examinations in all food producing animals including poultry since 2007. Since 2008 also exotic domesticated hoof animals are included. In addition to post mortem examinations samples are collected from defined categories of animals for salmonella, paratuberculosis, PRRS, CSF, brucellosis, TSE and antibiotic resistance. Since 1999 approximately

3,000 animals have been examined yearly within the program.

The program also includes further education of the veterinary employees at the post mortem facilities; yearly courses are held and quarterly newsletters are produced.

Transportation of the carcasses to the laboratories is arranged and financed by the owner, which with large animals can be a problem particularly when the distance between the farm and post mortem facility is long.

## RESULTS

During 2009 post mortem examinations were performed at five different sites throughout the southern part of the country; Skara (Eurofins), Kristianstad (Eurofins), Uppsala (SVA and SLU), Visby (Swedish Meats) and Karlskoga (DVO in cooperation with SvDHSV and Konvex). Large animals, such as adult cattle, could be examined at four of these sites; Uppsala, Visby, Kristianstad and Karlskoga. A total of 2,972 post mortem examinations were performed within the program, the distribution between species is shown in Table 17. Out of the 2,972 cases, 111 were diagnosed with a notifiable disease of which 81 were primary cases. In one case diseases included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) were detected by the post mortem examinations (Table 18).

## DISCUSSION

As well as being a vital part of the national surveillance for infectious and emerging disease, as illustrated by the detection in 2009 of 81 index



## ADDITIONAL SURVEILLANCES 2010

Table 17. Number of post mortem examinations in food producing animals performed during 2009.

| Species          | Total in 2009 |
|------------------|---------------|
| Swine            | 1,112         |
| Cattle           | 655           |
| Sheep            | 510           |
| Goat             | 11            |
| Farmed deer      | 10            |
| Poultry          | 651           |
| Exotic ungulates | 18            |
| Other            | 5             |
| <b>Total</b>     | <b>2,972</b>  |

cases of notifiable diseases, including one case of an epizootic disease. Post mortem examination is furthermore an important tool for the individual farmer in solving animal health problems at the farm. The last decade the number of post mortem examinations have been around 3,000 per year, and stayed close to this number in 2009 also.

During 1998-2001 the number of examinations performed on different species did not correlate to

the size of the population in each region (Wahlström 2003). Most cattle, sheep and swine underwent post mortem examination in the Uppsala region whereas the biggest populations are present in the southern parts of the country. A regional imbalance can still be seen in that more examinations are performed in the relatively few regions with close proximity to post mortem examination facilities, but the number of examinations is highest in regions having high animal density in addition to access to a regional laboratory performing post mortem examinations.

Vicinity to facilities where post mortem examinations can be performed is also important for quality reasons, as long time before cooling of the body will result in higher degree of cadaverous change and will thus have impact on the quality of the examinations.

In 2011 a study will be performed at SVA, aiming at investigating and evaluating different alternatives for post mortem examinations in Sweden.

### REFERENCES

Redovisning av uppdrag om veterinär obduktionsverksamhet. veterinär obduktionsverksamhet (SJV dnr 33-9465/09)

Wahlström, H. 2003. Sjukdomsövervakning hos animalieproducerande djur – en översyn på uppdrag av Jordbruksverket och Köttböndernas Forskningsprogram.

Table 18. Number of diagnosed cases with a notifiable disease 2009.

| Disease                      | Index case | Following cases | Unknown  | Total      |
|------------------------------|------------|-----------------|----------|------------|
| Botulism                     | 2          | 10              | 0        | 12         |
| Malignant catarrhal fever    | 1          | 0               | 0        | 1          |
| Influenza pigs               | 3          | 4               | 0        | 7          |
| Clostridiosis                | 17         | 5               | 1        | 23         |
| Fowl cholera                 | 1          | 4               | 0        | 5          |
| Infectious laryngotracheitis | 8          | 3               | 0        | 11         |
| Listeriosis                  | 32         | 2               | 0        | 34         |
| Lymphoma                     | 10         | 0               | 0        | 10         |
| Atypical scrapie, Nor98      | 1          | 0               | 0        | 1          |
| Salmonellosis                | 6          | 1               | 0        | 7          |
| <b>Total</b>                 | <b>81</b>  | <b>29</b>       | <b>1</b> | <b>111</b> |

# Post mortem examinations in wildlife

## BACKGROUND

A passive surveillance program for diseases of wildlife based on pathology and ancillary testing was established in Sweden in the 1940s. The surveillance program is funded by governmental funds managed by the Environmental Protection Agency, making the examinations free of charge for the submitters. An active disease surveillance program for wildlife was established in 2006 in order to follow up and define present and emerging diseases in Swedish wildlife.

## SURVEILLANCE

The general public, local authorities and hunters can submit wildlife that is found dead or euthanized to the National Veterinary Institute (SVA) for examination. Around 2,000 wildlife cases (bodies or parts of animals) are received each year. The aim of the passive and active wildlife disease surveillance programs is to monitor the health situation in wildlife in Sweden. Whenever possible, disease-causing agents are identified. The disease surveillance and diagnostics provide key information for wildlife management, is part of zoonotic and epizootic disease control efforts and can serve as indicators of environmental and ecosystem health.

The National Veterinary Institute is the only laboratory in Sweden where post mortem examinations of fallen wildlife is performed. An annual report summarizes the disease events and results of the disease surveillance programs for the past year, and is published (so far only in Swedish) on [www.sva.se](http://www.sva.se). SVA is the national wildlife focal point for OIE and submits half-year and annual reports of diagnosed wildlife diseases listed by the OIE.

## RESULTS

In 2010, 2,173 wild animal samples including 1,858

whole carcasses were submitted to SVA. This includes fallen wildlife, parts of fallen wildlife, lesions found in game animals, and standard samples collected from hunted large carnivores. Of these samples, 1,725 were mammals, including 341 red foxes (*Vulpes vulpes*) consisting mostly of hunted animals sampled for echinococcus surveillance, 230 lynx (*Lynx lynx*) both from hunted animals and many road kills, 25 raccoon dogs (*Nyctereutes procyonoides*) killed as invasive species, 318 brown bears (*Ursus arctos*), most from licensed hunted animals, and 30 otters (*Lutra lutra*), most killed by traffic. Regarding game animals, 217 moose (*Alces alces*) were sampled or investigated; 31 whole carcasses and many samples from hunted individuals. There were 33 roe deer (*Capreolus capreolus*) carcasses necropsied, and a total of 51 roe deer samples, as well as 22 hares examined. There were 738 birds or samples from birds examined, including many birds of prey (254) as they often are protected species of special concern and there are established routines for submission to SVA when they are found dead.

The diagnosed reportable wildlife diseases listed by OIE for 2010 include 52 cases (Table 19). An active disease surveillance noted the first finding of the fungus *Batrachochytrium dendrobatidis* by PCR-analysis of skin swabs from free-ranging frogs and toads in Sweden in 2010. Trichomoniasis cases in finches were very few compared to the high numbers noted in the initial outbreak years of 2008-2009. Tularemia cases were again noted in 2010, a disease not diagnosed in 2009.

## DISCUSSION

The presence of serious contagious wildlife diseases in Sweden remains at a low level, but introduction of new diseases from the European continent occur and can be expected to continue both with migrating animals and due to the high risk factor of human transportation, travel and interference.

## ADDITIONAL SURVEILLANCES 2010

Table 19. Wildlife diseases and number of outbreaks/cases reported to the OIE for 2010.

| Disease/infection                                    | Species in Latin name        | Outbreaks/cases |
|--|------------------------------|-----------------|
| Avian infectious laryngotracheitis (ILT)             | <i>Phasianus colchicus</i>   | 1               |
| Avian Pox  | <i>Parus major</i>           | 1               |
|  | <i>Pica pica</i>             | 1               |
| Botulism   | <i>Anas platyrhynchos</i>    | 1               |
|  | <i>Bucephala clangula</i>    | 1               |
| Bovine anaplasmosis                                  | <i>Alces alces</i>           | 1               |
|  | <i>Capreolus capreolus</i>   | 1               |
| Chemical poisons (lead poisoning)                    | <i>Anas platyrhynchos</i>    | 1               |
|  | <i>Aquila chrysaetos</i>     | 2               |
|  | <i>Cygnus olor</i>           | 1               |
|  | <i>Haliaeetus albicilla</i>  | 1               |
| Infection with <i>Batrachochytrium dendrobatidis</i> | <i>Bombina bombina</i>       | 1               |
|  | <i>Bufo bufo</i>             | 1               |
|  | <i>Bufo viridis</i>          | 1               |
| Mycotoxins (aspergillosis)                           | <i>Alces alces</i>           | 1               |
|  | <i>Anas platyrhynchos</i>    | 1               |
|  | <i>Anser anser</i>           | 1               |
|  | <i>Bubo bubo</i>             | 1               |
|  | <i>Capreolus capreolus</i>   | 2               |
|  | <i>Cervus elaphus</i>        | 1               |
|  | <i>Columba livia</i>         | 1               |
|  | <i>Haliaeetus albicilla</i>  | 1               |
|  | <i>Larus argentatus</i>      | 1               |
|  | <i>Larus marinus</i>         | 1               |
|  | <i>Larus ridibundus</i>      | 1               |
|  | <i>Lutra lutra</i>           | 1               |
|  | <i>Lynx lynx</i>             | 1               |
|  | <i>Somateria mollissima</i>  | 1               |
| <i>Sus scrofa</i>                                    | 1                            |                 |
| Myxomatosis  | <i>Oryctolagus cuniculus</i> | 1               |
| Newcastle disease                                    | <i>Columba livia</i>         | 1               |
| Pseudotuberculosis                                   | <i>Delichon urbicum</i>      | 1               |
| Salmonellosis ( <i>S. enterica</i> )                 | <i>Bubo bubo</i>             | 1               |
|  | <i>Carduelis spinus</i>      | 1               |
|  | <i>Corvus frugilegus</i>     | 1               |
|  | <i>Larus argentatus</i>      | 1               |
|  | <i>Larus marinus</i>         | 1               |

Continued

## ADDITIONAL SURVEILLANCES 2010

Table 19 *Continued*. Wildlife diseases and number of outbreaks/cases reported to the OIE for 2010.

| Disease/infection                 | Species in Latin name                | Outbreaks/cases |
|-----------------------------------|--------------------------------------|-----------------|
| Sarcoptic Mange                   | <i>Canis lupus</i>                   | 1               |
|                                   | <i>Lynx lynx</i>                     | 1               |
|                                   | <i>Sus scrofa</i>                    | 1               |
|                                   | <i>Vulpes vulpes</i>                 | 1               |
| Toxoplasmosis                     | <i>Lepus europaeus</i>               | 1               |
| Trichinellosis                    | <i>Canis lupus</i>                   | 1               |
|                                   | <i>Lynx lynx</i>                     | 1               |
| Trichomonas sp.                   | <i>Carduelis chloris</i>             | 1               |
|                                   | <i>Coccothraustes coccothraustes</i> | 1               |
| Tularemia                         | <i>Apodemus flavicollis</i>          | 1               |
|                                   | <i>Lepus europaeus</i>               | 2               |
|                                   | <i>Lepus timidus</i>                 | 1               |
| <b>Total cases/outbreaks 2010</b> |                                      | <b>52</b>       |



Photo: Erik Ågren



# Antimicrobial resistance in bacteria from animals and food

## BACKGROUND

SVA has the assignment to monitor and analyze the development of antimicrobial resistance in bacteria from animals and in bacteria from food of animal origin. This is carried out in the Swedish Veterinary Antimicrobial Resistance Monitoring Program (SVARM) which has been running since 2000. Results of SVARM, i.e. data on antimicrobial resistance in bacteria from animals and data on sales of antimicrobials for use in animals, are published in a yearly report.

The program is organized and run from the Department of Animal Health and Antimicrobial Strategies at SVA. Integrated with SVARM is the program SVARMpat focusing on resistance in animal pathogens from farmed animals. SVARMpat is run in cooperation with Swedish Animal Health Service and is financed by the Swedish Board of Agriculture. The reports from SVARM are available at [www.sva.se](http://www.sva.se).

The objectives of SVARM are to detect trends in resistance and to provide a basis for recommendations on use of antimicrobials in animals. Details on methodology used are available in the report ([www.sva.se](http://www.sva.se)). Briefly, three types of bacteria are monitored: zoonotic bacteria, specific animal pathogens and indicator bacteria (*Escherichia coli* and *Enterococcus* spp.) from healthy animals and from food of animal origin. The rationale for monitoring indicator bacteria, i.e. commensal bacteria from the normal intestinal flora of healthy animals is that resistance among these bacteria reflects the selection pressure of use of antimicrobials in an animal population. Moreover, these bacteria can constitute a reservoir of mobile resistance genes that can reach human through the food chain. By using harmonised methodology for studies on indicator bacteria, data can be compared on an international level and over time. Thereby valid conclusions on trends in resistance can be made.

## SUMMARY SVARM 2009

The 2010 report shows that the situation regarding antimicrobial resistance in bacteria from animals remains favourable from an international perspective. However, the importance of continuous monitoring as a tool to discover introduction of new types of resistance and to identify trends is again manifested. In SVARM 2010, occurrence of resistance to 3rd generation cephalosporins and an increase in quinolone resistance in *Escherichia coli* from broilers is reported. Also reported is the first isolation of methicillin resistant *Staphylococcus aureus* of the livestock associated type (MRSA CC398) from Swedish pigs. These examples illustrate a constantly changing situation where only informed actions on several levels, national as well as local, can counteract spread and thereby mitigate the consequences of resistance. The measurable improvement in “prudent use” of antimicrobials for companion animals is a good example of a situation where effective activities were initiated from knowledge of trends gained by monitoring.

## Use of antimicrobials

The total amount of antimicrobials used for animals was 14,177 kg in 2010, which is the lowest figure in 30 years. The amount of antimicrobials for in-feed or in-water medication has decreased by 38% since 2006 and is today but 10% of the total sales. This reflects a marked decrease in sales of macrolides, pleuromutilins and tetracyclines for pigs. The sales of antimicrobials for dogs have decreased by 22% since 2006 measured as total number of prescriptions dispensed. Prominent decreases in sales of cephalosporins, aminopenicillins with clavulanic acid and fluoroquinolones are noted. The downward trend in prescriptions for dogs is explained by ongoing national and local work with improved implementation of hygiene and prescribing policies.

### Zoonotic bacteria

*Salmonella* is rare in Swedish animals and most incidents involve susceptible strains. In 2010, 87% of the strains were susceptible to all antimicrobials tested and only 6 of 62 strains from food producing animals and none of 20 strains from companion animals and wildlife were multiresistant. Resistance to 3rd generation cephalosporins was not observed. There are no indications of increased occurrence of resistance but in view of the public health consequences vigilance towards resistant *Salmonella* in food-producing animals is warranted. This is emphasised by the occurrence in later years of multiresistant monophasic *Salmonella* (*S. enterica* 4,5,12:i-) *Salmonella* subspecies I, O 4,5,12;i- in animals.

In broilers *Campylobacter jejuni* resistant to quinolones (21%) was more common in 2010 than in previous years. The reasons for this are not known. Selection through use of antimicrobials is unlikely since quinolones are seldom used in broiler production in Sweden. Continuous monitoring to follow up the finding is needed as well as further studies to elucidate the epidemiology of quinolone resistant *Campylobacter*.

Methicillin resistant *Staphylococcus aureus* (MRSA) in animals is notifiable to the Board of Agriculture. In 2010, MRSA were confirmed in four dogs, two cats, five horses and in one sample from pigs. Since first reported in 2006 and until the end of 2010, MRSA have been isolated from 18 cases in dogs, 4 in cats, 15 in horses and in one sample from pigs. The isolate from pig, the first from food producing animals in Sweden, was of spa-type t011 and belonged to the livestock associated CC398. Most isolates from dogs and cats were of spa-types that are common among MRSA from humans in Sweden. In contrast, all but two isolates from horses are of spa-type t011 associated to MRSA CC398. This type is common in several animal species in other countries but rare among humans in Sweden. Since there is a zoonotic aspect to MRSA in animals the situation should be closely monitored. Also, routines and recommendations for prevention of spread, as well as for management of MRSA in animals, should be elaborated.

### Indicator bacteria

Resistance in indicator bacteria (*Escherichia coli* and *Enterococcus* spp.) from the intestinal flora of healthy animals, are believed to reflect the antimicrobial selective pressure in an animal population.

Also, indicator bacteria from food reflect the exposure of humans to resistant bacteria from food animals. Resistance in indicator bacteria from broilers was low and reflected by an equally low level in indicator bacteria on broiler meat.

However, resistance to quinolones in *E. coli* from broilers has increased from 2% in 2002 to 13% in 2010. Moreover, screening by more sensitive selective cultures revealed *E. coli* with cephalosporinases of extended spectrum beta-lactamase (ESBL)- or AmpC-type in 34% of samples from broilers. These findings are puzzling and cannot be explained by antimicrobial use in Swedish broiler production. Preliminary findings indicate introduction and spread from imported breeding stock.

In this year's report indicator bacteria from horses are presented for the first time. In *E. coli*, the dominating findings were resistance to streptomycin, sulphonamides or trimethoprim (13-16%). Multiresistance occurred in 12% of the isolates. Resistance to 3rd generation cephalosporins was not found. However, on screening faecal samples by selective culture SHV producing *E. coli* was isolated from six of 431 samples. In *Enterococcus faecalis* a quadruple resistance; macrolides, aminoglycosides (gentamicin and kanamycin), tetracyclines and chloramphenicol was found in six isolates (18%). Resistance was rare in *Enterococcus faecium*.

Vancomycin resistant enterococci (VRE) were isolated from 23% of 200 samples of intestinal content from broilers and from 2 of 100 samples of broiler meat. Samples were cultured on vancomycin supplemented media. Prevalence of VRE in Swedish broilers increased to a peak of 41% in 2005 and has since declined. This year, the prevalence is about the same as in 2006-2009 indicating a stable situation.

### Animal pathogens

Isolates of *Escherichia coli* from clinical submissions from pigs and calves were often resistant to ampicillin, streptomycin, tetracycline or trimethoprim-sulphonamides. In *E. coli* from horses resistance to streptomycin and trimethoprim-sulphonamides were the most common traits whereas in isolates from dogs and cats resistance to ampicillin dominated. Multiresistance varied, ranging from 3% in isolates from cats to 38% in isolates from calves.

Since 2008, production of ESBL has been confirmed in 28 isolates of *Enterobacteriaceae* from dogs, cats and horses. Beta-lactamases involved

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were of groups CTX-M-1 or SHV and all the isolates were multiresistant.

In isolates of *Brachyspira* spp. from pigs, resistance to tiamulin occurred in *B. pilosicoli* but was not observed in *B. hyodysenteriae*. The majority of isolates of *B. pilosicoli* and *B. hyodysenteriae* were resistant to tylosin.

Resistance was rare in isolates of *Actinobacillus pleuropneumoniae* and *Pasteurella* spp. from the respiratory tract of pigs as well as in *Pasteurella* spp. from the respiratory tract of calves. However, penicillin resistance in *Mannheimia haemolytica* from calves was confirmed in one herd.

In *Aeromonas salmonicida* subsp. *achromogenes*, *Flavobacter columnare* and *Flavobacter psychrophilum* from farmed fish, deviating high MICs to nalidixic acid, tetracycline or florfenicol in some isolates indicate acquired resistance to these antimicrobials.

Isolates of *Streptococcus zooepidemicus* from the respiratory tract of horses were uniformly susceptible to penicillin, but resistance to trimethoprim-sulphonamides occurred.

Beta-lactamase production was the most common resistance trait in *Staphylococcus aureus* from skin samples of horses (21%) but only <1% were multiresistant. One isolate was methicillin resistant and confirmed as MRSA.

Most isolates of *Staphylococcus pseudintermedius* from the skin of dogs were resistant to penicillin through beta-lactamase production. Resistance to clindamycin, erythromycin, fusidic acid or tetracycline was also common (20-31%). One third of the isolates of *S. pseudintermedius* were multiresistant and 8% were resistant to at least five antimicrobials. In addition, 4% were resistant to oxacillin and a majority of these were confirmed methicillin resistant. In Sweden isolates of methicillin resistant *S. pseudintermedius* (MRSP) are notifiable. During 2010, 100 isolates from dogs and five from cats in Sweden were reported to the Swedish Board of Agriculture.

Isolates of *Pseudomonas aeruginosa* isolated from the external ear canal of dogs were susceptible to polymyxin B, whereas 2% of the isolates were resistant to gentamicin and 20% to enrofloxacin.



### REFERENCES

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# Antibiotic resistance in bacteria from humans



## BACKGROUND

Swedish surveillance of antibiotic resistance is based on testing of clinical samples and samples taken according to local screening programs. Some bacterial species with specific mechanisms of antibiotic resistance are notifiable under the Communicable Disease Act and therefore form an important part of the surveillance program. The vast amount of data on antibiotic resistance in Sweden is however based on susceptibility testing of clinical samples in local clinical microbiology laboratories. Data is voluntarily reported to one or both of the systems RSQC, in which all laboratories take part, and EARS-net, in which three fourths of the laboratories contribute with data on defined invasive isolates. In the present SWEDRES report the most recent data on antibiotic resistance is presented and analyzed together with data from previous years. Some of the most important findings are summarized below.

## *Staphylococcus aureus* and MRSA

A total of 1,580 cases of MRSA were notified in 2010, a seven percent increase compared to 2009. Of all the reported cases 43% had acquired MRSA in Sweden, and 38% had acquired the infection abroad. The average country incidence was 16.8 cases/100,000 inhabitants, an increase compared to 15.8 in 2009. Community-acquired infections dominated among domestic cases (63%) but were less frequent among imported cases (36%). Hospital-acquired infections were comparatively more common in imported cases (40%) than among domestic cases (9%), indicating continued good compliance to basal hygiene principles. Invasive isolates of MRSA were as few in 2010 (n=15) as in previous years and thus Sweden is still one of the few countries having less than one percent of MRSA among invasive *Staphylococcus aureus*, as reported in the European surveillance network EARS-Net.

Epidemiological typing of all MRSA isolates by *spa*-typing showed that the five most commonly encountered *spa*-types in 2010 were t008, t002, t044, t019 and t223, comprising almost one third of all isolates. The prevalence of MRSA with PVL toxin was 36% and was present in all or a majority of isolates with the common *spa*-types t008, t044, and t019. Multiresistance among MRSA, defined as resistance to betalactam antibiotics and to three or more other categories of antibiotics, was rare. Most cases could be correlated to seven different *spa*-types, and the acquisition of such strains was often from abroad and associated with healthcare.

*Staphylococcus aureus* from skin and soft tissue infections (RSQC program) were susceptible to tested antibiotics in > 95% of cases except for fusidic acid where the level of resistance was 6.2%.

## *Streptococcus pneumoniae* and PNSP

In 2010 there were 409 notifications of PNSP



(*Streptococcus pneumoniae* with MIC of penicillin > 0.5 mg/L) in Sweden, a decrease by eight percent compared with 2009. PNSP have decreased in annual incidence rate per 100,000 inhabitants from 10 in 1997 to 4.3 in 2010. Most cases were identified through nasopharyngeal culture. The majority of PNSP cases, independent of year observed, were found in the age group 0–4 years. In 23 cases the PNSP isolates came from an invasive site, i.e. blood. Multiresistance (resistance to penicillin and at least two more antibiotics) was common among PNSP. The most commonly found serotypes among all PNSP were, in decreasing order, types 19F, NT, 9V, 14, 19A, and 35B.

For five antibiotics tested on *Streptococcus pneumoniae* in the yearly RSQC program 2010 the rates of resistance were either slowly increasing or stable compared to 2009, and low rates of quinolone-resistant isolates have been seen since 2005.

Rates of non-susceptibility to penicillins in *Streptococcus pneumoniae* (=PNSP) were lower among invasive isolates reported to EARS-Net than in the nasopharyngeal isolates from the RSQC program, and in 2010 also resistance to macrolide antibiotics was lower.

### *Enterococcus faecalis*, *Enterococcus faecium* and VRE

From 2000 to 2006 only low numbers (18–35 per year) of VRE-cases were reported in Sweden. In 2007 there was an increase to 53 notified cases, followed by 618 in 2008, 402 in 2009, and 214 in 2010. These high notification rates were attributable to the spread of a *vanB*-carrying *Enterococcus faecium* strain in three counties, Stockholm, Halland and Västmanland. Intensive infection control efforts, implementation of screening programs, contact tracing, and also other measures undertaken have all contributed to the reduction in numbers of new cases in 2010. In 2010, however, yet another new strain of *Enterococcus faecium* with *vanB* was spread within the healthcare setting in the county of Västernorrland.

There were only two new cases of invasive vancomycin resistant *Enterococcus faecium* in 2010. One of them was reported from an “EARS-Net-laboratory”, resulting in 0.3% as reported to EARS-Net. Among invasive isolates of both *Enterococcus faecalis* and high-level resistance to aminoglycosides (HLAR) was common with 15% and 22%, respectively.

### *Escherichia coli*, *Klebsiella pneumoniae* and ESBL

*Enterobacteriaceae* producing extended spectrum beta-lactamases (ESBL) were made notifiable by the laboratories from February 2007. A total of 4983 cases were notified during 2010, an increase with 33% compared to 2009. Reports came from all 21 counties of Sweden, corresponding to a national incidence of 53 cases per 100 000 inhabitants. The most commonly reported species was *Escherichia coli* with 81% of all cases, followed by *Klebsiella pneumoniae* with 8%. Most ESBLs were found in urine samples (65%). 204 new cases of invasive infections with ESBL-producing bacteria were noted in 2010. Isolates with ESBLs, most often of CTX-M-type, were often multiresistant, i.e. resistant to several other antibiotics, seriously limiting the options for treatment.

*Escherichia coli*, mainly derived from urinary tract infections, has been included in the national surveillance program (RSQC) since 1996, and invasive isolates have been reported to EARS-Net since 2001. Ampicillin resistance, caused by production of plasmid-mediated beta-lactamase (most often of TEM-type) was increasingly found in both blood isolates and urine isolates (34% and 28%) in 2009. The level of resistance to third generation cephalosporins among blood isolates has increased to 3.2%, and in the majority of these cases the resistance was caused by plasmid-mediated ESBLs of CTX-M type. This resistance was often accompanied by resistance to many other antibiotics, e.g. aminoglycosides and fluoroquinolones. Resistance to fluoroquinolones has increased every year and was almost the same in urine as in blood isolates (13 and 14%) in 2010.

*Klebsiella pneumoniae* has also been monitored in the RSQC program and through EARS-Net since 2005. The rates of resistance to tested antibiotics were comparable between the two surveillance programs. Approximately two percent of *Klebsiella pneumoniae* were cephalosporin resistant and ESBL-producing, thus no increase from 2009. Since 2007, when the first isolate of *Klebsiella pneumoniae* with a carbapenemase (KPC-2) was detected in Sweden, more attention has been put to this new threat of multiresistant bacteria. In total, we have encountered 18 cases of ESBLCARBA in Sweden to date, 9 isolates with KPC enzymes, 6 cases with VIM enzymes, and 3 cases with the newly detected carbapenemase NDM-1. All the cases were healthcare related and imported from abroad.



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### *Clostridium difficile*

The national surveillance program for *Clostridium difficile*, initiated by SMI in 2009, continued in 2010. The program included both a voluntary laboratory reporting system of all new cases and determination of resistance and epidemiological typing of collected isolates. On all *Clostridium difficile* isolates collected during weeks 11 and 39, susceptibility tests and PCR ribotyping was performed. Resistance rates to moxifloxacin, erythromycin and clindamycin were 16-20%, and most of the resistant isolates were associated with PCR ribotypes 012, 017, 046 and 231/SE37. There was an overall positive correlation between the rate of moxifloxacin use and the proportion of moxifloxacin resistant isolates.

### *Helicobacter* and *Campylobacter*

*Helicobacter pylori* derived from gastric biopsies have been monitored for clarithromycin resistance at the (University Hospital MAS, Skåne. Following a steady increase since 1994, a peak of 16% in 2006, a temporary decline during three years, the level of resistance was back to 16% in 2010. In *Campylobacter* spp. high levels of resistance were seen for fluoroquinolones (30-60%), tetracyclines (20-35%) and low but variable for erythromycin (1-7%) during the last ten years.

### *Salmonella*

In *Salmonella* spp. and *Shigella* spp. the levels of fluoroquinolone resistance is high although these species are not monitored as regularly as others. In 2010 there was special focus on a monophasic variant of *Salmonella* (*S. enterica* 4,5,12:i-), which in 2010 was the third most common serotype in Sweden. Susceptibility testing at SMI showed that almost 70% of the isolates were resistant to ampicillin, streptomycin, sulphonamides and tetracycline (ASSuT). A few isolates were also resistant to fluoroquinolones and to cefotaxime (ESBL-producing).

### *Neisseria gonorrhoeae*

Gonorrhoea is a notifiable disease, and in 2010 842 cases of the disease were reported. Isolates from 618 of the notified clinical cases were completely characterised at the Swedish Reference Laboratory for Pathogenic Neisseria, Örebro University Hospital, and at the Division of Clinical Bacterio-

logy, Karolinska University Hospital Huddinge, Stockholm, representing more than 70% of the notified cases. In 2010 29% of these isolates were beta-lactamase producing and ampicillin resistant, and 56% were resistant to ciprofloxacin.

### *Mycobacterium tuberculosis*

The total number of new cases of TB diagnosed in Sweden 2010 was 683, a six percent increase compared to 2009. The numbers of cases diagnosed with isoniazid resistant TB in 2010 were 57/523 (11%) and with MDR-TB 18/523 (3.4%).

Genetic typing with RFLP (restriction fragment length polymorphism) was completed on 56 of the 70 resistant strains of *Mycobacterium tuberculosis* or *M. africanum* and is ongoing on the remaining 16. Thirty-one of the 56 examined isolates belong to 24 different clusters with two or more patients in each cluster.

## REFERENCE

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