

# SURVEILLANCE OF INFECTIOUS DISEASES IN ANIMALS AND HUMANS IN SWEDEN 2012

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Photo: Anders Lindström.

# Introduction

**Surveillance of infectious diseases in animals and humans 2012**, is an annual update on the surveillance activities carried out in Sweden during the year, for animal diseases and zoonotic agents in humans, food, feed and animals.

Sweden has had a low burden of serious animal diseases for several decades. The high health status of Swedish animals has led to the official declaration of freedom from several infectious diseases, which are present elsewhere in the European Community. In recent year, Sweden regained freedom from porcine reproductive and respiratory syndrome in 2008, from bluetongue serotype 8 and bovine tuberculosis in deer in 2010. As of 2013, Sweden is also considered free from bovine paratuberculosis and will likely soon be declared free from bovine viral diarrhoea.

The prevalence of *Salmonella* in food producing animals is, like in Finland and Norway, very low compared to most countries. This is illustrated by the low numbers of human cases of *Salmonella* caused by food produced in Sweden. During 2012 the surveillance of *Echinococcus multilocularis* has continued and the prevalence of the parasite is considered endemic at a low level.

Trade in live animals remains the greatest risk for introduction of new diseases to Sweden. Vectors play an important role in the transmission of infectious diseases to humans and animals. The reservoir for these vector borne pathogens is often found in wildlife, which makes surveillance and control challenging.

In order to improve existing surveillance, a national strategy for animal surveillance will be developed as a tool for prioritising surveillance programmes. The aim is to identify short and long term objectives and needs for animal health surveillance. In addition, strategic documents for important zoonoses such as *Salmonella*, *Campylobacter*, *Listeria* and *Yersinia* have been produced in collaboration with the Swedish Board of Agriculture, the National Food Agency, the Swedish Institute for Communicable Disease Control, the National Board of Health and Welfare and the National Veterinary Institute. The shared knowledge and analysis in the documents will serve as a basis for a common strategy to deal with these infections in humans and animals.

# The livestock population and trade in live animals

Demographic data show that most farms are located in the southern and central parts of Sweden and meat and milk are the major lines of production. In the northern part of Sweden, farms are mainly small. During recent decades the number of holdings with livestock has decreased, but those remaining have increased in size. The data below relates to the situation in June 2012. The slaughter figures cover the year 2012. Maps 1-3 and Figure 1 give an overview of the livestock population in Sweden.

## CATTLE

There are 19,560 holdings with a total number of 1,500,923 cattle (dairy cows, cows for calf production, 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. However, an increase by 1,500 animals was noted from June 2011 to June 2012. There were 348,500 cows in 5,000 dairy herds with an average of 70 cows per herd. The number of cows for calf production was 192,500 in June 2012 with an average herd size of 17 cows.

In total, approximately 392,000 adult cattle and 29,000 calves were slaughtered during 2012, which is a decrease for adult cattle and a slight increase for calves compared to 2011.

## PIGS

The total number of pigs was 1,363,000 (Map 2) in June 2012, which represents a decrease compared to 2011. Fattening pigs decreased by 49,500 animals between 2011 and 2012. This corresponds to a decrease of more than 5%. The number of sows and boars has decreased by 11,200 animals or 7% compared to 2011. Since 1995, the number of holdings with production of fattening pigs has decreased by 87% or 7,200 holdings and the breeders of piglets have decreased by 90% or 6,100 holdings.

About 2,592,000 pigs were slaughtered during 2012. Of these approximately 46,000 were sows.

## SHEEP

In June 2012, there were about 9,260 sheep holdings with a total of 296,680 ewes and rams and 313,850 lambs (Map 3). Sheep holdings in Sweden are usually small-scale enterprises but the size has increased somewhat in recent years. During 2011 and 2012 the average herd size was 32 adult sheep.

During 2012, approximately 260,000 sheep were slaughtered of which 225,000 were lambs.

## GOATS

In 2012 the reported number of goats and goat holders in Sweden were 11,600 and 2,135, respectively.

## POULTRY

The number of fowl has increased by 10% since 1995. Between 2011 and 2012, there was a 6% increase in the number of fowl and a 1% increase in the number of holdings with fowls, corresponding to 6.7 million hens ( $\geq 20$  wks) in 3,900 holdings.

Eggs delivered to wholesalers during 2012 amounted 97.8 million kilos during 2012 which is an increase compared to 2011.

The number of holdings in June 2012 with broiler production was 217 and about 76.8 million chickens were sent for slaughter during the year.

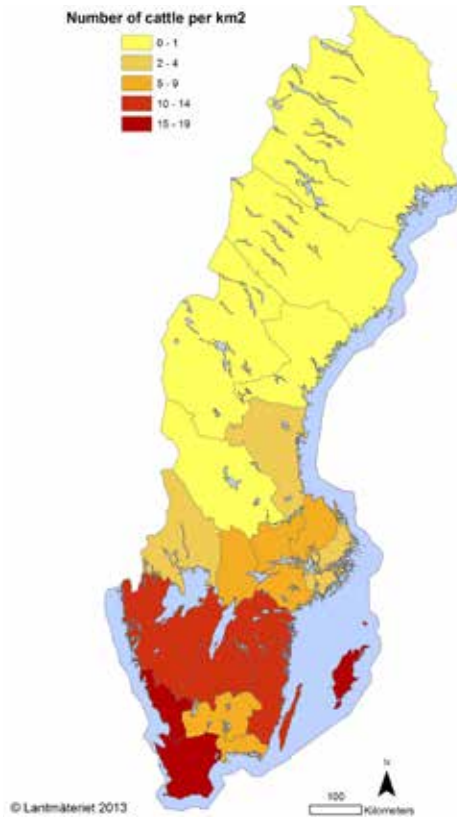
During 2012 466,000 turkeys were slaughtered, a decrease compared to 2011.

The production of geese and ducks is very small. About 13,672 geese and only 154 ducks were slaughtered during 2012.

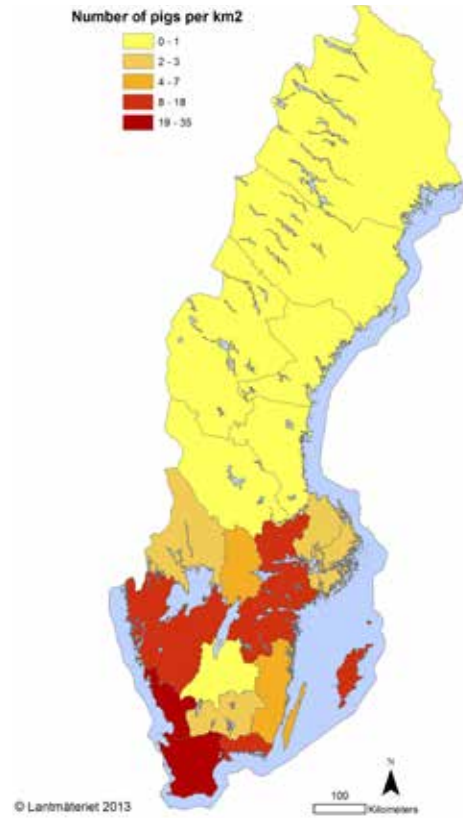
## FISH AND SHELLFISH

Swedish fish farms are evenly distributed over the country with a slight predominance to the middle and southern parts. Rainbow trout are the most frequently farmed fish followed by char, salmon and brown trout; salmon and brown trout are mainly for restocking of feral populations. Eels are imported from Severn in the UK through quarantine procedures for restocking of Swedish feral populations. A minor part of the Swedish aqua culture is farming of pike-perch and perch. Of the shell fish production, blue mussel has the highest tonnage, while oysters and crayfish are more limited. The main tonnage of

Map 1. Number of cattle per km<sup>2</sup> in 21 Swedish counties as of June 2012.



Map 2. Number of pigs per km<sup>2</sup> in 21 Swedish counties as of June 2012.



Map 3. Number of sheep per km<sup>2</sup> in 21 Swedish counties as of June 2012.

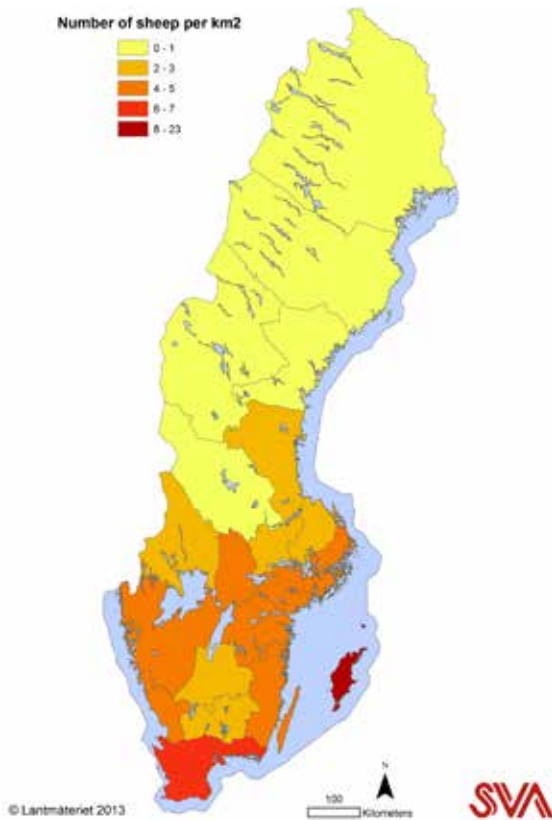
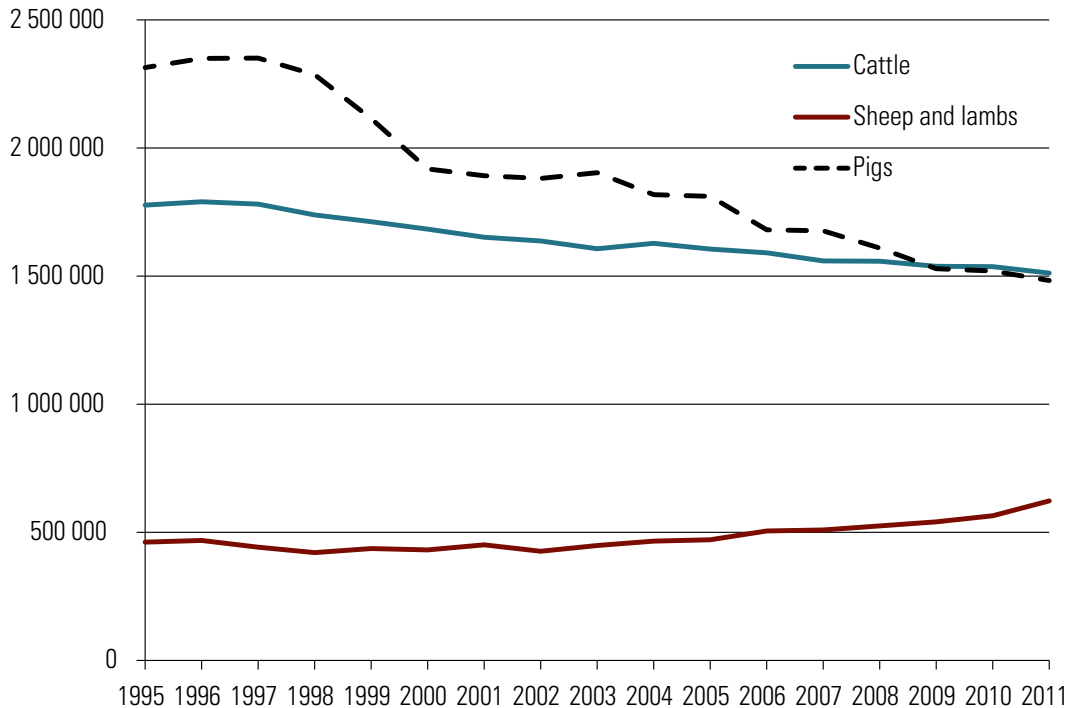


Figure 1. Number of Swedish livestock 1995-2012.



fish is produced in the continental zone, while the Swedish west coast is the area for production of blue mussels for consumption. Many of the Swedish farms are quite small compared to the ones in other parts of Europe, but there is a trend towards bigger units. A large proportion of Swedish aquaculture is owned by foreign companies, mainly Finnish. The interest in production of blue mussel for consumption has slightly stagnated during 2012, while interest remains high for the cultivation for the purpose improving environmental conditions. Swedish oysters are popular and in demand but it is difficult for the industry to maintain a high production. The health status in Swedish aquaculture is still high, serious diseases and outbreaks are rare.

#### TRADE IN LIVE ANIMALS

In 2012, 198 pigs were brought into Sweden from Norway, 5,400 pigs from Finland and 6 pigs from Denmark. Thirty-two cattle came from Denmark, 13 cattle (*Bubalus bubalus*) from Germany, 90 sheep from Finland (of which 82 for slaughter) and

270,400 day-old chicks from Great Britain, Germany, the Netherlands, France and Norway.

The number of animals leaving the country during 2012 were 330 cattle, 7,871 pigs of which 7,467 were sent for slaughter to Germany, 9 sheep were sent to Denmark and 4 sheep to Lithuania. Altogether 2,515, 500 day-old chicks were sent to Denmark, Lithuania, Poland, Germany, Latvia and Norway.

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# Animal databases

## *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 holdings 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. All egg producers with a capacity of at least 350 laying hens and all those selling eggs for consumption must 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 Animal Movements

The Swedish Board of Agriculture is responsible for the Central Database of Animal Movements. It contains data on all holdings with pigs, sheep and goats and their movements between holdings. The data encompasses address and the 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. For sheep and goats herds 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 are reported. The keeper is responsible for reporting 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 abattoirs are responsible for reporting all slaughtered animals including wild game to the register. The producer's organization number or personal code number must be reported for all species except wild game to the register. The holding number of the supplier is compulsory information for all species except horses and wild game. Reports must 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 includes milk recordings, fertility results and disease recordings for all animals at the dairy farm. It forms the basis for the development of different management tools used by the farmers, advisors and veterinarians. It is also a valuable tool for research on topics such as: feeding, animal health and genetics. Approximately 90% of all dairy cows in Sweden are included in this recording programme.

### Records at the Swedish Animal Health Service

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

### 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 obligated to continuously report activities of their veterinary practice on production animals. The purpose is to monitor the animal health situation in Sweden and use it as a base for preventive measures.

# 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, analysing 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. The SBA is also the chief authority for the Swedish district veterinarians. Besides their official tasks, the district veterinarians also do clinical work and are increasingly involved in herd health service in dairy herds.

## NATIONAL VETERINARY INSTITUTE

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

Diagnostic capacity for the most important 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 programmes are 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 of infectious diseases in humans. Central to SMI operations is to efficiently trace, analyse and combat infectious diseases. Preparedness for outbreaks of severe infectious diseases, both inside and outside the country's borders is a high priority for SMI. Diagnostic analyses of bacteria, viruses, parasites and fungi, as well as water and environmental analyses

are also a part of SMI's capacity. SMI's research and development is closely connected to its other preventative measures, as well as response to the current public health situation.

## NATIONAL FOOD AGENCY

The Swedish National Food Agency (NFA) is a federal agency that falls under the Ministry for Rural Affairs. The NFA works in the interest of the consumer to ensure food safety, to promote fair practices in food trade and to promote healthy eating habits.

To accomplish this mission, the agency develops and issues regulations, advice and information as well as coordinates and carries out control. As a basis for these activities the agency performs risk and benefit analyses, collects data on food consumption and composition, and carries out microbiological, chemical and nutritional analyses on food and water. The NFA is also responsible for environmental issues, emergency preparedness, and co-ordination of drinking water control. The work to promote fair practices in the food trade aims at ensuring that each food is in fact what it appears to be, so that consumers are not misled as to the food's composition, nutritional or product content, weight or volume, keeping qualities or production methods as well as how the food is presented in the shop.

## 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 for 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 in Sweden. These companies represent more than 99% of Swedish milk production, including three 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 animal health. The Swedish Dairy Association is further organising the surveillance programmes for bovine leucosis and infectious bovine rhinotracheitis. It is also organising the eradication programme for bovine virus diarrhoea virus and a voluntary control programme 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; SvDhv serves 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 programmes for pigs, cattle and sheep. In addition, SvDhv is officially responsible for specific disease control programmes, monitoring of resistance in pathogenic bacteria and the routine necropsy activities in farm animals. Research and development are also performed by SvDhv.

#### LUNDEN ANIMAL HEALTH ORGANISATION

Lunden Animal Health Organisation is a veterinary consulting company working with pig health and welfare. The objective is to gather, develop and communicate knowledge associated with pig issues. The organisation is a part of the national surveillance programme for pig diseases and has permission to perform health control as well as administering a voluntary *Salmonella* control programme.

#### 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 obligated to participate in the animal health programmes, administered by SPMA such as control for *Salmonella*, *Campylobacter*, coccidiosis and clostridiosis.

The SPMA is multi functional; the major task is the work associated with economic and political industry related matters important to its members. SPMA receives legislative referrals from the Swedish public authorities 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 organisation for Swedish egg producers, hatcheries, rearing companies, egg packing stations and pullet feeding companies.

The Swedish Egg and Poultry Association is responsible for the organisation of surveillance programmes regarding animal health and welfare and the voluntary *Salmonella* control programme. The objective is to further support profitable egg production, with a high standard of animal welfare and food hygiene and safety.

#### SWEDISH FISH HEALTH CONTROL PROGRAM

The Fish Health Service, owned by the aqua culture industry is presently being reorganised.

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# **Disease Surveillance 2012**

# African swine fever

## BACKGROUND

African swine fever (ASF) is a contagious disease of domesticated pigs and wild boar. The acute clinical form of ASF cannot be distinguished from the clinical manifestation of classical swine fever (CSF) although it is by an unrelated virus. African swine fever originated in sub-Saharan Africa where the virus persists in a cycle including sylvatic wild pigs and soft ticks. Outside Africa it is usually spread by contaminated meat fed to pigs. Because of this, swill feeding of pigs is prohibited in the European Union.

Europe experienced a long-lasting outbreak of ASF in Spain and Portugal beginning in the late 1950s. This lasted until 1995 and one result of this outbreak is the continuous presence of the disease in Sardinia. In 2007, ASF spread to Georgia and further to neighbouring countries in The Caucasus including Russia. The spread of ASF in this region and especially in Russia is ongoing and there is a great concern for neighbouring countries and the EU. During 2012 Ukraine reported an outbreak of ASF. African swine fever has never been diagnosed in Sweden.

## DISEASE

After an incubation period of 2-19 days (commonly 4-8 days), infection with ASF virus gives rise to acute, severe illness including high fever, inappetence, and severely impaired general condition. Dyspnoea, discolouration of the skin, diarrhoea and sometimes vomiting and haemorrhages are seen. Abortion is a common feature in pregnant sows. Milder forms of the disease have also been described.

## LEGISLATION

ASF is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and the control of the disease is regulated in detail through EU-directives.

## SURVEILLANCE

The purpose of the surveillance activities is to document freedom from ASF in the Swedish pig population and to contribute to the maintenance of this

situation by early detection of an introduction.

The National Veterinary Institute has been responsible for sample selection, sample analysis and reporting to the Swedish Board of Agriculture.

The serological analyses of ASF and analyses for ASF virus genome were performed at the National Veterinary Institute. ASF serology was done using a commercial kit (Ingezim PPA COMPAC 11.PPA.K.3) and in case of positive ELISA results a confirming western blot assay for detection of antibodies against ASFV was performed.

## Passive surveillance

As clinical suspicion of ASF is notifiable for both veterinarians and farmers, cases with suspect clinical signs will be investigated following notification to the Swedish Board of Agriculture. The investigation includes restrictions on the farm during the investigation, sampling of sick or dead animals and examination of the herd for prevalence of clinical signs and production results. Due to the similarity of clinical signs, samples are analysed for both CSF and ASF. This strategy is strongly recommended by the EU.

## Active surveillance

In 2012, all samples collected from the abattoir sampling part of the surveillance carried out by the Swedish Animal Health Service for porcine respiratory and reproductive syndrome virus (PRRS) were used for the active surveillance. See chapter on PRRS for details on sampling and population.

## RESULTS

### Passive surveillance

Five investigations following clinical suspicion of CSF/ASF were carried out during 2012. One of these was a wild boar with neurological signs. The clinical manifestation of suspicions in domestic pigs were varying and included reproductive failure, increased mortality in piglets, fatteners or sows and circulatory disorders including haemorrhages. Following investigation that included sampling, the herds were declared negative for CSF/ASF.



#### Active surveillance

In total 2,146 samples were analysed for antibodies to ASFV and all samples were negative regarding these antibodies.

#### DISCUSSION

The results from the passive and active surveillance regarding ASF in Sweden during 2012 adds to the documentation of freedom from this infection in the Swedish commercial pig population.

The present situation regarding ASF within and in close proximity of the EU with the persistence of ASF in Sardinia, spread of ASF to new areas in

Russia and to Ukraine during 2012 emphasizes the need for surveillance for ASF. The reported detection recently of ASFV in commercial pork products in Russia illustrates the well known fact that infected meat is the most important means of spread of ASF to previously uninfected areas.

# Atrophic rhinitis

## BACKGROUND

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

Atrophic rhinitis was a common disease in pig production, but as improvements in rearing and disease preventing measures have been made the disease has gradually faded away. The Swedish Animal Health Service administers a control programme which has been running since 1995.

## DISEASE

When *P. multocida* penetrates the nasal mucosa the nose muscles are destroyed and inhaled air will reach the respiratory organs without being filtered or warmed, which in turn increases the risk for other infections. Further, the bone building process is affected and the snout may become twisted in young pigs. Affected pigs will also show a retarded growth.

## LEGISLATION

Atrophic rhinitis is a notifiable disease according to SJVFS 2012:24.

## SURVEILLANCE

The purpose of the control programme is to declare herds selling breeding stock free from infection with

*P. multocida*, and thereby decrease the incidence of AR in all herds. Eradication of *P. multocida* is not realistic since it is an ubiquitous bacterium that can affect all mammals.

Nucleus and multiplying herds are controlled for the presence of *P. multocida* on an annual basis. Anytime AR is suspected in a herd, it should be tested for presence of *P. multocida*. If *P. multocida* is detected, the health declaration is withdrawn and restrictions on sale of pigs are employed until the herd is sanitised and declared free from the disease. Diagnostic tools developed by DAKO (Copenhagen, Denmark) and evaluated at the National Veterinary Institute during the late '80s and early '90s offered a possibility to combat AR in an effective way. Nasal swabs are cultured on a special media overnight. The entire microbial growth is harvested and diluted in water and the presence of the *P. multocida* toxin is assessed by an ELISA system.

## RESULTS AND DISCUSSION

Atrophic rhinitis was a common disease, but due to efforts made in the early 90s and the control programme initiated in 1995 the disease is now very rare. The last Swedish herd was diagnosed with AR in 2005 (Table 1). In 2009, *P. multocida* was detected in 10 out of 34 imported Norwegian boars in quarantine. These boars were isolated and found negative for *P. multocida* at resampling and moved to a boar station as intended.

Table 1. The total number of samples and the outcome of nasal swabs analysed for *P. multocida* 2005-2012. 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	2413	29	2
2006	1836	2	0
2007	1878	1	0
2008	462	0	0
2009	1724	10	1
2010	1523	0	0
2011	1323	0	0
2012	1431	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. The disease is important in the pig production worldwide although many countries have controlled the disease, at least in the domestic pig 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, goats, dogs and cats, 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 programme, operated by the Swedish Animal Health

Service that was introduced in 1991. The Swedish Animal Health Service is also responsible for the ongoing active surveillance programme and reports to the Swedish Board of Agriculture.

## DISEASE

The clinical presentation 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. Species other than pigs develop neurological signs including severe itch ("mad itch") and die within 1-2 days.



### LEGISLATION

The disease is included in the Swedish Act of Epizootic Diseases (SFS 1999:657 with amendments) and is 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 pig health status.

### SURVEILLANCE

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

#### Passive surveillance

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

#### Active surveillance

In 2012, all samples collected in the abattoir sampling part of the surveillance carried out by the Swedish Animal Health Service for porcine respiratory and reproductive syndrome virus (PRRSV) were used for the active surveillance for AD. See chapter on PRRS for details on sampling and population.

### RESULTS

#### Passive surveillance

During 2012, no clinical suspicions of AD were investigated and samples originating from pretesting for export and at breeding centres were all negative for AD virus.

#### Active surveillance

In 2012, 2,152 samples originating from 717 herds sampled at slaughter were analysed within the active surveillance programme. All these samples were negative for antibodies to the 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.

# Bluetongue

## BACKGROUND

Bluetongue is a vector borne disease of ruminants and camelids caused by any of 27 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, after extensive surveillance, 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 restriction of movements of certain animals of susceptible 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. Serum samples were analysed with a competitive ELISA (ID Screen® Bluetongue Competition ELISA) and milk samples were analysed with an indirect ELISA (ID Screen® Bluetongue Milk). Organs and blood were analysed with a real-time pan-PCR detecting 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, and at breeding centres was performed.

### Active surveillance

#### *Vector surveillance*

The vector surveillance was initiated in 2007 in order to document the activity of relevant *Culicoides* spp. throughout the different seasons of the year. The programme was continued until 2010 but not performed thereafter as Sweden was declared free from BTV-8.

#### *Targeted risk based monitoring*

Two hundred and fifty animals from 125 herds geographically spread over the country were selected for testing. The holdings were not randomly selected, but the number of holdings tested was distributed among the state district veterinarians in accordance with the cattle density in each county. Two animals from each holding were selected for testing by the sampling veterinarian according to certain fixed inclusion criteria, older than six months, unvaccinated, having grazed (been exposed to the vector) during the last season. The sampling took place after the vector season in November and December 2011 and samples were analysed with the real-time pan-PCR routinely used. The number of tested herds was sufficient to detect 2% prevalence with 95% confidence.



### RESULTS

Nine clinically suspect cases were investigated and tested during 2012, none were found positive. All other testing performed in 2012 was also negative.

### DISCUSSION

In summary, no clinical suspicions of bluetongue were confirmed nor was there any indication of viral circulation during 2012.

Competent vectors are present in Sweden and may spread the infection. Reintroduction of the virus to Sweden may occur by infected animals, infected vectors 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 could rapidly change. Moreover, as national vaccination campaigns in northern Europe are ceasing 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. During 2012 BTV-14, was detected in cattle in Estonia, Latvia, Lithuania, Poland and Russia. Sequencing was performed and

indicated that the positive cases were derived from a common source and suggested significant spread of the virus in the field. The strain was identified as a BTV-14 reference or vaccine strain, possibly indicating the use of a live BTV-14 vaccine and again demonstrating 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). It 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 misfolded 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 a 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, recognized as having negligible BSE risk, as a result of a resolution adopted by the OIE International Committee.

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 2 up to several years. Clinical signs are related to the neurological system and include altered behaviour and sensation as well as affected movement and posture. Clinical signs 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 saknr K19, amended through SJVFS 2011:29 (and SJVFS 2013:3). 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 and the farm level, of imported raw material for feed production and analysed 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 programme, which is carried out in cooperation with the National Veterinary Institute (SVA). SVA is the National Reference Laboratory, NRL (Regulation (EC) 999/2001). Samples from animals in passive surveillance and risk categories are analysed at the SVA, and samples from healthy slaughtered animals are analysed at a private laboratory in Sweden (until March 2013).

### *Passive surveillance*

All suspicions of BSE (bovine animals not responding to treatment, with clinical signs that are compatible with a BSE diagnosis) 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 analysed 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 2012:

- All healthy slaughtered cattle above 72 months of age.
- All healthy slaughtered cattle over 30 months of age if they originate 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 necropsy. 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 abattoirs were examined with Bio-Rad TeSeE 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 IDEXX HerdChek Bovine Spongiform Encephalopathy Antigen Test Kit (BSE EIA). In case of positive or inconclusive results the material was prepared and examined by Bio-Rad TeSeE Western Blot at the SVA.

## RESULTS

### Feed

In 2012, 196 feed samples were taken at feed mills and 182 samples were collected at primary production at farm level. All of these were negative.

### Animals

#### *Passive surveillance*

In 2012 four cattle were examined due to clinical suspicion, all with negative results.

#### *Active surveillance*

In 2012, in total 60,480 samples were examined for BSE and all samples were negative. Of these 10,764 were from fallen stock.

**DISCUSSION**

No positive BSE cases were detected. Preventive measures have been in place for many years and the fact that no cases were detected supports 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 suggestions have been made to allow the use of MBM in feed within the EU. Strict separation and bans of these feeding practices must be kept in place to avoid any possibility of recirculation of BSE if it were to enter the system again.

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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 programme 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 2001, there is also a compulsory control programme 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 distress, diarrhoea are typical signs of acute BVD. In pregnant cattle, infection may result in reproductive failure such as abortion, stillbirth or the birth of calves that are 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 2012:24). 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 or 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 beef herds live animals can also be sampled. Herds that are infected are screened and persistently infected virus carriers

are identified and removed. Other important parts of the programme are creating a positive attitude to biosecurity in the farming community and protecting the free herds from acquiring BVDV.

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

## RESULTS

In 2012, the total number of herds affiliated to the voluntary programme was 16,012 and at the end of the year 16,004 herds were certified as free from the disease. Of the remaining herds, three are considered infected. The other herds only have to be tested further before becoming certified free from the disease. In 2012, there were no incident cases detected.

## DISCUSSION

All herds in Sweden were affiliated to the voluntary or compulsory programmes during 2012. At the end of 2012, only 8 herds were not certified BVD-free, three of those herds were confirmed to be infected by BVDV. 2012 was the first year with no newly infected herd since the start of the control programme. The goal is to eradicate the disease at the turn of the year 2013/2014.

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# Brucellosis

## BACKGROUND

Brucellosis is caused by a zoonotic, gram-negative bacterium 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, *Brucella suis* in pigs, *Brucella abortus* in cattle and *Brucella 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 faeces. *In utero* infections occur, however venereal transmission seems to be uncommon. Humans are usually 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. Not more than 10 human cases have been reported annually. All patients have acquired the infection outside Sweden.

## DISEASE

### Animals

In animals brucellosis causes mainly 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 occurs 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 has been 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 from 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. Serum samples are tested with the Rose Bengal Test, and in case of positive reactions, confirmed with the Complement Fixation Test. A positive case is defined as an animal from which *Brucella* spp. has been isolated, or an animal with a confirmed positive serological reaction.

### Passive surveillance

Suspicious based on clinical signs in food producing animals must be reported to the Swedish Board of Agriculture and will be 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.

Brucellosis in dogs is not included in the Swedish Act of Epizootic diseases and the zoonotic potential of *Brucella canis* is considered to be significantly smaller than that of *Brucella abortus* or *Brucella melitensis*. Nevertheless, confirmed cases of infection with *Brucella canis* are notifiable and cases have



also been investigated and put under restrictions by the Swedish Board of Agriculture. Imported dogs or dogs mated abroad are seen as a risk factor for introduction of *Brucella canis* into Sweden. In 2011, an American Staffordshire terrier bitch imported to Sweden tested positive for *B. canis* using bacterial culture and serology. This dog was mated in Serbia and in Poland.

#### Active surveillance

Screening for *Brucella abortus* has been conducted regularly in Sweden since 1988, for *Brucella melitensis* since 1995 and for *Brucella 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. Since the start of the screenings, no samples have been confirmed positive.

In addition to the screenings described per species below, yearly surveillance is performed by post mortem examination and culture of aborted foetuses. In 2012, 79 ovine, five caprine, 63 bovine, one wisent, one bison and 54 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 for antibodies against *Brucella abortus*. Samples have been collected within the surveillance programmes for bovine virus diarrhoea and enzootic bovine leucosis and obtained from those samples by convenience sampling (in other words not strictly random), evenly distributed throughout the sampling period. This sampling was not performed in 2012 and will onwards be conducted every third year, next time in 2013.

#### Surveillance for brucellosis in sheep and goats

During 2012, 7,042 serum samples from 763 individual holdings were analysed for *B. melitensis*. The serum samples were collected within the surveillance programme for Maedi/Visna. In addition 204 serum samples from goats were analysed, those samples were collected within the Caprine Arthritis Encephalitis programme. 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

From 1996 until 2008 approximately 3,000 serum samples from pigs have been tested for antibodies against *Brucella suis* each year. Beginning 2009 and onwards serum samples will be tested every second year and therefore this sampling was not performed in 2012.

#### Humans

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 2012 clinically suspect cases were reported from eight bovine, one sheep, one goat and one water-buffalo herd. Bulk milk, serum samples from affected individuals and samples from aborted foetuses were taken. All samples were negative. No clinical suspicion was seen in any other animal species.

All samples, serological and bacteriological, from active as well as passive surveillance were negative.

During 2012 there were two clinically suspected cases in dogs. One of them was imported from Romania. In both cases the suspicion could be ruled out at post mortem examination.

#### 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 was not considered to be infected by a Swedish product but had consumed dried milk powder imported from Afghanistan after returning back to Sweden. Also during 2011, a domestic case was reported which was not actually infected in Sweden. This case was a child born in Sweden by a mother infected in Syria while she was pregnant. *Brucella* was isolated in blood from both mother and child. The child was healthy but was sampled since *Brucella* was detected in her mother. In 2012, 13 cases were reported, 6 men and 7 women. In 2012 one case was reported as domestic. This case had eaten green cheese brought to Sweden from Iraq. Country of infection was Iraq for 7 cases and one case each was reported from Ethiopia, Lebanon, Somalia, Syria and Turkey.

## DISCUSSION

In summary, no herd or any individual animal was diagnosed with *Brucella* infection during 2012. The long standing and extensive serological screenings performed without finding any infection and the very low number of human cases, only occasionally domestically acquired, confirms that *Brucella* is not present in Swedish food-producing animals. The active surveillance in aborted foetuses from food-producing animals is an important part of the surveillance system.

An unknown number of stray dogs from countries where *Brucella canis* is endemic enter Sweden every year. It is important to be aware of the risk this group of dogs represents, for *Brucella* infection as well as for other diseases.

# Campylobacteriosis

## BACKGROUND

Thermophilic *Campylobacter* spp. are gram negative curved rods, and are the most common causes of human bacterial gastroenteritis in many countries. *Campylobacter* was 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* spp. 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 infec-

tion 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 incidence of human campylobacteriosis has varied between 66.6 and 96.4 cases per 100,00 (Figure 2). Of these, approximately 20–40% have been reported as domestic.

## DISEASE

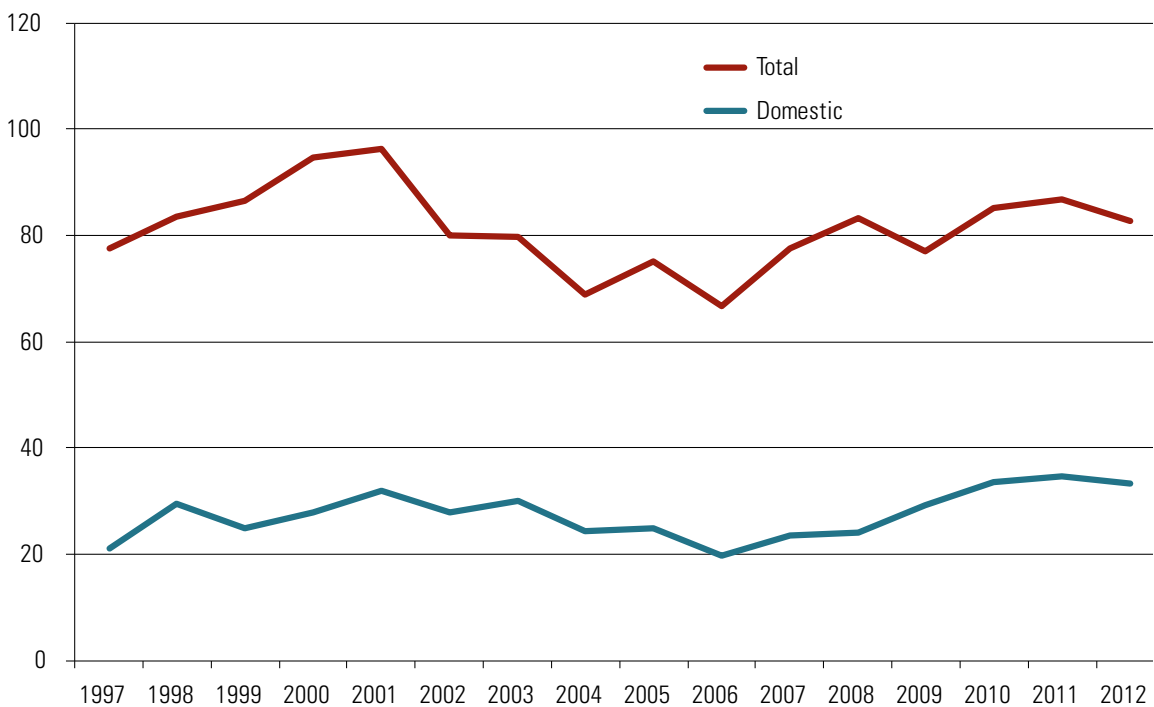
### Animals

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.

Figure 2. Notified incidence (per 100,000) of human campylobacteriosis in Sweden 1997-2012.



The symptoms are mild to severe: diarrhoea, fever, abdominal pain, nausea and malaise. The infection can be complicated by reactive arthritis, irritable bowel syndrome and a neurological disorder, as well as Guillain-Barré syndrome.

#### LEGISLATION

##### Animals

Thermophilic *Campylobacter* spp. are notifiable in broilers. In addition, *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 programme 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 of every slaughter flock at the major abattoirs. The caeca are pooled into one composite sample per batch. The programme covers 99% of broilers slaughtered in Sweden. Samples are analysed according to ISO 10272: 2006 parts 1-3.

##### Food

Monitoring is based on in-house control in the companies and on sampling by the local authorities. Sampling by the authorities can be performed as part of a project or as a follow up of complaint or outbreak investigation. No major projects were done in 2012. Results from some earlier major projects can be found at [www.slv.se](http://www.slv.se).

##### Humans

Surveillance in humans is passive.

#### RESULTS

##### Animals

In 2012, thermophilic *Campylobacter* spp. were detected in 217 (9.01%) of the 2,346 flocks at slaughter in the national *Campylobacter* programme (Figure 3). A seasonal variation of *Campylobacter* in

broilers was observed with the lowest value in the winter and highest in the summertime.

##### Humans

In 2012, 7,902 cases of campylobacteriosis were notified. A majority of the reported cases were infected outside Sweden. Of the reported cases, 43% (3,155 cases) were domestic. The incidence in domestic cases (33.0/100,000 inhabitants) decreased by 2% compared to the year before. The number of notified cases of campylobacteriosis usually increases during the late summer, and this also happened in 2012. Furthermore, in 2012, seven outbreaks were identified with 100-200 exposed cases. Suspected sources for these outbreaks ranged from drinking water and chicken products to direct contact with animals. Subtyping of isolates from humans and suspected sources by PFGE was used to confirm the link between the source and the cases.

##### Food

Available results from the local health authorities showed that approximately 50 samples of various food products were analysed qualitatively. The majority of these were taken as part of follow up of complaints or outbreak investigations. No positive samples were detected.

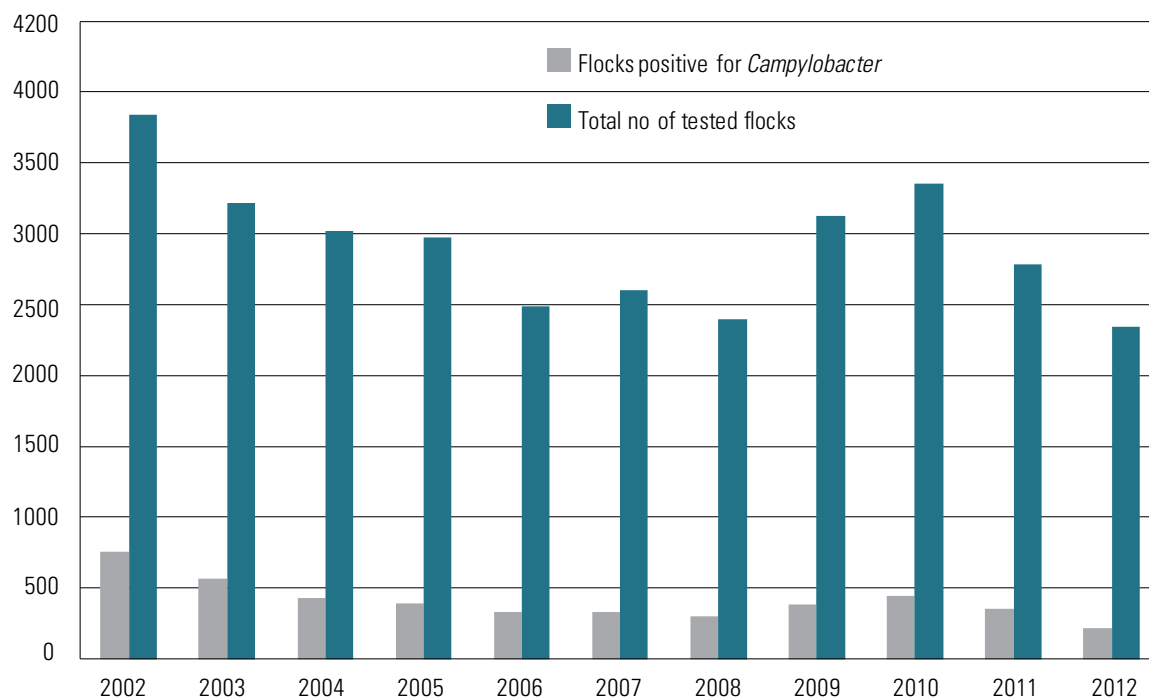
#### DISCUSSION

During the last fifteen years, the number of notified human cases of campylobacteriosis has remained high. Although most campylobacteriosis cases are considered sporadic, outbreaks do occur. This was noticed in 2012, when stored human isolates could be subtyped together with strains from suspected sources. The subtyping showed to be a useful tool in the outbreak identifications.

From 2000 to 2005, the prevalence of *Campylobacter* in broiler flocks decreased from approximately 20% to 12-13%. In 2012, the percentage of *Campylobacter* positive broiler flocks was 9% which is the lowest reported since 2002 (Figure 3). Reasons for this decrease are not clear but might be related to better hygiene and/or weather conditions in the summer of 2012 which had few hot days. During a hot and dry summer ventilation in the broiler houses needs to be increased with the risk of introduction of *Campylobacter*.

Reducing *Campylobacter* prevalence at the farm level decreases the risk of human infection. Applying strict biosecurity measures has decreased the



Figure 3. Prevalence of *Campylobacter* in broiler flocks in 2002-2012.

number of *Campylobacter* positive broiler slaughter batches in Sweden. Still, more effective measures to control colonization of broiler flocks are needed. Since flies have been associated with the spread of the infection, a fly control programme 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 the application of good hygiene practices. Also, freezing *Campylobacter* positive carcasses or scheduling them for heat-treatment would reduce the risk to consumers.

Strict hygiene in the kitchen is essential to avoid cross-contamination between contaminated food and food that will not be heated such as raw vegetables. Likewise good hygiene is important when preparing food at barbecues.

In order to decrease human incidence of campylobacteriosis a national 5-year strategy plan for *Campylobacter* was prepared and published as a co-operation between the Swedish Board of Agriculture, National Food Agency, Swedish Institute for Communicable Disease Control, the National

Board of Health and Welfare and the National Veterinary Institute. Several measures to control the infection were proposed in the strategy document.

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# Classical swine fever



Photo: Jonas Malmsten

## BACKGROUND

Classical swine fever (CSF) is a dreaded disease of pigs caused by a pestivirus closely related to bovine virus diarrhoea virus and border disease virus. The acute clinical form of CSF cannot be distinguished from the clinical manifestation of african swine fever (ASF), although it is caused by an unrelated virus. CSF is considered one of the most important and devastating pig diseases worldwide. During 1997-98 an extensive outbreak occurred in the Netherlands, Germany, Belgium and Spain. Since then, outbreaks in Europe have been confined to more limited geographic regions although the outbreaks in Lithuania 2009 and 2011 involved very large farms and are thus considered extensive. The most recent reported outbreak within the EU was in Latvia in late 2012. Classical swine fever (CSFV) is present in the wild boar population in some European countries. Some Eastern European countries have had difficulties in controlling CSFV in back yard and feral pigs although the situation has improved in recent years.

CSFV is also present in Russia as well as 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 swill contaminated with CSFV is considered the main route of spreading the disease to new areas. Because to this, swill feeding of pigs is prohibited in the European Union.

## DISEASE

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

### LEGISLATION

CSF is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and the control of the disease is regulated in detail through EU-directives.

### SURVEILLANCE

The purpose of the surveillance activities is to document freedom from CSF in the Swedish pig population and to contribute to the maintenance of this situation by early detection of an introduction. The National Veterinary Institute is responsible for selection of samples, sample analysis and reporting to the Swedish Board of Agriculture.

The serological analyses of CSF, analyses for the presence of CSF viral genome and CSFV culturing is performed at the National Veterinary Institute. CSF serology was done using a commercial kit (IDEXX® HerdChek CSFV Antibody Test Kit) and in case of positive ELISA results a confirming serum neutralization (SN) test for detection of antibodies against CSFV was performed.

#### Passive surveillance

Because CSF is notifiable on clinical suspicion for both veterinarians and farmers, cases with clinical signs consistent with CSF will be investigated following a notification to the Swedish Board of Agriculture. The investigation includes 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. Due to the similarity of clinical signs, samples are analysed for both CSF and ASF. This strategy is strongly recommended by the EU.

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

#### Active surveillance

In 2012, all samples collected for the abattoir sampling part of the surveillance carried out by the Swedish Animal Health Service for porcine reproductive and respiratory syndrome (PRRS) were used for the active surveillance. See chapter on PRRS for details on sampling and population.

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

### RESULTS

#### Passive surveillance

Five investigations following clinical suspicion of CSF/ASF were carried out during 2012. One of these concerned a wild boar with neurological signs. The clinical manifestation in suspicions of domestic pigs were varying and included reproductive failure, increased mortality in piglets, fatteners or sows and circulatory disorders including haemorrhages. Further investigations, including sampling the herds, could be used to declare a herd negative for CSF/ASF.

Samples originating from sampling for export and at breeding centres were all negative for CSFV.

#### Active surveillance

Serum samples from 2,139 pigs were analysed for antibodies to CSFV. In two of these samples (from the same sampling occasion from one farm) the results were inconclusive and the herd was investigated. None of the samples included in the investigation had antibodies to CSFV and the suspicion of CSF could be ruled out. Within the surveillance of aborted foetuses, 54 foetuses from 27 herds were examined for the CSF viral genome and all samples were negative.

### DISCUSSION

The results from the passive and active surveillance for CSF in Sweden during 2012 adds to the documentation of freedom from this infection in the Swedish commercial pig population.

The present situation regarding CSF in the EU, with isolated outbreaks close to Sweden (most recently in Latvia 2012) and the extensive movement of products and people, including labour in the animal production sector, emphasizes the need for both passive and active surveillance for CSF.



# Coccidiosis and clostridiosis

## 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 a 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 management factors and loss of mucosal integrity cause lesions in the intestines (necrotic enteritis) and liver (cholangiohepatitis).

Clinical signs of coccidiosis and clostridiosis range from clinical disease with significantly increased 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 programme for 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 anticoc-

cidials used. 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 broiler chickens from selected farms. If the lesion score of an individual flock exceeds a certain level (2.5) an analysis of the feed for 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 monitored at the abattoir, and if more than 0.5% of the birds in a flock are affected samples are sent for histological examination to the National Veterinary Institute. Further, data are compiled on a quarterly basis from all abattoirs on the overall level of condemnations due to liver lesions.

## RESULTS AND DISCUSSION

In 2012, a lesion score of >2.5 was not found in any of 38 investigated broiler flocks. Samples for histological examination of the liver were submitted from 20 broiler flocks with >0.5% condemnation due to liver lesions. The samples were collected at the abattoir. Lesions consistent with clostridiosis (i.e. cholangiohepatitis) were observed in 18 out of the 20 flocks. Three out of five abattoirs reported condemnation levels exceeding 0.1% caused by liver disease for at least one quarter during 2012. 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.

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# Echinococcosis

## BACKGROUND

Echinococcosis is a common name for different diseases in humans caused by tapeworms belonging to the genus *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: Karin Bernodt

# Alveolar echinococcosis

## BACKGROUND

*Echinococcus multilocularis* is endemic in large parts of Europe and has been reported to extend its geographical area. 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 raccoon dogs, dogs, coyotes and wolves can also act as definitive hosts. Rodents, mainly voles, serve as intermediate hosts. Foxes contract *E. multilocularis* by eating infected rodents.

## History

Prior to 2010, *E. multilocularis* had not been detected in Sweden and no case of alveolar echinococcosis had been reported in Sweden. As a response to finding *E. multilocularis* in Denmark in foxes, an active monitoring programme of the red fox (*Vulpes vulpes*) was implemented in Sweden in 2000. From 2000 to 2009, a total of 2,962 red foxes, 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. The remaining samples, plus those from which samples were ELISA-positive, were examined using the sedi-

mentation and counting technique (SCT) ( $n=726$ ). All samples from raccoon dogs and wolves were examined by SCT.

During 2010, 304 foxes were examined for *E. multilocularis*. A total of 103 were tested by SCT and 201 by egg-PCR. One fox, shot in south-west Sweden (Västra Götaland) and analysed in 2011 was found to be positive.

During the spring of 2011, a national surveillance programme was implemented where 2,985 hunter-shot foxes were analysed with segmental sedimentation and counting technique (SSCT). Three foxes were found positive: one in Västra Götaland, one in Södermanland and one in Dalarna county. In addition, 119 faecal samples from hunting dogs collected in the region of the first positive finding were analysed with egg-PCR and all were negative. In the same area 236 rodents were necropsied and all potential lesions examined by an in-house PCR without any positive finding.

## DISEASE

### Animals

In the definitive animal host, the infection is asymptomatic. The main intermediate hosts, rodents, will usually die from the infection if not captured by a predator.

## Humans

In humans, alveolar echinococcosis may develop into a serious, potentially fatal disease characterized by infiltrative tumour-like lesions in the affected organ. The incubation period for developing alveolar echinococcosis in humans is assumed to be between 5 and 15 years. 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.

## LEGISLATION

### Animals

Detection of the parasite is notifiable according to Swedish legislation (SJVFS 2012:24).

Until December 31, 2011, all imported dogs and cats (except for certain countries) were required to be treated with praziquantel before entering Sweden as a preventive measure. Because *E. multilocularis* has been detected in Sweden, there is presently no legal requirement to deworm of pets entering Sweden. However, as the prevalence of the parasite in foxes is very low in Sweden compared to many European countries, dog owners are encouraged to deworm their dogs prior to entry to Sweden.

## Humans

Infection with *Echinococcus* spp. has been notifiable since 2004 according to the Communicable Disease Act (SFS 2004:168). Before 2004 *Echinococcus* spp. was voluntarily reported by the laboratories.

## SURVEILLANCE

### Animals

Fox scats collected from Södermanland county during 2011 were analysed in 2012 with a newly developed and validated semi automated capture probe and real time PCR assay for *E. multilocularis* (hereafter named PCR). The aim was to get a better prevalence estimate in a known infected area. A second national screening was initiated in 2012 and continues in 2013, aiming at sampling about 4,000 faecal samples from foxes. Samples are analysed using the PCR.

From the three known infected areas, hunters were asked to submit 30 foxes from each area. Sampling was done during 2012 and continues in 2013. The foxes are tested with SSCT.

During 2012, 29 wolves (*Canis lupus*) and one arctic fox (*Alopex lagopus*) were tested with SSCT. Faecal samples from 5 dogs were tested with the PCR. Liver samples from 8 wildboars were also tested for *E. multilocularis* by histology and PCR.

## Humans

Surveillance in humans is passive.

## RESULTS

### Animals

Six out of 790 (0.8%) faecal samples from Södermanland county were positive. By the end of 2012, preliminary results from the national screening, showed that 1 out of 661 analysed samples were positive. The positive sample originated from a previously known infected area (Västra Götaland). In the sampling of foxes in a known infected area, preliminary results show that one positive fox has been found out of 10 examined. All wolves, the arctic fox, the dogs and the wildboars were negative.

## Humans

In 2012, alveolar echinococcosis was diagnosed in humans in Sweden for the first time. There were two cases with clinical symptoms and both were considered to be infected abroad, one in Central and one in Eastern Europe.

## DISCUSSION

*E. multilocularis* is considered to be endemic at a very low prevalence in Sweden. It is not known how and when the parasite was introduced into the country. Increased surveillance using fox faeces will continue to clarify the distribution of the parasite and also any future change in prevalence. Surveillance in intermediate hosts will also continue to try to identify the intermediate host(s) involved in the life cycle of *E. multilocularis* in Sweden. Based on the studies that exist today, the risk that humans become infected in Sweden is considered negligible.

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# Cystic echinococcosis

## BACKGROUND

Cystic echinococcosis is caused by *Echinococcus granulosus*. Domestic dogs and wolves are the most frequent main hosts. Eggs of the parasite are excreted in faeces into 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 quite common in reindeer in the northern parts of Scandinavia in the beginning of the 20<sup>th</sup> century. In the 1990s single cases of *E. granulosus* were 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, the lungs, brain or other tissues may also be involved. Infected patients may remain asymptomatic for years or permanently. Clinical signs of disease depend on the number of cysts, their size, 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 2012:24.

### Humans

Echinococcosis has been notifiable according to the Communicable Disease Act since 2004 (SFS 2004:168). Before 2004 *Echinococcus* spp. was voluntarily reported by the laboratories.

## SURVEILLANCE

### Animals

All animals are inspected for cysts during routine meat inspection. Lesions from two reindeers were tested. During 2012 lesions from two reindeer were tested. Furthermore, 29 wolves (*Canis lupus*) and one arctic fox (*Alopex lagopus*) were tested with SSCT.

### Humans

Surveillance in humans is passive.

## RESULTS

### Animals

*E. granulosus* was not detected in any animals in 2012.

### Humans

In 2012, 14 newly diagnosed cases of cystic echinococcosis were reported, which is a decrease from the peak in number of cases in 2010. The reported cases ranged from 17 to 66 years of age (median 36 years) and 4 were women and 10 men. They were all considered to have been infected abroad in areas where the parasite is endemic and the most frequently specified country of infection was Iraq (5 cases).

## DISCUSSION

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

# Enzootic bovine leucosis

## BACKGROUND

Enzootic bovine leucosis (EBL) is caused by bovine leukaemia 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 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 programme had started in 1990 and a mandatory eradication programme 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 tumours can develop rapidly in many sites, which may cause variable clinical signs depending on the site. Persistent lymphocytosis, without clinical signs, develops earlier but rarely before 2 years of age.

## LEGISLATION

EBL is included in the Swedish legislation for notifiable diseases (SJVFS 2012:24). 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 onwards, surveillance in dairy herds has been performed by random sampling of at least 1,700 herds every year. Milk samples are collected within the quality control programmes 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 originating from sampled herds.

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

## RESULTS

At the end of 2012, one slaughtered animal above 2 years of age tested positive for EBL.

## DISCUSSION

Sweden was declared free from EBL in 2001, and has had a very stable disease-free situation since then. The herd from which the positive animal originated is under investigation and all animals over 6 months will be tested for EBL in April/May 2013.

## REFERENCES

Swedish Dairy Association, Statistics for 2012.

# Footrot

## BACKGROUND

Footrot is a globally distributed contagious disease in sheep and goats. The causative agents are *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 recorded since 2004. A prevalence study on slaughter lambs was performed in 2009. A voluntary control programme for footrot 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, 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 2012:24).

## SURVEILLANCE

The aim of the control programme is to eliminate footrot from affected sheep flocks and to provide certification of footrot-freedom for the sheep trade. Another important part of the programme is training of veterinarians and non-veterinary staff to perform clinical inspection and footrot scoring. 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 is highest due to the weather conditions. If no signs of footrot are detected, the flock is certified free from footrot (F-status). However, if signs of footrot are noted the following measures are taken: foot bathing, moving to clean pastures and culling of chronically infected sheep. Flocks with a history of footrot can be certified a year after no signs of the infection.

Diagnostic testing of samples from interdigital skin is performed at the National Veterinary Institute, Uppsala, Sweden. The development of additional diagnostic tools is also linked to the control programme.

## RESULTS

During 2004–2012, footrot was reported in 186 sheep flocks. Following the recommended measures as a part of the control programme, footrot was eliminated from 95% of those flocks, which were subsequently certified free. In 2012, 13 flocks were detected with footrot, compared to 47 flocks during 2007.

During 2012, 82% of the sheep farmers with footrot-free certified flocks did not trade or exchange sheep with non certified flocks.

## DISCUSSION

The incidence of footrot has decreased since 2007. The awareness about disease control has been enhanced in the sheep farming community, and their agreement on a trade ban between certified and non certified flocks has been key to the programme's success. Good collaboration between authorities, the sheep farming community and individual sheep farmers has resulted in a cost-effective control programme.

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# 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 programme was initiated in 1994 and the last seropositive animal was found in 1995.

## DISEASE

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

## LEGISLATION

The Swedish IBR eradication programme was approved in 1994 (Decision 73/94/ COL and Decision 95/71/EC). Sweden was allowed additional guarantees by the EU to reduce the chance of IBR introduction 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 from the EU 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 of clinical suspicion is mandatory.

## SURVEILLANCE

All diagnostic testing as outlined below was performed at the National Veterinary Institute. Milk and sera were analysed for the presence of antibodies using an indirect ELISA (SVANOVIR™ 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 for IBR.

## Passive surveillance

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

In addition to the clinical surveillance, bulls are tested at semen collection centres and all cattle, deer, musk oxen, moose and llama are tested at export and import. During 2012, 40 semen samples from 22 animals were tested at semen collection centres and 1,028 animals were tested prior to import or export.

## 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 programme, dairy herds are tested by bulk milk samples, in farms with more than 60 cows, pooled milk samples from individual cows are used. The sampling is conducted twice a year within the Dairy association's quality control programme and synchronised with the programmes for bovine viral diarrhoea and enzootic bovine leucosis and thus not strictly random. The surveillance also includes serum samples from beef cattle. In 2012, 3,100 bulk milk samples and 6,881 serum samples from beef cattle were examined.

## RESULTS

In 2012, 14 bovine and one water buffalo case were investigated by serology and/or PCR, due to clinical suspicions of IBR. Diagnostic testing ruled out the suspicions.

All other samples tested in 2012 were also negative.

## DISCUSSION

In summary no herd or individual animal was diagnosed with IBR infection during 2012. This supports Sweden's IBR free status.

# Influenza

## BACKGROUND

Influenza is a viral disease affecting both birds and mammals, including humans. The causative agent is an RNA-virus of the family *Orthomyxoviridae* that changes over time. New strains are created through both mutations (“antigenic drift”) and through mixing of existing strains (“reassortment”). Influenza viruses are classified into subtypes based on the 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 of avian influenza infecting humans, but typically each species has its own influenza viruses.

# Avian Influenza

## BACKGROUND

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

During 2012, there were no outbreaks of HPAI or LPAI in Sweden. In the European Union (EU) 19 outbreaks of LPAI in poultry were reported in Ireland (n=1), the Netherlands (n=2) and Italy (n=16). In addition, Germany reported three outbreaks of LPAI in captive birds (non poultry). In the cases where subtyping was available, H5N2 was the most common type (n=14). Subtype H7N7 was identified in one outbreak and H7N2 was found together with H5N5 in another outbreak, the remaining were identified as H5/H7 or with no subtype given.

## Animals

Morbidity in birds infected with HPAIV may be as high as 100%, but depends on species affected, co-infections, virulence of the virus and other factors. In general, gallinaceous birds including turkeys and chickens suffer a more severe disease than waterfowl such as ducks and geese, which may only exhibit minor or no clinical disease. LPAIV infections most often cause asymptomatic infections or mild respiratory disease. HPAIV infections cause variable clinical signs such as cyanosis, respiratory distress, diarrhoea, nervous signs, depression, decreased food and water intake and decreased egg production with altered egg quality. In some cases the only sign is sudden death of a large numbers of birds.

## Humans

Since 2003 more than 600 human cases of H5N1 infection have been identified with a death rate of 60%. According to the WHO, most of the positive cases have been diagnosed in Egypt, Indonesia and Vietnam. The majority of human cases of H5N1 infection have been associated with direct or indirect contact with infected live or dead poultry. Controlling the disease in animals is the first step in decreasing the risk to humans.



## LEGISLATION

## Animals

Highly 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 upon 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.

## Humans

H5N1 infection is notifiable according to the Communicable Disease Act (SFS 2004:168).

## SURVEILLANCE

The Avian Influenza surveillance programme in Sweden in poultry and wild birds 2012 was based on Council directive 2005/94/EC and Commission decision 2010/367/EU.

The surveillance programmes have been carried out annually in all member states since 2002 to determine the prevalence of avian influenza, in particular the subtypes H5 and H7. The aim of the surveillance in poultry is to detect infections of avian influenza virus subtype H5 and H7 in different species of poultry. Surveillance of wild birds contributes to the knowledge of the threats from wildlife to ani-

mal health and serves as an early warning system for avian influenza in domestic poultry flocks.

## Poultry

In 2012 sampling was performed in game birds (mallard ducks and pheasants), layers, turkeys, breeders, geese, ducks, ratites and small-scale broiler production. Ten blood samples from each holding were collected except for holdings with geese, ducks and mallard ducks where 20 samples from each flock were collected. In flocks with fewer individuals than the above mentioned sample size, all individuals were sampled. In total 2,479 samples were taken. Table 2 gives an overview of all poultry flocks sampled in 2006 to 2012. In addition to the surveillance programme, samples were taken on clinical suspicion of avian influenza. Any clinical suspicions of Newcastle disease, were also analysed for avian influenza virus.

The serological analyses were performed at the National Veterinary Institute. All poultry were sampled at slaughter except for breeders, game birds and some of the layers. Blood samples from these categories of birds were collected at their holdings. Breeders were sampled late in their production period. Samples were analysed using an ELISA (IDEXX Influenza A Ab Test). Positive results were

Table 2. Number of flocks of different poultry categories sampled in 2006-2012.

	2006	2007	2008	2009	2010	2011	2012
Laying hens <sup>1</sup>	60	60	65	61	62	61	52
Free range laying hens <sup>1</sup>	n/a	n/a	n/a	n/a	n/a	30	27
Turkeys	26	23	23	17	21	22	19
Ducks	2	3	8	3	4	6	3
Geese	28	16	30	13	11	20	20
Broilers <sup>2</sup>	7	17	28	27	24	39	34
Ratites	15	10	10	6	4	5	3
Breeding hens (parents)	40	40	42	33	34	36	36
Breeding turkeys (parents)	4	4	2	4	3	3	3
Game birds (mallards)	0	7	6	6	7	9	7
Game birds (pheasants)	0	23	23	20	17	15	16
Backyard flocks (geese, ducks)	0	0	0	6	0	0	0

<sup>1</sup> Between 2006 and 2010 sampling of all laying hens were reported under the same category regardless of housing system. From 2011 free-range (organic) laying hens are reported separately while the category 'laying hens' includes hens in furnished cages and indoor litter-based housing systems.

<sup>2</sup> Small-scale production.

confirmed with haemagglutination inhibition tests (for subtypes H5 and H7) in accordance to the guidelines.

### Wild birds

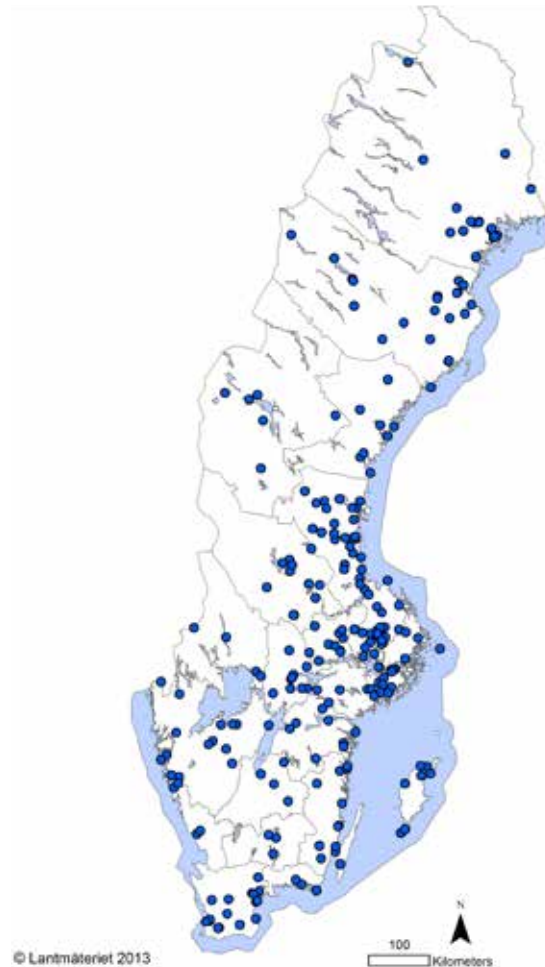
The surveillance in wild birds is passive and based on birds found dead or diseased, Map 4, shows the distribution of birds analysed for avian influenza. From birds that were autopsied, swab samples (both cloacal and tracheal) were used for PCR analyses. The samples were analysed for the detection of avian influenza viral genome by using an M-gene qRT-PCR. Positive samples, if found, are further analysed for detection and identification of H5 and H7 viruses, including virus pathotyping by amplicon sequencing.

In total, 297 birds including: 199 predator birds, 21 waterfowl or shorebirds and 76 birds of other groups were sampled within the passive surveillance carried out by SVA. From 2006-2010 there was active surveillance of 2,000-4,500 wild birds annually. Since 2011, the surveillance has been conducted on dead birds submitted for necropsy only.

### Humans

Every year during the influenza surveillance season 1,500-2,000 samples are collected from patients with influenza like illness. These samples are analysed for influenza A. If influenza A is detected, further subtyping is performed. The Swedish Institute for Communicable Disease Control also performs a specific PCR for A/H5N1 if requested.

Map 4. Geographical location of wild birds analysed for avian influenza.



**RESULTS****Poultry**

Antibodies to avian influenza virus subtype H5 and H7 were not detected in any of the sampled holdings.

On clinical suspicion of AI or Newcastle disease, laboratory analyses for both diseases are performed. During 2012 19 such suspicions were raised based on clinical signs, post mortem examinations, production losses and/or egg shell abnormalities. Seven of the suspicions were in hobby flocks and 12 in commercial holdings. All clinical suspicions were negative for influenza.

**Wild birds**

Within the passive surveillance programme, 297 wild birds of 61 different species were sampled and all birds were negative for Influenza A virus.

**Humans**

Influenza A subtype H5N1 has not been identified in any human sample in Sweden.

**DISCUSSION**

The first large outbreak of HPAI in wild birds was reported from China in May 2005. Thereafter wild birds infected with HPAI have been detected in Europe. Although no great mortality has been observed in wild birds, they do pose a risk to domestic birds since the virus is pathogenic in poultry. In Sweden, and the rest of the EU preventive measures 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 further spread between poultry flocks by routes as: infected live animals, contaminated vehicles and products. Therefore, continuous biosecurity measures are important to prevent the spread of virus that, if introduced, could be transmitted to other flocks prior to diagnosis. To combat avian influenza, focus should be on preventive measures that reduce the probability of transmission of virus between poultry flocks.

At the European level, highly pathogenic avian influenza has mostly been found within the passive surveillance programmes. In contrast, the low pathogenic strains have been detected within active surveillance programmes. Therefore, since 2011, the European Commission will no longer economically support active surveillance in wild birds. The Swedish surveillance programme in wild birds has been changed accordingly since this decision.

Influenza viruses are unpredictable and changes by mutation or reassortment occur. This might enable the virus to become more transmissible among humans. Monitoring of human infections with these viruses is also critically important to assess their pandemic potential

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OIE – WAHID database.

# Swine influenza

## BACKGROUND

The most common swine influenza virus (SIV) subtypes internationally are H1N1, H1N2 and H3N2. Of these, the H1N1 SIV was reported to infect pigs in North America already in 1918. In 2009, a new triple reassortant type of influenza H1N1, partly of 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. This reassortant H1N1 virus became known as influenza A(H1N1)pdm09.

## Animals

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 waned over time. Since 1982, H1N1 virus has been considered endemic in Sweden. Influenza H3N2 is also present in the Swedish pig population. Antibodies to H3N2 were first detected in 1999, but the clinical signs were not as evident as when H1N1 was introduced. Actually, antibodies to H3N2 were first detected in a screening of apparently healthy animals, and it is therefore less clear when this subtype was introduced. However, H3N2 has since 1999 occasionally been correlated to severe respiratory illness.

Another swine 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 of 2009.

There has not been regular monitoring for influenza in pigs in Sweden, but serological screenings were performed in 1999, 2002, 2006 and 2010. At each occasion 1,000 porcine sera were analysed for H1N1, H3N2 and H1N2. The screening in 2006 also included analyses for antibodies to H5 and H7.

Infection with influenza virus can produce clinical respiratory disease including dyspnoea, sometimes with nasal discharge and coughing, accompanied by fever, inappetence and inactivity. The disease can affect pigs of varying ages and the severity of clinical signs vary from severe respiratory disease to sub-clinical infection. The morbidity of affected herds is generally high but mortality is low.

## Humans

Globally, 5-10 human cases of influenza virus infections with domains associated to pigs are reported every year. However, human-to-human transmission of such reassortant virus types are rarely reported. An exception is the pandemic in 2009, caused by influenza A(H1N1)pdm09. The transmission of the influenza A(H1N1)pdm09 virus to pigs in the USA was followed by reassortment with endemic SIV. This resulted in reassortant viruses that include the novel influenza A(H3N2)v genotypes. The swine-origin A(H3N2)v strain includes the M (matrix) gene from the A(H1N1)pdm09 virus. Since August 2011, twelve human cases of swine-origin influenza A(H3N2)v (triple reassortant) were diagnosed in the USA (in five states). For 6 of the cases, no exposure to pigs was reported. In these cases, human-to-human transmission was suspected. Eleven of the cases occurred in children under 10 years of age. Swine influenza virus H3N2 with triple reassortant internal genes has been enzootic in USA since 1998.

## LEGISLATION

Influenza in pigs is not regulated in the Swedish legislation.

However, sustained transmission of influenza among humans with a virus originating from another host is notifiable.

## SURVEILLANCE

### *Passive surveillance*

During 2009 to 2012, samples from pig herds with respiratory signs that were consistent with influenza were collected with the aim to analyse the samples for presence of the pandemic influenza A (H1N1)pdm09 virus using a polymerase chain reaction (PCR)-method. From each affected herd, 5-10 nasal swab samples were collected and analysed first for swine influenza A and then any positive samples were further analysed for pandemic influenza A(H1N1)pdm09. These samples were also investigated for other influenza A types.

### *Active surveillance*

The surveillance in 2010 included 1,008 pig sera collected at slaughter. These sera were randomly selected from the PRRS control programme and included a maximum of 4 sera per herd and sampling

occasion. These sera were monitored for antibodies to Swine influenza types H1N1, H1N2 and H3N2 using haemagglutination inhibition tests (HI). Titres of  $\geq 1:64$  were interpreted as significant levels of serum antibodies. For 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

### Animals

#### *Passive surveillance*

Samples from 21 herds with respiratory signs were analysed for swine influenza virus from 2009 to 2011. In 4 of these herds influenza A virus was detected, but in no case was the pandemic influenza A (H1N1)pdm09 virus found. In 2012, 15 herds with acute respiratory signs were analysed, and influenza A was demonstrated in 5 of them. Again the pandemic A(H1N1)pdm09 virus was not detected.

#### *Active surveillance*

The surveillance in 2010 revealed low frequencies of pigs with significant levels of antibodies to swine influenza types H1N1, H1N2 and H3N2 using HI-tests (Table 3). 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.

### Humans

Since its appearance in 2009, the influenza A(H1N1)pdm09 strain has become a seasonal influenza. Season 2011-2012 was, however, dominated by influenza A(H3N2) and only 145 laboratory-confirmed cases of influenza A(H1N1)pdm09 were diagnosed in Sweden. Of these, 42 were reported as hospitalized, with 5 needing intensive care. No deaths were reported.

## 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 H1N1 and H3N2 was low. The prevalences of pigs with significant levels of serum antibodies was lower during 2010 than 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, indicate unspecific reactions rather than true antibodies to the influenza strains analysed for. Still, the difference in results depending on H1N2-viral strain used for analysing illustrates the necessity to include relevant influenza strains (Table 3) in the testing protocol. The new pandemic influenza A(H1N1)pdm09 that has affected pigs internationally has not yet been detected in pigs in Sweden.

Influenza viruses are unpredictable and changes (mutations or reassortment) might be induced. This might enable the virus to be more transmissible among humans. Monitoring of human infections of these viruses is critically important to assess their pandemic potential.

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Table 3. Reactors from the serosurveys performed 2006 and 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 reacoion 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 and all mammals, including humans, are susceptible to one or several *Leptospira* serovars. Leptospirosis occurs worldwide but dominant serovars vary by region. Cattle are considered the reservoir for *L. hardjo* and pigs for *L. pomona*. Between 1994 and 2006 sampling and testing for antibodies to *L. hardjo* and *L. pomona* was performed each year. The last surveillance was carried out in 2010 and surveillance is ongoing for 2013.

*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.

## 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 adults may go unnoticed, because the early clinical signs of fever and depression are often transient and mild. Infected herds may have problem with abortions, decreased fertility and decreased milk yield as well as increased mortality in calves. The clinical signs in sheep and goats are similar to those in cattle. Sheep and cattle can act as reservoir hosts because the disease may be asymptomatic. *Leptospira* infections in pigs may also be asymptomatic or may give rise to reproductive failure. In piglets, fever, gastrointestinal disorders and jaundice may be present.

### 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 2012:24).

## HUMANS

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

## SURVEILLANCE

### Animals

In a passive surveillance during 2012, sera from 349 cattle and 32 pigs were analysed for *L. hardjo* and *L. pomona*, respectively. The samples were collected as part of ongoing testing of animals for export and at breeding centres. The latest screening performed in 2010 included both bulk milk samples and blood samples. A total of 2,496 blood samples randomly selected from several abattoirs within the surveillance programme for bovine viral diarrhoea and evenly distributed throughout the sampling period. In addition, 750 bulk milk samples were selected by systematic random sampling from the surveillance programme for BVD. The latest screening of *L. pomona* in pigs included 2,873 serum samples analysed in 2010.

The serological analyses were performed at the National Veterinary Institute. The diagnostic test used for *L. hardjo* was an indirect ELISA (PrioCHECK *L. hardjo*, Antibody detection ELISA, Lelystad, Holland) for both blood and bulk milk samples. Positive blood samples were further tested with MAT (Microscopic agglutination test). For positive or doubtful ELISA results on bulk milk samples, an investigation was carried out in the herd and additional sampling of individuals were taken. *Leptospira pomona*-antibodies were detected using the microscopic agglutination test (MAT).

### Humans

The surveillance in humans is passive.

## RESULTS

### Animals

All samples were negative for antibodies to *L. hardjo* and *L. pomona* in the passive disease surveillance in 2012. For the screening programme in 2010, all samples were negative for antibodies to *L. pomona* and all samples but one were negative for antibodies to *L. hardjo*. The result from one bulk milk sam-





ple was doubtful. 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 were no clinical signs suggesting *L. hardjo* infection in the herd and all samples turned out to be serologically negative.

#### Humans

In 2012, four cases of leptospirosis were reported. All of them were considered infected in Asia; three in Thailand and one in Nepal. The cases which are imported to Sweden have often acquired their infections during leisure activities in contact with water.

#### 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. Certain *Leptospira* serovars are present in Sweden. Occasional cases of pigs serologically positive to *Leptospira* spp (other than *L. pomona*) are diagnosed in Sweden, mostly to an indigenous serovar of *L. sejroe* (Mouse 2A), *L. bratislava* and *L. icterohaemorrhagiae*,

and an even lower prevalence to the indigenous strain Mouse 2A in cattle has been recorded.

However, the surveillance of *L. hardjo* and *L. pomona* that has been in place since 1994, suggest that these serovars are not present in the Swedish cattle or the commercial pig population. Since 2006, the surveillance programme in cattle and pigs is no longer performed on a yearly basis as the serological screening of *Leptospira* is considered of less importance compared to screening programmes of other contagious animal diseases. Also, human infections are mainly travel-associated. The Swedish Board of Agriculture can decide to initiate an epidemiological investigation in case of clinical disease consistent with leptospirosis in animals.

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# Listeriosis

## BACKGROUND

The genus *Listeria* contains several species. The only zoonotic one, *Listeria monocytogenes*, was first described in 1926. Previously, sporadic cases of listeriosis were reported, often in workers 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 including soil, silage and water. The bacteria can survive for long periods in the environment and tolerate disinfection and can grow at refrigeration temperature. 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 fish products, meat products and soft cheeses or ready-to-eat foods with a 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 for the pathogen.

*L. monocytogenes* is destroyed by heating (pasteurisation and cooking). The bacterium is able to grow in vacuum-packed food, at refrigeration temperature and in modified atmospheres. *L. monocytogenes* is often found as an environmental contaminant in food preparation facilities.

In Sweden, during the last ten years, 40-60 cases of human listeriosis have been reported annually. Outbreaks have been associated with vacuum-packaged fish (1995-1996) and with cheese made from raw goat milk (2001). An increasing trend of cases of listeriosis has been observed both in Sweden and internationally. In 2009, the highest number of cases ever was reported (73 cases). The number of cases decreased in 2010 and 2011 and again increased in 2012, thus the overall increasing trend remains.

## DISEASE

### Animals

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

### 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. The severe form occurs mostly in immuno-compromised persons, newborns, 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 2012:24).

### Food

Regulations 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 macroscopic 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 initiate epidemiological investigations if needed.



#### Food

No official control programme 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 or other methods available at accredited laboratories.

#### Humans

The surveillance in humans is passive. Isolates from human cases are sent to the Swedish Institute for Communicable Disease Control for typing using the method provided by the *Listeria* reference laboratory in Paris. Every third year all human isolates from listeriosis cases will be collected. Next collection takes place in 2013.

### RESULTS

#### Animals

In 2012, listeriosis was reported in 32 sheep, 10 cattle and one farmed deer.

#### Food

The local authorities reported results from approximately 375 samples from various food products that were analysed qualitatively. *L. monocytogenes* was detected in 12 of these samples.

In 2010, a national survey was run in cooperation between the National Food Agency and the local authorities. In addition, Sweden participated in an EU-wide baseline survey targeting the same three categories of ready-to-eat foods as the national survey: packaged heat-treated meat products, soft and semi-soft cheeses and packaged gravad and smoked fish. Altogether, 1,590 food samples were analysed and they generated 83 *L. monocytogenes* isolates, 70 isolated from fish, 10 from meat and 3 from cheese. During the same time period 31 *L. monocytogenes* isolates were found in processing plant environments and on equipment.

All isolates (n=166) from food, the food processing environment and human cases of the study performed in 2010 were serotyped using PCR and agglutination and genotyped using pulsed-field gel electrophoresis. Serotype 1/2a was identified in 73-93% of the isolates from the three groups;

making it consistently the most frequent serotype. The food isolates differentiated into 19 pulsotypes (ID=0.843), the human isolates into 31 pulsotypes (ID=0.950) and the processing plant isolates into 22 pulsotypes (ID=0.991). Six of the pulsotypes were shared between the food and human isolates. This study indicated the presence of *L. monocytogenes* in the processing plant environment as a likely source of contamination of gravad and cold-smoked fish, and this food category as an important source of human exposure to the pathogen.

#### Humans

In 2012, 72 cases of listeriosis were reported, representing an incidence of 0.75 cases per 100,000 inhabitants. This is an increase by almost 30% from the year before (56 cases). A trend analysis for the years 1983-2012 shows that the incidence of listeriosis has increased by 2.5% per year. No large outbreaks were reported in 2012 (Figure 4).

The majority of the cases were in elderly people, thirty-six percent of cases occurring in people over 80 years of age. Two pregnant women and/or infants were reported with listeriosis in 2012 which is within the normal range of 0-2 cases per year. In 2012 54% of the reported cases were women. The counties with the highest incidence per 100,000 inhabitants in 2012 were: Västmanland (1.6), Värmland (1.5), Dalarna (1.5) and Blekinge (1.2). On a ten-year-average (2003-2012), several counties in the north have reported the highest incidences in Sweden (Map 5). A statistical analysis of the change in incidence in the three regions Götaland, Svealand and Norrland shows that the northern region Norrland has had the largest increase followed by the southern region Götaland. For the middle region Svealand, no change over time could be statistically confirmed.

Listeriosis is most often considered to be domestically acquired. During 2012, 62 cases were reported with Sweden as country of infection. Three cases were reported as infected abroad and seven cases had missing information about country of infection.

In 2012, only 43% of all isolates were sent for typing. The most common molecular serotypes were IIa (61%), IVb (19%), IIc (16%) och IIb (3%).

DISCUSSION

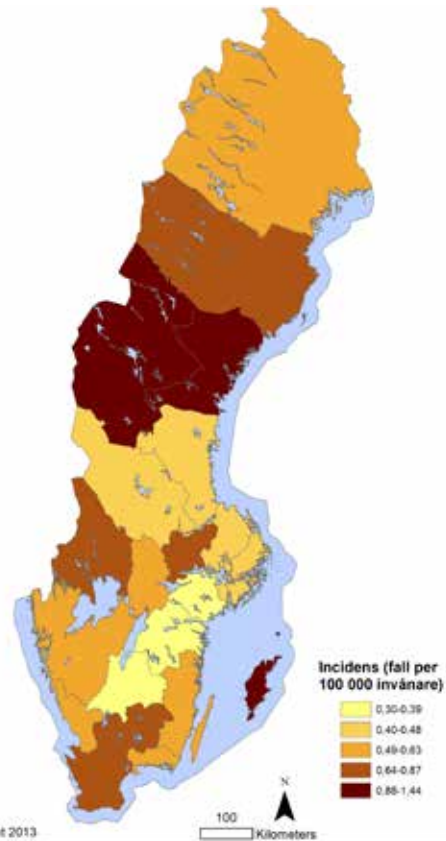
An increasing trend of reported human cases of listeriosis has been observed in Sweden and several other European countries. This trend has led to study projects and baseline studies across Europe. The reasons for the increase remain unclear but are most likely related to a combination of factors such as an aging population, the widespread use of immunosuppressive medications and consumer preference changes to more ready-to-eat foods.

The decreasing Swedish incidence of listeriosis in 2010 and 2011 was negated in 2012 when the incidence nearly reached the peak level from 2009 (Figure 4).

The case-fatality rate of listeriosis is high. Almost 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. The microbiological standards for *L. monocytogenes*, set in 2005 determine the standard the industry has to achieve for their products to be considered safe for consumers. The results from the 2010 survey showed that the fish industry still has problems with *L. monocytogenes*. The results indicate that this is a problem primarily in packaged cold-smoked and gravad fish. Due to the successful nationwide project in 2010 where almost all isolates were typed, a similar collection of human isolates will be performed every third year. Surveillance of *L. monocytogenes* in humans and in food and food processing environment will be essential for understanding the sources for human infection and producing tools for how to prevent infections.

With a common goal to reduce the incidence of listeriosis, a national 5-year strategy plan for listeriosis is being prepared as part of a collaborative project on prioritised zoonoses between the Swedish Board of Agriculture, National Food Agency, Swedish Institute for Communicable Disease Control, the National Board of Health and Welfare and the National Veterinary Institute. The strategy will be published in 2013.

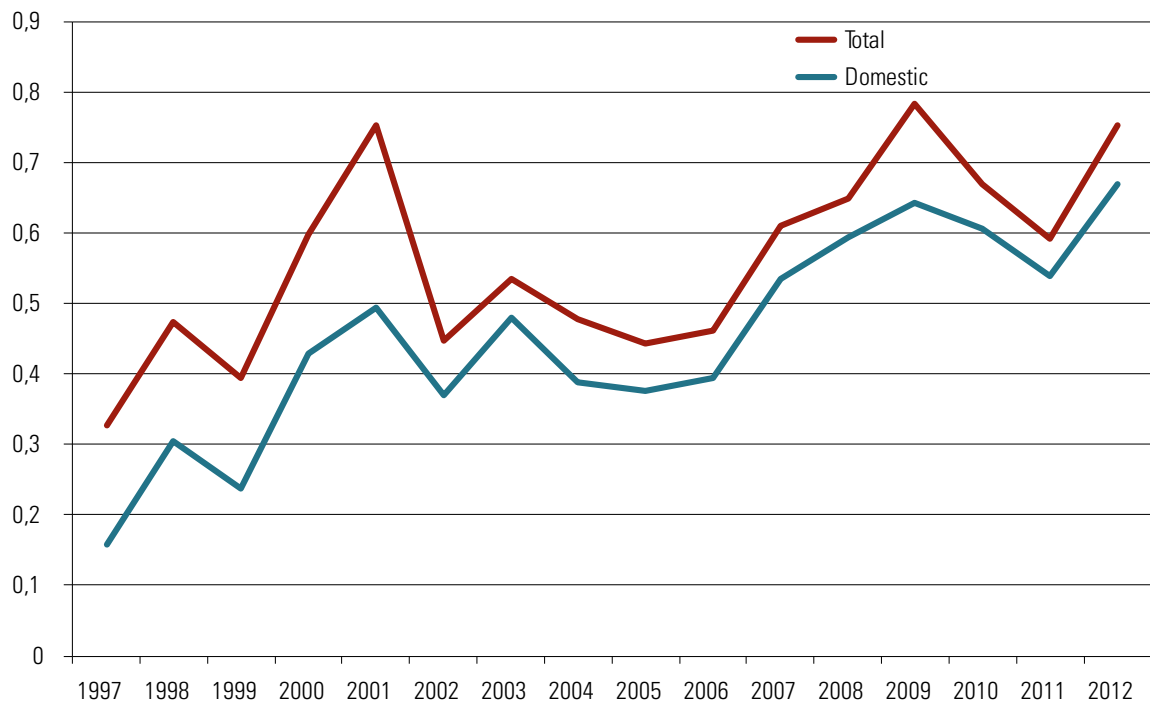
Map 5. Geographical distribution of human cases of listeriosis in Swedish counties.



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Source: SMI

Figure 4. Notified incidence (per 100,000) of human listeriosis in Sweden 1997-2011.



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# Maedi-Visna

## BACKGROUND

Maedi-visna (MV) is a disease of sheep and goats caused by 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 as indicated by the name *lenti*, meaning slow.

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

Since 1993 more than 600 flocks have been diagnosed with MV of which 285 flocks with 16,500 sheep have been culled and the majority of the remaining flocks have taken measures to eliminate the infection.

## DISEASE

In most cases, clinical signs such as wasting, respiratory distress, arthritis and staggering occur in sheep >3-4 years of age. However, it can have variable clinical presentations.

## LEGISLATION

Decision 1991/0068/EEC encompasses MV. Maedi-visna is also included in the Swedish legislation for notifiable diseases (SJVFS 2012:24) stating that the disease shall be reported when it has been diagnosed.

## SURVEILLANCE

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

Farmers joining the initial programme signed a contract where they agree that all animals have to be individually identified and the farmers have to keep a record of the flock. As a part of this programme, blood samples are collected from all sheep older than 12 months of age. If the serology is negative, the flock gets an M1-status. Twelve to sixteen months later, a second sampling of all individuals older than 24 months is performed and if all samples are negative for MV 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 from MV. Farmers within the programme are only allowed to bring in animals from flocks with the same or higher MV 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 2012, 3,218 flocks with a total of 134,299 sheep were enrolled in the initial programme. During the year almost 28,000 samples were analysed within the programme.

Diagnostic testing was performed at the National Veterinary Institute. Sera were analysed 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

Maedi-visna antibodies were detected in 27 samples. The number of flocks with M3-status (i.e. declared MV free) was 2,965 at the end of the year, with a total of 125,627 sheep.

## DISCUSSION

It is estimated that more than 200,000 sheep are monitored in the two programmes, which is more than 80% of Swedish sheep. However, a significant number of small flocks are not included in the control programmes. Efforts to contact and enroll new flocks will continue. The proportion of MV positive flocks among the non-affiliated flocks is decreasing.

# Nephropathia epidemica



Photo: Gert E Olsson

## BACKGROUND

Nephropathia epidemica (NE) is caused by Puumala virus, a member of the 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 in saliva, urine and faeces from its natural reservoir, the bank vole. 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.

Nephropathia epidemica was first described by two Swedish physicians independently in 1934. The linkage to 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 the bank vole, the infection is understood to be subclinical.

### Humans

The clinical picture is characterised by a sudden onset of 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 2012, 48 cases of NE were reported, which is a 86 % decrease from the number in 2011 (Figure 5).

Most reported cases were in the age category between 50 and 69 years and the median age was 56.5 years. No children below the age of 10 years were reported. The disease was more common in men (63%) than in women. The reason for this difference between age groups and genders is not completely understood, but most likely behaviour is an important factor.

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

Like in previous years, most of the cases (92%) were reported from the four northernmost counties in Sweden. The incidences in the counties of Jämtland, Västernorrland and Norrbotten were similar, between 5 and 6 cases per 100,000 inhabitants. However, the incidence in the Västerbotten county, from where most cases are usually reported, was slightly lower compared to the other three counties.

More than half of the cases were reported in January and February, when there were probably

still some infected bank voles outdoors and some of these found their way indoors to human dwellings. During the winter, there was a substantial reduction of the bank vole population which was reflected in the small number of human cases later in the year.

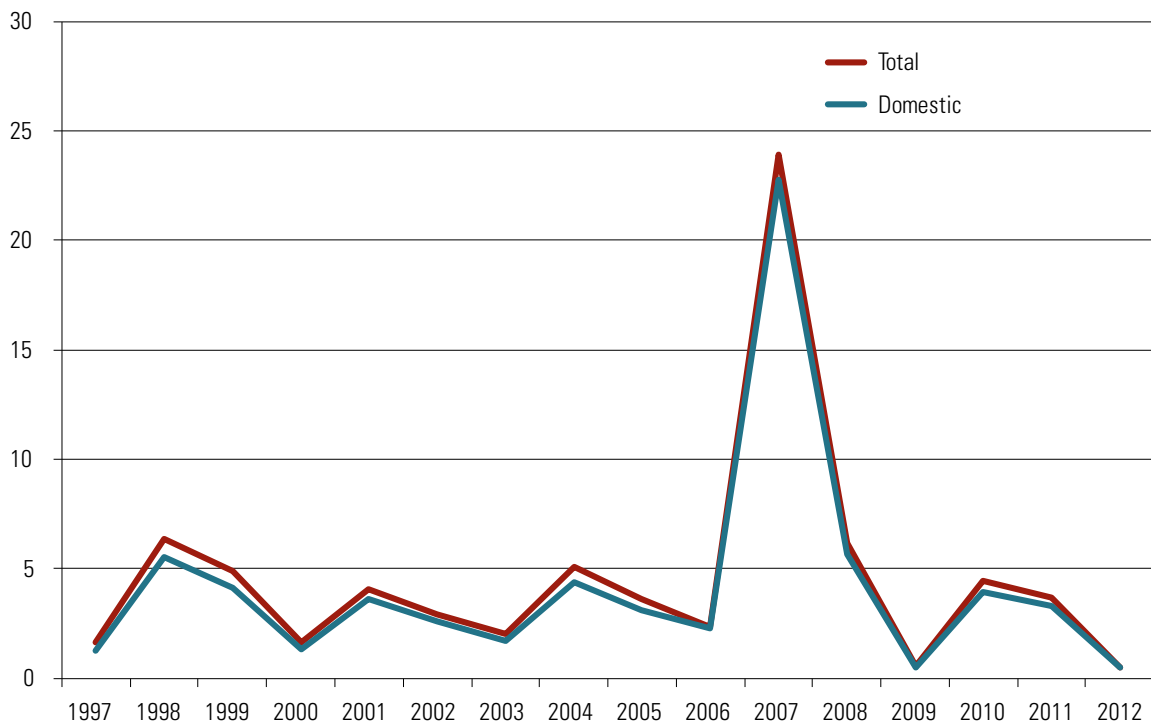
DISCUSSION

During the last year, fluctuations in the bank vole population coincided with increases and decreases in the number of human cases of Puumala virus infections. As the vole population was substantially reduced during the winter of 2011/2012 and then remained at a low to very low level, the number of infected humans decreased during 2012. The 3-4 year natural population cycle and variations in the climatic conditions impact the rodent populations.

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Figure 5. Notified incidence (per 100,000) of human Nephropathia epidemica in Sweden 1997-2012.







# Paratuberculosis

## BACKGROUND

Paratuberculosis is a common disease in most countries in the world. Sweden has a unique and extremely low prevalence of the disease. However, sporadic cases have previously occurred in beef cattle, all of them connected directly or indirectly to imported animals. The latest case was detected in 2005. Paratuberculosis has never been detected in dairy cattle, other ruminant species or wildlife in Sweden. The overall purpose of the surveillance and the control programme 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:

- Annual screening of 200 dairy herds in the years of 2000, 2003 and 2005.
- Since 2004 sampling of all ruminants above one year of age submitted for necropsy for *Mycobacterium avium* subsp. *paratuberculosis* (MAP) by culture.
- Screening of sheep herds during the years 1993-2011, first with serology, then with faecal culture.
- In 2007-2009 screening of beef herds with importation of animals during 1990-2005 with faecal culture.
- In 2012 screening of beef herds with importation of animals during 2005-2011 with faecal culture.

During 2012, a campaign to inform clinicians and raise the awareness of the disease was initiated to improve the passive surveillance. Bovine practitioners are encouraged to look for and sample cows with low bodyweight, with or without diarrhoea, by faecal PCR. The study will end in 2013.

### DISEASE

Paratuberculosis, also called Johne's disease, is an intestinal infection in ruminants caused by *Mycobacterium avium* subsp. *paratuberculosis* (MAP). *Mycobacterium* is excreted in the faeces of an infected animal and the normal transmission route is faecal to oral. It causes chronic diarrhoea and emaciation resulting in suffering and death. The disease causes great economic losses due to reduced milk production, reproductive losses and increased replacements 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 and there are ongoing discussions about MAP as a possible contributing factor to the development of Crohn's disease in humans. In countries with a high prevalence of Crohn's, 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) has been included in the Swedish Act of Epizootic diseases since 1952 (SFS 1999:657 with amendments). Vaccination is prohibited by law and notification of the infection is mandatory based on clinical suspicion. Whole-herd slaughter with subsequent sanitation and tracing of animal trade is performed if MAP is detected in a herd.

### SURVEILLANCE

#### Diagnostic tests

In 2012 all samples from surveillance were cultured, except the faecal samples from the clinical awareness campaign which were analysed by PCR. The cultures were pre-treated with HPC and double incubation. Samples were then cultured on modified Löwenstein-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 samples was performed on samples within the control programme that had mould overgrowth in the culture.

Samples collected because of clinical suspicion were analysed with both direct PCR and culture. All tests for MAP were performed at the National Veterinary Institute.

#### Passive surveillance

Notification, sampling and diagnostic testing is mandatory in animals of any ruminant species clinical signs that lead to clinical suspicion of paratuberculosis. Sampling includes faecal samples from live animals and post-mortem samples from dead or culled animals. The latter include samples from the ileal wall, ileal contents and ileocaecal lymph nodes as well as any macroscopic lesions in the intestines. Wildlife is sampled when MAP is suspected at necropsy.

In 2012, six cattle, two alpacas, two bison and one camel were analysed due to clinical suspicion of MAP.

#### Active surveillance

##### *Control programme in beef cattle*

In the control programme, the target population is beef herds that sell animals for breeding. The control programme is managed by the Swedish Animal Health Service and financed by the Swedish Board of Agriculture. In total, the control programme for bovine paratuberculosis encompassed 464 herds at the end of 2012 including all main breeding beef herds and a smaller number of dairy herds. In 2012, 36 herds were sampled within the control programme with 783 samples from cattle, 224 samples from sheep, 14 goats and 9 water buffalo.

The programme underwent some changes in 2011, in affiliated herds, faecal samples are collected annually for three consecutive years, from all cattle over two years of age and all purchased animals from one year of age. After three years of negative results, the faecal sampling is replaced by necropsy of all deceased or euthanized cattle on the premises where paratuberculosis cannot be excluded as a cause of culling.

##### *Post mortem examinations*

Sampling was performed on ruminants above one year of age submitted to post mortem examinations. Samples were taken from the ileal wall, ileal contents and ileocaecal lymph nodes and submitted to the National Veterinary Institute. In 2012, 464 animals were sampled; 244 cattle, 189 sheep, 10 goats and 21 exotic ruminants (10 alpacas, 9 bison, and 2 camels).

*Screening of sheep*

Separate screening of sheep was discontinued in 2012. The sheep are sampled on clinical suspicion, at necropsy and when there are mixed herds within the beef cattle control programme.

**RESULTS**

No cases of MAP were detected in any of the examinations carried out in 2012 (Tables 4 and 5). The results from the clinical awareness campaign which so far included 78 cattle were all negative.

**DISCUSSION**

The prevalence of MAP in Swedish ruminants remains at a very low level, if present at all.

The screening of beef herds with cattle imported from 1990-2005 and 2006-2011 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 traced back to imported animals with the latest case back in 2005. A previous screening of older cows at abattoirs in 2009-2010, was also aiming at a risk group including cows older than six years with signs of weight loss, and resulted in 1,211 sampled cows.

The ongoing clinical awareness campaign is targeting another risk-group with animals expressing weight loss with or without diarrhoea. The study will be finished in 2013 and the results presented after the campaign is complete.

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 with the control programme will have to send fallen stock for post mortem examination. The post mortem sampling also includes other susceptible species, like exotic ruminants, which are often kept in herds with animals imported from countries where MAP is common.

In a recent study, the probability of freedom and sensitivity of the surveillance system for MAP was estimated. Results show that, at the end of 2008, there was a high probability that the Swedish cattle population was free from or had a very low prevalence of MAP. This supports the need for continued investigations of animals being imported, as imports of susceptible species pose the greatest risk to introduction of MAP to the Swedish cattle population.

Table 4. Screening of sheep and goats.

Surveillance in sheep	No of sampled sheep	No of herds
Sheep in cattle herds within the control programme	244	6
Sampled at post mortem examinations	189	142

Table 5. Screening of cattle and exotic ruminants.

Surveillance in cattle and exotics	No of sampled cattle	No of herds
Control programme	783	29
Sampled at post mortem examinations	244	197
Sampled at post mortem examinations of exotic ruminants	21	16

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# 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 pigs. PRRS is a highly contagious disease transmitted between pigs through both 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 PRRSV. The disease was first described in USA in 1987 and the virus was subsequently identified in 1991. Since then PRRSV has spread and is endemic in most of the pig populations of the world. It is considered to be one of the most economically important viral diseases in swine production. In 2006, an atypical variant of PRRSV was reported from Asia. This variant causes more severe clinical signs and higher mortality than previously described genotypes of the virus.

In 1998, the Swedish Animal Health Service launched a surveillance programme for PRRSV. The Animal Health Service does the sampling and the National Veterinary Institute performs the analyses for the surveillance programme. The first case of PRRS in Sweden was confirmed in July 2007. Until then, Sweden was one of few countries that had declared themselves free of PRRSV. The outbreak was detected through routine sampling as a part of the surveillance programme. 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 during the fall of 2007. Sweden was declared 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 programme was revised in order to enable even earlier detection of an introduction of PRRSV.

## DISEASE

Infection with PRRSV causes varying clinical signs depending on the 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 fever and inappetence for a few days. The devastating effect of PRRSV infection in this category of animals is that it causes reproductive failure including abortions, mummified foetuses, small litters and increased incidence of non pregnant sows. In fattening pigs the infection mainly causes respiratory signs.

The atypical variant of PRRSV may cause high fever, discolouration of the skin and high mortality rates 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 PRRSV and to detect introduction of the virus before it has widely spread in the population. Both sampling for detection of viral genome and antibodies against PRRSV are used in the surveillance. To detect antibodies against PRRSV a commercial ELISA-method (HerdChek® PRRS X3 Antibody ELISA, Idexx Laboratories) is used and presence of the viral genome is analysed using a polymerase chain reaction (PCR)-method. Samples positive for PRRSV antibodies in the ELISA-test are analysed by an immunoperoxidase monolayer assay (IPMA) for confirmation.

### Passive surveillance

Because 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 sampling of sick or dead animals and examination of the herd for presence of clinical signs and analyses of production results. During the investigation the farm is placed under restrictions.

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

### Active surveillance

The active surveillance programme 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 analysed at each sampling occasion and at slaughter three samples per herd are analysed.

In addition, analyses for the PRRSV genome with PCR are included in the active surveillance of aborted foetuses.

## RESULTS

### Passive surveillance

Eight investigations following clinical suspicion of PRRS were undertaken during 2012. In the majority of these herds, reproductive failure was the main clinical manifestation and in two cases, African and classical swine fever were investigated in parallel to PRRS. Following sampling and testing, the herds were declared negative for PRRSV.

Two samples originating from pre-testing for export and at breeding centres were positive for PRRSV. These herds were investigated and declared negative for PRRSV. The positive animals were regarded as singleton reactors.

### Active surveillance

In 2012 1,055 samples from nucleus herds, multiplying herds and sow pools and 2,145 samples originating from 717 herds sampled at slaughter were analysed. All samples were tested for antibodies against PRRSV, all were negative.

Within the surveillance of aborted foetuses, 54 foetuses from 27 herds were examined for the PRRSV genome and all samples were negative for PRRSV.

## DISCUSSION

Following the outbreak of PRRSV in 2007, the active surveillance programme was further developed for an earlier detection of PRRSV introduction into the country. The surveillance programme was evaluated in 2012 and changes were suggested to reflect the decreasing pig population in Sweden, changing production methods and increased risk of introduction of PRRSV

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# Psittacosis

## BACKGROUND

Psittacosis is caused by *Chlamydia 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 intermittently for years without any clinical signs. People acquire the infection mainly via inhalation of contaminated dust or through contact with infected birds. In birds, the infection is transmitted via contact, by ectoparasites or contaminated equipment. *C. psittaci* may persist in dry faecal material 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 clinical signs when stressed or their immune system is depressed. Clinical signs in birds range from an asymptomatic infection to conjunctivitis, sneezing, pneumonia and generalized infection. Adult birds recover from the infection but 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 2012:24).

### 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

In 2012, *C. psittaci* was identified twice (budgie and zoo animal).

### Humans

In 2012, four cases of psittacosis were reported and all of them were infected in Sweden. Three cases were men, aged 40 to 75 years, one was a 10-year-old boy. One case had contact with a newly purchased budgie, the second had cleaned his bird table, a third had demolished a hen house, the fourth had no obvious route of transmission.

## DISCUSSION

In the 1980s around 100 human cases were reported each year. During the last decade, between 2 and 24 cases were reported annually. There is no obvious explanation to the 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 caged birds but psittacosis is considered common in both caged 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, foetal and vaginal fluids, faeces, 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 unpasteurised milk may be 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 associated with small ruminants, whereas cattle appear to be the 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 has been known since the early 1990s. The bacterium was first isolated from a sheep placenta in a herd on the isle of Gotland. In 1993, a survey of Swedish sheep and cattle showed a low seroprevalence, 0.3% in sheep (n=1,001) and 1.3% in cattle (n=784). In 2008/2009, a national survey of dairy cattle herds was performed showing that 8% of the herds were antibody positive in bulk milk. There were large regional differences, with the highest prevalence on the isles of Gotland and Öland (59% and 35%, respectively). In 2010/2011, regional bulk milk surveys were carried out on the isle of Gotland, reconfirming that this region has a high prevalence of cattle herds exposed to the agent. In 2010, national surveys in dairy goats and sheep showed a very low prevalence of antibodies; 0.6% (n=518 sheep herds) and 1.7% (n=58 herds), respec-

tively. In addition, goat bulk milk was also analysed for detection of the agent and *C. burnetii* was not detected. Also, in 2011 sheep farms (n=80) were investigated for the agent by RT-PCR based on vaginal swab sampling in conjunction with lambing, without detecting the agent in any of the samples. The evidence supports that *C. burnetii* is a rare pathogen in the Swedish sheep and goat populations. A survey was carried out during 2008-2010, investigating the *C. burnetii* status of 99 Swedish moose hunted in the county of Småland, including the Isle of Öland, where *C. burnetii* is highly prevalent in cattle. No positive samples were found, indicating that *C. burnetii* is also rare in this wild species.

In humans, only two domestic cases were reported in the 1980s and '90s. During the same period, a serological survey 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 was observed. Only one case was classified as domestic during the period from 2004-2009. In 2010, the 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 a national survey on dairy herds and where the bulk milk from the cows was shown to be antibody positive for *C. burnetii*.

## DISEASE

### Animals

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

#### Humans

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

#### LEGISLATION

##### Animals

Q fever is a notifiable disease (SJVFS 2012:24). 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

There was no active surveillance for *C. burnetii* in 2012. Limited testing was done for export. Serum samples from 17 bulls were analysed for the presence of antibodies by an indirect ELISA (CHEKIT Q-fever), and from 2 bulls by complement fixation test. Four serum samples and five bulk milk samples from cattle in eight herds were investigated for presence of antibodies due to clinical investigation by indirect ELISA (CHEKIT Q-fever). In addition, two samples from cattle in two herds were tested for the agent by PCR in conjunction with surveillance for *Brucella* spp. in aborted material.

##### Humans

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

#### RESULTS

##### Animals

All samples from cattle that were submitted for testing prior to export and for clinical investigations were negative for *C. burnetii*.

##### Humans

Since the 1980s, few domestically acquired cases of Q fever have been reported apart, from the cluster in 2010. Most reported cases have been infected in Mediterranean countries.

In 2012, two Q fever cases were reported. Both were infected abroad, in Spain and in Mozambique. Both cases were men in their fifties and sixties. During the 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.

#### DISCUSSION

After four years of active surveillance for Q fever, as well as other related studies, the surveillance for 2012 in animals was passive. It is notable that awareness and concern with Q fever as a differential diagnosis has decreased. Due to the nature of the infection, this situation is not likely to change as long as the surveillance remains passive, i.e. dependent on the health- or veterinary care seeking behaviour of individuals.

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# Rabies

## BACKGROUND

Rabies is caused by a lyssavirus in the family *Rhabdoviridae*. Rabies can infect all warm-blooded animals. Rabies occurs worldwide with some exceptions. 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 foxes and raccoon dogs. Bats in Europe may carry another type of rabies virus called European Bat Lyssa virus (EBLV), but not 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 clinical signs of EBLV in infected bats. They may express weight loss, disorientation, lack of coordination, muscle spasms and aggression, but some infected bats may be normal in behaviour.

## 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.

To prevent the introduction of rabies, dogs and cats have to be rabies vaccinated before entering Sweden. In addition, depending on the country of origin, some must have their antibody titre tested. The rules are set in the EU Regulation 998/2003.

### Humans

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

## SURVEILLANCE

### Animals

Since 1998, a passive surveillance programme 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 programme has been performed in different regions in Sweden.

### Passive surveillance

During 2012, three cats, two dogs and three red foxes 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). If the specimen was in poor condition due to decomposition, a PCR was performed as well.

Eighty-one dead or wounded and euthanised bats were sent to the National Veterinary Institute (SVA) for rabies examination (Map 6). The contributors were mostly private persons. The diagnostic method used was FAT. Of these, 37 bats were not in a suitable 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.

### Active surveillance

Sixty-eight Daubenton's bats (*Myotis daubentonii*) were caught in the region of Kalmar by using mist nets. The places were chosen by identifying rivers or creeks with good places for the nets. Blood samples and oral swabs were taken and the species and age were determined. After sampling, the bats were banded and released.

For serology the FAVN-method with EBLV-2 virus was used. The swabs were analysed by real-time PCR for EBLV 1 and 2 and classical rabies virus (RBV).

Humans

The surveillance in humans is passive.

## RESULTS

Animals

All animals included in the passive surveillance tested negative for rabies. Six specimens of Daubenton's bats (*Myotis daubentonii*) caught in the Vassmolösa area, tested serologically positive for EBLV2. However, no virus was detected and they all appeared clinically healthy at the time.

Humans

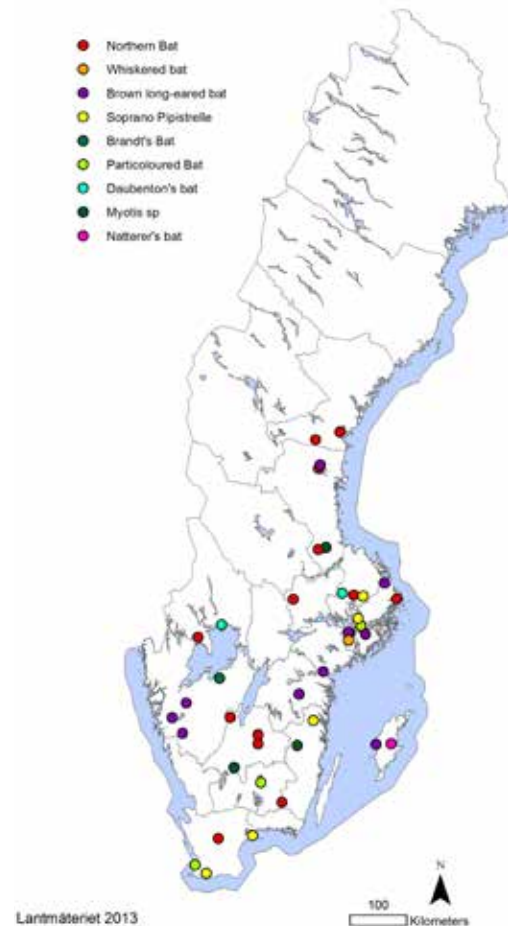
No human cases were reported during the year.

## DISCUSSION

During the recent decades, two people have been hospitalised 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 to Thailand. Both patients had most probably been infected by rabid dogs. Since Sweden is 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.

In recent years, antibodies to EBLV have been detected in specimens from live Daubenton's bats suggesting that EBLV is present in Sweden. Daubenton's bat (*Myotis daubentonii*) with EBLV-2 infections are 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 bat in Sweden, and may be found all over the country. There are 18 different species of bats in Sweden, all insectivorous belonging to the family of *Vespertilionidae*.

Map 6. Distribution of bats tested for rabies in passive surveillance during 2012.



# Salmonellosis



Photo: Désirée Jansson

## BACKGROUND

Salmonellosis 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 types, 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 programme 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 programme was accepted.

Around 3,000-4,000 human cases of salmonellosis are reported every year to the Swedish Institute for Communicable Disease Control. 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 typically imported food.

## DISEASE

### Animals

Infected animals are often asymptomatic. However, *Salmonella* can cause clinical illness with diarrhoea, abortions and fever, and lead to death. In Sweden clinical signs are frequently seen in cattle herds and horses, 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 typically 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 occur 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 programme for *Salmonella* at farm level. The feed business operator is responsible for producing *Salmonella*-free feed. Poultry feed must be heat treated according to the legislation. The majority of cattle and pig feed is also heat-treated. The control of feed is supervised by the Swedish Board of Agriculture which carries out announced and unannounced inspections at feed mills. *Salmonella* in feed is regulated in national legislation (SJVFS 2006:81) as well as in an EU regulation (Commission Regulation (EU) No142/2011).

## Animals

Investigation is required upon clinical suspicion of *Salmonella* and any finding of *Salmonella*, regardless of serovar, is notifiable and action is taken to eliminate the infection or contamination. Vaccination is not used in Sweden. The *Salmonella* control programme is governed by the Swedish Act on Zoonosis (SFS 1999:658) and its regulations. The aim of the programme 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 programme for feed, the emphasis is on control of feed raw materials, the heat treatment process and preventive measures for preventing recontamination of heat-treated feed. Suspected feed-borne infections are also investigated.

*Surveillance of feed raw materials*

Raw materials are the most important risk factor in feed production. In the domestic legislation, feed materials are classified according to the empirical risk of being contaminated, and high-risk feed materials have to be tested negative for *Salmonella* contamination before being used for feed production. All consignments of intra community traded

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

*Surveillance of feed mills*

The purpose of the surveillance is to ensure the absence of *Salmonella* in the production lines as well as in the feed mill environment. A safety management system is applied in the processing line according to HACCP (Hazard Analysis and Critical Control Points). The management system covers a number of specific GMP (Good Manufacturing Practice) requirements, according to Swedish legislation. A minimum of five samples from mills manufacturing compound feeding stuffs feed for poultry and a minimum of two samples from those manufacturing compound feeding stuffs for other food-producing animals must be collected in the processing line on a weekly basis. These samples are analysed at National Veterinary Institute (using MSRV, amendment to ISO 6579:2002 Draft 251004) and any finding of *Salmonella* is reported to the Swedish Board of Agriculture. The manufacturers also take additional samples from the processing line and the feed mill environment.

## Food

Control of *Salmonella* is an important part of in-house control programmes in most food enterprises in Sweden. All findings must be reported to the competent authority.

Official sampling by local authorities at food enterprises, other than abattoirs and cutting plants, is at a level above 1,000 samples per year and samples are analysed using mainly NMKL (nr 71:1999) and Vidas-SLM methods.

*Surveillance at abattoirs and cutting plants*

According to the Swedish *Salmonella* control programme, 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 22,000 samples from cattle, adult swine, fattening pigs and poultry are collected annually at abattoirs.

At red meat cutting plants, approximately 6,000 samples are taken annually from crushed meat and

meat scrapings and approximately 900 samples are taken in poultry meat cutting plants. The samples are analysed by regional laboratories using the current edition of the NMKL (nr 71:1999) method, with the exception of approximately 850 samples analysed by Vidas-SLM.

#### Control in food-producing animals

##### *Control in poultry*

The programme 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 programme – poultry*

All breeding flocks having more than 250 birds are tested (Table 6). Grandparents of *Gallus gallus* broilers are imported as day-old chicks. Laying hens, turkeys, geese and ducks are imported as parents. Samples consist of sock samples 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 6). All poultry flocks having more than 500 birds, irrespective of species, are tested 1-2 weeks before slaughter. In practice, all poultry flocks are tested prior to slaughter. The results must be available before slaughter.

The producers pay the costs for laboratory analyses and the visits to the farms. 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 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 programme – poultry*

A preventive voluntary programme includes all-in all-out production, hygienic measures and a high standard for poultry houses, such as hygienic barriers between the clean and unclean part. Animals purchases may only occur from holdings affiliated to the voluntary programme and 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 into the voluntary programme. An official veterinarian inspects the housing regularly. The producers affiliated to the voluntary programme receive higher compensation in case of *Salmonella*. All broiler producers belonging to the Swedish Poultry Association are affiliated to the voluntary programme (approximately 99% of the slaughtered broilers). The voluntary programme has been in place for more than 40 years. All broiler flocks are analysed for *Salmonella* before slaughter. Positive flocks are destroyed.

##### *Control in cattle and pig herds*

The programme includes a compulsory and a voluntary part.

Table 6. 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

The compulsory part consists of annual faecal sampling from breeding pig herds and gilt-producing herds and twice-a-year sampling 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 is suspected by macroscopic findings. All imported animals are sampled. On clinical suspicion, herds or single animals should be tested for *Salmonella*.

The voluntary programme is a preventive hygienic programme aiming at decreasing the risk of *Salmonella*. Holdings affiliated to the programme receive higher compensation in case of positive findings. The majority of all breeding herds and many of the large dairy herds are affiliated to the programme. 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 analysed using the MSRV (EN-ISO 6579:2002/A1: 2007: Amendment 1: Annex D) method.

#### Humans

*Salmonella* infection is notifiable in humans. A trace back investigation is completed for all domestic cases of *Salmonella*. All isolates sent to the Swedish Institute for Communicable Disease Control are analysed 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

#### Isolates

All suspected primary isolates of *Salmonella* from non-human sources are sent to the National Veterinary Institute 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 intra community traded or imported feed materials and compound feeds are



Photo: Désirée Jansson

reported in 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 negative before use in feed production. Finished feed containing *Salmonella* has to be withdrawn from the market. Extended sampling and cleaning are done in the production line if *Salmonella* is detected in the weekly surveillance. 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 obligated to take samples and implement measures to 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.

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

All *Salmonella* positive poultry flocks are destroyed irrespective of serotype. The poultry house 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, appropriate follow-up measures will be applied, such as careful cleaning and disinfection and environmental sampling.

## RESULTS

### Feed

Thirteen major feed mills produce approximately 95% of the feed for food producing animals. In the weekly surveillance of feed mills, 8,647 samples were analysed for *Salmonella* with 36 samples (0.42%) pos-

itive. Twelve serotypes were detected; *S. Typhimurium* was the most common (n=7) (Table 7).

In addition, *Salmonella* was detected in 17 (0.4%) out of 3,880 samples from feed materials of vegetable origin. The most common serotype was *S. Senftenberg* (n=5). *Salmonella* was detected in two environmental samples from domestic rapeseed processing plants. *Salmonella* was detected in 4 (0.2%) out of 2,200 samples from feed materials of animal origin and from pet food.

### Animals

#### Poultry

*Salmonella* was not detected from any breeding flocks or from turkeys. *Salmonella* Typhimurium RDNC was detected in one flock (0.03%) of 2,977 broilers in routine sampling before slaughter (Table 8). In addition, *S. Livingstone* was detected in two (0.32%) of 626 flocks of layers. *Salmonella* was also identified in two flocks of ducks and in one goose flock (Table 8). Moreover, an outbreak of *S. Gallinarum* was detected in four hobby flocks.

#### Cattle

In 2012, 17 cattle herds were under restrictions due to infections of *Salmonella* and at the end of the year ten cattle herds remained under restrictive measures. Five new herds were detected during 2012 (Table 9);

- 3 herds were detected in the control programme at the abattoirs.
- 1 herd was detected by post mortem examination of a diseased calf.
- 1 herd was detected by trace-back investigation from a *Salmonella* positive herd.

*Salmonella* was isolated from 8 of 3,364 lymph nodes that were analysed (Table 10, Figure 6). At three occasions (mentioned above), *Salmonella* was detected in the whole-herd samplings in the originating herds.

In addition, *Salmonella* was also isolated from one individual case at necropsy. In this case, *Salmonella* could not be detected in the whole-herd sampling in the originating herd.

#### Pigs

In 2012, *Salmonella* was detected in two pig herds (Table 9). In both herds, the investigations were initiated after isolation of *Salmonella* from lymph nodes at slaughter. From one of the farms, a multi-site farrow-to-finish farm, pentaresistant *Salmonella* Typhimurium DT104, was isolated.

Table 7. Serotypes of *Salmonella* isolated in feed control in 2012

Serotype	Feed material of animal origin A	Pet food	Feed material of oil seed origin B	Feed material of cereal grain origin	Process control feed mills	Rape seed (environmental)
<i>S. Agona</i>			2			
<i>S. Cubana</i>			1		2	
<i>S. Derby</i>		1				
<i>S. Duesseldorf</i>					1	
<i>S. enterica</i> subsp.		1			5	
<i>S. enterica</i> subspecies diarizonae (IIIb)					3	
<i>S. Havana</i>					2	
<i>S. Infantis</i>					1	
<i>S. Isangi</i>			1			
<i>S. Livingstone</i>				1	2	
<i>S. Mbandaka</i>	1	1	2		4	1
<i>S. Montevideo</i>			2			
<i>S. Ouakam</i>					3	
<i>S. Rissen</i>					2	
<i>S. Senftenberg</i>			5			1
<i>S. Soerenga</i>					1	
<i>S. Stanleyville</i>					1	
<i>S. Tennessee</i>			1		1	
<i>S. Typhimurium</i>			1			
<i>S. Typhimurium</i> fagtyp 120					5	
<i>S. Typhimurium</i> fagtyp 41					1	
<i>S. Typhimurium</i> Fagtyp NST 11:71					1	
<i>S. Yoruba</i>			1			
Non typable					1	
<b>TOTAL</b>	<b>1</b>	<b>3</b>	<b>16</b>	<b>1</b>	<b>36</b>	<b>2</b>
(total number of samples)	2042	158	3784	96	8647	614

A – Meat and bone meal, fish meal, greaves, bone meal, protein meal, meat meal, blood products, milk products, and poultry offal meal.

B – Derived from palm kernel, rape seed, soya bean and sunflower seed.

On one of the sites there were cattle as well but no *Salmonella* was isolated from cattle. In the second farm, *Salmonella* Typhimurium DT104 was also isolated and both cattle and pigs were kept on the farm (described above). By the end of the year, restrictions were lifted on all pig herds.

*Salmonella* was detected from 2 (0.09%) of 2,231 lymph node samples taken from adult pigs (Table 10, Figure 7) and from 1 of 3,071 lymph node samples from fattening pigs (Figure 8). In one of these cases, *Salmonella* could be isolated in the subsequent whole-herd sampling.

*Sheep*

During February and March 2012 a prevalence study for *Salmonella diarizonae* serovar 61:(k):1, 5, (7) in Swedish sheep was conducted by SVA following a request from the Swedish Board of Agriculture. *S. diarizonae* 61:(k):1, 5, (7) is considered to be adapted to sheep. The result indicated that *S. diarizonae* 61:(k):1, 5, (7) is present in approximately 18% of the sheep herds and not limited to certain parts of the country.

*Other animals*

In 2012, *Salmonella* Typhimurium was identified from 200 cats (Table 11). Most of these were reported from January to May. Nineteen of these isolates belonged to phagetype U277, a type commonly encountered in passerine birds.

In addition, *Salmonella* was detected in five dogs, 19 wild birds, three wild mammals and in 49 reptile pets.

*Food*

In the Swedish *Salmonella* control programme, *Salmonella* was not detected in any of 3,375 cattle carcass samples or 5,317 pigs carcass samples (Table 10). *S. Infantis* was identified in 1 of the 5,153 poultry neck skin samples (Table 10, Figure 9). *Salmonella* was not isolated from any of the 5,965 samples from cutting plants. In 2012, some samples at red meat cutting plants were taken from meat of foreign origin. The identified samples of imported meat have been excluded from the results. It cannot be ruled out that samples of imported meat are included in the figures.

Figure 6. *Salmonella* in lymph node samples of cattle at slaughter.

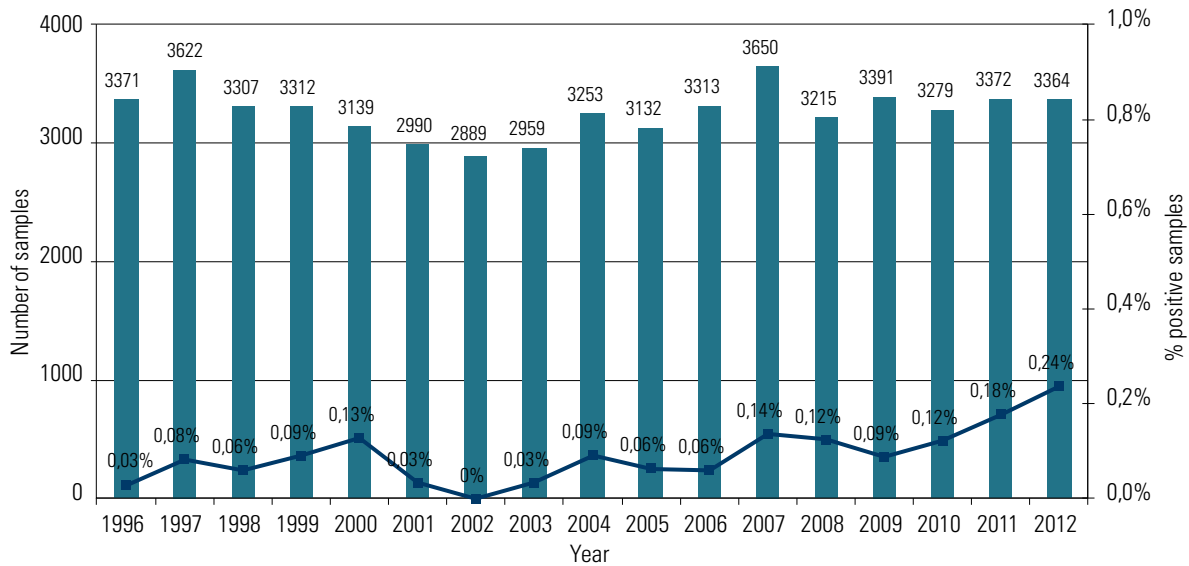




Table 8. Results from *Salmonella* control programme in poultry flocks

Animal species	Production type	Production stage	No. flocks	No. positives	Percentage	Serotype
Gallus gallus	Meat production	Adult Grand Parent	15	0	0,00%	
Gallus gallus	Meat production	Adult Parent	110	0	0,00%	
Gallus gallus	Meat production	Production	2,977	1	0,03%	S. Typhimurium RDNC
Turkeys	Meat production	Adult Parent	4	0	0,00%	
Turkeys	Meat production	Production	139	0	0,00%	
Gallus gallus	Egg production	Adult Parent	18	0	0,00%	
Gallus gallus	Egg production	Production	626	2	0,32%	S. Livingstone
Geese	Meat production	Production	25	1	4,00%	S. Typhimurium DT 40
Ducks	Meat production	Production	5	2	40,00%	S. Hadar, S. Typhimurium DT 41

The local health authorities reported approximately 1,200 samples for *Salmonella* taken for reasons other than the *Salmonella* control programme. None of these 1,200 samples were positive.

In 2010 and 2011, samples were taken from meat on the Swedish market originating from other EU member states or third countries. These samples were tested for ESBL-producing *E. coli* and *Salmonella*. In this study, *Salmonella* was found in 5 of 430 imported meat samples. Four of these isolates were resistant to three or more antibiotics.

A project designed to investigate compliance with the *Salmonella* guarantees stated in Commission Regulation (EC) No 1688/2005 was carried out during 2012. Document checks were performed on 132 consignments at receiving establishments by personnel from both the National Food Agency and several Swedish municipalities. Thirty-three of these consignments were tested for *Salmonella*. This report will be published during 2013.

The National Food Agency also received reports of 34 findings of *Salmonella* from in-house control programmes during 2012. In two instances, local authorities reported findings of *Salmonella* in official sampling of food enterprises other than abattoirs and cutting plants. More than 1,000 samples were collected.

#### Humans

During 2012 a total of 2,917 cases of salmonellosis were reported (Figure 10), compared to 2,885

cases in 2011. Domestic cases decreased by 15% to 663 cases, an incidence of 6.9 cases per 100,000 inhabitants.

A majority of the cases in 2012 (77%) were infected abroad. Travel-associated cases increased slightly by 7.5% compared to 2011, to 2,227. In the longer term, the travel-associated cases have decreased, despite an increase in international travel. Number of cases infected abroad has been decreasing since the beginning of 2000. In 2011, the travel-associated cases were fewest since the beginning of the 1980s. The observed decrease has been most clear for those travelling within Europe. As in previous years, *Salmonella* infection was most commonly acquired in Thailand (668 cases) followed by Turkey (326), Egypt (148), Spain (111), Tunis (71) and India (66).

Among the domestic cases, the median age was 35 years. Children aged 0-9 years accounted for 14% of the domestic cases and for 16% of the travel-associated cases. The gender distribution was even for the travel-associated cases but slightly more women than men were reported among the domestic cases.

As in previous years, most cases were reported from the three largest counties in Sweden (Stockholm, Västra Götaland and Skåne). The domestic incidence in different counties varies from year to year depending on occurrence of outbreaks. In 2012, the counties with the highest incidences were Jämtland (11.1), Örebro (10.2) and Gävleborg (10.1).

Table 9. Cattle and pig herds restricted in 2012 due to *Salmonella* infection.

Primary serotype	Species	Phagetype	Restricted since	Restrictions lifted	Reason for sampling
S. Derby	pig	not relevant	2010	2012	Abattoir sampling control programme
S. Dublin	cattle	not relevant	2008	not	Necropsy
S. Dublin	cattle	not relevant	2009	not	Screening survey
S. Dublin	cattle	not relevant	2011	2012	Necropsy
S. Dublin	cattle	not relevant	2011	not	Clinical symptoms
S. Dublin	cattle	not relevant	2012	not	Necropsy
S. Dublin	cattle	not relevant	2012	not	Trace-back
S. enterica sp. enterica O 4,5,12:i:-	cattle	not relevant	2009	not	Trace-back
S. enterica sp. enterica O4:i:-	pig	not relevant	2011	2012	Trace-back
S. Infantis	pig	not relevant	2011	2012	Abattoir sampling control programme
S. Reading	cattle	not relevant	2009	2012	Human infection
S. Reading	cattle, pig	not relevant	2010	2012	Clinical symptoms
S. Typhimurium	bison, cattle	41	2011	2012	Necropsy
S. Typhimurium	cattle	104	2012	not	Abattoir sampling control programme
S. Typhimurium	cattle	120	2010	not	Human infection
S. Typhimurium	cattle	120	2011	2012	Human infection
S. Typhimurium	cattle	RDNC	2010	2012	Human infection
S. Typhimurium	cattle	RDNC	2011	not	Initiative of the farmer
S. Typhimurium	cattle	RDNC	2012	not	Abattoir sampling control programme
S. Typhimurium	pig	104	2012	2012	Abattoir sampling control programme
S. Typhimurium	pig	120	2009	2012	Abattoir sampling control programme
S. Typhimurium	pig	120	2009	2012	Trace-back
S. Typhimurium	pig, cattle	104	2012	2012	Abattoir sampling control programme

NT= non tytable

RDNC=reacts but does not conform

Table 10. Results from the *Salmonella* control programme at slaughterhouses and cutting plants in 2012.

Animal species	Sample type	No. samples	Positive	Percentage (%)	Serotype
Cattle	Lymph node	3,364	8	0,24%	<i>S. Agona</i> , <i>S. Typhimurium</i> RDNC (n=4)*, U277, DT 104, DT 12
	Carcass swab	3,375	0	0,00%	
Breeding swine	Lymph node	2,231	2	0,09%	<i>S. Typhimurium</i> DT 40*, DT 104
	Carcass swab	2,236	0	0,00%	
Slaughter swine	Lymph node	3,070	1	0,03%	<i>S. Typhimurium</i>
	Carcass swab	3,081	0	0,00%	
Cattle and swine	Meat scrapings**	5,965	0	0,00%	
Poultry	Neck skin	5,153	1	0,02%	<i>S. Infantis</i> *
	Meat scrapings	903	0	0,00%	

\* *Salmonella* was detected only in the pooled sample

\*\* Samples may include both domestic and imported meat

Figure 7. *Salmonella* in lymph node samples of adult pigs at slaughter.

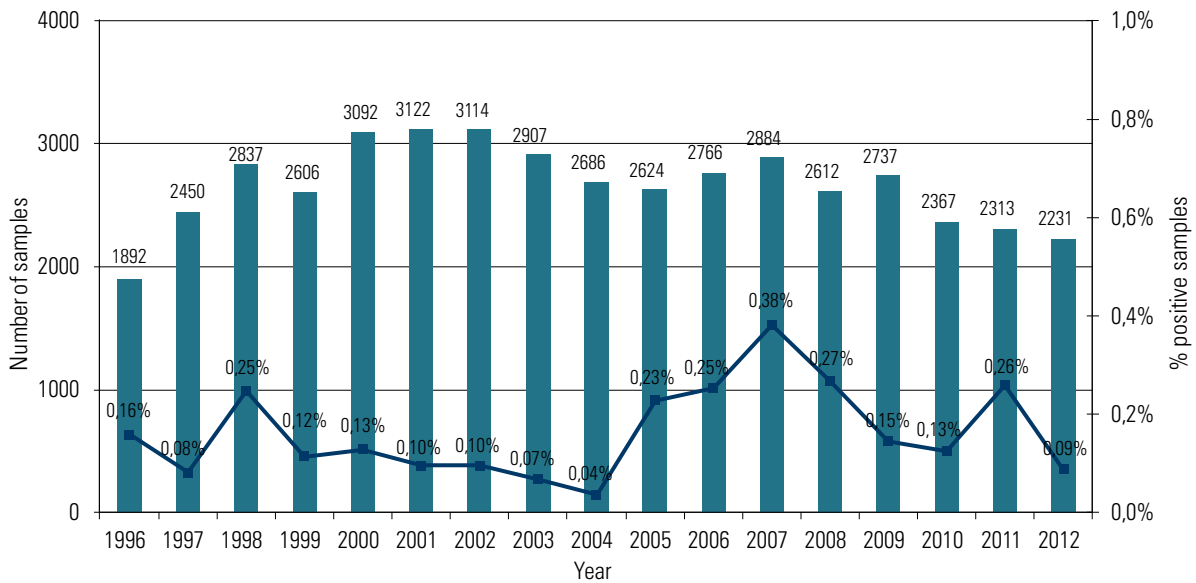
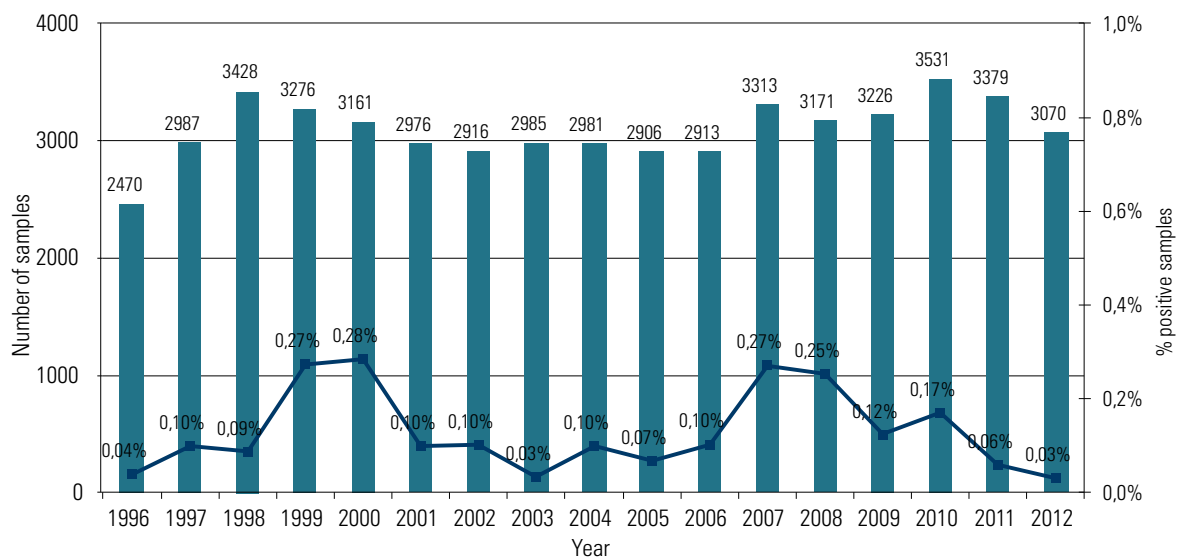


Figure 8. *Salmonella* in lymph node samples of fattening pigs at slaughter.



Among the domestic cases, 91% of the isolates were serotyped compared to 13% for the travel-associated cases. *S. Typhimurium* was most common among the typed domestic isolates (28%) followed by monophasic *S. Typhimurium* (*S. enterica* sp. *enterica* 1,4,[5],12:i:-) (22%) and *S. Enteritidis* (12%). Among domestic isolates of *S. Typhimurium*, phage types U302, NST 11:7 (U277), 1, NT (Non Typable) and 12 were most common. *S. Enteritidis* accounted for 36% of the isolates typed from travel-associated cases. In Sweden, *S. Typhimurium* is the most common domestic serotype, whereas in most European countries it is *Enteritidis*.

*Salmonella* cases are reported with a clear seasonal variation with most cases during May to September. In 2012, the seasonal peak in August was not as evident as it usually is, instead the peak extended over July to November. Most travel-associated cases were reported during January to March when travelling to warmer destinations is more common.

During 2012, 14 domestic *Salmonella* outbreaks were reported with 122 notified cases. The same number of outbreaks were observed the year before but with more cases (235). Some outbreaks were local and associated with poor restaurant hygiene but some larger national outbreaks were detected.

Table 11. Reported cases of *Salmonella* in cats, dogs, reptile pets, wild birds and other wild mammals in 2012.

Serotype	Phagetype	Cat	Dog	Reptiles	Wild birds	Wild mammals
<i>S. Belem</i>	not relevant				1	
<i>S. Brandenburg</i>	not relevant				1	
<i>S. Carrau</i>	not relevant			1		
<i>S. Enteritidis</i>	not relevant					2
<i>S. Fluntern</i>	not relevant			6		
<i>S. Heidelberg</i>	not relevant				4	
<i>S. Infantis</i>	not relevant			1		
<i>S. Kentucky</i>	not relevant			1		
<i>S. Muenchen</i>	not relevant			4		
<i>S. Newport</i>	not relevant			1		
<i>S. Pomona</i>	not relevant			1		
<i>S. Schwarzengrund</i>	not relevant				1	
<i>S. Tennessee</i>	not relevant			1		
<i>S. Typhimurium</i>	DT 40				1	
<i>S. Typhimurium</i>	DT 110b				1	
<i>S. Typhimurium</i>	DT 195				1	
<i>S. Typhimurium</i>	U277	12			6	
<i>S. Typhimurium</i>	not phagetyped	60			3	1
<i>Salmonella enterica</i> sp <i>arizonae</i>	not relevant		2	3		
<i>Salmonella enterica</i> sp <i>diarizonae</i>	not relevant	1		13		
<i>Salmonella enterica</i> sp <i>enterica</i> (I) = 4,5:-:1,5	not relevant					
<i>Salmonella enterica</i> sp <i>enterica</i> (I) = 4,5:i:-	not relevant		3			
<i>Salmonella enterica</i> sp <i>enterica</i> (I) = 4,5:b:1,2				4		
<i>Salmonella enterica</i> sp <i>enterica</i> (I) = =9:-:1,2	not relevant			1		
<i>Salmonella enterica</i> sp <i>houtenae</i>	not relevant			3		
<i>Salmonella</i> , not serotyped	not relevant	128		9		
<b>Total</b>		<b>201</b>	<b>5</b>	<b>49</b>	<b>19</b>	<b>3</b>

Outbreak investigations were challenging. Unfortunately, the source could seldom be determined. The largest outbreak occurred in November 2012, when 34 people in 15 different counties fell ill with monophasic *Salmonella* Typhimurium (MLVA 3-13-9-N-211). The Swedish Institute for Communicable Disease Control conducted a case-control study including all cases. Four controls were invited to answer an online questionnaire per case. The response rate to the online questionnaire was 21% for controls and 59% for cases. Infection was strongly associated with consumption of a ready-mix salad (OR = 20.3). Unfortunately, it was not possible to identify the brand of the salad-mix concerned. Thus, no microbiological evidence could be found and no product could be withdrawn from the market. Also in 2012, a large international outbreak of *S.*

Stanley was reported. A European outbreak investigation was started in July and the outbreak peaked in August. Since then, the number of new cases has declined. In October, the outbreak strain was identified in Swedish cases with no recent travel history. Altogether 12 Swedish cases from five counties were confirmed with the outbreak strain. This strain was detected in various turkey products as well as in other meat in several European countries. It was not detected in any Swedish products. In November, a rare serotype, *S. London*, caused an outbreak with eight reported cases (four men and four women) and with a mean age of 58 years. Typically less than one case of *S. London* is reported annually. Questionnaires were sent the eight cases but no source could be identified.

Figure 9. *Salmonella* in neck skin samples of poultry at slaughter.

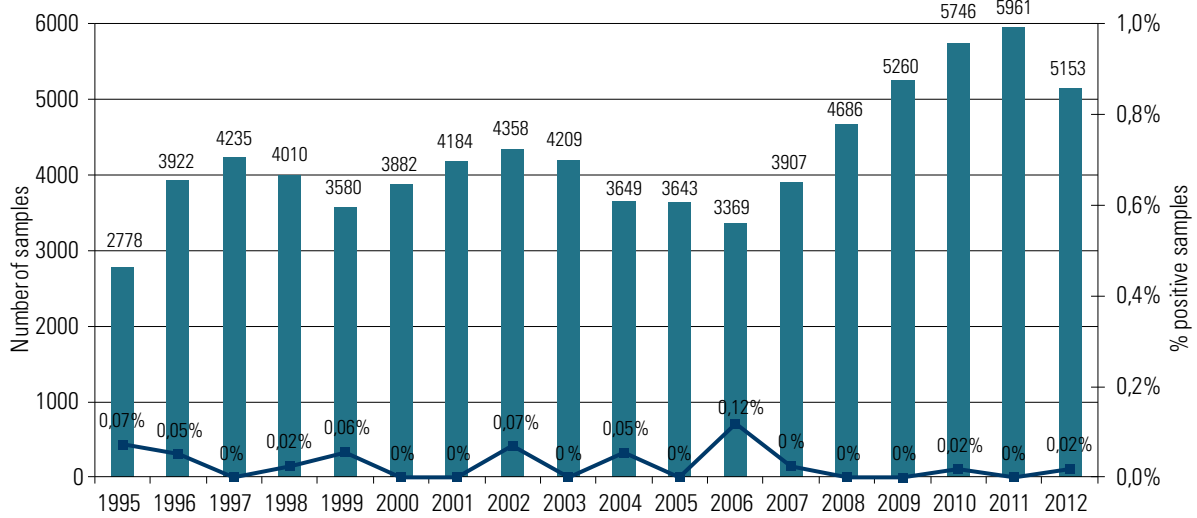
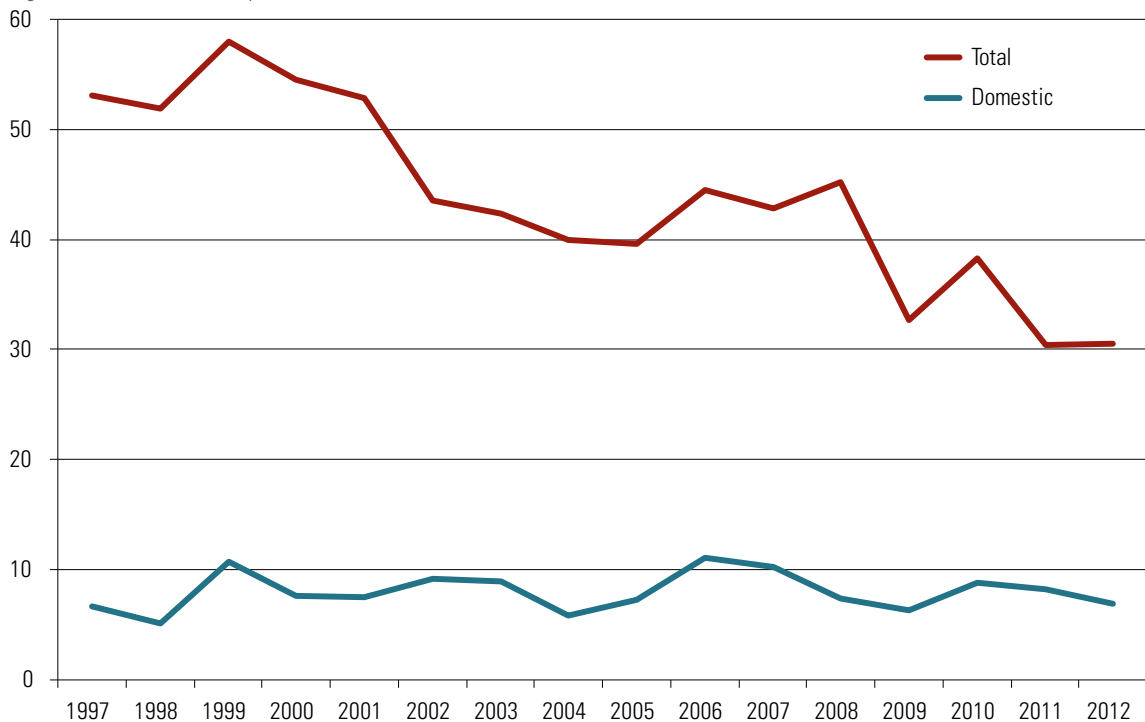


Figure 10. Notified incidence (per 100,000) of human salmonellosis in Sweden, 1997-2012.



**DISCUSSION**

The low proportion of domestic human infections is unique to Sweden, Norway and Finland when compared to most European countries. In order to trace and further control the sources of infection it is important to report both the total incidence and domestic incidence in humans. The total notified incidence in 2012, 30.54 cases per 100,000 inhabitants is considerably higher than the domestic incidents of 6.9 cases per 100,000 inhabitants. The Swedish situation with few domestic human cases

reflects the low *Salmonella* burden in domestic animals and food.

In the feed sector, *S. Typhimurium* was the most frequently isolated serotype (n=7) in the weekly surveillance of feed mills. In 2011, this serotype was detected in 29 samples, most from one major feed mill. This feed mill had been struggling with contamination of *S. Typhimurium* in the vicinity of the production lines but was able to solve this problem in 2012.

For the first time, *Salmonella enterica* subspecies *diarizonae* (IIIb) was found in the weekly surveillance of feed mills.

The number of cattle herds (n=5) where *Salmonella* was detected in 2012 was similar to the previous year but less than in 2008 (n=21) and 2009 (n=19) (Figure 11). In 2008 bulk milk screening for *Salmonella* was performed and this revealed more infected herds. In 2009 extensive samplings were performed during a *Salmonella* outbreak in the county of Skåne. Less sampling of cattle herds rather than decrease in the number of infected herds seems to be the reason for detection of fewer cattle herds. In 2012, the county of Skåne detected its first cases of *Salmonella* Dublin in two cattle herds. The source for this infection has not been determined.

During 2012, *Salmonella* was detected in only two herds keeping pigs. This is consistent with the low incidence of *Salmonella* in pigs in previous years. However, the dramatic decrease in the number of pig herds in Sweden during the last few years may also play a role in the low incidence.

Due to the results of the prevalence study on *Salmonella diarizonae* serovar 61:(k):1,5,(7) in sheep the Swedish Board of Agriculture and the National Food Agency have decided to make changes in current control measures regarding *S. diarizonae* 61:(k):1,5,(7) in sheep and sheep meat. The Swedish Board of Agriculture will change the national regulation of *Salmonella* control in animals and make an exemption for this particular serotype when found in sheep. All findings of *S. diarizonae* 61:(k):1,5,(7) in animals will still be notifiable and isolates will be tested for resistance to antibiotics. However, control measures at the herd level will no longer be initiated when *S. diarizonae* 61:(k):1,5,(7) is isolated from sheep. The Swedish Board of Agriculture will still have the option to act on individual cases. If change in the pathogenicity or development of resistance is suspected, the exemption for *S. diarizonae* 61:(k):1,5,(7) will be reconsidered. Likewise, the National Food Agency intends to make an exception for *S. diarizonae* 61:(k):1,5,(7) on sheep carcasses in the national legislation on official control of foodstuffs. This means that fresh meat from sheep carcasses with demonstrated presence of *S. diarizonae* 61:(k):1,5,(7) will no longer be considered unsafe.

Reported domestic human cases of *Salmonella* vary from year to year depending on the number of outbreaks. The total number of reported human cases has significantly decreased from 1997-2009, but this trend could not be identified for the domestic cases. The largest decrease was seen for the travel-associated cases, especially from European countries. This decrease in *Salmonella* cases has been seen in countries throughout the EU for the last six years and is considered to be the result of the harmonised *Salmonella* control programmes in poultry.

Thailand is the most common country for travel-associated *Salmonella* measured by cases per travel events. A decrease in the incidence of Thai travel related salmonellosis has also been observed. However, information to travellers about risks of contracting *Salmonella* and other infectious diseases remains necessary to further decrease the incidence. Also, information on how to prevent secondary transmission to other persons, to the environment and to animals when returning back to Sweden is crucial.

Investigations of the 2012 national outbreaks of *Salmonella* were difficult and did not reveal any confirmed sources. It was challenging to confirm suspected food sources as sampling delay resulted in the actual batch not longer being available on the market.

As the patients were living across the country, the outbreaks were most likely caused by food items widely spread in Sweden. The causative sero and phage types of the 2012 outbreaks have rarely been observed in domestic human cases or animals. This indicates that contaminated imported food items were the most likely sources. Also, statistics of domestic outbreaks over time confirms that very few outbreaks are caused by food items originating from Swedish raw materials.

An increased awareness regarding the risk of *Salmonella* in imported food, especially leafy green vegetables is needed as these products are commonly not cooked or heated prior to eating

Routine MLVA subtyping isolates of *S. Typhimurium* from humans and comparison with isolates from animals, food, feed and the environment has proved to be a useful tool to detect clusters and outbreaks. PFGE is another useful molecular tool to



identify sources in outbreaks and to connect cases to outbreaks, both with historical cases and with present cases as seen with the outbreak of *S. Java*.

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

The Swedish *Salmonella* control programme has been in place for decades. It is extensive and the continuous work has resulted in a very low *Salmonella* burden in domestic animals (Figures 11-14).

However, the programme is costly and could be modernised. The Swedish Board of Agriculture, the National Food Agency, the Swedish Institute for Communicable Disease Control, the National Board of Health and Welfare and the National Veterinary Institute have prepared a new common national strategy for the control and monitoring of *Salmonella* for the entire chain from animal feed to humans. The strategy includes goals and proposals for important actions to achieve goals, including how the control programme should be made more cost effective.

Figure 11. Notified incidence of *Salmonella* in cattle herds during 1968-2012.

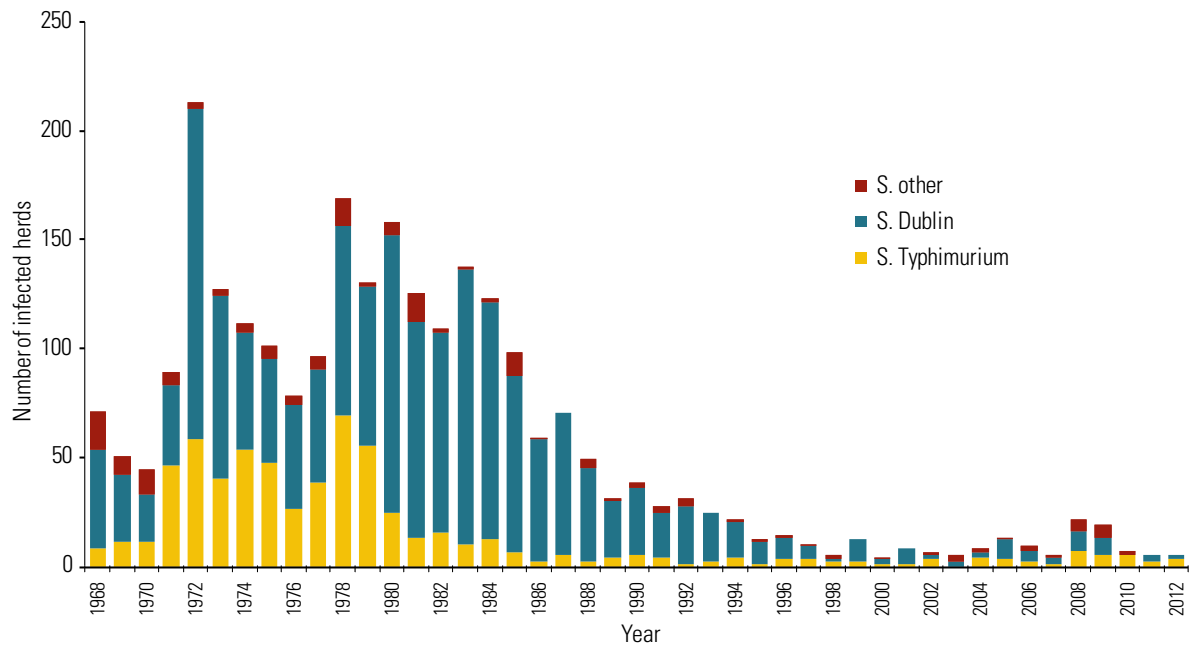


Figure 12. Notified incidence of *Salmonella* in pig herds during 1968-2012.

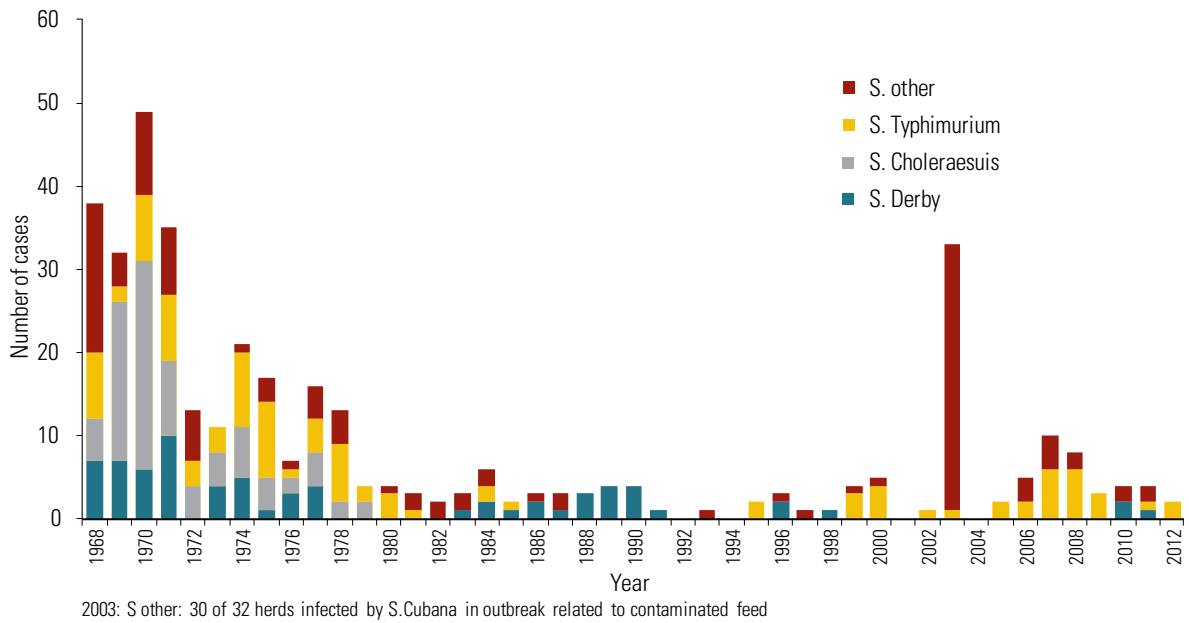


Figure 13. Notified incidence of *Salmonella* in layer holdings during 1968-2012.

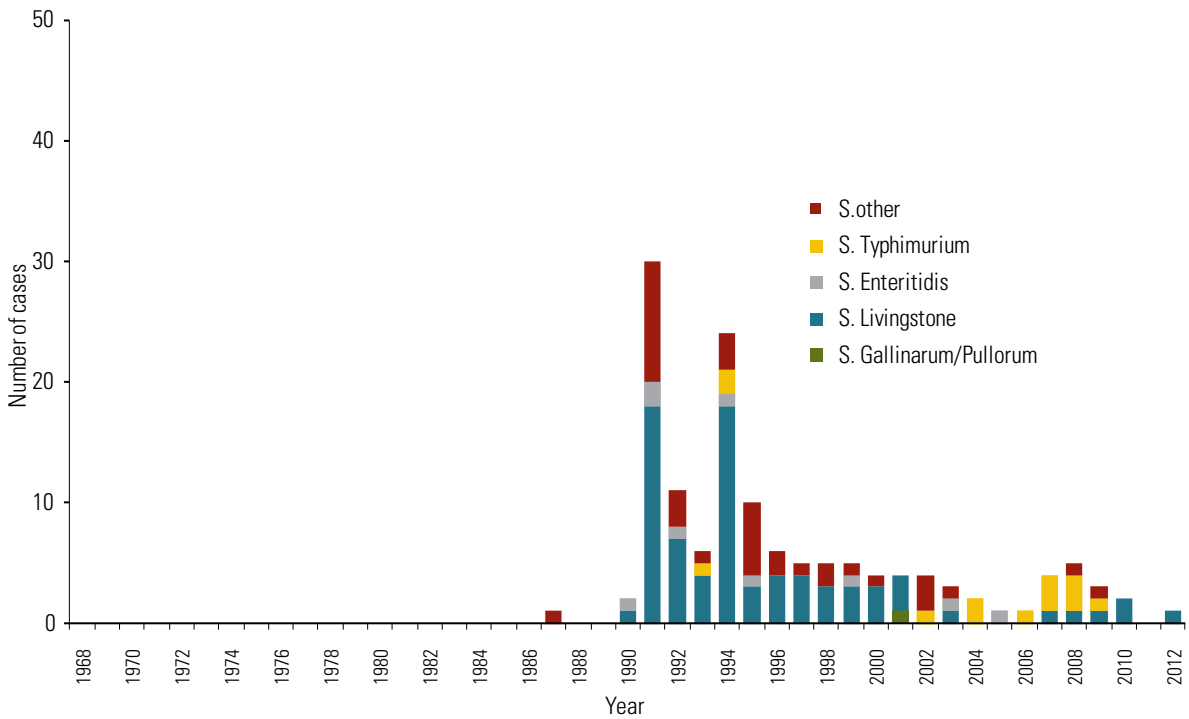
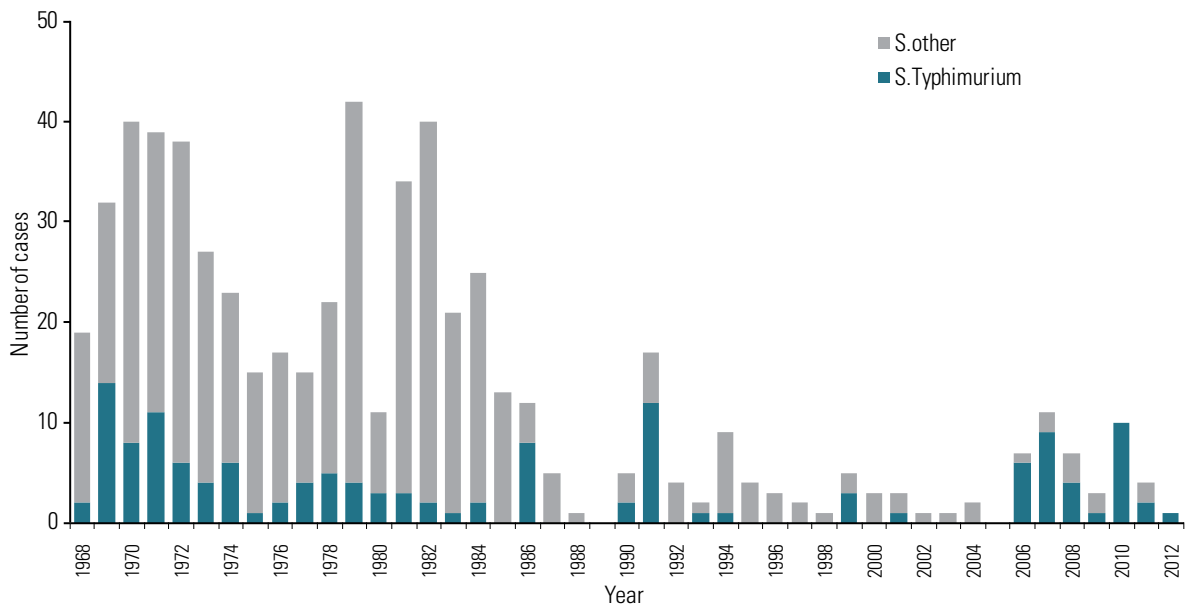


Figure 14. Notified incidence of *Salmonella* in broiler holdings during 1968-2012, breeding flocks included.

2006-07: outbreak of *S.Typhimurium*

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# Schmallenbergvirus

## BACKGROUND

Schmallenberg virus (SBV) is a novel vector borne virus which affects ruminants. The virus is transmitted by haematophagous midges (*Culicoides* spp) and is classified as an Orthobunyavirus of the family *Bunyaviridae*, Simbu serogroup. Schmallenberg virus was first identified in the autumn of 2011, when the novel disease was reported in central Europe. It is related to viruses that are endemic in Australia, Africa and Asia. But the new virus appears to originate from a reassortment of several other viruses of the Simbu serogroup. Recent studies that tested stored blood samples for the presence of antibodies against SBV, indicate that the virus emerged during the spring and summer of 2011. Samples from before this time were all negative. A suggested route of introduction is that infected vectors were carried on imports of fruits, flower or vegetables into the harbours or airports of north-central Europe. Further spread was possible because of the dense ruminant population in the region.

In 2012, several serological studies were conducted in countries where infected animals had been detected, showing that a very large proportion of the susceptible population was exposed to the infection already in autumn 2011.

The new virus was detected because of an unrecognised disease syndrome characterized by transient fever, diarrhoea, reduced appetite and lowered milk production in dairy cows in North Rhine-Westphalia in Germany and concurrently in multiple locations in the Netherlands during the late summer of 2011. Bacteriological, virological and parasitological samples from recovered animals were analysed, but no previously known cause of infection could be identified. On November 18<sup>th</sup> 2011, the Friedrich Loeffler Institute in Germany reported that they had found gene sequences of a new virus that could be the cause of the disease using metagenomic techniques. The new virus was named Schmallenberg virus after the name of the place where the first positive samples were taken. The virus was later isolated from, and identified as the cause of, an epizootic outbreak of abortions, stillbirths and malformations in calves and lambs throughout several European countries.

Vertical transmission via the placenta has been demonstrated. Recent unpublished data also suggests that virus can also be spread through semen. The virus has been isolated from semen and also reisolated from animals infected subcutaneously with virus positive semen.

## DISEASE

SBV infection has a very short viremic phase in domestic ruminants. Adult animals often do not exhibit any clinical signs but can occasionally present with a mild transient fever, diarrhoea, anorexia and reduced milk production. If infection occurs between 28 and 36 days of gestation in sheep and between 75 and 100 days of gestation in cattle, fatal malformations (arthrogryposis, scoliosis and hydrocephalus), stillbirths and perinatal death can occur. Infection earlier in gestation can lead to abortion or reduced fertility of the dam. If infection occurs later in the gestation when the foetus has developed its immune system the infection might again pass unnoticed.

## LEGISLATION

According to the Swedish Act of Epizootics (SFS 1999:657 with amendments) any disease not previously present in the country is notifiable to the competent authority. This principle was applied to infections with SBV. As antibodies against the virus were later detected in animals from many parts of the country and in addition the virus genome was isolated in material from several lambs the Swedish Board of Agriculture declared that the infection had become endemic and thus was no longer notifiable on January 3<sup>rd</sup> 2013.

## SURVEILLANCE

All diagnostic testing as outlined below was performed at the National Veterinary Institute (SVA). Serum samples were analysed with virus neutralisation test, a commercially available ELISA with a recombinant SBV nucleoprotein antigen and a multispecies conjugate (ID Screen® Schmallenberg virus Indirect ELISA, France) and an in-house SBV ELISA (Näslund et al, in preparation). Milk samples (bulk milk and individual samples) were analysed

with an indirect ELISA (ID Screen® Schmallenberg virus Milk Indirect ELISA, France). Organs and blood were analysed with a real-time PCR.

#### Passive surveillance

Passive surveillance was based on clinical suspicions and on screening of foetuses submitted for post-mortem examination.

#### *Investigation of cases with clinical suspicions of infection with SBV*

Samples from cases with clinical suspicion of SBV-infection were sent to SVA for laboratory investigations. The samples consisted of either entire ruminant foetuses or neonates for post-mortem examination, or organ samples (i.e. brain, lymph node, spleen, abdominal fluid, pericardial fluid), sent in by regional laboratories or field veterinarians for PCR-analysis.

#### *Risk based surveillance on aborted ruminant foetuses*

After February 1<sup>st</sup> 2012, all ruminant foetuses sampled within a risk-based surveillance programme for brucellosis targeting aborted ruminant foetuses submitted for post mortem examination, were also sampled for SBV-analysis. The tissues collected were: brain, lymph node, spleen, abdominal fluid and pericardial fluid. The surveillance programme is administrated by the Swedish Animal Health Service and post mortem examinations were carried out either at SVA or at regional laboratories. All samples were tested for the presence of the viral genome by RT-PCR.

#### Active surveillance

In 2012, several surveillance activities to detect and monitor SBV infection in cattle and sheep were performed. Three different serological surveys were conducted. Each was designed to detect a prevalence of SBV infection at a minimum of 2% and with at least 95% confidence. All samples were analysed and all data processed at the SVA.



Photo: Marianne Elvander

#### *Serological survey in sheep, conducted before the vector season 2012*

Six hundred sheep sera, collected between August 1<sup>st</sup> 2011 and March 31<sup>st</sup> 2012, were analysed for presence of antibodies against SBV. The samples were originally collected within the Swedish surveillance programme for Maedi/Visna. The samples were obtained from the Maedi/Visna surveillance programme by convenience sampling (not strictly random). The study period was chosen to reflect the highest possible chance for serological conversion due to virus introduction during autumn 2011. Samples were selected from 150 sheep herds for which stored sera were available. Sera from four individual sheep from each herd were randomly selected. The herds were located in different parts of the country, and their distribution corresponded roughly to the density of the Swedish sheep population. The geographical distribution of the samples is shown in Map 7.

### *Serological bulk milk survey, conducted before the vector season 2012*

From April to June 2012, 641 bulk milk samples from dairy herds in the four most southern counties of Sweden were collected and analysed for presence of antibodies against SBV. The counties were chosen based on contemporary official reports of the geographical location of the infection in Europe and the most probable route of introduction was by wind borne haematophagous insects. The bulk milk samples were collected by the milk assembly truck (Eurofins, Sweden) and delivered to SVA by overnight post. The geographical distribution of the samples is shown in Map 8.

### *Serological bulk milk survey, conducted after the vector season 2012*

In November 2012, 723 bulk milk samples were analysed in a second bulk milk survey. As by this time serologically positive animals had been detected in both neighbouring Norway and Finland it was considered appropriate to include the entire country in the surveillance. The samples were collected and delivered as described above. The geographical distribution of the samples is shown in Map 9.

## RESULTS

### *Serological survey sheep sera, conducted before the vector season 2012*

Of the 600 samples analysed, one sample was found positive for antibodies against SBV. The samples were anonymous but identified to the level of county. For the purpose of visualisation an approximate location was retrieved from the sample data stored at SVA and coordinates from the Swedish post-code system were used for mapping. The approximate locations of the positive and negative samples are shown in Map 7.

### *Serological bulk milk survey, conducted before the vector season 2012*

Out of the 641 bulk milk samples analysed, one was found positive for antibodies against SBV. The herd was located in the County of Blekinge in the coastal area south of Sweden. This was the same county as the sheep herd with the positive sample from the serological survey on sheep sera. The farmer was interviewed and reported that no clinical signs related to possible infection with SBV had been observed in the herd. The herd was not put under any restrictions but all individual cows (21) were

blood-sampled and the sera tested for presence of antibodies against SBV. Three of these samples were positive. The entire herd was retested after 27 days and none but the same individual cows were again positive for antibodies against SBV. After another six months, in December 2012, the herd was retested and all individual cows were now positive for SBV-antibodies. The locations of the positive and negative samples are shown in Map 8.

### *Serological survey bulk milk, conducted after the vector season 2012*

Out of 723 samples received and tested 520 were found to be positive for antibodies against SBV both by the commercial and the in-house ELISA. For 22 samples the results of the two different tests disagreed, these were classified as 'grey zone'. From 181, samples both tests were negative. The locations of the positive and negative samples are shown in Map 9.

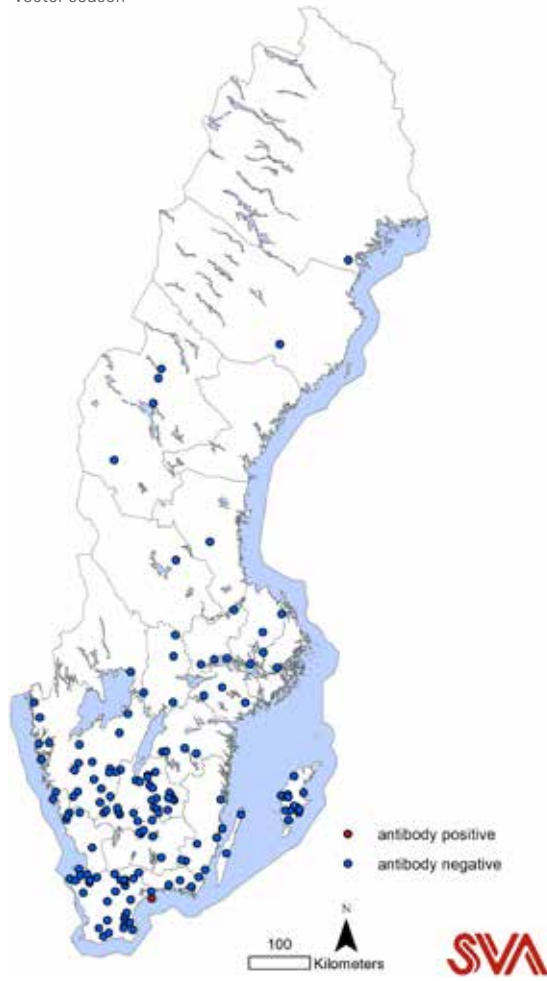
### Passive surveillance

Investigation of cases with clinical suspicions of infection with SBV and risk based surveillance of aborted ruminant foetuses.

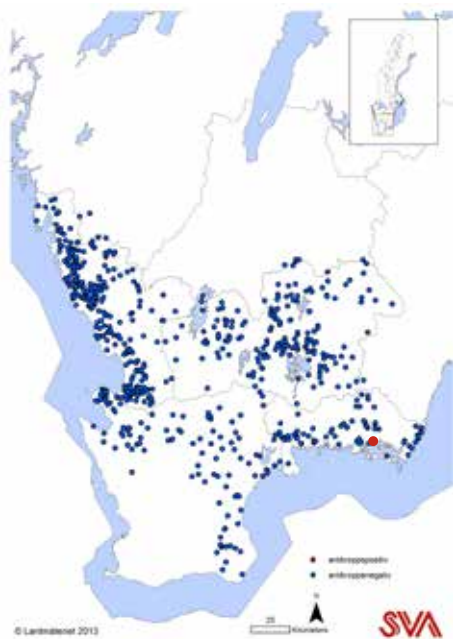
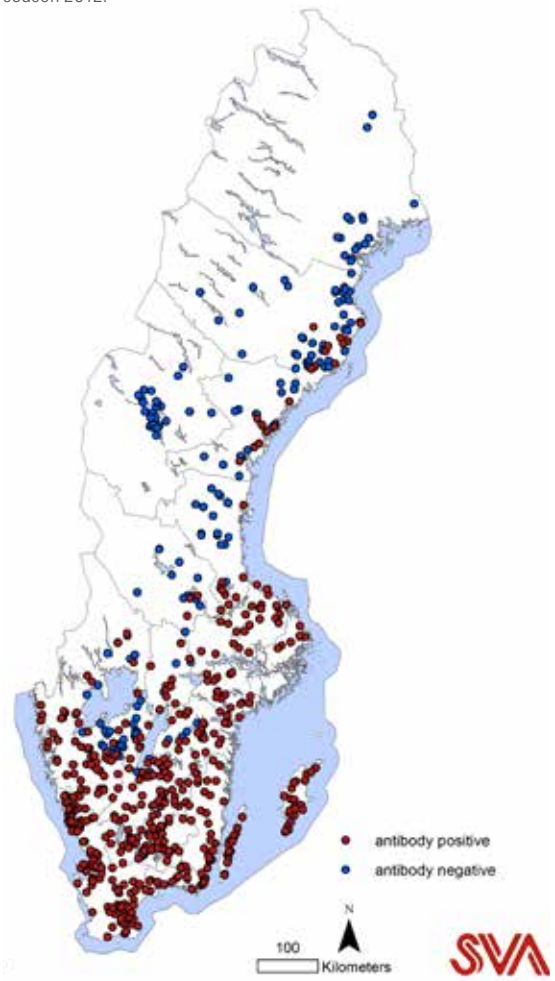
During 2012, 112 aborted ruminant foetuses or neonates (67 lambs, 38 calves, five goat kids, one alpaca and one deer fawn) were investigated for the presence of the SBV-genome by RT-PCR. In some of the cases, blood samples were collected from the dam and serum tested for presence of antibodies. The first positive cases were detected on November 22nd 2012, before that all results were negative. The first case was a herd with reproductive problems where many ewes were found non-pregnant on the routine diagnostic ultrasound investigation. Out of nine empty ewes tested, eight had antibodies against the virus. The herd was situated on the island of Öland in the Baltic Sea. On November 28th 2012, one lamb that was aborted due to purulent placentitis was tested for the presence of the SBV-genome by RT-PCR. Samples from brain, lymph nodes, spleen and amniotic fluid were tested. PCR-products of the SBV-genome were found in all samples. The animal came from a herd in the southwestern part of Sweden (County of Halland). Following this first finding of the SBV-genome, between November 28th and December 31st five lambs from seven sheep herds were diagnosed positive for SBV by PCR.



Map 7. Geographical distribution of sheep surveyed in 2012 before vector season



Map 9. Serological survey bulk milk, conducted after the vector season 2012.



Map 8 Geographical distribution of bulk milk surveyed before vector season 2012

## DISCUSSION

Only a couple of months after the first detection of SBV in Sweden, during late autumn 2011, a small number of SBV-infected midges were introduced to the south of Sweden. These midges subsequently infected a small number of animals on the south coast of Sweden in Blekinge county. At the first incursion of SBV, no spread within the county or within the two affected herds was seen. It is considered unlikely that the disease subsequently overwintered because previous studies have shown that Sweden has a vector free period between November and April. No cases with clinical symptoms consistent with acute infection with SBV were reported in Sweden during this vector free period.

Approximately one year after the first appearance of Schmallenberg virus in mainland Europe, 72% of tested dairy cow herds in Sweden had been in contact with the virus as shown by the presence of antibodies in bulk milk samples. This rapid spread within the country took place in less than three months, based on a suggested introduction time between mid-July and mid-August 2012 and the results from the serological survey on bulk milk conducted after the vector season.

In the dairy herd in the County of Blekinge identified as positive for SBV-antibodies in the serological bulk milk survey conducted before the vector season 2012 only three cows tested positive in June and again in July 2012. All 21 cows in the herd had, however, seroconverted in December. This, together with the first findings of lambs positive for the viral genome with RT-PCR in November 2012 and later the first calf positive for the virus genome with RT-PCR in January 2013, supports that SBV was re-introduced into Sweden between mid-July and mid-August 2012.

SBV appeared in 2011 in the same region of Europe (Netherlands, Germany, Belgium) as Blue-tongue virus serotype 8, 6 and 11 did several years earlier. The region has several factors that make it a hotspot for introduction of emerging vector-borne infectious diseases: numerous international airports

and harbours with importation of fresh goods such as flowers and fruit every day, high human and livestock population densities and a domestic population of competent vectors such as *Culicoides* spp. Drawing conclusions from these last outbreaks, further introduction of vector borne diseases can be expected in this region, which may lead to extensive spread over Europe. More than 60% of emerging diseases are zoonotic, many of these are vector borne. It is most probable that more exotic vector borne diseases, possibly zoonotic, will be introduced via the same route to the identified hot spot in central Europe.

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# Scrapie

## BACKGROUND

Scrapie belongs to a group of diseases called Transmissible Spongiform Encephalopathies (TSE) and was first described more than 250 years ago. The current theory about the causative agent is the prion-only hypothesis. This theory assumes that misfolded prions (small proteins) induce the same misfolded and 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 transmission can occur at lambing.

After classical BSE became a disease of public health concern (see earlier chapter on BSE), and the 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 and again in Sweden in 2003. Since then a number of cases have been detected in Sweden. 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. Clinical signs 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 the national level, surveillance and control is also regulated by the national scrapie control programme and Sweden has since 2003 had additional guarantees

related to trade within the union (Commission Regulation (EC) 546/2006). Moreover, sampling on the national level is regulated by SJVFS 2010:9, saknr K19, amended through SJVFS 2011:29 (and SJVFS 2013:3). 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 programme, 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 analysed at the SVA.

### Passive surveillance

All suspicions of scrapie must be reported to the authorities. The obligation to report applies to 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 programme is in accordance with Regulation (EC) 999/2001 Annex III and the Swedish national control programme. Within the programme, all dead sheep and goats over 18 months of age which are not slaughtered for human consumption should be sampled. The carcasses are sampled at rendering plants and at necropsy. In remote areas where there is no collection of carcasses, the farmers must send the whole head to the SVA for testing. Farms with confirmed cases of atypical scrapie are obligated to have increased surveillance in the herd for two years. In addition to fallen stock, healthy slaughtered animals above 18 months of age are 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 examined by Bio-Rad TeSeE Western Blot.

### RESULTS

#### Passive surveillance

In 2012 no sheep were examined due to clinical suspicion of scrapie.

### ACTIVE SURVEILLANCE

#### Sheep

In 2012 SVA examined 7,317 sheep from fallen stock for scrapie. Out of these, all samples were negative for classical scrapie and three were positive for atypical scrapie Nor98. In addition, 87 sheep were examined at slaughter at a private laboratory within the framework of intensified surveillance in flocks with positive cases of atypical scrapie (Regulation (EC) 999/2001), all these were negative for both classical and atypical scrapie.

#### Goats

In 2012 SVA examined 26 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 60,000 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. Despite the fact that, not all sheep are collected and some are too autolysed to be sampled during the warmest summer months, the animals tested in 2012 constitute approximately 2.4% 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 from the EU 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 28 cases had been detected by the end of 2012. 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. At the 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 within flock transmission between animals seem to be very low, other routes of spread and the potential zoonotic aspect are being discussed.

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# Swine vesicular disease

## BACKGROUND

Swine vesicular disease (SVD) is a disease that only affects pigs and it is caused by a porcine enterovirus closely related to human Coxsackie B5 virus. The first report of SVD in pigs was from Italy in 1966 and the disease has since then been reported in several European countries and Japan and China. Today SVD is present in Italy and sporadic outbreaks have been reported from Portugal. The route of transmission is mainly by direct contact between infected and non-infected animals and by feed contaminated with SVD virus.

## DISEASE

Infection with SVD virus can lead to fever and blisters on the snout, tongue, teats and coronary bands. The similarity of these clinical signs with foot and mouth disease (FMD) is the reason this disease is monitored and controlled in countries free from FMD. Most infections with SVD virus are very mild or subclinical.

## LEGISLATION

SVD is included in the Swedish Act of Epizootic diseases (SFS 1999:657 with amendments) and the control of the disease is regulated in detail through EU-directives.

## SURVEILLANCE

The purpose of the surveillance activities is to document freedom from SVD in the Swedish pig population and to contribute to the maintenance of disease freedom. The National Veterinary Institute has been responsible for sample selection, sample analysis and reporting to the Swedish Board of Agriculture.

The serological analyses of SVD antibodies on surveillance samples were performed at the National Veterinary Institute using ELISA and positive results were confirmed with a serum neutralisation (SN) test.

At present, SVD active surveillance is performed every second year and was not performed during 2012.

### Passive surveillance

Because SVD 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 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.

### Active surveillance

Sera for the active surveillance are collected by systematic random sampling from the surveillance carried out by the Swedish Animal Health Service for porcine reproductive and respiratory syndrome.

## RESULTS

### Passive surveillance

No clinical suspicions of SVD were investigated during 2012.

### Active surveillance

At present active SVD surveillance is performed every second year and was not performed during 2012.

## DISCUSSION

The results from the surveillance of SVD in Sweden gives additional documentation of freedom from this infection in the Swedish commercial pig population. Discussions are ongoing within EU and OIE concerning the status of this disease.

# Tick-borne encephalitis

## 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 may cause 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 suck blood from infected rodents. Rodents are suggested as a possible virus reservoir. The virus is also circulating in the tick population through transovarial transmission without involvement of vertebrate hosts. Large species of mammals, predominantly ungulates, are important to maintain large tick populations. Humans typically become infected via ticks, although unpasteurised cow's and goat's milk and milk products have also been reported as sources. Vaccination of persons living, visiting or working in endemic areas is recommended.

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

The first case of TBE infection in Sweden was reported in 1954. During the following three decades, there were 10-40 annual cases reported. From the mid-1980s a clearly increasing trend has been observed. In recent years about 200-300 cases have been reported annually. With a few exceptions, the cases were domestic. Most were infected in the eastern coast and archipelago close Stockholm. 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

A few confirmed cases of disease in dogs have been reported. Seroconversion has been demonstrated in grazing goats and cows. Most authors consider these animals to be a dead end for the viral infection. Wild rodents are the natural reservoir for TBEV but are not reported to get the disease. Roe deer also seroconvert but there are no reports of disease in this species.

### Humans

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

## LEGISLATION

### Animals

Demonstration of TBE virus in animals is not notifiable.

### 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 2012, 288 cases of TBE were reported, which is about the same number as in 2011. This is the highest number since the infection was first described in Sweden in the 1950s (Figure 15). More men (61%) than women were identified with TBE. The disease was most common among people in the age group 40-69 years, but there were cases reported from the age of 1 to 90 years of age.

All but three cases had acquired their infection in Sweden. The others had been infected on the islands of Åland (2 cases) and in the Finnish archipelago (1 case).

The first TBE cases became ill in April and the last in November, but the peak occurred in July and August.



The spread of the disease 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 10. The incidence was highest in the County of Södermanland (18 cases per 100,000 inhabitants). There were also cases infected close to the two big lakes of Vänern and Vättern, as well as a few along the Swedish west coast from Gothenburg in the south and with a northward spread. As in previous years, occasional cases were infected along the coastline in Kalmar and Blekinge Counties and in the northeastern part of Skåne County. The northernmost reported cases had acquired the infection in the southern part of Dalarna County.

and 2010-2011. This situation in combination with many small host animals, for example bank voles, at times as well as optimal weather for both virus spread and humans spending time outdoors, could explain the large number of cases reported.

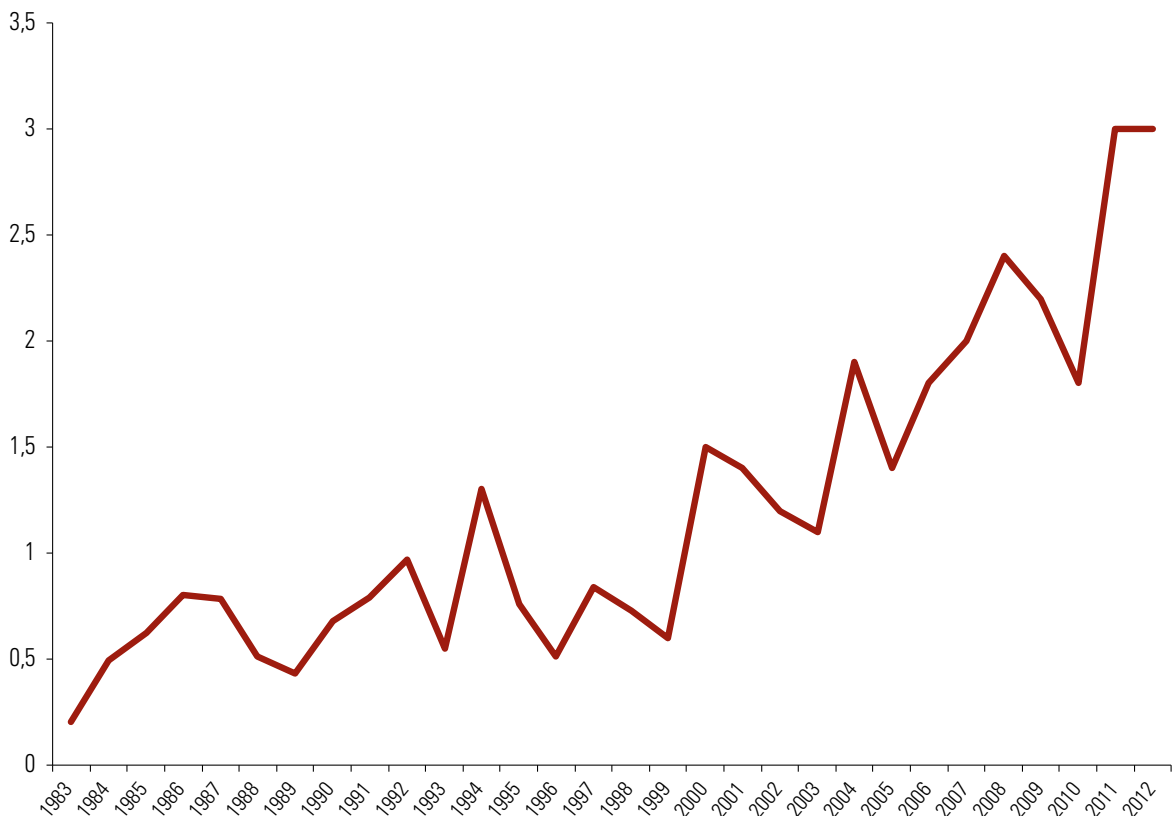
Map 10. Distribution of TBE cases in Sweden 2012.



**DISCUSSION**

The large increase in the number of TBE cases seen in Sweden in 2011-2012 was probably due to several interacting factors. The most important cause was presumably the very dense population of ticks, a consequence of a large roe deer population from the 1980s up until the recent snowy winters, 2009-2010

Figure 15. Notified incidence of TBE in humans 1983-2012.



# Trichinellosis



## BACKGROUND

Trichinellosis is caused by parasitic nematodes of the genus of *Trichinella*. The parasites can be hosted by different mammals including domestic pigs and horses but the main reservoirs are wild carnivores and omnivores. Humans typically acquire the infection by eating raw or inadequately heated contaminated meat and meat products, often cold-smoked, fermented sausages. In Western Europe, the wild boar appears to be the main source of human infection.

In Europe, *T. spiralis* and *T. britovi* are the dominant causes of human infections. In Sweden, these species are also detected as well as *T. nativa* and *T. pseudospiralis*. *T. pseudospiralis* is mainly isolated from wild boars. 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 in an encapsulated form for years.

In Sweden, *Trichinella* has been monitored at slaughter in domestic pigs since the 20th century.

From 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 human case, in 2007, had consumed wild boar sausage imported privately from Spain. The previous case occurred in 2003 after consumption of cold-smoked ham in the Balkans. In 1997, there was also one travel-associated case.

## DISEASE

### Animals

Animals rarely develop a clinical infection, although both pigs and rodents can exhibit the typical clinical signs.

### Humans

The disease in humans and animals 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. Intestinal 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.

#### LEGISLATION

##### Animals

*Trichinella* is notifiable in animals according to SJVFS 2012:24.

##### Humans

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

#### SURVEILLANCE

##### Animals

All slaughtered domestic pigs and wild boars, horses, 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: foxes, lynxes, wolves, badgers, birds and wolverines.

##### Humans

Surveillance in humans is passive.

#### RESULTS

##### Animals

In 2012, all slaughtered domestic swine (2,585,660) and horses (4,140) were tested for *Trichinella*. *Trichinella* was not detected in domestic pigs or horses. *Trichinella* spp. was detected from six of 66,399 (0.009%) wild boar samples and also from 8 lynx, 5 wolves, and 1 bear (Table 12).

##### Humans

No human cases of *Trichinella* were reported in 2012.

#### DISCUSSION

Trichinellosis is extremely rare in Swedish food-producing animals and detected human cases in the last several 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. Currently, revisions of the regulations on *Trichinella* in meat inspection is in progress in the EU which may lead to decreased testing of slaughtered pigs.

Table 12. Findings of *Trichinella* in wild animals 2012.

Animal species	No. Samples	No. positives	Percentage (%)	T. britovi	T. nativa	T. pseudospiralis	T. spp.
Badgers	5	0	0,00%				
Wild birds	90	0	0,00%				
Red foxes	69	0	0,00%				
Lynx	140	8	5,71%				8
Otter	41	0	0,00%				
Raccoon dogs	3	0	0,00%				
Wild boars	66399	6	0,009%	1		4	1
Wolves	26	5	19,23%				5
Wolverine	8	0	0,00%				
Bears	307	1	0,33%		1		
<b>Total</b>	<b>67088</b>	<b>20</b>		<b>1</b>	<b>1</b>	<b>4</b>	<b>14</b>

# 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 including badgers, deer and wild boar cause persistent problems in some countries. Humans usually acquire *M. bovis* infection via unpasteurised 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 now 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 programme 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 1940s was above 300/100,000 inhabitants. This was followed by a rapid decline, beginning before effective treatment was available in the early 1950s. 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 localisa-



tion of the infection. The disease progresses slowly and clinical signs 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, are 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, mesenteric 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 and Stonebrink's) according to the method at the National Veterinary Institute 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.

During 2012, five alpacas, imported from the UK and since arrival three months earlier being housed in a voluntary on-farm quarantine, were tested for

the presence of TB-antibodies with a serological method (Stat-Pak TB).

##### Humans

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

#### SURVEILLANCE

##### Passive surveillance

##### Animals

As TB is notifiable on clinical suspicion, clinical signs 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. Asylum seekers from high incidence countries are offered health examination where screening for TB is included.

##### Active surveillance

##### Animals

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

The control programme 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 if they originate from a herd that has 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 31 pigs, 5 cows, 3 deer, 3 sheep and one moose. From these samples, bacteria from the

*Mycobacterium avium/intracellulare*-complex were isolated in 15 pigs. No other samples yielded any mycobacteria.

Due to clinical suspicions or lesions found at necropsy, samples from three alpacas, two deer, one wild boar, one camel, one capybara, one llama, three dogs, one cat and a pet bird were investigated. TB could be ruled out by histological examination or, if relevant, by culture.

Approximately 600 holdings were registered for farmed deer, however a large proportion of these do not have deer anymore. The number of herds considered active, kept deer and had obtained TB free status, was 312. Fifteen herds were not tested and four of these herds will be depopulated in 2013 or 2014. The remaining 11 herds are exempted from regular testing and instead slaughtering 20% of the herd yearly with meat inspections and necropsies for 15 years to obtain a free status. No TB was detected in any farmed deer in Sweden during 2012.

During 2012, a decision was taken to stop using the intra-dermal test in alpacas as it has been proven to have extremely low sensitivity in this species. Following the decision five alpacas imported from the UK, in a voluntary on-farm quarantine, were tested with Stat-Pak TB. Two of the alpacas tested positive for the presence of TB-antibodies. The animals were culled and post mortem examinations were performed. No lesions indicating TB were found. Histological and bacteriological testings were negative.

#### Humans

Five cases of *M. bovis* were reported in humans in 2012. They all originated from TB endemic countries and were most likely infected before arrival in Sweden. Three had gastrointestinal TB, one had pulmonary TB and one had peripheral lymphoglandular TB.

## DISCUSSION

### Animals

The officially free status for bovine tuberculosis has been maintained during 2012. The overall TB situation in animals and humans remains favourable. No cases of TB were detected in Swedish animals during 2012. Although the surveillance is mainly dependent on inspections of slaughtered animals, this is considered to be sufficient for monitoring. However, the submission rates of lesions from slaughtered ruminants should be improved. Passive surveillance based on clinical suspicions and nec-

ropsy findings will always have a 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. The aim is to be able to declare the remaining deer herds 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. In recent years, the keeping of alpacas has increased in popularity in Sweden and most of the alpacas are imported, many of them from the UK. Despite recent control efforts, TB is identified in new alpaca herds every year. Also, transmission of *M. bovis* from alpacas to humans has been confirmed. The situation is a high risk because alpacas are not individually marked and no control programme for TB in alpacas exists. Import of alpacas from the UK is seen as a risk for re-introducing TB to Sweden. In order to address this risk the Swedish authorities together with the Swedish Animal Health Service and the Swedish Alpaca Association aim to start a control programme with voluntary TB-testing in alpacas.

### Humans

The rapid decline of tuberculosis in humans in the 1940s coincided with the eradication of tuberculosis in cattle and started before the introduction of effective treatment in the 1950s. A much larger part of the human population lived in close contact with domestic animals. This change in contact between humans and animals likely played a role in the changing TB incidence in humans. Today, Sweden has one of the lowest incidences of human tuberculosis in the world.

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# Tularaemia

## BACKGROUND

The 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 the late summer.

Sweden has reported cases of 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. However, in recent years, tularaemia has been detected in the European brown hare in new geographic areas.

The yearly numbers of reported 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 2012:24).

### 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 PCR or immunohistochemistry of the sample.

### Humans

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

## RESULTS

### Animals

*F. tularensis* was detected from twelve wild animals: ten brown hares and two mountain hares. Five of the hares were from Uppsala region, one from Västergötland and rest from the northern parts of the country.

Humans

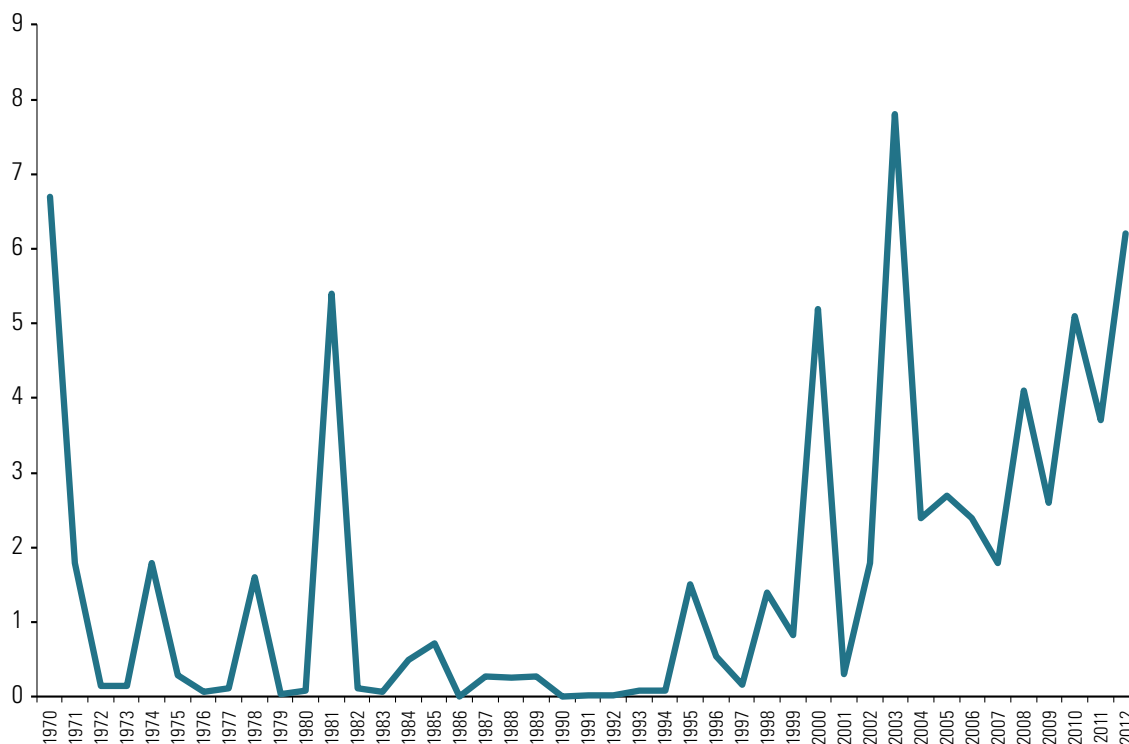
In 2012, 590 cases were reported, which is the highest number since 2003 and a 69% increase from 2011. (Figure 16). The substantial increase could be explained by the accumulation of cases in northern Sweden, which will be further described below. There are quite large natural fluctuations in the number of tularaemia cases observed between years and in different regions, which is probably due to several combined factors like the number of reservoirs and mosquitoes as well as the weather conditions.

More men (55%) than women were reported to be infected in 2012, but the difference between sexes was slightly less pronounced than it has been previous years. In reported tularaemia cases younger than 40 years of age, the disease was as common in both sexes. The incidence of tularaemia was highest

in the age group 40-69 years which is in line with previous years. The uneven distribution among age groups and sexes might partially be attributed to their somewhat different leisure and professional activities.

Almost all cases (95%) were reported as domestic. Six cases were considered to have acquired their infections abroad; four in Finland, one in Norway and one in Germany. As in previous years, except from a few sporadic cases, tularaemia was only reported from northern, western and central parts of Sweden. The incidence was highest in the county of Norrbotten, 82 cases per 100,000 inhabitants. This represents the highest number of reported cases from Norrbotten as far back as reliable data exist. From the end of July until the beginning of November, more than 250 tularaemia cases were reported

Figure 16. Notified incidence (per 100,000) of human tularaemia in Sweden during 1970-2012.



from the counties of Norrbotten and Västerbotten. As a comparison, 91 cases were reported from the same region during the last peak year of 2008. More than half of the cases had been infected in or close to the towns of Boden and Piteå. Health care providers in the affected counties reported a larger percentage of pneumonia in the tularaemia patients than during an average year. There were also an unusually high number of cases reported from the counties of Dalarna and Västernorrland.

About half of the cases were stated to have been infected via an insect bite and this proportion was likely much larger, since the route of transmission is not always specified in the notification. There are estimates that about 90% of the Swedish tularaemia cases are caused by mosquito bites. In 2012, 34 cases were assumed to have been infected through direct contact with animals and three persons by drinking contaminated water. Also, according to the notification reports, seven persons were occupationally infected.

During the first half of the year, just a few cases were reported in each month. The vast majority of the cases were reported in August to October, which is the usual seasonal distribution with a peak of cases in September or October. During the last two months of the year the number of cases quickly subsided.

## DISCUSSION

Tularaemia has been endemic in northern and central Sweden at least since the early 20th century with a marked annual variation. 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. The reservoir for the bacterium between outbreaks has not been clearly identified. 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.

# Verotoxinogenic *Escherichia coli*

## BACKGROUND

Verotoxinogenic *Escherichia coli* (VTEC) may cause serious intestinal infections in humans. When these bacteria cause hemorrhagic diarrhoea they are 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 less than 100 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 EHEC O157:H7 were notified. In 1996, VTEC O157 was isolated in Swedish cattle for the first time and human EHEC O157 infection was traced to a cattle herd. In 2002 an outbreak of EHEC 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 reported cases, including 11 (8%) HUS (haemolytic uraemic syndrome) cases were infected with O157:H7 after eating contaminated fresh lettuce irrigated with water from a local stream 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. In 2011, one of the largest known VTEC outbreaks occurred in Germany with 3,816 reported cases of which 845 (22%) developed HUS. Sweden reported the highest number of cases outside Germany (n=53) during this outbreak. The epidemiological characteristics of the cases and the massive media impact and public awareness make this outbreak unique. The need for a continuous prioritisation of EHEC was highlighted by the large outbreak in Germany with serious consequences not only for the affected individuals but also for politics, the

economy, trade and food production in the countries directly or indirectly affected.

Around 250-450 cases (3-5 cases per 100,000 inhabitants) of EHEC are reported in Sweden annually, of which around 50% are domestically acquired. Most of the domestic 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 2012:24).

### 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 have been notifiable since 1 July 2004 (SFS 2004:168).

## SURVEILLANCE

### Active surveillance

#### Animals

If a County Medical Officer suspects an association with a human VTEC infection to animals or to

a farm with animals, the County Veterinary Officer will be informed. A request to the Swedish Board of Agriculture will be made for a trace back investigation and sampling of suspected animals and/or the environment of the 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, approximately 2,000 cattle faecal samples are randomly selected from abattoirs representing about 90% of slaughtered cattle. In the study conducted from 2011-2012, all positive VTEC O157:H7 were also analysed for a subgroup of VTEC O157:H7, called clade 8. This subgroup is often isolated from cattle farms associated with human cases. A baseline study on cattle carcasses was done in 2006-2007 and a prevalence study in sheep was done at nine abattoirs in 2007-2008. Results from a slaughter prevalence study from 1998 showed that 0.1% of the pigs were positive.

##### *Humans*

Surveillance in humans is passive.

## RESULTS

### *Animals*

#### *Active surveillance*

During 2012, 10 cattle farms and one sheep farm were investigated as suspected sources for human infection. An epidemiological association was established for one cattle farm (VTEC O121) and for the sheep farm (VTEC O121).

#### *Monitoring*

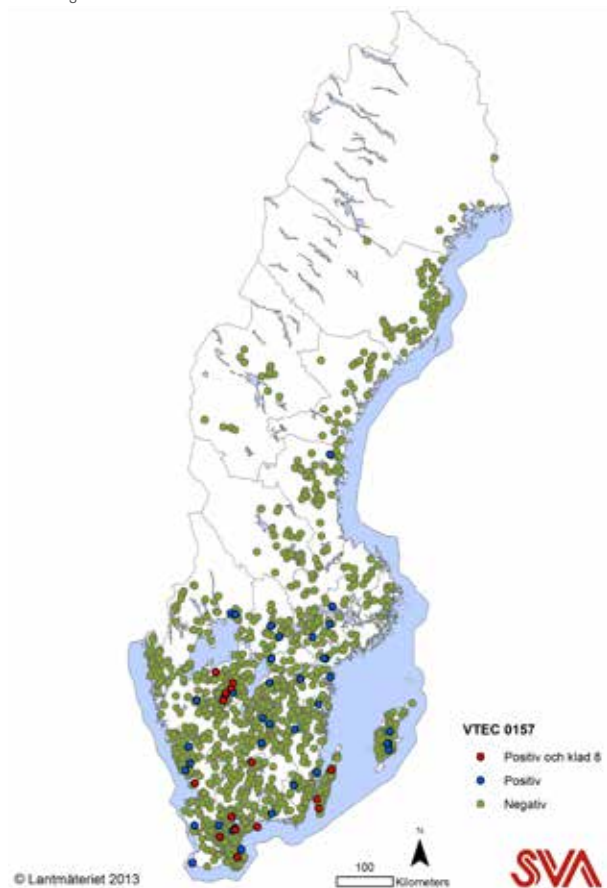
VTEC O157 was detected in 9 (1.8%) of 492 faecal and 2 (1.9%) of 105 ear samples from sheep in a survey performed in 2007-2008. In cattle, surveys during 1997-2002 showed a prevalence of approximately 1%. In the study done in 2005-2006, VTEC O157 was detected in 3.4% of faecal samples. In the abattoir survey conducted in 2008-2009 VTEC O157 was detected in 3.3% of 1,993 faecal and 8.2% of 500 ear samples. In the study conducted during 2011-2012, VTEC O157 was detected in 73 of 2,376 faecal samples (3.1%). Clade 8 was detected

in 15 of the 73 positive samples. In these studies, VTEC O157:H7 has predominantly been isolated from cattle in southern Sweden but rarely from the northern two thirds of the country, Map 11. From the samples collected during 2011-2012, there are ongoing analyses for VTEC O26 and VTEC O103.

#### Food

During 2012 there were eight investigations, where food was suspected to have caused sporadic cases. The suspected food were analysed at the National Food Agency. In two investigations, a pathogen identical to the EHEC isolated from the humans could be detected in food. The implicated food was

Map 11. Geographical distribution of findings of VTEC O157 in cattle at slaughter in 2011-2012.



minced meat and homemade sausage respectively. In both cases the meat had been bought directly from the farm. However, when sampling the animals at the farms, the pathogen could not be found.

Available results from official sampling by local authorities analysed by other laboratories than mentioned above showed only one analysis for O157:H7.

Humans

In 2012, 472 human cases were notified, which is only slightly less than in 2011 when the highest number was reported since EHEC became notifiable in 1996. The high number cannot be explained by large outbreaks during that year.

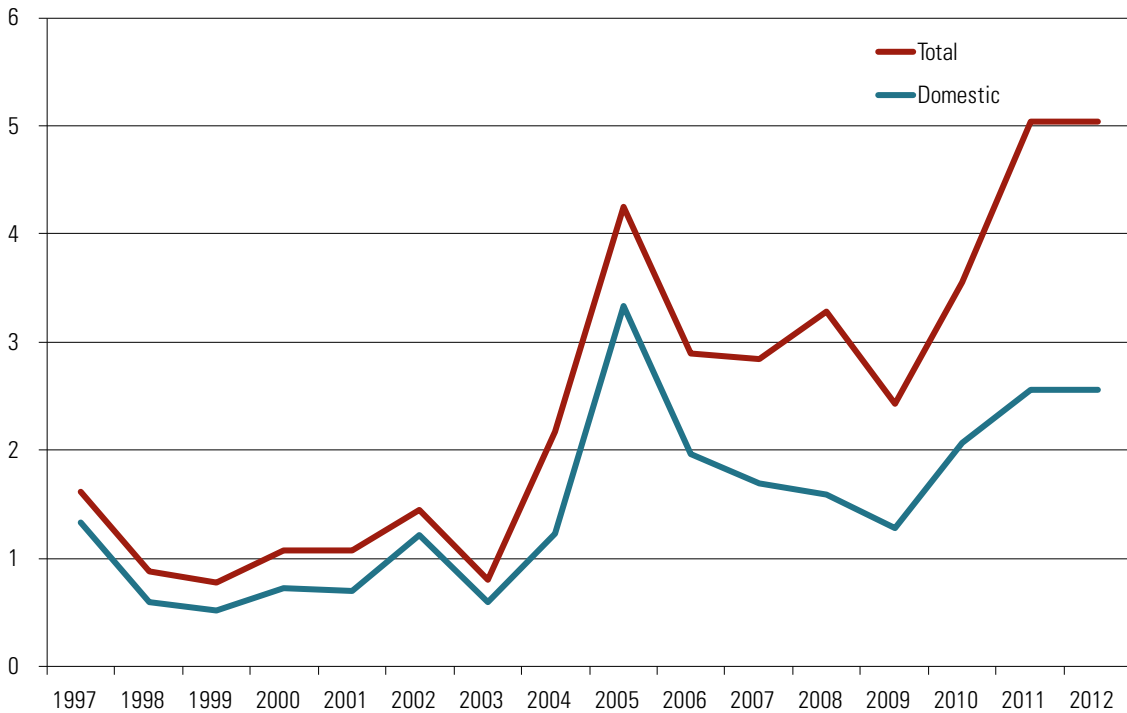
In 2012, 242 domestic cases were reported (52% of the total number, incidence 2.5 cases per 100,000 inhabitants), which is comparable to 2011 (243 cases). The apparent increasing trend in domestic incidence continued in 2012. However, due to the few years when comparable data is available (since

2005) the increase is not statistically significant (Figure 17).

As in previous years, most domestic cases (25%) were in the age group of 1-4 years. A total of 7 cases of HUS were reported, of which all were reported as domestically infected. Five of the HUS cases were in the age group 1-6 years and two were in their twenties. Three of the HUS cases belonged to the kindergarten outbreak described below. Bacteria from six HUS cases could be isolated and one was O157:H7, one O121, two O26, one O55:H7 and one with two types O111 and O109. All strains were verotoxin 2 producing.

The domestic incidence was highest in Gävleborg (7.6 cases per 100,000 inhabitants) followed by Halland (5.6), Västra Götaland (5.3) and Kalmar (5.1). The counties in the southern part of Sweden usually have higher incidences partly due to screening of faecal samples from children with diarrhoea for EHEC. The northern county of Gävleborg had

Figure 17. Notified incidence (per 100,000 ) of human VTEC cases in Sweden 1997-2012.





an unusually high incidence. Almost twice as many samples were sent to the local laboratory compared to the year before.

Of the reported cases, 48% were infected abroad and Turkey was the most common country of infection (n=60) followed by Egypt (43) and Spain (12). Turkey and Egypt are usually the countries outside Sweden where most Swedes become infected with EHEC.

EHEC has a seasonal variation with the most cases reported during the summer months. In 2012, 50% of the domestic cases were reported from June to September.

In 2012, O157 constituted 21% and non-O157 79% of the domestic cases. Of the non-O157, O26 was the most common (21%) followed by O103 (17%), O Non Typable (7%) and O121 (7%). The proportion of domestic cases with O157 (21%) has not been this low since the reporting system

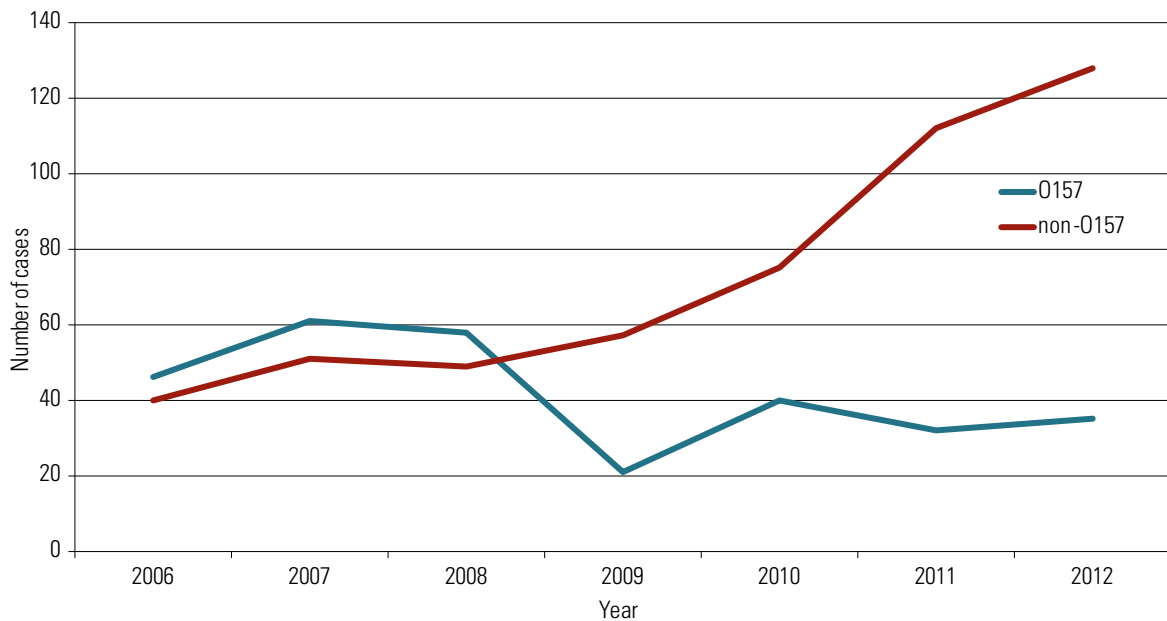
changed in 2004. In the earlier years, O157 was more common than non-O157 (Figure 18).

Three outbreaks were reported in 2012. In a kindergarten outbreak in Lycksele during the summer, three children and two parents were infected with EHEC O26. All three children developed HUS which is a rare observation. Despite an extensive local investigation, the source was never found.

In Kalmar an outbreak involving five cases of EHEC O157:H7 occurred in October. The cases all shared the same subtype of EHEC. The source was never found.

Four persons were infected with EHEC O157:H7 of the subgroup clade 8 after having eaten in the same restaurant. The restaurant was closed and sanitised and the cause of the outbreak was not determined.

Figure 18. Domestic cases of EHEC O157 and non-O157 2006-2012.



## DISCUSSION

The incidence of EHEC in 2012 was comparable to 2011 and the increasing trend since 2005 continued. Increased sampling, probably an effect of the large outbreak in Germany in 2011, as well as improved analytical methods are probably the most important explanations for this trend. To better understand the fluctuations in data over time, an analysis on how sampling, screening strategies and methods have changed regionally in the last years must be done.

The explanation for the increase in cases reported with EHEC non-O157 is not known and needs further investigation. The increase in EHEC non-157 is largely responsible for the entire increase in serotyped domestic cases in 2012. Samples collected during 2012 in the cattle prevalence study are analysed for VTEC O26 and VTEC O103 to increase the knowledge of these serotypes in the cattle population.

Several investigations were performed on suspected connections to farms and food items. Most reported cases from humans are in counties with high cattle-density as well as screening routines for faecal samples of children with diarrhoea i.e. in southern Sweden. However, higher numbers of cases are also annually reported for other counties. The findings of EHEC in minced meat and homemade sausages emphasise the importance of cooking meat properly. Advice concerning this was published on the website of the Swedish Institute for Communicable Disease Control before the summer barbeque season and also at the time of the investigations.

The prevalence among cattle, based on samples taken at slaughter, has since 2005 been in the range of 3.1-3.4%. In these studies, VTEC O157:H7 has predominantly been isolated from cattle in southern Sweden but rarely from the northern two thirds of the country. In the latest survey, positive VTEC O157 samples were also analysed for the subgroup clade 8. There is a tendency for geographical clustering of clade 8.

A joint study between the National Veterinary Institute and the Swedish Institute for Communicable Disease Control was initiated in 2012 with the aim to better understand the epidemiology and the underlying mechanisms of different sources of infection and the importance of different serotypes.

In order to reduce the human incidence of EHEC a national five-year strategy plan being developed in co-operation between the Swedish Board of Agriculture, National Food Agency, Swedish Institute for Communicable Disease Control, the National Board of Health and Welfare and the National Veterinary Institute. One way to reduce the human incidence is to implement control measures to reduce prevalence of human pathogenic VTEC among cattle.

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# Yersiniosis

## BACKGROUND

The genus *Yersinia* has been associated with human and animal diseases for centuries. Two enteropathogenic species of the genus are zoonotic: *Yersinia enterocolitica* and *Yersinia pseudotuberculosis*. Pigs are considered the main reservoir of *Y. enterocolitica*. *Yersinia* bacteria are widespread in nature but non-pathogenic 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 unclear but infections caused by consumption of contaminated carrots and iceberg lettuce have been described. *Yersinia* bacteria are destroyed by heating (pasteurisation and cooking) but are able to grow at refrigerator temperature and can therefore grow in food that is kept cool.

*Y. pseudotuberculosis* was isolated from diseased guinea pigs in the 1880s. 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 1980s.

## 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 diarrhoea to acute mesenteric lymphadenitis, which might be difficult to differentiate from appendicitis. Long-time sequelae including reactive arthritis, uveitis and

glomerulonephritis occur occasionally. 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 in humans is passive.

## RESULTS

### Animals

*Y. enterocolitica* was identified in one zoo animal and *Y. pseudotuberculosis* from another zoo animal tested at the SVA.

### Food

No samples analysed for *Yersinia* were reported by the local authorities.

### Humans

Yersiniosis is mainly a domestic infection. In 2012, 303 cases were reported. Of these, 236 cases (78%) were reported as domestic. Of the 52 cases infected abroad, six cases were reported as infected in Spain, five in Thailand and four in Italy and Cuba respectively, from other countries only a few cases were reported.

During the years 2000-2004, the number of domestic cases of yersiniosis increased until 2004 when 594 domestic cases were reported (Figure 19). Since 2004, the number of cases has decreased. In 2010, the lowest number (n=219) of domestic cases since 1997 was reported. However, the number of domestic cases increased 2011 (n=254) but decreased again during 2012 when 236 cases were reported. A trend analysis was performed that included all the domestic cases from 2004-2012 and cases from children younger than six years. All age groups showed a statistical significant downward trend except in the group of children younger than 1 year for which the downward trend changed in 2011.

In 2012, the majority of the domestic cases were in young children and 30% of them were 0-4 years. Most cases were reported in the summer, during July.

**DISCUSSION**

Yersiniosis is one of the most reported zoonoses in Sweden. Since 2004, the number of reported yersiniosis cases in humans has decreased. This decrease has occurred without any active interventions 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 that consumption of pork products is a risk factor. Good slaughtering hygiene and good manufacturing practices in food processing are essential for controlling *Yersinia*.

There is a need for more sensitive and selective analytical methods for *Yersinia*. The current ISO standard method will be revised and validated.

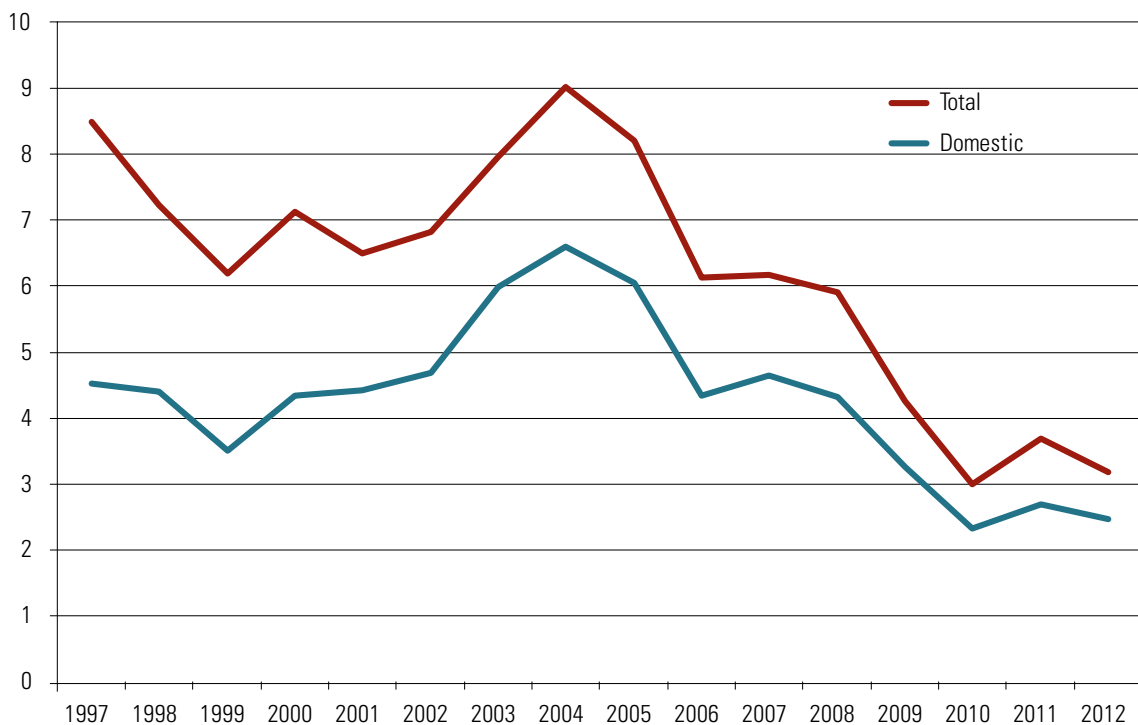
In order to decrease human incidence of yersiniosis a national 5-year strategy plan for human pathogenic *Y. enterocolitica* is being drafted in co-operation between the Swedish Board of Agriculture, National Food Agency, Swedish Institute for Communicable Disease Control, the National Board of Health and Welfare and the National Veterinary Institute.

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Figure 19. Notified incidence (per 100,000) of human yersiniosis in Sweden, 1997-2012



# **Additional surveillances 2012**



Photo: Linda Ernholm

# Poultry Health Control Programme

## BACKGROUND

The Poultry Health Control Programme is based on provisions (SJVFS 2010:58) issued by the Swedish Board of Agriculture. The programme is mandatory for all hatcheries producing more than 50,000 day-old chicks 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 programme consists of rules on biosecurity, standards for poultry houses, management and clinical surveillance.

## LEGISLATION AND DISEASE

All diseases in the programme are notifiable according to provisions issued by the Swedish Board of Agriculture (SJVFS 2012:24). The diseases included in the programme during 2012 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 serotypes of *Salmonella* were eradicated from the Swedish commercial poultry population in the beginning of the 1960's. *Salmonella* Pullorum was last detected in two backyard flocks in 2001. These two serotypes of *Salmonella* are important vertical infections in addition to the common horizontal spread. Pullorum disease mainly affects foetuses and chickens up to 3 weeks of age. *Salmonella* Gallinarum was detected in four backyard flocks in 2012. Before that, the last case was detected in a backyard flock in 1984. *Salmonella* Gallinarum commonly infects and causes disease (diarrhoea, inappetence, production losses and mortality) in older birds.
- *Mycoplasma gallisepticum* and *Mycoplasma meleagridis* are important poultry pathogens. However, *M. meleagridis* is only pathogenic for turkeys. These two mycoplasmas are able to spread both horizontally and vertically. They mainly cause respiratory disease and egg production losses. *Mycoplasma 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 disease, 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, eleven 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 has a status of Newcastle free country without vaccination according to Commission Decision 95/98/EEC.
- Egg drop syndrome – the virus is a naturally occurring adenovirus in water fowl (including the wild population) in which it does not cause any clinical disease. In chicken, the clinical signs 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.





Photo: Asa Odelros

### SURVEILLANCE

Serological screening within the programme is administered by SVA and financed by the Swedish Board of Agriculture and the participating companies. In 2012, eight different breeding companies participated in the programme; four broiler-, three laying hen- and one turkey breeding company. In accordance with the provisions of the programme, sixty blood samples were taken from the breeding flocks included in the programme, once during the rearing period and several times during the production period. The blood samples were sent by mail to the National Veterinary Institute where serological tests were performed. The sampling and testing schemes are presented in Tables 13 and 14.

### RESULTS

Table 15 gives an overview of all samples taken in breeding flocks of chickens and turkeys, and the laboratory methods used, during 2012. All analysed samples tested negative for *Salmonella Gallinarum*, *Salmonella Pullorum*, *Mycoplasma gallisepticum*, *Mycoplasma meleagridis* and Paramyxovirus type 1.

During 2012, 14 chicken flocks (one grandparent and 13 parent flocks) were further investigated due to a few positive samples for egg drop syndrome. No clinical signs were seen in these flocks and after testing new samples from these flocks, the previous positive samples were considered as unspecific serological reactions.

### DISCUSSION

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

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

## ADDITIONAL SURVEILLANCES 2012

Table 13. Sampling schedule for chicken grandparent and parent flocks. Number of blood samples tested at different weeks of age.

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

Table 14. Sampling schedule for turkey parent flocks. Number of blood samples tested at different weeks of age.

<b>Agent</b> \ <b>Age in weeks</b>	<b>20</b>	<b>32</b>	<b>44</b>	<b>56</b>
<i>S. Pullorum/ 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 15. Number of sampling occasions for grandparent (GP) and parent (P) flocks of chickens and turkeys and total number of samples tested.

<b>Agent</b>	<b>No of sampling occasions</b>			<b>No of samples</b>			<b>Method</b>
	Chickens		Turkeys	Chickens		Turkeys	
	GP	P	P	GP	P	P	
<i>S. Pullorum /S. Gallinarum</i>	9	78	4	540	4 860	240	Serum plate agglutination test
<i>Mycoplasma gallisepticum</i>	38	395	17	2 280	23 700	1 020	ELISA Svanovir MG antibody test, SVANOVA
<i>Mycoplasma meleagridis</i>	0	0	17	0	0	1 020	Serum plate agglutination test
Paramyxovirus type 1	10	80	4	600	4 800	240	NDV screen competition ELISA, ID.Vet
Egg drop Syndrome-virus	9	78	0	270	2 340	0	Haemagglutination inhibition test

# Infectious diseases in wild boars

## BACKGROUND

Wild boars are susceptible to contagious diseases that affect domestic pigs and therefore wild boars have a potential role in spreading diseases to domestic pigs. This is particularly the case for classical swine fever which has been spread from wild boars to domestic pigs in several European countries. The Swedish wild boar population is increasing and is presently estimated at 150,000 – 200,000 animals. The extent of the wild boar population is moving north and is at present at the level of the river Dalälven. Since the year 2000 almost 4,000 dead hunted wild boars from different parts of the country have been blood sampled for surveillance purposes. The samples have been sent to National Veterinary Institute for analysis for antibodies to infectious agents that are of importance for the domestic pig production.

## LEGISLATION

The infections in the wild boar surveillance programme of 2012 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 control the disease and to prevent further spread.

## SURVEILLANCE

In 2012, 435 blood samples from wild boars were analysed for antibodies to Aujeszky's disease virus, porcine reproductive and respiratory syndrome virus, African swine fever virus and classical swine fever virus. The samples were analysed using the methods described under the respective disease headings in this report.

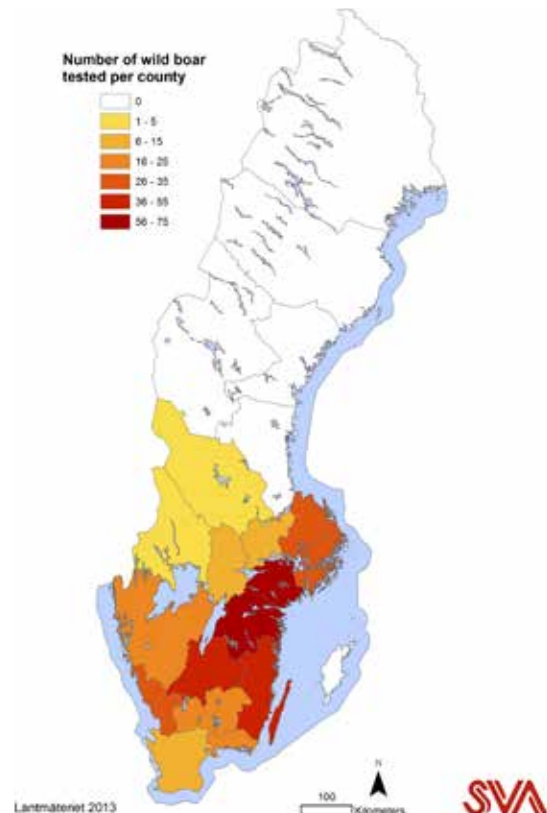
## RESULTS

The geographical distribution of sampled wild boars was roughly correlated to the distribution and density of the Swedish wild boar population (Map 12). All samples tested were serologically negative.

## DISCUSSION

The Swedish wild boar population is growing and the boundary of the population is moving north. In areas where wild boars already are present the population is also becoming denser, which increases the risk of direct or indirect contact between wild boars and domestic pigs. The area in Sweden populated by wild boars is surrounded by sea border. Therefore, there is no risk of wild boars migrating into Sweden with disease. Instead the role of the wild boar in disease spread might be to pick up infectious agents introduced into Sweden by other routes. It is possible that wild boars could gain access to infected meat for example in garbage or indirect spread by other means from people, vehicles or equipment. All diseases monitored in 2012 are or have recently been present in neighbouring countries or in close proximity to Sweden.

Map 12. Geographical distribution of wild boars sampled in 2012.



# Infectious diseases in fish and shellfish

## BACKGROUND

Sweden has a very healthy aquaculture as well as wild populations of fish and shellfish. None of the serious diseases that occur through Europe are found in Sweden. The diseases that do occur, are of lower importance and occur at low frequencies. The reason for this is found in the history of Swedish aquaculture. A restrictive approach to the importation of live fish for restocking/farming was an important part as well as an early introduction of health-control in farms. To maintain this good health status, a comprehensive approach to disease control is required. Fish and shellfish are included in several multifaceted activities related to each other with the risk of spreading diseases. Other considerations such as ballast water, shipping, sport fishing, ornamental/aquarium fish and migrating wild fish play a significant role in the assessment and management of the health protection for the animal species.

Most Swedish rivers have hydroelectric dams in their reaches. These are very effective migration barriers for feral fish and therefore protect the water upstream from existing and emerging coastal diseases. This also results in a different health status at the coast compared to the more disease free continental zone. To maintain this situation, all transport of live fish from the coast to the continental zone is forbidden. Due to the migration barriers, Sweden has a national conservation programme 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 renibacteriosis/BKD. After fertilisation 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 coast. All eggs from positively tested parents are destroyed. After hatching and rearing, in freshwater from the continental zone, the offspring are released to the coastal zone.

Sweden has an approved disease free zone status (2002/308/EC) for Viral haemorrhagic septicaemia (VHS) and Infectious hematopoietic necrosis (IHN)

(2008/427/EG). Also, additional guaranties are in place for the whole country for Spring Viremia of Carp (SVC) and for the continental zone for Infectious Pancreatic Disease (IPN) (2010/221/EC). The continental zone of Sweden has an EU accepted eradication programme for BKD and the coastal zone for IPN (2010/221/EU). Sampling and diagnostics for these diseases have included all Swedish fish farms since the late 80:ies, and are performed according to EU directive 2001/183 and 2006/88.

## DISEASES

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

Both diseases are caused by rhabdovirus and occur frequently in Europe. They are transferred horizontally although, vertical transmission cannot be completely ruled out for IHN. VHS is found in a marine form, but a low frequency in wild populations of sensitive species, cannot be excluded in the Swedish coastal zone.

Both diseases have greatest impact in aquaculture of rainbow trout (*Oncorhynchus mykiss*) in freshwater, but has also been detected in several other species. For both diseases, the fish exhibit behavioural changes, lethargy and abnormal swimming (whirling). The fish are anaemic with varying degrees of bleeding in multiple organs. Therapy and vaccines are not available.

Infectious pancreatic necrosis (IPN)

IPN is caused by a virus associated with the group *Birnaviridae*. The virus is highly infectious to juvenile salmonids but susceptibility declines with increasing age. Fish that survive the infection become asymptomatic virus carriers. In addition to salmonids, virus has been detected in several other 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 has high consequences, with high mortality in young fish. The clinical presentation including darkening, abdominal distension, and





Photo: Anders Alfjorden

corkscrew swimming. Bleeding in the abdominal fat and internal organs are the most dominant inner findings. Mortality rates can vary between 10-90%.

#### Renibacteriosis (BKD/*Renibacterium salmoninarum*)

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

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

In rainbow trout, the disease is chronic with a continuous low mortality of about 5-10%. Infected fish may have reduced growth and disease can result in a deterioration of quality of fish for human consumption. Salmon and arctic char are most susceptible to BKD, especially in situations of stress, and mortality can reach up to 80%.

#### Spring viraemia 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 cyprinid family. The disease is transmitted only horizontally.

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

#### Marteiliosis

Marteiliosis, a disease in oysters and blue mussels, is caused by a unicellular parasite (*Marteilia refringens*). The parasite needs a crustacean (*Paracartia grani*) as an intermediate host, a species considered not to exist in Sweden due to the climate. The disease causes reduced fitness, impaired growth and resorption of the gonads and hence reduced reproductive capacity. When the animals weaken, they cannot keep the shell halves closed. The parasite is considered to exist in two forms the "o" form which occurs in oysters, and "m" form, which occurs in blue mussels.

#### The crayfish plague

Crayfish plague is caused by an aquatic fungus, (*Aphanomyces astaci*), which spread to Europe in the

late 1800's from the U.S. with live crayfish. The disease occurs throughout Europe and North America. The parasitic fungus reproduces by spores spread in the water. When the spores find a crayfish they grow through the skin and attack the underlying tissues.

The signal crayfish – exhibit black (melaninated) areas in the shell adjacent to the presence of the fungus in the skin. The spots will disappear in the shedding of the shell, but may gradually reappear.

The noble crayfish – the first sign is high mortality in the crayfish populations. Disease in the individual is characterised by behaviour changes such as moving during daytime, reduced coordination and balance difficulties.

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

### White spot syndrome

White spot syndrome is caused by a virus of the genus *Whispovirus* within the *Nimaviridae* family. The virus can infect a wide range of aquatic crustaceans, especially decapods, including marine, brackish and freshwater prawns, crabs, crayfish and lobsters. To date, no decapod crustacean from marine and brackish or freshwater sources has been reported to be resistant. Outbreaks of white spot syndrome occur at a water temperature between 18 and 30°C which means there is a potential for the disease in Swedish waters. The most common clinical sign is white spots in the exoskeleton, but the disease can occur without any obvious external signs. The virus is transmitted both horizontally and vertically, and has a long survival time outside the host animal. The virus is present in imported frozen raw shrimp intended for consumption which may be used by anglers for bait. There is a non-negligible risk that the virus will be introduced to the aquatic environment by this practice. The consequences of this are difficult to predict but may have a negative impact on the Swedish populations of crustaceans (cf. crayfish plague)

### LEGISLATION

Except for crayfish plague, the above mentioned diseases are included in the Swedish legislation for

notifiable diseases (SJVFS 2012:24) and the control is specifically regulated in SJVFS 1994:94. Further, IHN, VHS, IPN (other than serotype ab) and SVC are included in the Swedish Act of epizootic diseases (SFS 1999:657). Crayfish plague is regulated by The Swedish Agency for Marine and Water Management (SwAM) a new government authority which replaces the former Board of Fishery.

### SURVEILLANCE

Sweden has two control programmes: a national compulsory programme and a voluntary programme.

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

The national compulsory programme is regulated by EU directive 2006/88 and Swedish legislation. The programme is carried out by official veterinarians in cooperation with the industries through the Fish health organisation. The programme assigns inspections and sampling for virus and renibacteriosis (*BKD/Renibacterium salmoninarum*) based on the risk for the farm becoming infected, the risk that the farm will further spread the pathogen and the impact of the agent. For each farm, a risk analysis is done, forming the basis for its classification and hence the number of visits and samples to be performed. The inspections are to be performed when the water temperature that is optimum for agent being tested for.

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

The SwAM implements the control of crayfish for crayfish plague (*Aphanomyces astaci*). White spot syndrome is considered a high risk disease for Sweden due to the risk for transmission to wild populations of *Crustacea* through angling. The disease is not included as an active target in the Swedish control programme but incoming samples of crayfish are routinely tested.



Sweden conducted a screening for *Marteilia refringens* during 2012 as it had done in 2011. The 2012 study was conducted on farmed and wild oysters and blue mussels from the Swedish west coast.

All diagnostic analyses are performed at the Swedish reference laboratory, the National Veterinary Institute.

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

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

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

Presence of the crayfish plague is demonstrated by light microscopy and cultivation and verified by PCR, and WSD by PCR.

## RESULTS

Viral haemorrhagic septicaemia, Infectious hematopoietic necrosis, Infectious pancreatic necrosis

During 2012, 478 pooled samples were tested, equal to approximately 5,000 individuals from both the continental and coastal zones.

No positive samples were found.

Spring Viremia of Carp

In 2012, 15 pools, equal to approximately 50 – 150 individuals.

No positive case was detected during 2012.

Bacterial Kidney Disease

Kidneys from 2,616 fish were tested.

No positive sample was found.

Koi-herpes

Samples from 10 fish at 3 locations were tested.

No location tested positive.

*Marteilia refringens*

150 samples from oysters (*Ostrea edulis*) and 150 samples from blue mussels (*Mytilus edulus*) from 15 aqua culture companies located on the Swedish west coast were tested. Of these, none tested positive.

*Crayfish plague*

The disease was investigated in cases from seven different locations. Two were positive.

Other reported diseases in fish during 2012 were perch rhabdovirus in brown trout isolated from a coastal farm

## DISCUSSION

Sweden has a high health aquaculture, all severe diseases of importance are absent. The most problematic disease to control is renibacteriosis/BKD, due to its vertical transmission and “sneaky” appearance. This is expected to be resolved by modified sampling and improved methodology. Additional resources must be invested in the risk-based analysis of individual aqua culture farms to get a more reliable assessment for health surveillance.

# Post mortem examinations in food producing animals

## BACKGROUND

Early detection of infectious diseases is of outmost importance in order to prevent negative effects. For diseases with severe clinical signs the first line of defence is the detection of disease by animal owners, field veterinarians or pathologists. International experiences, as well as practical examples from Sweden, show that post mortem examinations remain a vital part in disease control and that emerging diseases may be detected at post mortem examinations. Post weaning multisystemic wasting syndrome was first detected at post mortem examination when it was introduced into Sweden in 2003. In 2008 when anthrax was diagnosed, at post mortem for the first time since 1981. A second anthrax outbreak 2011 was also detected at post mortem examination. During 2012, *Salmonella* Gallinarum (fowl typhoid) was found at post mortem examination and diagnosed for the first time since 1984 in Sweden.

As post mortem examinations are considered an important part in the early detection and national surveillance for infectious and emerging diseases, a specific programme for encouraging such examinations by financial means started in the early nineties. The Swedish Board of Agriculture finances the programme and the Swedish Animal Health Service is responsible for the organisation.

## PROGRAMME

The programme finances post mortem examinations in all food producing animals including poultry, which were included in the programme in 2007. Since 2008, domesticated exotic ungulates are also included. Approximately 3,000 animals have been examined yearly within the programme since 1999. In addition to post mortem examinations, samples are collected from defined categories of animals for surveillance of salmonellosis, paratuberculosis, PRRS, CSF, brucellosis, TSE and antimicrobial resistance.

The programme 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. This can be a problem for large animals, particularly when the distance between the farm and post mortem facility is long.

## RESULTS

During 2011 and 2012 post mortem examinations were performed at five different sites throughout the southern part of the country; Skara (Eurofins Food & Agro), Kristianstad (Eurofins Food & Agro), Uppsala (SVA and SLU), Visby (SvDHSV) and Karlskoga (SvDHSV in cooperation with DVO, SJV:s field veterinary organisation, and Konvex). Large animals, such as adult cattle, were examined at three of these sites, Uppsala, Kristianstad and Karlskoga. A total of 2,587 (2011) and 3,121 (2012) post mortem examinations were performed within the programme. The distribution species and the region of origin is shown in Map 13.

In 2011, 78 cases and in 2012, 95 cases were diagnosed with a notifiable disease at post-mortem examinations. Table 16 shows the reported primary cases of notifiable diseases detected at post mortem examination.

## DISCUSSION

The post-mortem examinations are a vital part of the national surveillance for infectious and emerging diseases, as illustrated by the detection in 2011, of 78 and in 2012, 95 index cases of notifiable disease. Post mortem examination is also an important tool for the individual farmer to solve animal health problems at the farm. In the last decade the number of post mortem examinations have been around 3,000 per year. The number of post mortem examinations in 2011 and 2012 are similar.

During 1998-2001 the number of examinations performed on different species did not correlate to the size of the population in each region. Most cat-

Table 16. Number of index cases of a notifiable disease 2011 and 2012, diagnosed from samples taken at post mortem examination.

Disease	2011	2012
Anthrax	1	0
Avian tuberculosis (poultry)	2	2
Blackleg	7	8
Bovine Malignant Catarrhal fever	0	1
Fowl Cholera (pasteurellosis)	2	0
Fowl typhoid (S. Gallinarum)	0	1
Infectious Bronchitis	2	4
Infectious laryngotracheitis	16	17
Influenza, pigs	0	3
Listeriosis	35	38
Lymphoma (not EBL)*	7	11
Mycoplasma gallisepticum	0	3
Mycoplasma, poultry, not gallisepticum*	2	3
Necrotic hemorrhagic enteritis (Clostridium perfringens type C)	0	1
Salmonellosis	4	3
<b>Total</b>	<b>78</b>	<b>95</b>

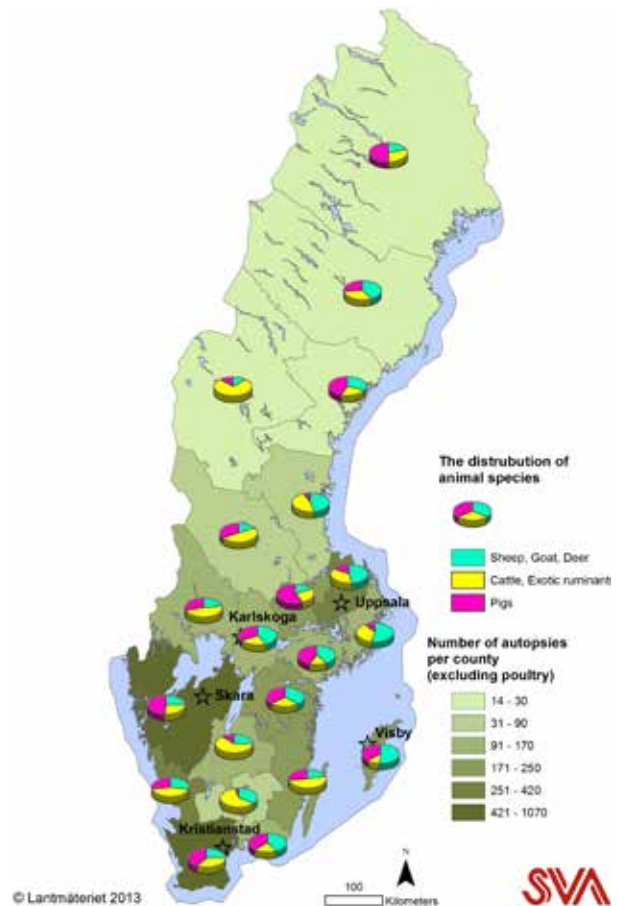
Statistics from Swedish Animal Health Services.  
 \*) these two diseases are no longer notifiable since November 2012

tle, 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 local post mortem examination facilities. The highest number of examinations are performed in regions with high animal density and access to a regional laboratory performing post mortem examinations.

Distance and transportations to facilities where post mortem examinations can be performed is important for quality reasons. A longer time before cold storage and examination will result in a higher degree of cadaverous changes and will negatively influence the quality of the post-mortem examinations.

A 3-year study of the national surveillance of infectious diseases will start in 2012. The possibility of improving surveillance by using post mortem investigations on fallen stock will be considered. This may also increase the possibilities of early detection of newly introduced infectious diseases.

Map 13. Geographical distribution and proportion of species that underwent post mortem examinations during 2011-2012.



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Personal communication, Jenny Lundström Swedish Animal Health Service

# Post mortem examinations in wildlife



## BACKGROUND

A passive surveillance programme for diseases of wildlife based on pathology and ancillary testing was established in Sweden in the 1940s. The surveillance programme is funded by governmental funds managed by the Environmental Protection Agency, making the examinations free of charge for the submitters. An active disease surveillance programme 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 was found dead or euthanised to the National Veterinary Institute (SVA) for examination. The aim of the passive and active wildlife disease surveillance programmes is to monitor the health status of wildlife in Sweden. When-

ever possible, disease causing agents are identified. The disease surveillance and diagnostics provide key information for wildlife management. It is also part of zoonotic and epizootic disease control efforts and can serve as an indicator of environmental and ecosystem health.

SVA is the only laboratory in Sweden where post mortem examination of fallen wildlife is performed. 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 2012, almost 2,200 wild animal samples were submitted to the Department of Pathology and Wildlife Diseases at SVA. This includes fallen wildlife, parts of fallen wildlife, lesions found in game animals, and standard samples collected from hunted large car-

nivores or other hunted game species. Hunter harvested wild boar samples for *Trichinella* analyses are not included in these numbers. All dead large carnivores including: lynx (*Lynx lynx*), brown bears (*Ursus arctos*), wolf (*Canis lupus*) and wolverine (*Gulo gulo*) are necropsied at SVA. Samples from these species may also be submitted when hunted or euthanised as problem animals. Licensed hunting of lynx and brown bear and wolf was done in 2012. There were 748 birds or samples from birds examined, including 146 eagles, which are systematically sent to SVA together with other protected species. In 2012 there were 282 amphibians screened for diseases such as chytrid fungus and rana virus.

In 2012, 41 cases of OIE non-listed wildlife diseases were reported. The cases were dominated by sarcoptic mange in red fox (21 cases, Table 17). The surveillance of the fox dwarf tapeworm *Echinococcus multilocularis* continues after the finding of the parasite in Sweden in 2011. In 2012, a nation-wide

screening of faecal samples from foxes was initiated. A network of hunters submit samples for PCR analysis, as well as a more focused screening of hunted foxes in the three known areas of *Echinococcus* infection in Sweden.

**DISCUSSION**

The submitted samples and reports indicate that the presence of serious contagious wildlife diseases in Sweden remains low. The passive and active wildlife surveillance is a well established tool to identify new or threatening emerging wildlife diseases, as well as monitoring endemic diseases. The introduction of new diseases can be expected to continue both with migrating animals and due to the high risk factor of human transportation, travel and interference.

Table 17. OIE non-listed wildlife diseases and number of outbreaks/cases reported to the OIE for 2012.

Disease	Species	Latin name	Cases
Avian pox	Common chaffinch	<i>Fringilla coelebs</i>	1
Leptospirosis	Red fox	<i>Vulpes vulpes</i>	1
Malignant catarrhal fever	Moose	<i>Alces alces</i>	1
Salmonellosis	Great tit	<i>Parus major</i>	1
Salmonellosis	Eurasian siskin	<i>Carduelis spinus</i>	1
Salmonellosis	European hedgehog	<i>Erinaceus europaeus</i>	1
Salmonellosis	Green finch	<i>Carduelis chloris</i>	2
Salmonellosis	Gull sp.	Laridae sp.	1
Salmonellosis	Red fox	<i>Vulpes vulpes</i>	1
Salmonellosis	Wild boar	<i>Sus scrofa</i>	3
Sarcoptic mange	Lynx	<i>Lynx lynx</i>	2
Sarcoptic mange	Red fox	<i>Vulpes vulpes</i>	21
Sarcoptic mange	Wolf	<i>Canis lupus</i>	1
Toxoplasmosis	European brown hare	<i>Lepus europaeus</i>	1
Trichomoniasis	Green finch	<i>Carduelis chloris</i>	1
Trichomoniasis	Yellowhammer	<i>Emberiza citrinella</i>	1
Yersiniosis	European brown hare	<i>Lepus europaeus</i>	1

# Antimicrobial resistance in bacteria from animals and food

## BACKGROUND

SVA has the assignment to monitor and analyse 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 Programme (SVARM) which has been running since 2000.

The programme is organised and run from the Department of Animal Health and Antimicrobial Strategies at National Veterinary Institute. Within SVARM is the programme SVARMPat, which is focused 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 objectives of SVARM are to detect trends in resistance and to provide a basis for recommendations on use of antimicrobials in animals. Details on the methodology used are available in the report. Briefly, three types of bacteria are monitored: zoonotic bacteria, specific animal pathogens and indicator bacteria from healthy animals and from food of animal origin. The rationale for monitoring indicator bacteria, including commensal *Escherichia coli* and *Enterococcus* spp. from the normal intestinal flora of healthy animals, is that resistance among these bacteria reflects the selection pressure of the use of antimicrobials in an animal population. Moreover, these commensal bacteria can be a reservoir of mobile resistance genes that can reach humans through the food chain. Thus, prevalence of resistance in bacteria that may contaminate meat is an indicator of the magnitude of human exposure to such reservoirs in food producing animals. By using harmonised methodology for studies on indicator bacteria recommended by the European Food Safety Authority (EFSA), data can be compared on the international level and over time. Thereby valid conclusions on trends in resistance can be made.

Results of SVARM, are published in a yearly report together with corresponding data for human medicine from the SWEDRES programme at the Swedish Institute for Communicable Disease Control. The report includes data on antimicro-

bial resistance in bacteria from animals and data on sales of antimicrobials for use in animals. From 2012 onwards, results from SWEDRES and SVARM are reported in a fully integrated report – SWEDRES-SVARM – available at [www.smi.se/publikationer](http://www.smi.se/publikationer) or at [www.sva.se](http://www.sva.se).

## SUMMARY SVARM 2012

Overall the Swedish situation regarding antimicrobial resistance in bacteria from humans and animals is still favourable when seen in an international perspective. This confirms that the Swedish strategies to promote rational use of antimicrobials and to monitor antimicrobial resistance in bacteria from animals and humans are effective.

### Antibiotic use in veterinary medicine

In veterinary medicine, the total amount of antimicrobials consumed was 11,763 kg. Expressed as mg per 'population correction unit' (PCU), the sales in 2012 were 15.6 mg/PCU. This is 26% lower than five years ago. Decreases are noted for all antimicrobial classes and for all animal species.

### Resistance as notifiable disease

*Extended spectrum beta-lactamase producing Enterobacteriaceae (ESBL)*

The available data indicate that ESBL-producing bacteria are rare in animals in Sweden with the exception of poultry. *Escherichia coli* producing CMY-2 (ESBLM) are found in a large proportion of poultry. A comparison of plasmids from isolates of chickens and humans concluded that the overlap is limited, indicating that transmission is uncommon.

### *Methicillin resistant Staphylococcus aureus (MRSA)*

During 2012, MRSA was isolated from two horses, two cats and in a dairy herd. In the dairy herd case, it is likely that transmission from the farmer to the cows has occurred. The prevalence of MRSA in animals is still low which limits spread from animals to humans.



*Methicillin resistant Staphylococcus pseudintermedius (MRSP)*

Since 2009, an apparent decline in reported cases of MRSP is noted. In 2012, 53 cases of MRSP in dogs and cats were reported. Analysis of a random selection of isolates shows a high relatedness between isolates over the years. In human medicine, MRSP is not generally notifiable and no cases have been reported to the national authorities.

*Vancomycin resistant enterococci (VRE)*

Previous data from SVARM show that *E. faecium* with the *vanA* gene are present among Swedish broilers. The majority of the cases of VRE with the *vanA* gene in humans were associated with health care in other countries, and transfer from Swedish broilers therefore seems unlikely.

Resistance in zoonotic pathogens

*Salmonella* is rare in animals in Sweden and few incidents involve multiresistant strains. ESBL-resistance has not been found and resistance to fluoroquinolones is rare. The favourable situation makes animals in Sweden an unlikely source of resistant *Salmonellae* that in turn infect humans.

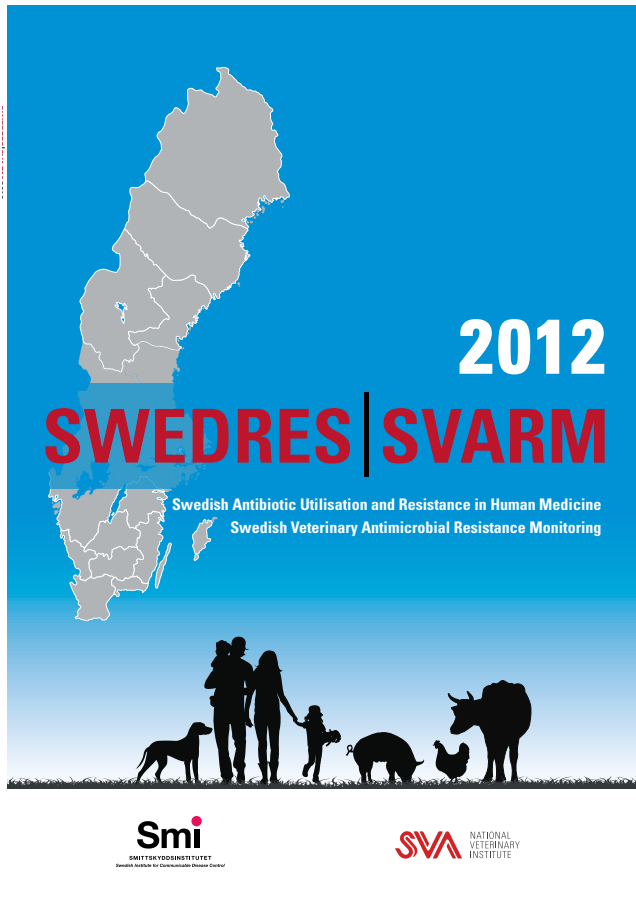
*Campylobacter* from animals in Sweden are mostly susceptible, for example, resistance to erythromycin is most uncommon. A substantial proportion of *C. jejuni* from broilers and *C. coli* from pigs are however resistant to quinolones. Nevertheless, animals in Sweden are an unlikely source of *Campylobacter* with the high resistance levels that are isolated from humans.

Resistance in animal clinical isolates

Bacteria causing clinical disease in animals are mostly susceptible to relevant antimicrobials. Particularly, bacteria causing respiratory infections in farm animals and horses are usually susceptible to benzylpenicillin. Resistance is, however, not uncommon in *E. coli* from all animals and susceptibility testing to guide the choice of antimicrobial for therapy is therefore warranted.

Resistance in indicator bacteria from healthy animals

Resistance in *E. coli*, *E. faecalis* and *E. faecium* from the enteric flora of healthy animals is an indicator of the prevalence of acquired resistance in the animal population and thus indirectly the magnitude of antimicrobial use in the population. Although these bacteria are unlikely to cause disease, they can be reservoirs for resistance genes that can spread to bacteria that cause disease in animals or humans. Prevalence of resistance in these “indicator bacteria” from Swedish animals is low and the situation is therefore favourable in an international perspective.



Download the report at:  
[www.smi.se/publikationer](http://www.smi.se/publikationer) or at [www.sva.se](http://www.sva.se).

## SWEDRES SVARM 2012

The introduction of antimicrobials some 70 years ago was a true paradigm shift with an immense impact on the possibility to treat infectious diseases in human and veterinary medicine. Unfortunately, the usefulness of these lifesaving drugs has been undermined by increasing antimicrobial resistance in bacteria of both humans and animals. Further efforts are needed to counter the selection and spread of resistance, and one key component in that work is good quality information on the situation. The SWEDRES-SVARM is an integrated report from SMI and SVA on use of antimicrobials and antibacterial resistance with data from humans, animals and food.

The Swedish situation regarding antimicrobial resistance in bacteria from humans and animals is still favorable when seen in an international perspective. The Swedish strategy to promote rational use and to contain antimicrobial resistance in bacteria from animals and humans has been effective, but this year's report also shows unfavorable trends. For example, the number of notified human cases of ESBL-producing Enterobacteriaceae and of methicillin-resistant *Staphylococcus aureus* (MRSA) are steadily increasing. These resistant bacteria are also found in animals, and the zoonotic aspects are discussed in the report. The need for continuous surveillance of the situation, and for translating data into action, is emphasised. Only through continued collaborative efforts of all parties concerned can we preserve the effectiveness of antimicrobials for treatment of current and future generations of people.

The report covers:

- o Use of antimicrobials in humans and animals
- o Occurrence of resistance in
  - Notifiable diseases, for example ESBL-producing bacteria, MRSA and VRE
  - Zoonotic pathogens
  - Clinical isolates from humans and animals
  - Indicator bacteria from animals

Swedish Institute for Communicable Disease Control, SMI, is a Government agency with the mission to monitor the epidemiology of communicable diseases among Swedish citizens and promote control and prevention of these diseases. SMI is responsible for national surveillance of antibiotic use and antibiotic resistance, and aims at providing expert analyses and advice to laboratories, infection control officers, Strama-groups and county medical officers.

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 and antimicrobial resistance. SVA is mandated to monitor antimicrobial resistance in animals and food and to promote rational use of antimicrobials in animals.





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