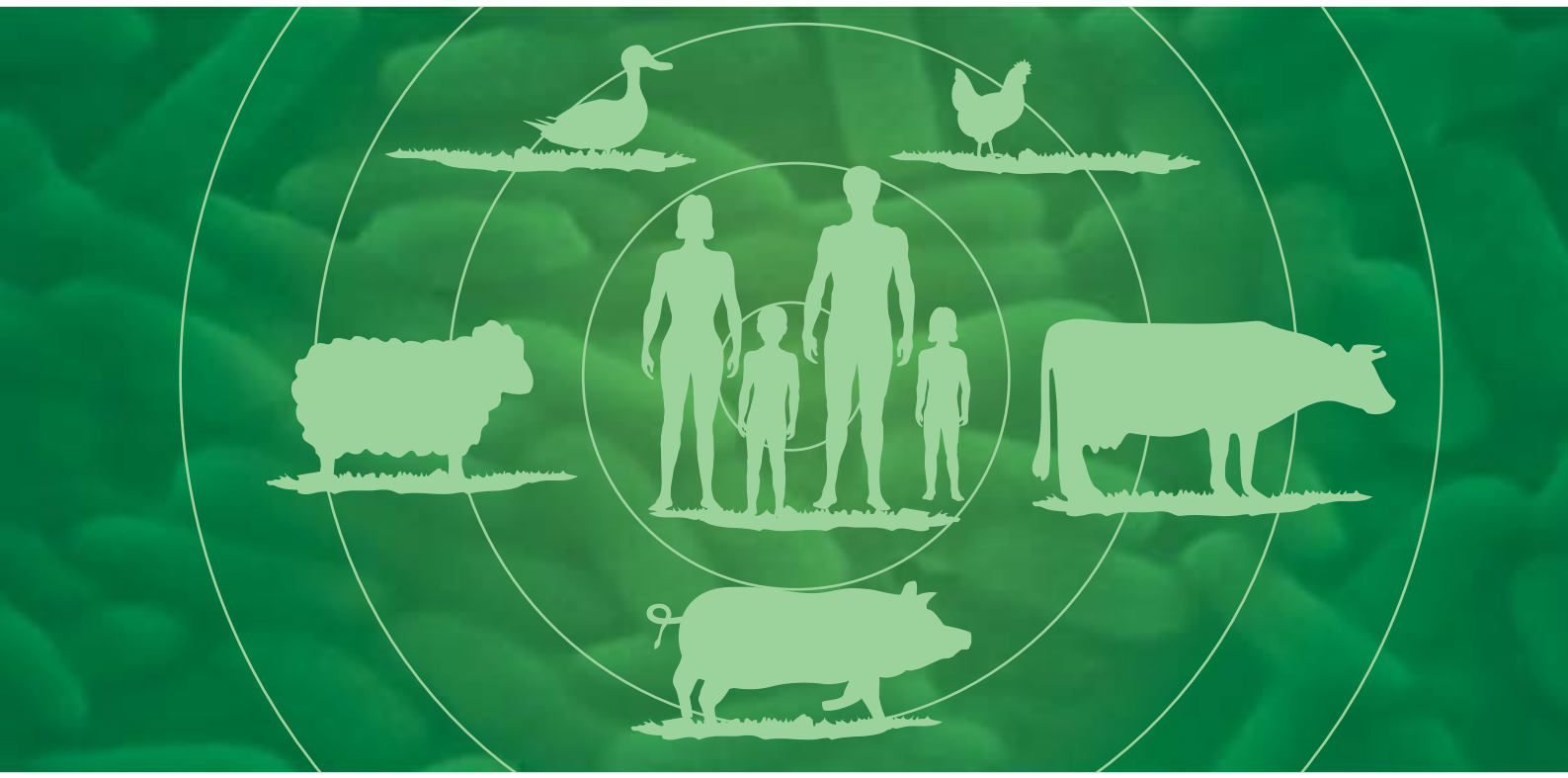
REPORT ON

ZOONOSES

IN IRELAND 2000 & 2001



THE DEPARTMENT OF AGRICULTURE & FOOD
AN ROINN TALMHAÍOCHTA AGUS BIA

NDSC NATIONAL DISEASE SURVEILLANCE CENTRE

Food Safety AUTHORITY OF IRELAND

REPORT ON

ZOONOSES

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ABBREVIATIONS

CMCL	Central Meat Control Laboratory
CSO	Central Statistics Office
CVRL	Central Veterinary Research Laboratory
DoHC	Department of Health and Children
DAF	Department of Agriculture and Food
ERHA	Eastern Region Health Authority
FSAI	Food Safety Authority of Ireland
HUS	Haemolytic Uraemic Syndrome
MHB	Midland Health Board
MWHB	Mid Western Health Board
NDSC	National Disease Surveillance Centre
NEHB	North Eastern Health Board
NSRL	National Salmonella Reference Laboratory
NWHB	North Western Health Board
OBF	Officially Brucellosis Free
OFML	Official Food Microbiology Laboratory
OTF	Officially Tuberculosis Free
SEHB	South Eastern Health Board
SHB	Southern Health Board
TB	Tuberculosis
TSE	Transmissible Spongiform Encephalopathy
VTEC	Verocytotoxigenic *Escherichia coli*
WHB	Western Health Board

DATA SOURCES

Human Data

Data on human infections is provided by various agencies of the Department of Health and Children (DoHC) and in three main formats: statutory notifications, voluntary laboratory reporting and reports of outbreaks investigated by health boards.

The 1947 Health Act entitles the Minister for Health and Children to specify diseases that must be notified. Appendix 1 lists the human diseases notifiable under the Infectious Diseases Regulation of 1981 (S.I. No. 390 of 1981). This list has since been extended to include other human infectious diseases (S.I. No. 707 of 2003). Under the 1981 Infectious Disease Regulations (as amended), when a medical practitioner becomes aware of, or suspects that a person on whom they are in professional attendance is suffering from, or is the carrier of an infectious disease, they are required to transmit a written notification to the relevant Medical Officer of Health in their health board. This information is now collated and analysed by the National Disease Surveillance Centre (NDSC).

A number of foodborne zoonotic diseases such as campylobacteriosis and listeriosis are reported under the category of 'Food Poisoning (bacterial other than salmonella)' but are not reported individually.

Clinical diagnostic laboratories are not required to report diseases to their local health board, though laboratories in some regions voluntarily report on the number of pathogens isolated. Human data on the non-notifiable zoonotic diseases represented here were obtained directly from clinical laboratories by the NDSC.

The National Salmonella Reference Laboratory (NSRL) in Galway collects data on *Salmonella enterica*. This laboratory participates in Enter-Net, an international surveillance network for the enteric infections – *S. enterica* and *Escherichia coli* O157.

The NDSC also carries out additional surveillance of specific diseases, including verocytotoxigenic *E. coli* infections, listeriosis, leptospirosis and tuberculosis.

All rates of human infections presented in this report were calculated using 2002 census data (Table I.) unless otherwise stated.

Table I. Population by health board (2002 census data)

Health board	Population
Eastern Region Health Authority	1,401,441
Midland Health Board	225,363
Mid Western Health Board	339,591
North Eastern Health Board	344,965
North Western Health Board	221,574
Southern Health Board	580,365
South Eastern Health Board	423,616
Western Health Board	380,297
Total Population	**3,917,212**

(Source: DoHC, 2002)

Outbreak Data

Between 1998 and 2001 the Food Safety Authority of Ireland (FSAI) examined reports of outbreaks of infectious intestinal diseases that had been investigated by health boards. The information gleaned from this surveillance was valuable in learning more about these diseases, their mode of transmission and how they can be better controlled.

Food Data

Microbiological data on food was obtained from the following sources: Department of Agriculture and Food (DAF), the regional health boards and the Enhanced Poultry Monitoring Programme co-ordinated by DAF and the FSAI (Table II.).

Table II. Laboratories providing data on zoonotic agents in food, 2000 and 2001 (Under Directive 92/117/EEC)

Laboratory (Lab)	Foods	Stage of sampling	Pathogens
Central Meat Control Lab (CMCL)	Meat and meat products	Processing	*S. enterica*
DAF approved labs (for Central Veterinary Research Lab [CVRL])	Raw meat (+ some meat products and other foods)	Slaughterhouse and processing	*S. enterica*
DAF approved private lab*	Raw poultry carcases	Processing	*S. enterica* *Campylobacter* spp.
3 Dairy Science Labs Regional Veterinary Labs Waterford and Sligo	Milk and milk products	Processing	*S. enterica* *Listeria* spp.
7 Official Food Microbiology Labs (OFMLs)	Food from retail level	Retail **	*S. enterica* *Campylobacter* spp. *Listeria* spp. *E. coli* O157

* For the FSAI/ DAF enhanced poultry monitoring programme.

**The majority of these samples were taken at retail level (i.e. from catering and retail premises), while a small percentage of samples were from distributors/transporters, manufacturers/packers and primary producers.

Data on *S. enterica and Campylobacter* spp. in raw poultry meat samples were provided through the enhanced poultry monitoring programme co-ordinated by FSAI and DAF. One bird per production cycle per house was sampled, as well as a proportionate number of samples of imported meat. The seven Official Food Microbiology Laboratories (OFMLs) analysed more than 10,000 food samples taken at retail level during 2000 and more than 12,500 in 2001. The majority of these were samples taken during routine inspections of catering and retail premises, but they also included a small number of samples taken from distributors/transporters, manufacturers, packers and primary producers. In some health board areas samples from local surveys were also included as were those taken as a result of food complaints, suspect food poisonings and outbreaks.

Animal and Animal Feed Data

Data on animals and animal feed were collected by DAF and were based on data available within its inspection and laboratory service.

Data on certain animal diseases were derived from specific surveillance and control programmes, particularly for tuberculosis, brucellosis, BSE and salmonellosis. The list of notifiable diseases of animals in Ireland that pertained during 2000 and 2001 is in Appendix 2.

Compulsory monitoring of animal feed was also carried out by DAF as part of the controls on feed and the DAF National Salmonella Monitoring and Control Programme. The Central Statistics Office (CSO) provides annual estimates of the numbers of livestock in Ireland (Table III).

Table III. Livestock estimates in Ireland, 2000 and 2001

Animal	2000	2001
Cattle	7,037,000	7,097,430
Sheep	7,555,000	7,330,000
Pigs	1,722,000	1,741,000
Poultry	13,953,000	12,603,000

(Source: CSO)

Pets as well as food producing animals can harbour zoonotic pathogens. The Control of Dogs Act, 1986 requires owners to hold a licence for each dog they own. Although there were 158,385 dog licences (individual and group) issued in 2000, the Department of the Environment and Local Government estimate that only one fifth of dogs are licensed and that a more accurate number of dogs was in the region of 750,000. A pet food company reported that Ireland has the highest per capita dog ownership in Europe, with 45% of homes having dogs and 22% of homes having cats.


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EXECUTIVE SUMMARY

Compilation of this report was a collaborative project by the Food Safety Authority of Ireland (FSAI), the National Disease Surveillance Centre (NDSC) and the Department of Agriculture and Food (DAF). Tracing foodborne pathogens from farm to fork is important for those engaged in control and prevention programmes and this report represents a first step in the feedback of such information to all sectors and stakeholders engaged in food safety in Ireland.

In both developed and developing countries, zoonoses transmitted through food and water are of particular concern as they are responsible for the majority of reported and unreported foodborne illnesses. The risk of human exposure to pathogens from a single source has increased due to modernised food production methods and distribution systems. The more common zoonotic diseases encountered include salmonellosis, campylobacteriosis and more recently verocytotoxigenic producing *Escherichia coli* (VTEC) infection.

In Ireland, the number of foodborne bacterial infections identified through clinical and laboratory diagnosis has declined in recent years. This decline coincides with improved detection methods that enable faster and more effective control and elimination strategies. In addition, as our knowledge of the sources, reservoirs and transmission routes of these diseases improves, so too does our ability to develop and enhance strategies that help in preventing human infection.

Salmonellosis

The incidence rate of human salmonellosis in Ireland declined between 1998 and 2001, coinciding with an apparent overall decrease at European Union (EU) level. The DAF National Salmonella Monitoring and Control Programme, the Bord Bia Egg Quality Assurance Scheme, education campaigns targeting consumers and caterers and increased inspections by official agencies have likely contributed to this downward trend in Ireland. *Salmonella enterica* was frequently linked to human illness in Ireland with 16 laboratory reported cases/100,000 population in 2000 and 11 in 2001. The *S. enterica* serovars most commonly associated with human illness in Ireland are *S.* Typhimurium and *S.* Enteriditis and to a lesser extent *S.* Bredeney, *S.* Kentucky, *S.* Dublin and *S.* Virchow.

A number of EU Member States, including Ireland, operate salmonella monitoring programmes that involve testing for *S. enterica* in poultry breeding flocks across all species. Relatively high levels of contamination by *S. enterica* in food samples tested in 2000 and 2001 point to raw poultry, pork and mushrooms as possible sources of human infection. Poultry flocks in Ireland are largely free of *S.* Typhimurium and *S.* Enteritidis as a result of a slaughter policy for flocks contaminated with these microorganisms with the result that contamination of poultry carcases by *S. enterica* in 2000 and 2001 was mostly due to *S.* Bredeney and *S.* Kentucky.

The Pig Salmonella Control Programme was not in operation during 2000 or 2001 but of the 54 pig herds tested in 2000, *S. enterica* (mostly *S.* Typhimurium) was identified in 23 herds.

Campylobacteriosis

The incidence rate of campylobacteriosis increased in the 1980s and 1990s across the EU, but the number of reported cases in Ireland has declined each year from 1999 to 2001. Unlike salmonellosis, notification of campylobacteriosis was not required by law in Ireland in 2000 and 2001, although the majority of cases listed in this report under the category "Food poisoning (bacterial other than salmonella)" are due to infection with *C. jejuni* and to a lesser extent *C. coli*. Laboratory data for 2000 and 2001 on campylobacteriosis was specifically collected by the NDSC according to the Zoonosis Directive 92/117/EEC (S.I. No. 2 of 1996) and amendments. Data on the source and risk factors involved in foodborne disease come mainly from case-control studies of outbreaks. In recent years, few outbreaks of campylobacteriosis have been recorded in Ireland with none being recorded in 2000 and just one in 2001. Commonly identified risk factors include the consumption of contaminated poultry and poultry meat products, handling of raw uncooked meat, consumption of raw unpasteurised milk, direct contact with farm animals and pets and the consumption of contaminated water. In 2000, 1,613 isolates of *Campylobacter* spp. from human cases were reported to the NDSC by the clinical laboratories, with 1,286 cases reported in 2001 (41 and 33 cases/100,000, respectively). The percentage of poultry carcases found to be harbouring *Campylobacter* spp. at processing plants was 54%, both in 2000 and 2001. At retail level, the incidence of *Campylobacter* spp. was very low for all foods tested except raw poultry and offal. *Campylobacter* spp. were identified in approximately 40% of raw poultry and offal samples tested in 2000 but this fell to 13% in 2001. Only small amounts of data on the incidence of *Campylobacter* spp. in animals are recorded in Ireland, however, in a survey of broiler flocks carried out by DAF in 2000, 85% of the 65 flocks tested were found to be infected with *Campylobacter* spp.

Listeriosis

Listeria spp. are ubiquitous in the environment and since 1995 between 2 and 7 human cases have been reported each year in Ireland. In 2000 and 2001, there were no listeriosis outbreaks reported but there were 7 individual cases each year. *Listeria* spp. were isolated from a wide variety of raw and ready-to-eat foods at retail level in 2000 and 2001. An average of 2% of retail samples tested contained *Listeria monocytogenes* but some categories of food contained higher levels such as 11% of ready-to-eat pork products in 2000 and 8% of fish and fish products in 2001. The FSAI, in conjunction with the Official Food Microbiology Laboratories (OFML) is developing improved systems for monitoring the prevalence of *L. monocytogenes* in ready-to-eat foods and has introduced practical guidelines for achieving acceptable levels of microbiological contamination based on internationally recognised standards. Testing of animals for *Listeria* spp. in Ireland was not routinely carried out in 2000 and 2001.

Infection by *E. coli* O157 (VTEC)

Verocytotoxin producing *Escherichia coli* (VTEC), particularly *E. coli* O157, has emerged as a global public health concern with cattle and sheep considered to be the main reservoirs. In 1999, the FSAI published a report entitled 'The prevention of *E. coli* O157: H7 infection: A shared responsibility'. Following this report, an extensive range of control measures were introduced across the food chain, especially in relation to clean animals and carcases.

In 2000, 42 cases of VTEC infection were identified (1.1 cases/100,000), 5 cases are not included in the population rate as they were in non-residents. Haemolytic Uraemic Syndrome (HUS) occurred in 5 cases, one of which was fatal. During 2001, 52 cases of *E. coli* O157 infection were reported, (1.3 cases/100,000), including 3 cases of HUS. Similar to other foodborne illnesses, the incidence rate of *E. coli* O157 cases was highest in the summer months of 2000 and 2001, though a significant number of cases also occurred in March of 2000.

Tuberculosis and Brucellosis

The control and eradication of certain animal diseases in Ireland, implemented for both consumer protection and trade reasons, has resulted in a shift in the epidemiology of many foodborne zoonotic diseases. For example, infections once common in humans such as tuberculosis (TB) and brucellosis (undulant fever) have all but disappeared since the introduction of routine milk pasteurisation. These diseases however, remain an occupational hazard for people such as veterinary surgeons, abattoir workers and farmers and are still detected at low levels in the animal population. Routine tests for brucellosis in 2000 found that 0.5% of cattle herds were positive with 0.2% positive in 2001. Since 1988, the number of brucellosis cases in humans has varied between 6 and 28 a year, with 15 cases being notified in 2000 and 14 in 2001.

INTRODUCTION

The World Health Organisation (WHO) describes zoonoses as diseases and infections that are naturally transmissible from animals to man. Zoonoses can be caused by common human pathogens such as *Campylobacter* and *Salmonella* species, but also by less frequently encountered microorganisms such as *Leptospira* spp. that cause leptospirosis and can give rise to Weil's disease. Transmission can be by direct contact with infected animals, animal tissue, urine or faeces, through infected insect vectors or the consumption of contaminated food and water. Some zoonoses, while posing a threat to the general population may have more serious consequences for the health of vulnerable groups such as the young, the elderly, or those suffering from chronic diseases. Zoonoses are occupational hazards for people in regular contact with animals such as farmers, veterinary practitioners and abattoir workers.

The incidence rate of many zoonoses has been declining, particularly in industrialised countries where a greater knowledge of the sources, reservoirs and possible routes of infection has led to more effective control and prevention policies being developed and implemented. However, the emergence of relatively new animal derived pathogens such as new variant Creutzfeldt-Jakob Disease (nvCJD) and verocytotoxigenic *Escherichia coli* (VTEC) means that a vigilant approach must be adopted to optimise control and prevention of such diseases.

In both developed and developing countries, zoonotic diseases transmitted through contaminated food and water are a particular concern because of the potential for large scale infection from a single source. The evolution of food production and processing methods as well as a more globalised distribution system means that control and prevention policies must be adapted accordingly to ensure an acceptable level of consumer protection.

This is the first national zoonosis report produced in Ireland and is intended to serve as an information resource for consumer protection, public health and regulatory bodies involved with food safety. Though the numbers of human infections reported here may not reflect the absolute scale of the individual diseases in Ireland, the information provided in this, and future reports, will nevertheless be a valuable tool for those monitoring zoonotic trends with a view to improving control and prevention strategies.

1. SALMONELLOSIS

Salmonella enterica is recognised as one of the most common causes of bacterial food poisoning globally. Salmonellosis is predominantly a foodborne disease, although infection can also occur through direct contact with infected animals or their faecal material. Other possible routes of transmission include person-to-person, infected food handlers and nosocomial infection. Gastroenteritis infections caused by *S. enterica* are usually self-limiting, being characterised by diarrhoea, fever and abdominal cramps. However, infection can result in more severe disease and even death in a small number of cases. Salmonella control strategies in Ireland have focused on reducing the burden of contamination in the food chain, for example during poultry and egg production. They have also focused on information and education campaigns for both the catering sector and consumers.

HUMAN

Salmonellosis (other than typhoid and paratyphoid) is a notifiable disease in Ireland. The incidence rate of this disease has been declining in Ireland since 1998 (Figure 1.1) and this trend continued with a decrease from 640 cases notified in 2000 (16 cases/100,000) to 428 in 2001 (11 cases/100,000).

Figure 1. 1. Salmonellosis notifications in Ireland between 1996 and 2001

Incidence rates for 1996 - 1999 calculated using 1996 census data and for 2000 and 2001 using 2002 census data

(Source: NDSC & DoHC)

While the number of cases remained relatively static in most health board areas, the incidence rates of *S. enterica* for the North Eastern, North Western and Western Health Boards declined significantly in 2001 from 2000 (Figure 1.2). The most dramatic reduction in incidence rate occurred in the North Eastern Health Board area, and may be linked to an outbreak that occurred in March 2000 that was mainly located in that region. The health board location in these results refers to the location of the clinical laboratory that the isolate was sent to and may not necessarily correspond to the geographic location of the case.

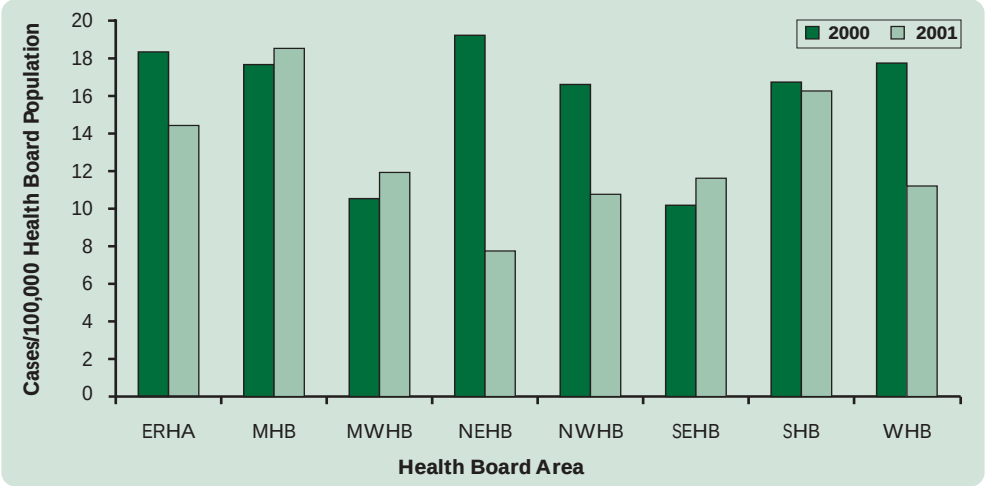

Figure 1. 2. Incidence rate of *S. enterica* by health board area, 2000 and 2001

(Source: NSRL)

Prevalence of *S. enterica* in various age groups

The highest incidence rate of *S. enterica* was identified in children under the age of 5 years in Ireland in 2000 and 2001 (Figure 1.3). This could be due, at least in part, to the fact that young children suffering from diarrhoea are more likely than other age groups to attend a physician and thus have follow-up investigations. It may also be due to the fact that a young child's immune system is still developing and thus unable to fight infection as vigorously as an adult.

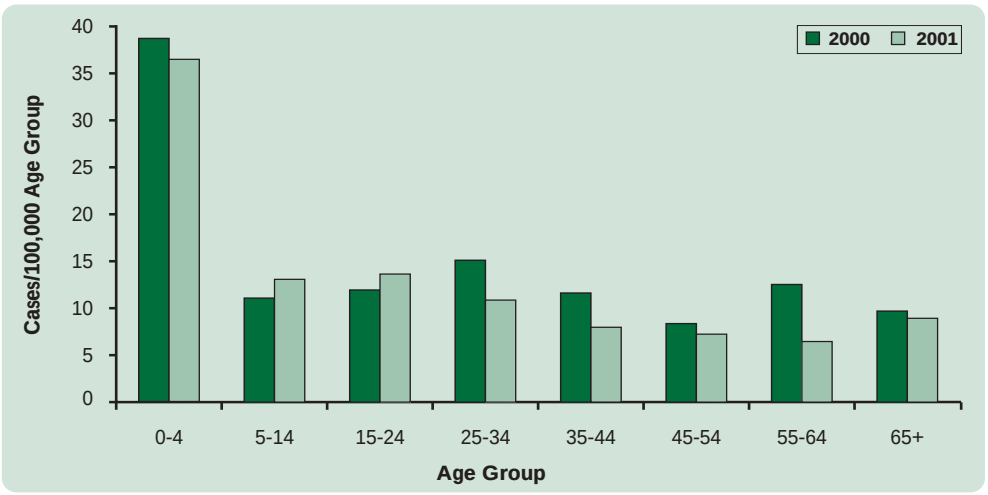

Figure 1. 3. Clinical isolates of *S. enterica* per 100,000 of each age group, 2000 and 2001

(Source: NSRL)

Distribution of salmonellosis cases during the calendar year

Incidence rate of salmonellosis in Ireland, and across Europe, traditionally peak in the summer months, possibly due to higher average ambient temperatures, increased preparation and cooking of meals outdoors and a greater use of prepared chilled foods and salads. Two distinct peaks in cases of salmonellosis (Figure 1.4) were observed in 2000. The first occurred in March and was associated with a large community outbreak of *S.* Typhimurium, mainly in the North Eastern Health Board area. The second peak occurred in August, and while it did not coincide with any known outbreaks, it is consistent with normal seasonal variation in salmonellosis and coincides with the 2001 trend.

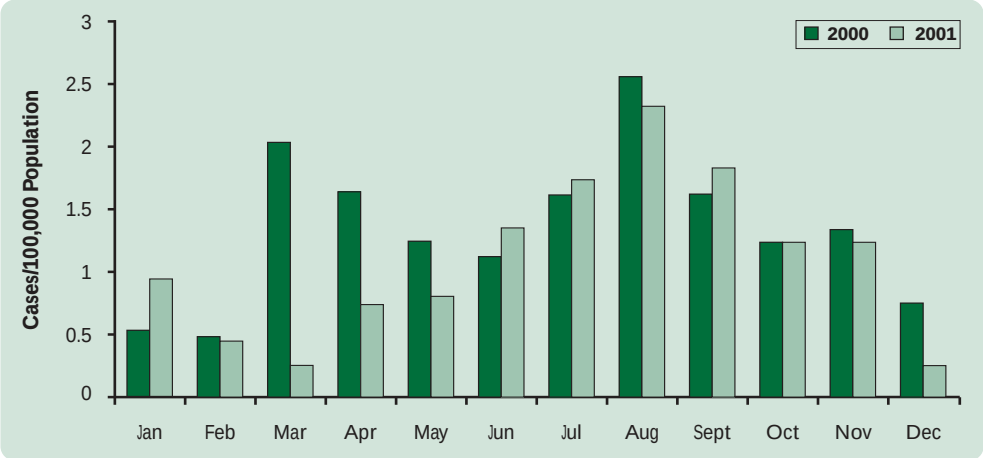

Figure 1. 4. Laboratory confirmed cases of salmonellosis per month, 2000 and 2001

(Source: NSRL)

S. enterica serovars identified from human samples in Ireland, 2000 and 2001

During 2000, the NSRL received 665 *Salmonella enterica* isolates from clinical laboratories around the country giving an incidence rate of 17/100,000 population. In 2001, 543 clinical isolates of *S. enterica* were received, an incidence rate of 14/100,000 population. Two serovars of *S. enterica*, *S.* Enteritidis and *S.* Typhimurium are associated with the vast majority of human salmonellosis cases in Ireland (Table 1.1) and the EU[1]. In contrast to the EU trend[2], *S.* Typhimurium has been more commonly associated with salmonellosis in Ireland than *S.* Enteritidis. However, in 2001 this trend in Ireland was reversed when *S.* Enteritidis accounted for 46% of the *S. enterica* isolates and *S.* Typhimurium accounted for 30%.

S. Bredeney is frequently found in raw poultry meat in Ireland and between 1998 and 2001 was the third most common serovar isolated from human samples.

Table 1. 1. *S. enterica* serovars isolated from human samples between 1998 and 2001

Serovar	1998 (%)	1999 (%)	2000 (%)	2001 (%)
Typhimurium	575 (63.6)	280 (42.2)	284 (43.0)	165 (30.4)
Enteritidis	113 (12.5)	193 (29.1)	239 (35.9)	248 (45.7)
Bredeney	37 (4.1)	63 (9.5)	24 (3.6)	11 (2.0)
Kentucky	21 (2.3)	9 (1.4)	15 (2.3)	4 (0.7)
Dublin	11 (1.2)	2 (0.3)	12 (1.8)	12 (2.2)
Virchow	7 (0.8)	6 (0.9)	9 (1.4)	16 (2.9)
Other	140 (15.5)	102 (16.6)	82 (12.4)	87 (16.0)
Total	**904 (100)**	**664 (100)**	**665 (100)**	**543 (100)**

(Source: NSRL & Clinical Diagnostic Laboratories)

Antibiotic resistance in human isolates of *S. enterica*

Antibiotic resistance is a serious problem in some *Salmonella* spp., especially *S.* Typhimurium[3] (and in particular *S.* Typhimurium phage type DT104) which is often found to be resistant to five or more antibiotics. Data collected in Ireland in 2000 and 2001 (Table 1.2) show high levels of antibiotic resistance among *S.* Typhimurium while other serovars, including *S.* Enteritidis, appear to exhibit lower levels of resistance.

Table 1. 2. Antimicrobial susceptibility of *S. enterica* serovars from human samples, 2000 and 2001

		% of *S. enterica* isolates resistant to antibiotics in 2000/2001						
Serovar	Number 2000/2001	Amp 2000/2001	Chl 2000/2001	Str 2000/2001	Su 2000/2001	Tet 2000/2001	Trim 2000/2001	Nal 2000/2001
S. Typhimurium	286/165	83/65	73/59	78/63	90/65	83/65	16/28	2/2
S. Enteritidis	239/248	8/7	0/0.4	1/5	2/7	3/12	0.5/2	15/24
S. Bredeney	24/11	0/0	0/0	0/18	8/18	0/18	8/0	0/0
S. Kentucky	15/4	7/0	0/0	13/0	80/0	13/0	67/0	13/0
S. Dublin	12/12	0/0	0/0	8/8	0/0	0/0	0/0	0/0
S. Virchow	9/16	22/6	0/0	0/0	11/6	0/6	0/12	56/69

Amp = ampicillin, Chl = chloramphenicol, Str = streptomycin, Su = sulphonamide, Tet = tetracycline, Trim = trimethoprim, Nal = naladixic acid

(Source: NSRL)

Salmonellosis outbreaks

The number of outbreaks in Ireland due to *S. enterica* declined between 1998 and 2001 (Figure 1.5) with 6 and 3 being recorded in 2000 and 2001 respectively. The most significant decline was in outbreaks caused by *S.* Typhimurium which was responsible for 11 outbreaks in 1998 but only 3 in 1999, 2 in 2000 and 1 in 2001. The number of outbreaks attributed to *S.* Enteritidis has remained relatively steady with 2 outbreaks in 2000 and 1 in 2001. *S.* Heidelberg was responsible for the third outbreak in 2001 and along with the *S.* Enteriditis outbreak was caused by person to person transmission. The 2001 outbreak due to *S.* Typhimurium occurred in a household and was thought to be caused by animal contact. The majority of *S.* Enteriditis outbreaks in Ireland have been associated with eggs and poultry products.

Figure 1. 5. Salmonellosis outbreaks in Ireland between 1998 and 2001

(Source: FSAI & NDSC)

The downward trend of outbreaks due to *S. enterica* coincides with the introduction of initiatives such as the DAF National Salmonella Monitoring and Control Programme, the Bord Bia Egg Quality Assurance Scheme along with the greater emphasis placed on the training of food handlers and education of consumers through consumer awareness programmes of the FSAI.

FOOD

Data on *S. enterica* isolates identified in food samples were provided by the Central Veterinary Research Laboratory (CVRL), the Central Meat Control Laboratory (CMCL), the Official Food Microbiology Laboratories (OFML) and the Enhanced Poultry Monitoring Programme carried out by the FSAI and DAF. Results are available from both slaughterhouse/processing plant and retail sectors and presented by food type.

Poultry meat and poultry meat products

In 2000, 9% of the raw poultry meat sampled at processing level was positive for *S. enterica*, this was reduced to 6% in 2001 even though twice the number of samples were tested (Table 1.3). Raw poultry meat sampled at retail level had *S. enterica* in 6% of samples in 2000 and 4% in 2001. The incidence rate of *S. enterica* was much lower for poultry meat products sampled at retail level – less than 1% in both years.

Table 1. 3. *S. enterica* in poultry meat and poultry meat products, 2000 and 2001

		2000		2001	
Food type	**Sampling site**	**Tested**	**Positive**	**Tested**	**Positive**
Raw poultry meat	Processing level	3,422	325 (9%)	7,205	467 (6%)
	Retail	587	38 (6%)	247	9 (4%)
Poultry meat products	Processing level	n/a	n/a	4	0
	Retail	1,292	7 (0.5%)	1,867	3 (0.2%)

(Source: DAF) n/a not available

Table 1.4 outlines data obtained from the Enhanced Poultry Monitoring Programme detailing the type of poultry tested at the processing level (Table 1.4) with duck showing relatively high levels of contamination with *S. enterica* both in 2000 and 2001.

Table 1. 4. *S. enterica* in poultry sampled at the processing level, 2000 and 2001

	2000		2001	
Sample	**Tested**	**Positive**	**Tested**	**Positive**
Chicken	3,017	280 (9%)	2,724	188 (7%)
Turkey	252	17 (7%)	275	20 (7%)
Duck	86	24 (28%)	74	30 (41%)
Unspecified	67	4 (6%)	215	8 (4%)
All poultry	3,422	325 (9%)	3,288	246 (7%)

(Source: FSAI & DAF)

Serological testing showed that there was a wide number (>25) of serovars detected in poultry but that *S.* Bredeney was particularly prevalent (Figure 1.6). Also, data from private laboratories in 2001 showed that of 221 positive samples, 98 contained *S.* Kentucky, 39 contained *S.* Bredeney and 29 contained *S.* Typhimurium.

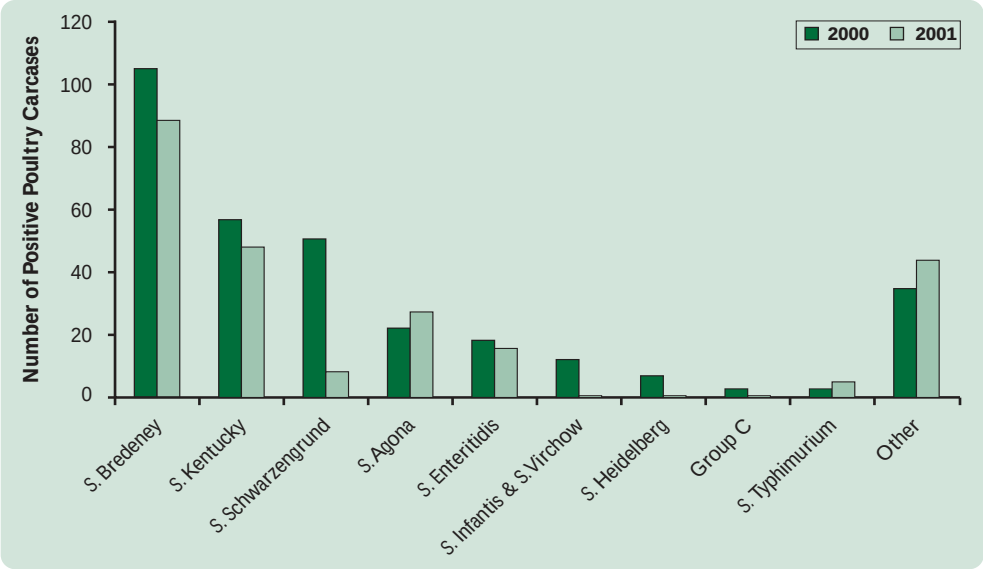

Figure 1. 6. *S. enterica* serovars in poultry carcases, 2000 and 2001

(Source: FSAI & DAF)

Eggs and egg products

Only one of the samples of eggs and egg products tested in 2000 or 2001 was positive for *S. enterica* (Table 1.5). This was in a sample of raw liquid egg that was contaminated with *S.* Enteritidis.

Table 1. 5. *S. enterica* in eggs and egg products, 2000 and 2001

	2000		2001	
Sample	**Tested**	**Positive**	**Tested**	**Positive**
Table eggs	208	0	251	0
Egg preparations	13	1 (8%)	4	0
Egg products	479	0	604	0

(Source OFML)

Pork and pork products

S. enterica was identified in slaughterhouse/processing plant pork samples in 2000 and 2001 and raw pork at retail level in 2001 (Table 1.6). Of more than 1,200 samples of pork meat products tested in 2000 and 2001, only 1 each year was found to be contaminated with *S. enterica.*

Table 1. 6. *S. enterica* in pork and pork products, 2000 and 2001

		2000		2001	
Food type	**Sampling site**	**Tested**	**Positive**	**Tested**	**Positive**
Raw pork meat	Slaughterhouse/ processing level	1,245	108 (9%)	3,086	144 (5%)
	Retail	15	2 (13%)	31	0
Pork meat products	Slaughterhouse/ processing level	n/a	4 (n/a)	28	1 (4%)
	Retail	1,286	1 (0.8%)	1,251	1 (0.08%)

(Source: CVRL, OMFL & CMCL) n/a not available

Beef, veal and their products

Though more than 2,000 samples of beef or veal and their products were tested each year in 2000 and 2001, the levels of *S. enterica* identified were very low (Table 1.7).

Table 1. 7. *S. enterica* in beef or veal products, 2000 and 2001

		2000		2001	
Food type	**Sampling site**	**Tested**	**Positive**	**Tested**	**Positive**
Raw beef/veal meat	Slaughterhouse/ processing level	1,790	4 (0.2%)	2,613	4 (0.2%)
	Retail	39	0	38	1 (3%)
Beef/veal meat products	Slaughterhouse/ processing level	n/a	1 (n/a)	nt	na
	Retail	466	0	681	0

(Source: CVRL, OFML & CMCL) n/a not available, nt not tested, na not applicable

Lamb, sheep and their products

S. enterica was not detected in any ovine meat or meat products in 2000 or in 2001 (Table 1.8).

Table 1. 8. *S. enterica* in ovine and ovine products, 2000 and 2001

		2000		2001	
Food type	**Sampling site**	**Tested**	**Positive**	**Tested**	**Positive**
Raw lamb	Slaughterhouse/ processing level	185	0	nt	na
	Retail	15	0	nt	na
Ovine meat products	Slaughterhouse/ processing level	n/a	0	nt	na
	Retail	59	0	31 (sheep)	0

(Source: CVRL, OFML & CMCL)

n/a not available, nt not tested or classified differently (eg. see other meat section), na not applicable

Fish

There were no data available on the prevalence of *S. enterica* contamination of fish at the processing level in Ireland for 2000 or 2001. At retail level, in 2000, two out of 542 samples (0.4%) of fish products tested by the OFMLs were positive for *S.* Bredeney, both of these were in oyster samples. In 2001, two out of 624 fish products (0.3%) sampled at retail level contained *S. enterica*, the serovars *S.* Enteritidis and *S.* Bredeney were identified.

Other meats and meat products and mixed meat products

The incidence of *S. enterica* was low in other meats and meat products as well as in unspecified meat and meat products for both 2000 and 2001 (Figure 1. 9).

Table 1. 9. *S. enterica* in other meat or meat products, 2000 and 2001

		2000		2001	
Food type	**Sampling site**	**Tested**	**Positive**	**Tested**	**Positive**
Raw meat					
Game	Retail	4	0	nt	na
Offal	Retail	1	0	nt	na
Pork & poultry	Retail	6	0	nt	na
Unspecified	Retail	15,432	111 (0.7%)	nt	na
Minced meat	Retail	81	3 (4%)	nt	na
Other	Processing	nt	na	7,368	9 (0.1%)
Meat products					
Game	Retail	22	0	nt	na
Pork & poultry	Retail	nt	na	44	0
Unspecified	Retail	117	0	nt	na
Salami	Retail	nt	na	31	0
Pate	Retail	nt	na	21	0
Cooked meats	Processing	nt	na	1,789	0
Other	Processing	nt	na	111	2 (2%)

(Source: CVRL, OFML & CMCL) nt not tested or classified differently, na not applicable

Milk and milk products

The levels of *S. enterica* in milk and milk products in Ireland is monitored through a compulsory monitoring programme based on Council Directive 92/46/EEC (S.I. No. 9 of 1996). The incidence of *S. enterica* in milk and milk products was very low in 2000 and in 2001 (Table 1.10). *S.* Brandenbery (5 samples), *S.* Bredeney (3 samples) and *S.* Kentucky (2 samples) were identified in the ready-to-eat milk products tested in 2001.

Table 1. 10. *S. enterica* in milk and milk products, 2000 and 2001

	2000		2001	
Food type	**Tested**	**Positive**	**Tested**	**Positive**
Raw milk	29	1 (3%)	nt	na
Milk powder	nt	na	332	0
Ready-to-eat milk products	7,605	0	11,138	10 (0.09%)
Other milk products	4,485	0	6,106	0

(Source: OFML) nt not tested or classified differently, na not applicable

Other foods

Few cases of contamination of other foods by *S. enterica* were reported in 2000 or 2001 (Table 1.11). Mushroom contamination with *S.* Kedougou, a serovar usually associated with poultry and birds was a problem detected in 2001.

Table 1. 11. *S. enterica* in other foods sampled at processing or retail level, 2000 and 2001

	2000		2001	
Food type	**Tested**	**Positive**	**Tested**	**Positive**
Fruit & vegetables	1,530	2 (0.1%)	366	5 (1%)
Mushrooms	nt	na	373	24 (6%)
Cereals	202	0	nt	na
Sandwiches	nt	na	456	0
Bakery products	168	0	nt	na
Ices & desserts	205	0	nt	na
Soups/broths/sauces	277	0	nt	na
Confectionary	9	0	nt	na
Baby food	46	0	nt	na
Herbs & spices	4	0	nt	na
Non alcoholic drinks	12	0	nt	na
Nut & nut products	1	0	nt	na
Fat & oils	1	0	nt	na
Potable water	nt	na	553	2 (0.4%)
Unspecified foods	96	0	5,853	25 (0.4%)
Other foods	nt	na	3,322	4 (0.1%)

(Source: CVRL & OFML) nt not tested or classified differently, na not applicable

ANIMALS

Salmonellosis caused by *S.* Typhimurium or *S.* Enteritidis is a notifiable animal disease. While certain serovars are host-adapted and can cause severe symptoms in animals (e.g. *S.* Choleraesuis in pigs and *S.* Dublin in cattle), livestock can also be carriers of an infection without showing any clinical symptoms. Started in 1988, a compulsory DAF National Salmonella Monitoring and Control Programme in poultry breeding flocks and table egg layers is ongoing. A Pig Salmonella Control Programme commenced in 1996 with samples of pig meat being taken at the slaughterhouse. However, the programme was temporarily suspended in 1999, but has since recommenced.

Poultry

The DAF National Salmonella Monitoring and Control Programme involves official and private sampling of both domestic chickens (*Gallus gallus*) and non-*Gallus gallus* flocks. Flocks, including those for breeding purposes, are categorised as either layers or broilers depending on whether their purpose is to lay eggs or to produce meat.

Breeding flocks

Breeding flocks from both meat and egg production lines in 2000 and 2001 were monitored under the Zoonosis Directive 92/117/EEC (S.I. No. 2 of 1996)*. Flocks are officially sampled six times each year at hatchery level where samples of fluff and meconium are taken and if positive for *S.* Enteritidis or *S.* Typhimurium are slaughtered out.

Broiler Breeders: In 2000, 19% of broiler breeder flocks were positive for *S. enterica* while in 2001 there were just 5% positive (Table 1.12). The figures include repeated tests of positive flocks and are therefore an overestimation of the level of flock infection. The serovars most commonly isolated in 2000 were *S.* Anatum/Meleagridis accounting for 50% of the total isolates, *S.* Livingstone, *S.* Kentucky, *S.* Idikan/Kedougou and *S.* Infantis/Virchow. In 2001, the serovars most often isolated were *S.* Kentucky and *S.* Livingstone.

Layer Breeders: *S. enterica* was not isolated from any of the layer breeder flocks that were tested every two months in 2000 and 2001 (Table 1.12).

Production flocks

Broilers: Broiler carcases were tested for *S. enterica* as part of the Enhanced Poultry Monitoring Programme targeted at the processing level as reported in Table 1.4.

Layers: As part of the national quality assurance scheme for egg production flocks, testing for *S. enterica* is carried out on an annual basis on environmental dust samples. *S. enterica* was found in 15 out of 331 (5%) table egg laying flocks sampled in 2000 but in only 3 out of 436 (0.7%) samples tested in 2001. Seven of the flocks found positive in 2000 were infected with *S.* Enteritidis and were slaughtered out in accordance with national policy. The other serovars isolated in 2000 were *S.* Kentucky (x 3), *S.* Agona/Derby (x 2), *S.* Bredeney, *S.* Mbandaka and *S.* Livingstone. In 2001, only serovars *S.* Bredeney and *S.* Senftenberg were identified.

*Directive 92/117/EEC has been repealed by Directive 2003/99/EC.

Table 1. 12. *S. enterica* in poultry breeding flocks, 2000 and 2001

		2000		2001	
Flock type	**Age/Stage**	**Tested**	**Positive**	**Tested**	**Positive**
Broiler breeding	Productive period	514	96 (19%)	681	34 (5%)
	Grandparent stock	149	0	32	1 (3%)
Laying breeding	Productive period	55	0	34	0

(Source: DAF)

Other poultry flocks

Official and private testing of non-*Gallus gallus* flocks is also carried out in Ireland (Table 1.13). *S.* Bredeney was the only serovar isolated from duck flocks in 2000 and 2001, while *S.* Kentucky was the only serovar isolated from turkey flocks.

Table 1. 13. *S. enterica* in duck and turkey flocks, 2000 and 2001

	2000		2001	
Flock type	**Tested**	**Positive**	**Tested**	**Positive**
Ducks	22	4 (18%)	14	6 (43%)
Turkeys	134	9 (7%)	176	2 (1%)

(Source: DAF)

Pigs

The Pig Salmonella Control Programme was temporarily suspended in 1999 thus data were not available from this programme in 2000 or 2001. However, some relevant data were available from regional laboratory testing. In 2000, 23 out of the 54 herds (43%) examined were positive for *S. enterica*. *S.* Typhimurium was the serovar most frequently isolated (10 herds), other serovars isolated were *S.* Derby (6 herds), *S.* Bredeney (5 herds), *S.* Agona/Derby (4 herds) and *S.* Kentucky (2 herds).

Clinical investigations of specimens from pigs submitted to the regional veterinary laboratories accounted for 36 *S. enterica* positive samples in 2000 and 45 in 2001. *S.* Typhimurium was the predominant serovar isolated from these samples, being found in 17 samples in 2000 and 35 in 2001.

Cattle

In 2000, clinical investigations of specimens from cattle revealed 906 *S. enterica* positive samples, 815 (90%) of which were *S.* Dublin. *S. enterica* was identified in 533 samples in 2001 and though *S.* Dublin was again identified, the total numbers were not recorded. *S.* Dublin is a cattle-adapted serovar that can cause disease in animals and may necessitate veterinary attention. *S.* Typhimurium was the next most frequently identified serovar, being found in 82 (9%) of the positive samples in 2000, and 36 (7%) in 2001.

Sheep

Of the 15 clinical samples from sheep that were positive for *S. enterica* in 2000, 11 were identified as *S.* Dublin, and 3 were *S.* Typhimurium. In 2001, there were 9 positive clinical samples and only *S.* Dublin was identified.

Other animals

A small number of samples were tested during clinical investigation of other animals. In 2000, *S.* Typhimurium was identified in 6 horses, 4 dogs, 3 cats, and one deer sample. *S.* Dublin was isolated from 2 dogs and 1 cat. Two samples from mink were also positive for *S. enterica* but the serovars involved were not identified. In 2001, *S.* Typhimurium was identified in 2 horses, 1 dog, 1 cat, and 4 avian samples.

Antibiotic resistant *S. enterica* in animals

The sensitivity of 3 *S. enterica* serovars, *S.* Typhimurium, *S.* Typhimurium DT104 and *S.* Dublin, to various antimicrobial agents was tested by DAF (Table 1.14). The majority of the isolates tested were from bovine sources.

Resistance to florfenicol by *S.* Typhimurium DT 104 isolates was very high in 2000 at 95%, but was 0% in 2001. Resistance to florfenicol was also lower in 2001 for *S.* Typhimurium at 19% as opposed to 43% in 2000. Resistance to tetracycline was relatively high for *S.* Typhimurium isolates: 63% in 2000 and 44% in 2001. Very few of the *S.* Dublin isolates were resistant to the various antimicrobials investigated, and this serovar was tested in large numbers in both years.

Table 1. 14. Antibiotic resistance in *S. enterica* isolated from animals, 2000 and 2001

		2000		2001	
Antimicrobial	**Serovar**	**Tested**	**Resistant**	**Tested**	**Resistant**
Tetracycline	S. Dublin	833	16 (2%)	585	6 (1%)
	S. Typhimurium	116	73 (63%)	48	21 (44%)
	S. Typhimurium DT 104	26	8 (31%)	23	3 (13%)
Florfenicol	S. Dublin	833	5 (0.6%)	585	0
	S. Typhimurium	116	50 (43%)	48	9 (19%)
	S. Typhimurium DT 104	21	20 (95%)	23	0
Enrofloxacin	S. Dublin	833	0	585	0
	S. Typhimurium	116	0	48	1 (2%)
	S. Typhimurium DT 104	21	0	23	1 (4%)
Sulphonamide /Trimethoprim	S. Dublin	833	27 (3%)	585	18 (3%)
	S. Typhimurium	116	26 (22%)	48	16 (33%)
	S. Typhimurium DT 104	26	3 (12%)	23	6 (26%)
Neomycin	S. Dublin	833	10 (1%)	nt	na
	S. Typhimurium	116	3 (3%)	48	5 (10%)
	S. Typhimurium DT 104	26	0	23	1 (4%)
Gentamycin	S. Dublin	nt	na	585	5 (0.9%)

(Source: DAF) nt not tested; na not applicable

ANIMAL FEED

Feed contaminated with *S. enterica* has the potential to infect animals. DAF is responsible for the implementation of legislation concerning animal feed and its officers sample feed and feed ingredients at ports and feed mills.

Table 1.15. ***S. enterica*** **in feed materials, 2000 and 2001**

	2000		2001	
	Tested	**Positive**	**Tested**	**Positive**
Feed material of animal origin				
Meat & bone meal	691	17 (2%)	301	2 (0.7%)
Poultry offal meal	1	0	nt	na
Ingredient of animal origin	nt	na	1,186	9 (0.8%)
Fish meal	1	0	2	1 (50%)
Ingredient of unspecified origin	nt	na	244	11 (5%)
Feed material of vegetable origin				
Barley (& derived)	nt	na	4	0
Wheat (& derived)	11	0	7	0
Maize (& derived)	nt	na	5	0
Other cereal (& derived)	1	0	2	0
Soya bean derived	15	0	5	0
Other oil seeds/fruits	12	0	8	1 (13%)*
Other/unspecified plant	3	0	1,701	4 (0.2%)
Compound feed for				
Cattle	3	0	39	2 (5%)
Pigs	2	0	9	0
Poultry	59	0	2,363	126 (5%)
Sheep	1	0	9	0
Fish	nt	na	2	0
Horse	nt	na	1	0

(Source: DAF) nt not tested, na not applicable, * sunflower seed

Feed materials

In 2000 and 2001, as well as previous years, sampling of feed materials under the DAF National Salmonella Monitoring and Control Programme was focused on feed ingredients of animal origin and poultry feed mills where environmental and finished feed samples are taken (Table 1.15). The use of meat and bone meal in feed for food producing animals is banned in accordance with Council Decision 2000/766/EC (S.I. No. 551 of 2002). Thus, in the years following 2000/2001 there is to be a greater emphasis on sampling and testing of feed materials other than meat and bone meal.

In 2000, 2% of the meat and bone meal samples tested were positive for *S. enterica*. Serovars isolated included: *S.* Mikawasima, *S.* Derby, group C, *S.* Senftenberg, *S.* Infantis, *S.* Virchow, *S.* Montevideo and Group E/G. In 2001, 0.7% of meat and bone meal samples were positive. *S.* Enteritidis or *S.* Typhimurium serovars were not isolated in 2000 or in 2001. In 2001, 1186 samples of unspecified animal origin were also tested, but only 0.8% were positive with most of the isolates being Group E or G.

In 2000, there were very few samples of feed material derived from fish or of vegetable origin tested for *S. enterica*, and none were positive. In 2001, four positive samples of unspecified plant origin were detected from 1701 samples tested, *S.* Enteritidis or *S.* Typhimurium serovars were not identified in any of those positive samples.

Compound feed

Compound feed is usually heat-treated during production and thus the presence of *S. enterica* is rare. Samples of compound feeding stuffs for various animals were tested and some cattle and poultry feeding stuffs were found to contain *S. enterica* in 2001.

As part of the DAF National Salmonella Monitoring and Control Programme for poultry in Ireland, environmental dust samples from feed mills producing poultry feed are routinely collected. In 2000, *S. enterica* was found in 55 out of the 660 (8%) samples taken from 13 mills. The percentage of positive samples within each mill ranged from 0-50%. In 2001, 118 out of 921 (13%) dust and swab samples were positive and all but two of the isolates were identified as *S.* Kentucky.

2. CAMPYLOBACTERIOSIS

Infection by *Campylobacter* spp. was identified as a cause of diarrhoeal illness in humans in the 1970s and later it became evident that this was one of the more common causes. *Campylobacter jejuni* and to a lesser extent, *Campylobacter coli,* are most often implicated in human disease. In many countries, including Ireland, the number of infections caused by *Campylobacter* spp. has surpassed that of *S. enterica*[4]. *Campylobacter* spp. are widespread in the intestinal tract of warm-blooded animals used for food production. Poultry in particular are frequently colonised and poultry meat is thought to be one of the main sources of human infections caused by *Campylobacter* spp.

The incubation period for campylobacteriosis is usually between 2 and 5 days, and symptoms include diarrhoea (sometimes bloody), cramping, abdominal pain and fever. Though the illness is generally self-limiting the rate of hospitalisation is high[5] and complications arise in about 1% of cases. Infections caused by *Campylobacter* spp. have been associated with the development of several sequelae (Guillain-Barré syndrome, reactive arthritis, Reiters syndrome, and haemolytic uraemic syndrome) and the social and economic costs have been estimated to be considerable[6]. Even though *Campylobacter* spp. replicate poorly in food, they can survive in the food distribution system and because the estimated infective dose is low, as few as 500 cells can cause illness.

HUMAN

Campylobacteriosis was not on the list of notifiable infectious diseases in 2000 and 2001. In humans it was notified in the category 'Food Poisoning (bacterial other than salmonella)'. In accordance with the Zoonosis Directive, a survey is conducted annually in conjunction with the health boards whereby clinical laboratories voluntarily provide data on laboratory isolates of *Campylobacter spp*. from clinical specimens.

There were 1,613 *Campylobacter* related human infections reported by laboratories in 2000 (41 cases/100,000) and 1,286 cases in 2001 (33 cases/100,000). There were no outbreaks of campylobacteriosis in 2000, but in 2001 there was one outbreak involving 23 cases. The species of *Campylobacter* responsible for the cases were not recorded (and/or not identified).

In most EU countries, the number of cases of campylobacteriosis increased by an average of 31% between 1995 and 1999[2]. Ireland had the largest overall increase of 224% of reported cases and it is likely that at least some of this dramatic increase can be attributed to an increase in detection and reporting of cases. While there were 2,085 cases reported in 1999[2], numbers declined in 2000 and again in 2001.

Seasonal variation in the number of cases of campylobacteriosis appears to be a factor in Ireland (Figure 2.1) as it does in other EU Member States[7]. The number of cases per month in 2000 was highest in May, though a similar number was recorded earlier in March. The rise in the number of cases per month in the summer of 2001 was not as pronounced as that in 2000, with highs being recorded in May and again in July.

Figure 2. 1. Cases of campylobacteriosis reported to the NDSC, 2000 and 2001

(Source: NDSC)

Children under five years of age had the highest incidence rate in both 2000 and in 2001 (Figure 2.2). There were 68 cases in babies under 1 year old in 2000 and 89 in 2001.

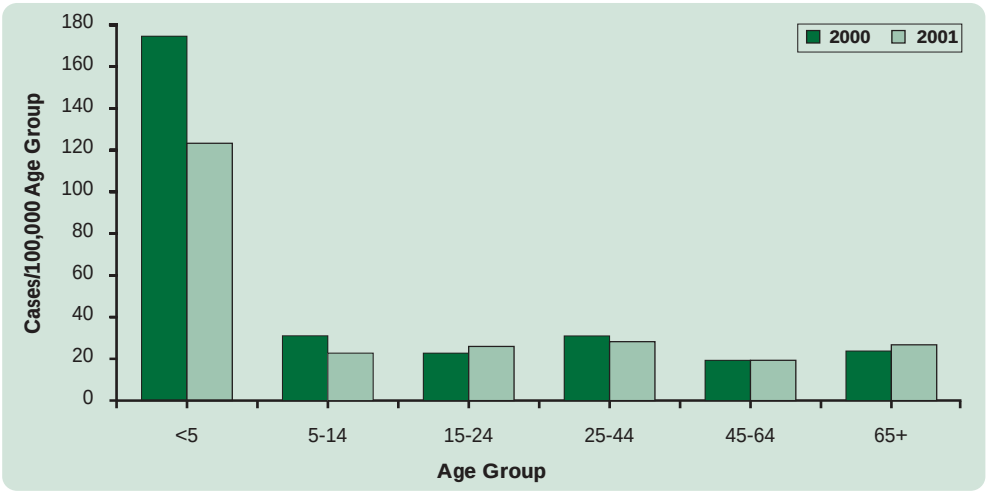

Figure 2. 2. Incidence rate of campylobacteriosis in Ireland by age group, 2000 and 2001

(Source: NDSC)

FOOD

An enhanced surveillance programme for poultry (co-ordinated by the FSAI and DAF) commenced in 2000 to detect *S. enterica* and *Campylobacte*r spp. in raw poultry at Irish processing plants. Around two thirds of the samples were of Irish origin. In 2000 and 2001, approximately half of the samples were positive for *Campylobacter* spp., mostly *C. jejuni* (Table 2.1).

Table 2. 1. Thermophilic *Campylobacter* spp. in poultry at processing level, 2000 and 2001

	2000		2001	
Sample	**Tested**	**Positive**	**Tested**	**Positive**
Chicken	3017	1,668 (55%)	2688	1,543 (57%)
Turkey	252	98 (39%)	272	94 (35%)
Duck	86	58 (67%)	74	45 (61%)
Unspecified	67	25 (37%)	180	63 (35%)
All poultry	3422	1,849 (54%)	3214	1,745 (54%)

(Source: DAF & FSAI)

Campylobacter spp. were isolated from 39% of the raw poultry and 44% of the raw offal tested at retail level in 2000 (Table 2.2). In 2001, only 13% of raw poultry sampled at retail level was found to contain *Campylobacter* spp. (Table 2.2), despite the fact that, similar to that in 2000, 54% of poultry sampled at the processing plant contained *Campylobacter* spp. (Table 2.1).

Table 2. 2. *Campylobacter* spp. in food at retail level, 2000 and 2001

	2000		2001	
Food type	**Tested**	**Positive**	**Tested**	**Positive**
Raw meat				
Beef & veal	13	0	10	0
Pork	9	0	9	0
Poultry	391	152 (39%)	151	19 (13%)
Offal	16	7 (44%)	nt	na
Meat products				
Beef & veal	125	0	121	0
Pork	202	0	137	0
Poultry	579	6 (1%)	903	1 (0.1%)
Poultry with Pork	14	0	14	0
Other	nt	na	17	0
Other foods				
Fish products	52	0	48	0
Dairy products	27	0	20	0
Eggs/egg products	22	0	13	0
Fruit & vegetables	83	0	29	0
Sandwiches	nt	na	82	0
Cereals	49	0	nt	na
Soups & sauces	61	0	nt	na
Other	46	0	216	0

(Source: OFML) nt not tested, or classified as "other", na not applicable as no samples were tested

ANIMALS

Most domestic animals, and in particular poultry, are readily colonised with *C. jejuni* and to a lesser extent *C. coli*. Pigs are the exception, as they are almost universally colonised with *C. coli*[8]. While *Campylobacter* spp. rarely cause disease in livestock, a significant number can be carriers. There is no national monitoring programme for *Campylobacter* spp. in animals in Ireland though in 2000, a special survey carried out by DAF (CVRL) examined broilers at the slaughterhouse and found that 55 out of the 65 flocks tested (85%) were positive for *Campylobacter* spp.. Clinical investigations at regional veterinary laboratories led to the reporting of 101 cases of *C. jejuni* in cattle, 6 in sheep, 3 in dogs and one flock of turkeys. In 2001, there was no broiler survey, but the laboratories reported 34 cases of *C. jejuni* in cattle and 180 in unspecified animals.

3. LISTERIOSIS

The genus listeria comprises six species, though most cases of human and animal listeriosis are caused by *Listeria monocytogenes* with three serovars in particular, 1/2a, 1/2b and 4b, being linked to human illness[9]. The organism is found widely distributed in the environment, and has been detected in soil, water, sewage and particularly in decaying vegetable material. The consumption of contaminated foods is the main route of transmission of *Listeria* spp. in both humans and animals. Human infection can also result from direct contact with an infected animal. Listeriosis symptoms range from a mild flu-like condition to severe life-threatening infections characterised by septicaemia and meningoencephalitis. Particularly vulnerable are pregnant women (infection can result in abortion or stillbirth), neonates, the elderly and immunocompromised. Even though listeriosis can be treated with antibiotics the mortality rate at between 20 and 40% can be relatively high[8].

Because of its ubiquitous nature, its ability to grow at refrigeration temperatures and the potentially serious consequences of human infection, *L. monocytogenes* is considered a serious threat to public health worldwide.

HUMAN

Listeriosis was not a notifiable disease in Ireland in 2000 and 2001 but the NDSC has been carrying out surveillance since 1999. Each year since 1995 between two and seven cases of listeriosis have been reported[2].

There were no listeriosis outbreaks in Ireland in 2000 or in 2001, but in both years there were seven laboratory reports of listeriosis, an incidence rate of 0.18/100,000 population. In 2000, there were 4 cases in males and 3 in females; one case was in a baby while four were in people over 45 years, the age of the remaining 2 cases was unrecorded. *L. monocytogenes* was isolated in 3 of the cases. In 2001, 3 cases were in males, 3 in females and for one the gender was unrecorded. Three of the cases were in babies, one was in the 1-4 age group, one in the 15-24 age group and two were in the 65+ age group.

FOOD

L. monocytogenes can survive and even grow at refrigeration temperatures and therefore ready-to-eat foods, particularly those kept in chill cabinets and domestic fridges, are a potential source of listeriosis. Although *L. monocytogenes* was isolated relatively frequently in some foods (Tables 3.1 & 3.2), food is considered safe for human consumption provided the number of *L. monocytogenes* present is less than 100 viable cells per gram of food[10]. In 2000 and in 2001, 2% of ready-to-eat foods tested were found to contain some level of *L. monocytogenes* (Table 3.2). Cooking effectively kills *L. monocytogenes* present in raw food. However, raw or uncooked food contaminated with *L. monocytogenes* is a potential source for cross contamination of ready-to-eat foods. In 2000 and 2001, 2% and 3% respectively were found to be contaminated with *L. monocytogenes* (Table 3.1).

Table 3. 1. *L. monocytogenes* in raw food at retail level, 2000 and 2001

	2000		2001	
Food type	**Tested**	**Positive**	**Tested**	**Positive**
Raw meat				
Beef & veal	144	5 (3%)	24	2 (8%)
Pork	757	5 (1%)	25	0
Poultry	243	13 (5%)	66	3 (5%)
Lamb	8	1 (13%)	nt	na
Unspecified	3	2 (66%)	nt	na
Meat products				
Beef & veal	nt	na	87	1 (1%)
Pork	nt	na	58	2 (3%)
Poultry	nt	na	130	2 (2%)
Sheep	nt	na	2	0
Other foods				
Fish / fish products	64	2 (3%)	42	4 (10%)
Eggs / egg products	8	0	8	0
Fruit & vegetables	nt	na	8	1 (13%)
Cereals	5	0	nt	na
Other	nt	na	57	0
Total	1,232	28 (2%)	507	15 (3%)

(Source: OFML) nt not tested, or classified differently, na not applicable as no samples were tested

Table 3. 2. *L. monocytogenes* in ready-to-eat food at retail level, 2000 and 2001

	2000		2001	
Food type	**Tested**	**Positive**	**Tested**	**Positive**
Meat & meat products				
Beef & veal	321	7 (2%)	546	12 (2%)
Pork	437	47 (11%)	1,108	37 (3%)
Poultry	771	43 (6%)	1,070	27 (3%)
Pork with poultry	59	0	nt	na
Beef with pork	1	0	nt	na
Beef with poultry/pork	1	0	nt	na
Lamb	56	1 (2%)	25	0
Game	1	0	nt	na
Unspecified	94	1 (1%)	90	4 (4%)
Other foods				
Milk/milk products	11,010	31 (0.3%)	9,943	2 (0.02%)
Fish/fish products	284	12 (4%)	821	62 (8%)
Eggs/egg products	428	30 (7%)	529	34 (6%)
Fruit & vegetables	1,498	84 (6%)	272	11 (4%)
Sandwiches	nt	na	432	25 (6%)
Cereals	261	11 (4%)	nt	na
Soups & sauces	216	3 (1%)	nt	na
Ices & desserts	159	7 (4%)	nt	na
Bakery products	131	3 (2%)	nt	na
Other	14	1 (7%)	2943	84 (3%)
Unclassified	86	1 (1%)	nt	na
Total	15,828	279 (2%)	17,779	298 (2%)

(Source: OFML) nt not tested, or classified differently, na not applicable as no samples were tested

ANIMALS

L. monocytogenes is the primary cause of listeriosis in animals although up to 10% of cases are due to *Listeria ivanovii* [8]. There was no routine testing of animals for *Listeria* spp. in 2000 and 2001, however, its presence in the brains of cattle and sheep has previously been discovered during examinations for BSE and scrapie.

4. VEROCYTOTOXIGENIC E. COLI (VTEC) INFECTION

Escherichia coli is found in the intestinal tracts of humans and other warm-blooded animals and while most strains are not pathogenic, some strains can cause serious illnesses. Verocytotoxigenic *E. coli* (VTEC), the most common of which is *E. coli* O157:H7, was first identified in 1975 and in 1982 was linked to outbreaks of haemorrhagic colitis in the USA. It is now recognised as a serious global public health threat. Though the illness is usually self limiting to about 8 days, symptoms can range from mild to severe and include diarrhoea (often bloody) and abdominal cramps while severe complications, such as haemolytic uraemic syndrome (HUS) or thrombotic thrombocytopenic purpura can also occur among vulnerable groups such as the very young and elderly. Cattle are the main reservoir for this microorganism but other animals can also be reservoirs. Humans may get infected by consumption of contaminated food, in particular inadequately cooked ground/minced beef, unpasteurised milk and contaminated or untreated water. Direct contact with infected animals is another mode of transmission while person-to-person contact and environmental contamination with animal faeces have also been implicated in some infections.

HUMAN

In Ireland there was no statutory requirement to notify cases of *E. coli* O157 in 2000 and 2001 though the NDSC, in collaboration with regional public health departments, has carried out surveillance of *E. coli* O157 since 1999. Some public health departments also report on VTEC other than *E. coli* O157 to this system.

In 2000, 42 cases of VTEC infection were identified (1.1 cases/100,000), 5 cases are not included in this population rate as they were in non-residents. HUS occurred in 5 cases, one of which was fatal. During 2001, 52 cases of *E. coli* O157 infection were reported, (1.3 cases/100,000), including 3 cases of HUS. While a majority of the cases occurred in the summer months of 2000 and 2001 (Figure 4.1), possibly for the same reasons as other food related infections such as salmonellosis, there was also a significant increase in the incident rate in March of 2000. Children under the age of 5 years were disproportionately represented in the incidence rate of *E. coli* O157 (Figure 4.2).

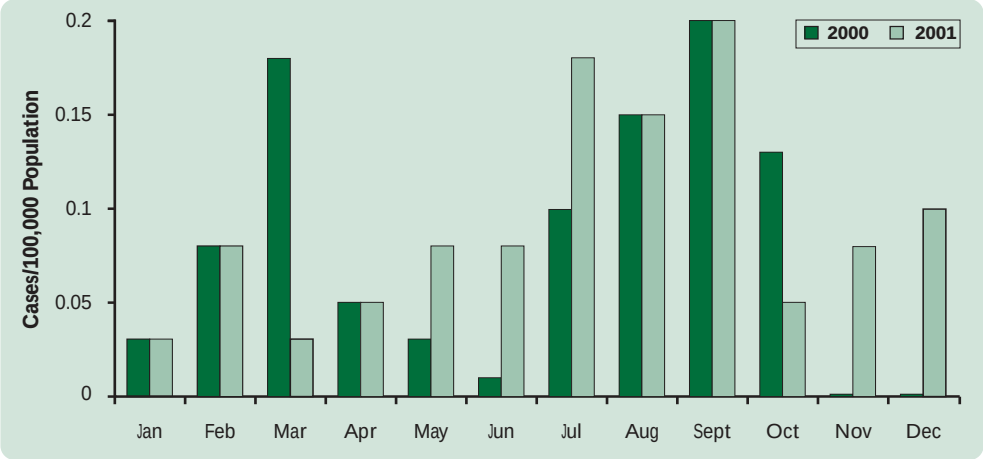

Figure 4. 1. Incidence rate by month of *E. coli* O157 in Ireland, 2000 and 2001

(Source: NDSC)

The first reported outbreak of *E. coli* O157 in Ireland occurred in a children's developmental day centre in November 1995. The outbreak involved 13 children, 1 developed full HUS and 4 had bloody diarrhoea. There were 4 outbreaks of VTEC infection in 2000 and 12 in 2001. All of the outbreaks in 2000, and 11 of the 12 in 2001 were family outbreaks. *E. coli* O157 was responsible for 3 of the 4 outbreaks in 2000 and all 12 outbreaks in 2001

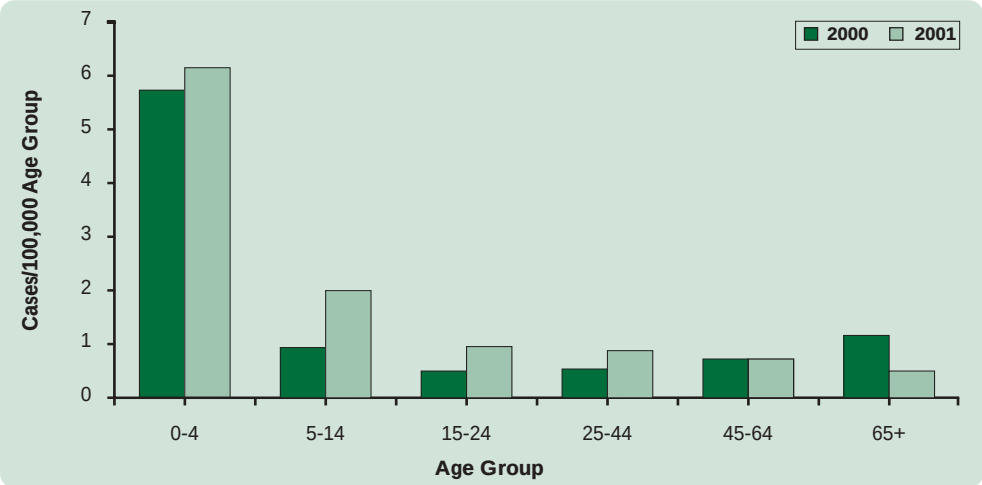

Figure 4. 2. Incidence rate of *E. coli* O157 infections in Ireland by age group, 2000 and 2001

(Source: NDSC)

FOOD

The presence of *E. coli* O157 in food is of concern, particularly since the minimum infectious dose is estimated to be as few as 10 viable bacteria. Three out of 279 samples of beef and veal tested in 2000 were found to be contaminated with *E. coli* O157. However, *E. coli* O157 was not identified in any of the other 282 food samples including meat and fish (and their products), milk, eggs, cereals and vegetables tested in 2000. *E. coli* O157 was not detected in samples of raw beef and veal (131 samples), pork (3 samples) and poultry (4 samples) tested in 2000. Similarly in 2001, *E. coli* O157 was not detected in any samples of meat (66 samples), milk (32 samples), fish (11 samples) or egg (2 samples) as well as other foods (39 samples).

ANIMALS

Data on the prevalence of VTEC in animals are unavailable for 2000 and 2001. A clean cattle policy was introduced into Ireland in 1998 in an attempt to minimise the risk of cross contamination of carcases by dirty hides.

5. TUBERCULOSIS

Human tuberculosis (TB) is mainly caused by *Mycobacterium tuberculosis*, but may also be associated with *Mycobacterium bovis* which is known to cause bovine tuberculosis. Historically, the main route of transmission of *M. bovis* to humans has been through the consumption of unpasteurised milk, though direct contact with infected animals and person-to-person contact have also been implicated.

HUMAN

Notification rates of TB have declined in Ireland in recent years (Figure 5.1) and the age profile suggests that cases now presenting for clinical care are manifestations of primary infection acquired many years ago[11]. A total of 395 notifications of human TB were made in 2000 and 409 in 2001 with *M. bovis* being implicated in a total of 4 cases for the two years, the remainder being due to *M. tuberculosis*.

Zoonotic TB is not considered a significant public health threat in Ireland at present as *M. bovis* infection accounts for only a very small proportion of cases of locally acquired TB[11].

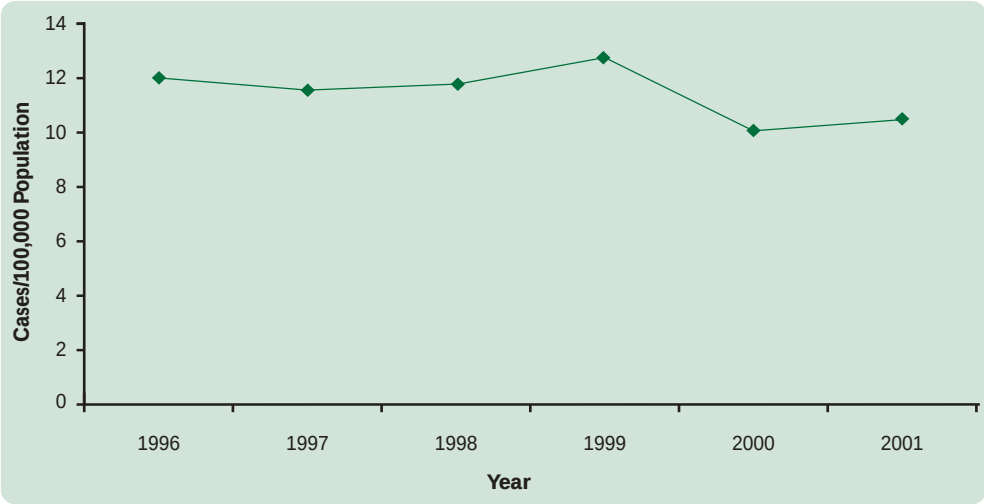

Figure 5. 1. Notifications of human tuberculosis in Ireland between 1996 and 2001

Incidence rates for 1996 - 1999 calculated using 1996 census data and for 2000 and 2001 using 2002 census data

(Source: NDSC)

FOOD

Food is not routinely tested for *Mycobacterium* spp. in Ireland, and the threat of infection from milk consumption has been reduced by the mandatory pasteurisation of all cows' milk destined for direct human consumption effective from 1997. However, products made from unpasteurised milk can still be sold.

ANIMALS

Austria, Denmark, Germany, Luxembourg, Finland, the Netherlands, Norway and Sweden are designated officially free of bovine tuberculosis (OTF) by the EU. In addition, two regions of Italy are also considered OTF. Bovine TB is a notifiable animal disease in Ireland and a national eradication programme in bovines is on-going. All herds are subject to test and control in accordance with Council Directive 64/432/EEC (S.I. No. 270 of 1997). In addition, all animals slaughtered are subject to full ante-mortem and post-mortem examination in accordance with Council Directive 64/433/EEC (S.I. No. 434 of 1997). The incidence rate in Ireland of bovine TB did not vary significantly between 1997 and 2001 (Table 5.1).

Table 5. 1. Results of routine tuberculin testing of cattle between 1997 and 2001

Year	Herds tested	Herds positive (%)
2001	130,525	9,195 (7.0)
2000	130,924	10,785 (8.2)
1999	135,349	10,660 (7.9)
1998	139,165	10,055 (7.2)
1997	142,491	8,139 (5.7)

(Source: DAF)

Wildlife reservoirs of TB, notably the badger, are considered an impediment to its eradication from the bovine population and research into possible methods of tackling this problem is ongoing. While the residual infection in cattle is still a concern, pasteurisation of milk, the annual programme of cattle testing and the routine examination at slaughter have all played a role in reducing the threat from *Mycobacterium* related disease in Ireland.

6. BRUCELLOSIS

Brucella abortis is the cause of human brucellosis, a systemic bacterial disease contracted through either direct or indirect contact with infected animals (mainly cattle). It is predominantly an occupational disease with farm workers, veterinarians and abattoir workers particularly at risk.

HUMAN

There were 14 cases of brucellosis in humans notified in 2001, compared to 15 in 2000 and 19 cases in 1999 (Figure 6.1). These numbers may be an underestimation however, as brucellosis can be difficult to diagnose.

Figure 6. 1. Notifications of brucellosis in humans in Ireland between 1991 and 2001

(Source: NDSC & DoHC)

FOOD

Food is not routinely tested for *Brucella* spp. in Ireland. Unpasteurised milk and milk products can be sources of infection by *Brucella* spp., though the risk from milk has decreased since it became mandatory in 1997 to pasteurise cows' milk destined for direct human consumption.

ANIMALS

As of 2001, Ireland is one of 7 EU Member States (Belgium, France, Greece, Italy, Portugal and Spain) that are recognised as not officially bovine brucellosis free (nOBF). However on the basis of Directive 91/68/EEC (S.I. No. 762 of 1992), Ireland is among the 10 Member States considered officially free of ovine and caprine brucellosis (oBMF) caused by *Brucella melitensis*.

Cattle

Brucellosis in ruminating animals and swine is a notifiable disease in Ireland. While vaccination is not permitted, a national eradication programme for bovine brucellosis is in operation comprising a test and slaughter policy with notification of abortions being mandatory.

The percentage of herds testing positive for brucellosis has been less than 1% in recent years (Table 5.1).

Table 6. 1. Routine brucellosis testing of cattle herds in Ireland between 1997 and 2001

Year	Herds tested	Herds positive (%)
2001	124,133	273 (0.2)
2000	130,924	659 (0.5)
1999	135,349	875 (0.6)
1998	139,165	1,081 (0.8)
1997	142,491	823 (0.6)

(Source: DAF)

Other animals

Goats and sheep, more so than cattle, are the natural hosts of *B. melitensis* which causes sypmtoms similar to *B. abortis*. Ireland is considered to be free of *B. melitensis* (OBmF) and is recognised as such by Commission Decision 91/68/EEC. A monitoring programme to demonstrate freedom from disease is conducted by DAF and none of the samples tested from sheep or goats were found to be positive for *B. melitensis* in 2000 or 2001.

Pasteurisation of milk and annual testing of all herds with eligible animals have contributed to limiting the risk of brucellosis as a zoonotic disease in Ireland. Risks persist however, particularly for vulnerable groups such as farmers, veterinarians and abattoir workers, as well as those who continue to consume unpasteurised milk or milk products.

7. TRANSMISSIBLE SPONGIFORM ENCEPHALOPATHIES (TSEs) AND NEW VARIANT CREUTZFELDT-JAKOB DISEASE (nvCJD)

Transmissible spongiform encephalopathies (TSEs) are a family of fatal neurodegenerative disorders of the central nervous system which includes scrapie in sheep, bovine spongiform encephalopathy (BSE) in cattle and Creutzfeldt Jakob Disease (CJD) and new variant CJD (nvCJD) in humans. These diseases display common characteristics including long incubation periods, similar pathology and a similar range of clinical symptoms. The weight of evidence points to a protein (prion), rather than microorganisms such as bacteria or viruses, as being the transmissible entity in these diseases. This prion protein, normally found on the nerve membranes in the brain, changes conformation and becomes a disruptive factor to neighbouring prion proteins and the associated nerve cells. The first identified member of this family of diseases was scrapie, which has been endemic in sheep (and goats) in certain parts of Europe for over two centuries.

BSE is not included in the list of zoonotic diseases covered by the Zoonosis Directive 92/117/EEC (S.I. No. 2 of 1996). The first case of BSE in Ireland was diagnosed in 1989 and the number of infected cattle rose dramatically in the mid 1990s. The number of reported BSE cases in Ireland rose significantly in 2000 and 2001 (Figure 7.1) probably due to an increase in active monitoring. The original source of BSE is still unclear, though proliferation of the disease has most likely been due to the use of contaminated animals parts left over from the beef processing industry (meat and bone meal) as feed for other cattle.

Figure 7. 1. Incidence of BSE in cattle in Ireland between 1991 and 2001

(Source: DAF)

CJD was first described in 1921, and has been divided into four main groups, sporadic, hereditary, latrogenic and new variant. Sporadic CJD accounts for approximately 80% of all CJD cases, is found worldwide and mainly affects middle aged and older people. Inherited CJD accounts for 15% of all cases. Several mutations in the prion gene have been reported and the gene is inherited in an autosomal-dominant fashion (i.e. a child has a 50% chance of inheriting the abnormal gene). Latrogenic CJD accounts for a small number of cases and is caused by exposure to infected human central nervous system or allied tissues. Examples include CJD in people that have had corneal transplants, and the use of human pituitary extracts for growth hormone or infertility treatment. New variant CJD (nvCJD), the most recently recognised form of the disease, was first described in 1996 in the UK[12] and tends to affect younger people. One case of nvCJD was reported in 1999 in Ireland with no cases in 2000 or 2001.

8. OTHER ZOONOSES

Anthrax

Anthrax is an acute infectious disease caused by the spore-forming bacterium *Bacillus anthracis*. Anthrax most commonly occurs in wild and domestic vertebrates (cattle, sheep, goats, camels, antelopes, and other herbivores), but it can also occur in humans when they are exposed to infected animals or tissue from infected animals. *B. anthracis* spores can live in the soil for many years, and humans can become infected with anthrax by handling products from infected animals or by inhaling anthrax spores from contaminated animal products. Anthrax can also be spread by eating undercooked meat from infected animals. Intestinal anthrax is rare and difficult to recognise except that it tends to occur in dramatic outbreaks with symptoms including abdominal pain followed by fever, signs of septicaemia and death. There have been no cases of anthrax in either humans or animals in Ireland in the last 25 years.

Cryptosporidiosis

There are several species of the protozoan parasite cryptosporidium, (*Cryptosporidium baileyi* and C. *meleagridis* in birds, *C. muris* and *C. parvum* in mammals, *C. nasorum* in fish and *C. serpentis* in reptiles) however, it is the species *C. parvum* that is responsible for zoonotic infections.

Diarrhoea accompanied by dehydration, weight loss, abdominal pain, fever, nausea and vomiting are the most common symptoms of human infection by *C. parvum*. The route of transmission to humans is generally faecal-oral, however, person-to-person, person-animal and waterborne transmission also occur. Oocysts (which are the infective stage) appear in the stool at the onset of symptoms and are shed for several weeks after symptoms ease. Although cryptosporidiosis was not a notifiable human disease in Ireland in 2000 and 2001, it is known to cause approximately 4% of gastroenteritis/acute diarrhoea in children.[13, 14]

Echinococcosis

The life cycle of the tapeworm, *Echinococcus granulosus* includes dogs (and other canines) as the definitive host, and a variety of species of warm blooded vertebrates (sheep, cattle, goats, and humans) as the intermediate host. The adult worms are very small (total length = 3-6 mm), and they live in the dog's small intestine. Eggs are liberated in the canine faeces, which, when ingested by the intermediate host, hatch in the small intestine and the resulting larvae penetrate the gut wall to enter the circulatory system. The larvae can be distributed throughout the intermediate host's body (although most end up in the liver) and grow into a stage called a hydatid cyst. The infection is transmitted to the canine host when the hydatid cyst is eaten. This species of parasite is more common in areas of the world where dogs are used to herd sheep. Under most circumstances humans are a "dead end" in the life cycle, but hydatid disease in humans remains a serious problem because the disease can cause such serious pathology. Echinococcosis was not a notifiable disease of humans or animals in Ireland in 2000 and 2001 and was not reported in animals or humans in 2000 or 2001.

Leptospirosis

Leptospirosis is considered the most common bacterial infection in the world, affecting humans and animals. A notifiable infectious disease of humans in Ireland, leptospirosis is caused by pathogenic strains of *Leptospira* spp. and can be spread through contact with rats or their urine, cattle or dogs, or foetal fluids from cattle[15]. Symptoms of the disease can range from a flu-like illness to the more severe and even fatal consequences of the rare but acute form known as Weil's disease.

In general, there is a correlation between animal reservoir, serovar and potential severity of illness. Traditionally, leptospirosis has been an occupational hazard for farmers, veterinarians, abattoir and meat workers/handlers, fish farmers and sewer workers and levels have remained relatively steady over the years (Figure 8.1). However, leptospirosis is increasingly being associated with leisure activities such as golf and water sports.

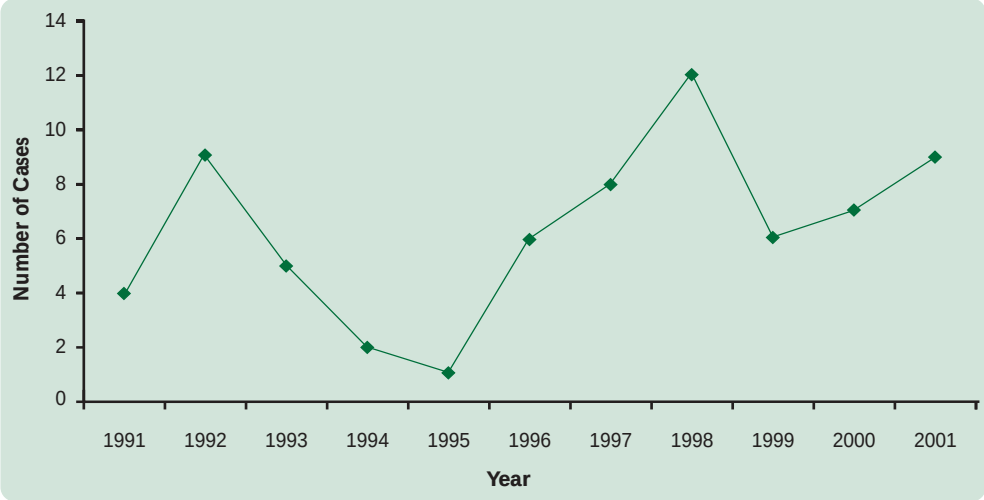

Figure 8.1. The number of human leptospirosis cases notified in Ireland from 1991 to 2001

(Source: NDSC & DoHC)

Research published in 1999 by University College Dublin and Teagasc shows that vaccination for leptospirosis was used on 29% of dairy farms and 4% of suckler farms[16]. Another survey of dairy herds using bulk milk tank ELISA test showed that almost 80% of unvaccinated herds contained animals which had acquired infection in the previous 12 months[17].

Toxoplasmosis

Toxoplasmosis is caused by an obligate intracellular protozoan parasite *Toxoplasma gondii*. This parasite is very common in cat faeces, raw meat, raw vegetables, and the soil. While the parasite generally replicates in its definitive host, the cat, it is an opportunistic parasite of many other hosts including humans. In general, humans infected with *T. gondii* are asymptomatic carriers. There are a number of factors such as age and immunocompetence that determine whether an infected host will express disease symptoms. However, infection of a pregnant woman can result in abortion or congenital malformation of the foetus while newborns are also particularly vulnerable. Infection may be acquired through the consumption of undercooked meat, food contaminated with cat faeces, or from handling contaminated soil or cat litter trays.

Toxoplasmosis was not a notifiable disease in Ireland in 2000 and 2001. Data were obtained from the clinical diagnostic laboratories by the NDSC but information on congenital cases of toxoplasmosis is not available in Ireland. Exposure to *T. gondii* is common in Ireland. Research has shown that 12.8% of children in 1997 had antibodies to *T. gondii* and the proportion testing positive increased with age. Significantly more rural than urban children were seropositive[18]. Data obtained from clinical investigations by regional veterinary laboratories in 2000 showed that 65 sheep samples and 1 canine sample were found to contain *T. gondii* though the total number of samples tested was not available and no data was available for 2001.

Trichinosis/Trichinellosis

Trichinosis is caused by *Trichinella spiralis*, a nematode (intestinal round worm) that parasitises the intestinal tract of mammals, particularly pigs and was not detected in humans in Ireland in 2000 or 2001. The larvae encyst in the tissues, particularly the muscles, which act as a source of infection for humans who consume raw or partially cooked meat. Though infections may be asymptomatic, clinical manifestations include fever, muscle pain, encephalitis, meningitis, myocarditis, and (rarely) death. Though pork has traditionally been associated with trichinosis, recent outbreaks in Europe have been linked to the consumption of undercooked horse meat[19]. Trichinella was not detected in tests carried out by the CMCL on official samples of pigs (1,489 in 2000, 3,074 in 2001) and horses (2,341 in 2000, 579 in 2001) in Ireland.

Rabies

Rabies, a viral disease that is almost always fatal in humans if not treated quickly, is notifiable for humans and animals in Ireland. Infection generally occurs through a bite from an infected animal with symptoms beginning with headache, fever and malaise that progress to paralysis. Without medical intervention, the usual duration is two to six days, and death is often due to respiratory paralysis. Wild and domestic dogs and bats are the most common source of infection worldwide. Ireland is completely free from rabies in its wild animal population and continues to maintain its rabies free status by strict quarantine of imported animals. Rabies has not been recorded in Ireland since 1903.

Yersiniosis

Yersiniosis is an acute bacterial enteric disease manifested by acute diarrhoea (especially in young children), enterocolitis, abdominal pain, fever, headache and vomiting. *Yersinia enterocolitica* and *Yersinia pseudotuberculosis* have both been identified as causing appendicitis-like symptoms in humans. Animals are the main reservoir for *Yersinia* spp. and though frequently colonised, they rarely display clinical symptoms.

Yersiniosis was not a notifiable disease in Ireland in 2000 and 2001. In 2000, 14 cases of *Y. enterocolitica* were reported, (0.36 cases/100,000) and 3 cases (0.08 cases/100,000) were reported in 2001, but these numbers may not be representative as laboratories do not routinely test stool samples for *Yersinia* spp.

There are very little data available on infection by *Yersinia* spp. in animals, or its presence in food. In 2000, one of the regional veterinary laboratories identified six isolates of *Y. pseudotuberculosis* during the course of investigations – 2 cases in exotic birds, 2 cases in zoo animals, 1 case in a bovine foetus and 1 case in a turkey.

9. CONCLUSIONS

A significant amount of the routine workload of many Government Departments and official agencies, as well as public and private laboratories in Ireland involves sampling and testing humans, animals, food and feed for agents of zoonotic disease. This report does not include all of the data collected in 2000 and 2001, but focuses primarily on those zoonoses that have, or are likely to have a significant impact on the health of the Irish human population. The risk to humans from zoonotic disease depends on a number of factors, some of which can be controlled, but only when critical information is available to allow intervention to be targeted effectively. For example, zoonoses that are the result of human contact with animals can readily be controlled and even prevented by limiting contact with infected or at risk animals and by reducing the levels of infection in animals. Foodborne zoonoses however, are more difficult to control because infected food from a single source can cause illness in many people over a wide geographical area. The risk to humans can be limited however, by educating producers to deliver cleaner animals to the factories and educating handlers at all points along the food production line on how to reduce or avoid the risk of cross contamination. Educating consumers of the potential dangers associated with transporting, cooking and storage of food is also an effective means of lowering the levels of infection.

The incidence rate of human salmonellosis in Ireland declined between 1998 and 2001, coinciding with a reduction in the percentage of *S.* Typhimurium isolated from humans. The reduction in levels of illness in Ireland associated with this serovar is especially welcome as the threat to human health posed by this pathogen has been compounded by an increase in the occurrence of antimicrobial resistant strains, particularly *S.* Typhimurium phage type DT104.

The DAF National Salmonella Monitoring and Control Programme for poultry, the Pig Salmonella Control Programme, increased inspection rates, a Bord Bia egg quality assurance scheme and enhanced education programmes for food handlers and consumers may be responsible for the reduction in *S. enterica* incidence rates in Ireland. However, raw pork and poultry products continue to pose a threat, with significant levels of *S. enterica* contamination recorded in both 2000 and 2001. Data from the Enhanced Poultry Monitoring Programme points to poultry as a possible source of the human salmonella serovar isolates, *S.* Bredeney and *S.* Kentucky which were third and fourth most commonly identified serovars from human isolates, with duck samples particularly at risk of contamination. While there is evidence to suggest that pigs and pig meat products are a possible source, or reservoir for *S.* Typhimurium, the data for 2000 and 2001 is insufficient to make any clear links between the most common human *S. enterica* serovars and those from animal sources.

The positive effect of education and awareness campaigns is also evident from the fact that even though Irish people now consume food outside the home more frequently, the number of foodborne outbreaks caused by pathogens like *S. enterica* decreased in 2000 and 2001. Nevertheless, the peak in the number of cases of human salmonellosis, as well as other zoonotic diseases such as campylobacteriosis, evident during summer months in Ireland and other EU Member States, suggests that education and awareness campaigns should continue, and even improve, in order to reduce the levels of illness during these months.

It is apparent that children under 5 suffer from zoonoses disproportionately more than other age groups. However, this must be viewed in the context that there is a greater likelihood that a parent or guardian will seek medical attention for a small child that is sick, whereas many adolescents or adults with a similar illness may chose not to. The fact that the immune system of a small child is not fully developed may also contribute to this increased susceptibility.

Though campylobacteriosis is not a notifiable disease in Ireland, it is recognised as a significant cause of human illness and considerable resources are in place to monitor the sources and reservoirs of *Campylobacter* spp. Though there is some ambiguity in the data for 2001, the data for 2000 strongly suggests that poultry and poultry products, more than any other animal products are a likely source for this microorganism.

Listeriosis, like campylobacteriosis is not notifiable in Ireland though the NDSC has been carrying out surveillance since 1999. The incidence of listeriosis in Ireland is low, compared to salmonellosis and campylobacteriosis, with only 7 individual cases recorded in 2000 and 2001 and no outbreaks reported. However, it is a disease that can have significant health consequences, particularly for vulnerable groups including pregnant women, neonates and the elderly. Though a number of foods sampled at retail level were positive for *Listeria* spp., animals are not routinely tested in Ireland and the data available from raw or ready-to-eat foods is not sufficient to draw any conclusions as to possible sources or reservoirs of the causative agent, *L. monocytogenes*.

Verocytotoxigenic *E. coli*, especially O157 is an emerging human health threat that is attracting much attention worldwide from health authorities and the food industry. A number of high profile outbreaks of VTEC in other countries around the world have demonstrated the serious consequences this disease can have. As few as 10 viable bacterial cells may be sufficient to cause human infection and it can be present in healthy animals, especially cattle. So serious is this pathogen viewed that the meat industry in the USA, and other countries, has adopted measures like irradiation to safeguard certain meat products, even meat for use in school lunches. Because human infection can have severe and even fatal consequences, monitoring and control of this pathogen is critical to limiting the risk to the public health. The data available in Ireland show that VTEC follows similar patterns of infection to other zoonoses in that it peaks in summer months and is identified more frequently in children under the age of 5 years. Data on the prevalence of VTEC in animals are not available in Ireland though it was identified in only a small percentage of beef products tested in 2000. There were 4 outbreaks of VTEC in Ireland in 2000 and 12 in 2001. The fact that most of these outbreaks were family outbreaks as well as the largely negative results on foods tested means that the meat industry, along with monitoring and control agencies, have been successful in safeguarding the food chain in Ireland thus far. However, complacency must be avoided and the highest levels of vigilance against this pathogen should be maintained.

The number of BSE cases in Ireland increased considerably in 2000 and 2001, though this was not unexpected as the level of active monitoring in animals was increased in this time period. No cases of the related human illness, nvCJD were reported in these 2 years but the incubation period for this particular disease is not known so the implications of BSE for human health in Ireland are still unclear.

Data on other zoonoses in Ireland is limited, possibly reflecting the impact they have had on the population over the years. Leptospirosis was traditionally recognised as an occupational hazard for farmers and sewer workers, but is now also associated with leisure activities such as golf and water sports. Though still a relatively rare disease, leptospirosis and especially the rare but acute form Weil's disease can have serious consequences and because the risk has expanded to include leisure activities, it may warrant some extra attention from control and monitoring agencies in the future.

To conclude, the monitoring and control of zoonoses in Ireland and the EU is a considerable task but with significant potential benefits for public health. The continued reduction in the incidence of human salmonellosis, evident in 2000 and 2001 in Ireland can be viewed as an encouraging sign that the collaborative work of several Government Departments, local agencies and laboratories nationwide is having a positive effect. However, there is no room for complacency as new and emerging problems like antimicrobial resistance and *E. coli* O157 have the potential to replace salmonellosis as the major zoonotic threat to the public.

APPENDIX 1
Human diseases notifiable under the Infectious Diseases Regulations 1981 (S.I. No. 390 of 1991)

Acute anterior poliomyelitis

Acute encephalitis

Acute viral meningitis

Anthrax

Bacillary Dysentery

Bacterial Meningitis (including meningococcal septicaemia)

Brucellosis

Cholera

Diphtheria

Creutzfeldt - Jakob disease (1996)

nv Creutzfeldt-Jakob Disease (1996)

Food Poisoning (bacterial other than Salmonella)

Gastroenteritis (when contracted by children under 2 years)

Infectious mononucleosis

Infectious parotitis (mumps) (1988)

Influenzal pneumonia

Legionnaires disease

Leptospirosis

Malaria

Measles

Ornithosis

Plague

Rabies

Rubella

Salmonellosis (other than typhoid or paratyphoid)

Smallpox

Sexually transmitted diseases (1985)

Tetanus

Tuberculosis

Typhoid and paratyphoid

Typhus

Viral haemorrhagic diseases (including lassa fever and marburg disease)

Viral hepatitis

- Type A
- Type B
- Type unspecified

Whooping cough

Yellow fever

APPENDIX 2
Notifiable Animal Diseases under the Diseases of Animals Act, 1966 (S.I. No. 6 of 1996)

General

Anthrax, Bluetongue, Brucellosis, Campylobacteriosis, Caseous Lymphadenitis, Contagious Agalactia, Foot & Mouth Disease, Johne's Disease, Parasitic Mange, Peste des Petits Ruminants, Pulmonary Adenomatosis, Rabies, Rift Valley Fever, *Salmonella enterica* serovars Enteriditis and Typhimurium, Tuberculosis

Cattle

Bovine Leukosis, BSE, Cattle Plague (Rinderpest), Contagious Bovine Pleuropneumonia, Lumpy Skin Disease, Warble Fly

Pigs

African Swine Fever, Aujeszky's Disease, Classical Swine Fever, Porcine Epidemic Diarrhoea, Porcine Corona Virus, Porcine Reproductive and Respiratory Syndrome, Swine Influenza, Swine Vesicular Disease, Teschen Disease, Transmissible Gastroenteritis, Vesicula Stomatitis

Sheep

Enzootic Abortion of Ewes, Maedi Visna, Scrapie, Sheep Pox, Sheep Scab

Poultry

Arizona Disease, Fowl Pest including Newcastle Disease & Fowl Plague (Avian Influenza), Infectious Laryngo-Tracheitis, *Mycoplasma gallisepticum, meleagridis* and *synovia*, Psittacosis, *Salmonella enterica* serovars Gallinarum and Pullorum, Turkey Rhinotracheitis, Diseases involving *Yersinia* spp.

Horses and Other Equines

African Horse Sickness, Contagious Equine Metritis, Dourine, Epizootic Lymphangitis, Equine Infectious Anaemia, Equine Viral Arteritis, Glanders or Farcy, Equine Encephalomyelitis

Rabbits

Myxomatosis

Goats

Caprine Viral Arthritis-Encephalitis, Goat Pox

Deer

Epizootic Haemorrhagic Disease

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