

## Chapter 2

### REPORTS OF *SALMONELLA* IN LIVESTOCK AND HUMANS

This chapter provides information on *Salmonella* isolated from livestock from samples taken on all premises, including farms, hatcheries, veterinary surgeries, zoos, slaughterhouses and human food premises. An overview of the number of incidents and isolations of *Salmonella* reported in farm animal species is given at Tables 8 & 9 and Figures 1 to 5. Poultry refer to reports from chickens, turkeys, ducks, geese and game birds.

For comparison purposes, data have been reproduced here on the number of laboratory reports of human isolations of *Salmonella* reported in England and Wales to the Health Protection Agency (HPA) Communicable Disease Surveillance Centre (CDSC) and in Scotland to the Scottish Centre for Infection and Environmental Health (SCIEH). Clinical microbiology laboratories voluntarily report data and there are a number of factors which influence these reports. These are discussed in the Zoonoses Report UK 2002 (Defra 2003, in press).

Since 1998 tables have been produced comparing the relative frequency of *Salmonella* serotypes in each species over the last five years. These data should be considered alongside absolute numbers of reports as the relative proportions may remain similar despite a change in number of reports, in which case we conclude that the change in number of reports is likely to be constant across serotypes. Similarly, if there is a change in serotype relativity, it is only by examining changes in absolute numbers that we can ascertain the size of any increase or decrease. For example, in 2002 the total number of *Salmonella* incident reports decreased by 13.4% compared with 2000 and increased by 23.8% compared with 2001. However, this was not consistent across serotypes. Reports of *S. Typhimurium* fell by 7.8%, reports of *S. Enteritidis* increased by 15.4% and reports of *S. Livingstone* rose by 82.7%. Therefore there was a change in the distribution of reports between these three serotypes; the proportion of *S. Typhimurium* fell to 13.8%, the proportion of *S. Enteritidis* was little changed at 1.1% of all incidents and the proportion of *S. Livingstone* reports increased to 5.1% of all incidents. *S. Dublin* was the most commonly isolated serotype from livestock in 2002, responsible for almost one third of reports. *S. Typhimurium* was the second most common type (14%). In 2002, *S. Livingstone* was the third, *S. enterica diarizonae* subspecies the fourth and *S. Senftenberg* the fifth most common.

Some serotypes of *Salmonella* can infect a wide variety of host species, for example, *S. Typhimurium*. Others tend to be associated with particular animal species, for example, *S. Enteritidis* and poultry, *S. Dublin* and cattle and *S. enterica diarizonae* subspecies and sheep. Thus the serotype distribution reflects the species distribution of reports. In 2002, 44.7% of reports were from poultry, 35.7% from cattle, 7.2% from pigs and 7.2% from sheep (see Figure 1). There were 35 reports of *Salmonella* from horses in 2002 and a single report from goats. There were no reports from either deer or rabbits in 2002.

Changes in the number of incidents have to be treated with caution in view of the inherent biases associated with the data collection. In particular, in 2001 the livestock industry was affected by an outbreak of Foot and Mouth Disease resulting in fewer clinical specimens being submitted for examination.

Tables 8 & 9 and Fig 1 show that in 2002 the total number of incidents of *Salmonella* reported fell by 415 (13.4%) compared with 2000 and increased by 514 (23.8%) compared with 2001.

The changes in the number of reports relating to cattle, pigs and chickens mirrored that seen in livestock as a whole, but the number of reports from game birds and turkeys fell compared with both 2000 and 2001 and the number of reports from ducks and geese increased.

The relative frequency of reports of *S. Enteritidis* in 2002 (1.1%) was similar to 2001 (1.2%). There were 6 reports of *S. Enteritidis* in cattle, one report in both pigs and game birds, 11 in ducks and geese, four in horses and 11 in chickens in 2002. The decline in reports of *S. Enteritidis* over the last five years was mirrored in 2002 by a decrease in the number of human *S. Enteritidis* infections in Great Britain in 2002, which was 11.8% lower than the previous year.

The frequency of reports of *S. Typhimurium* fell to 13.8% of all reports in 2002. The relative frequency of *S. Typhimurium* was reduced in cattle, sheep and chickens, and increased in pigs and turkeys. There was an increase in frequency of *S. Typhimurium* U302 in cattle in 2002. *S. Typhimurium* DT193a and *S. Typhimurium* DT2 were isolated in cattle for the first time since recording began in 1985. *S. Typhimurium* U288 was isolated from pigs for the first time since 1997 and U308a was isolated from turkeys for the first time since recording began in 1985.

The number of incidents of *S. Dublin* reported in cattle increased by 82.4% in 2002. This increase was greater in calves than in adult cattle

(100% and 77.2% respectively). The proportion of incidents of *S. Dublin* in cattle also increased in 2002 and this serotype was again the most common reported in cattle (76.5%).

*Salmonella* Virchow was the third most common serotype isolated from human cases of salmonellosis in Great Britain in 2002, but is rarely isolated from livestock and only 48 incident reports were recorded in 2002 (1.8% of all *Salmonella* incidents in livestock) (Table 8). However, reports of *S. Virchow* increased in chickens in 2002 to 5.4% of all incidents.

Reports of *S. enterica* subspecies *diarizonae* (mainly from sheep) rose by 122% and for the fourth year running *S. enterica* subspecies *diarizonae* 61:k:1,5(7) was the most common serovar isolated from sheep (62.1%).

These trends and others are highlighted further in the relevant species sections.

Table 5 ranks the most common *Salmonella* serotypes isolated from livestock in Great Britain in 2002 against the most common serotypes isolated from human cases of salmonellosis in Great Britain. Tables 6 and 7 provide a similar comparison for phage types of *S. Typhimurium* and *S. Enteritidis* in livestock and humans. Apart from *S. Typhimurium* and *S. Enteritidis* the other common serotypes associated with human cases are reported relatively rarely from British livestock. The total number of isolation reports to the HPA from human cases of salmonellosis decreased by 10.9% in 2002.

Perhaps the most important factor which may bias the number of *Salmonella* reports is the submission rate. This report presents numerator data but the denominator, in most cases, is unknown and may change over time. Most *Salmonella* incident reports from cattle, sheep and pigs result from the investigation of clinically diseased animals. Economic factors may exert a strong influence on diagnostic practices, such as whether a veterinary surgeon is consulted and whether samples are submitted for laboratory examination, and 2002 again saw a depressed livestock industry.

Diagnostic submissions to the Veterinary Laboratories Agency (VLA) and the Scottish Agricultural Colleges (SAC) have declined in recent years and were particularly affected in 2001 by the outbreak of Foot and Mouth Disease during which the testing of carcass samples from all areas and all samples from infected areas was suspended for a number of months (see Introduction). Over the five year period since 1998 cattle submissions have fallen by 37% and sheep submissions by 36%.

Submissions from pigs have continued to decline steadily since 1998 (by 36% over the five year period) (VLA 2003). Additionally as most of the data from species other than poultry relate to clinical investigations, the subclinical situation in these species of livestock is not usually known. A targeted national abattoir survey provides data for the period 1999 – 2000 on the prevalence of *Salmonella* in prime cattle, sheep and pigs at slaughter in GB. Results of this survey are given in Chapters 3 and 5.

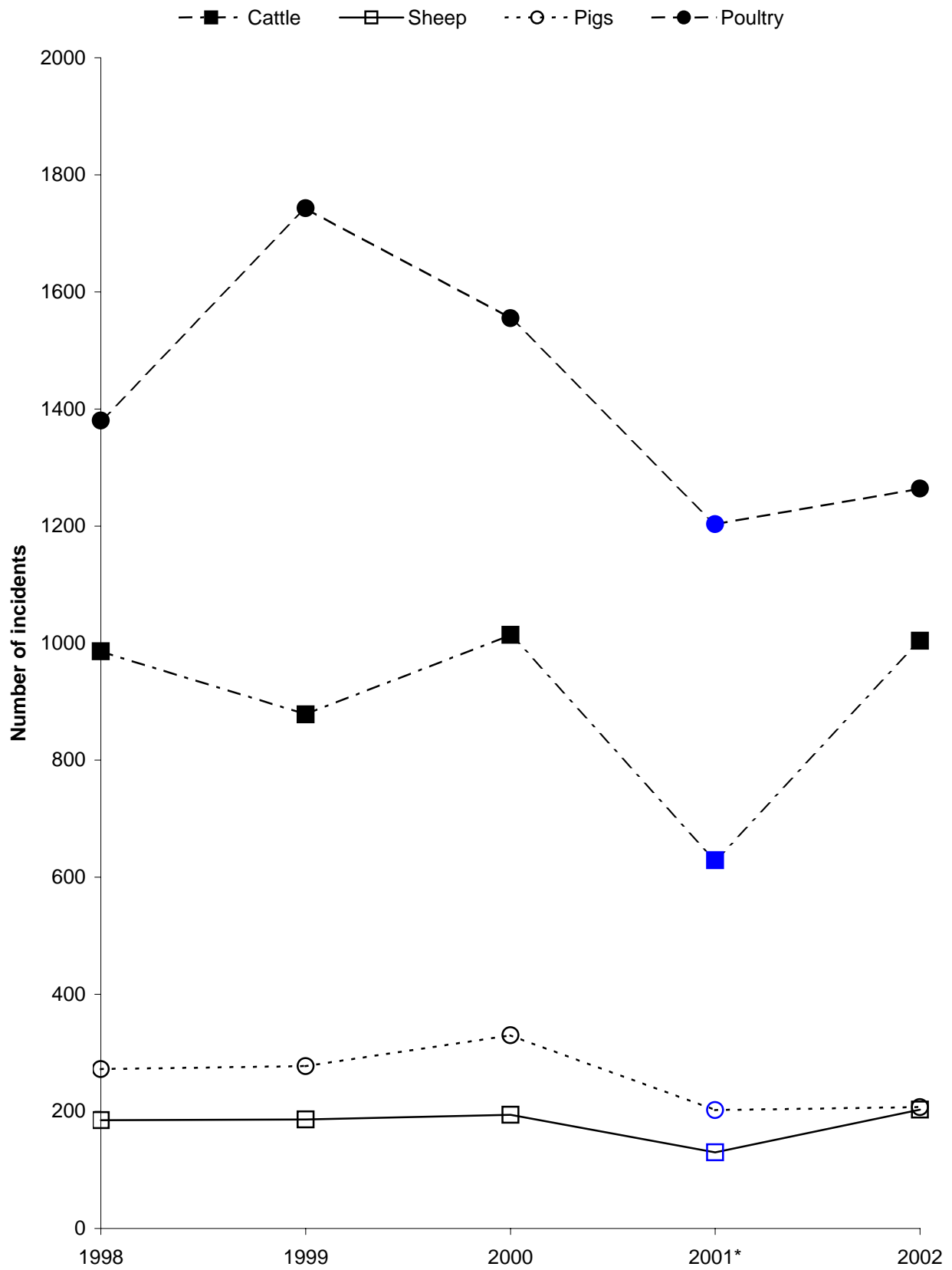
Changes in the denominator population for *Salmonella* reports from poultry, particularly chickens, turkeys and ducks, are difficult to assess and most sample submissions are associated with statutory or voluntary surveillance activities. Statutory monitoring of chicken breeding flocks for *Salmonella* detailed in the PBFHO 1993 has been supplemented by additional voluntary testing of many flocks in recent years. Turkeys and duck breeding flocks undertake voluntary monitoring for *Salmonella* following protocols in the PBFHO 1993 and there is also some voluntary monitoring in production flocks. Therefore, it is likely that there has been an increase in surveillance of poultry flocks for *Salmonella* over the five year period. It is particularly notable that there has been a marked increase in surveillance of duck flocks for *Salmonella* in 2002. The assessment of submission rates in poultry is further complicated by the large proportion of *Salmonella* testing undertaken by private laboratories. In 2002, the total number of poultry diagnostic submissions (to VLA/SAC laboratories) fell by 10.1%, to the lowest level ever recorded.

Although trends in *Salmonella* reports can be compared with diagnostic submission rates to VLA/SAC it should be remembered that not all submissions will have been examined for *Salmonella*. Private laboratories also report the isolation of *Salmonella* and the total number of submissions to these laboratories is unknown.

Livestock population data are reported by the June Agricultural Census and trends in *Salmonella* reports can be compared with changes in the animal populations by consulting these data. The numbers of cattle, sheep and pigs in Great Britain fell in 2002 but there was an increase in the numbers of poultry.

The VLA *Salmonella* database has clearly identified epidemics of *Salmonella* strains in livestock including *S. Enteritidis* PT4 (Fig 32) in chickens and *S. Typhimurium* DT104 (Fig 7) in cattle both of which are still in decline.

**Fig 1: Number of incident reports of *Salmonella* in livestock (1998 - 2002)**



\* 2001 data may not be comparable due to uncertain impact of FMD outbreak

**Table 5: Reports of the most common *Salmonella* serotypes in 2002 in livestock and humans in GB**

Human cases			Cattle			Sheep			Pigs			Poultry		
Serotype	No. isolations	%	Serotype	No. incidents	%	Serotype	No. incidents	%	Serotype	No. incidents	%	Serotype	No. incidents	%
Enteritidis	10365	64.5	Dublin	768	76.5	<i>Enterica diarizonae</i> subssp	126	62.1	Typhimurium	147	71.0	Livingstone	137	10.8
Typhimurium	2106	13.1	Typhimurium	140	13.9	Dublin	38	18.7	Derby	16	7.7	Senftenberg	117	9.3
Virchow	267	1.7	Anatum	15	1.5	Montevideo	13	6.4	Kedougou	10	4.8	Binza	100	7.9
Hadar	225	1.4	Agama	13	1.3	Agama	10	4.9	London	5	2.4	Typhimurium	73	5.8
Agona	185	1.2	Newport	11	1.1	Typhimurium	9	4.4	Reading	5	2.4	Montevideo	70	5.5
Infantis	175	1.1	Enteritidis	6	0.6				Goldcoast	4	1.9	Kedougou	64	5.1
Paratyphi B var Java	167	1.0	Agona	4	0.4				Dublin	2	1.0	Orion	53	4.2
Braenderup	160	1.0	Thompson	4	0.4				Infantis	2	1.0	Mbandaka	52	4.1
Newport	129	0.8	Goldcoast	3	0.3				Panama	2	1.0	Hadar	48	3.8
Stanley	109	0.7	Montevideo	3	0.3									
Other serotypes	2179	13.6	Other serotypes	37	3.7	Other serotypes	7	3.4	Other serotypes	14	6.8	Other serotypes	550	43.5
Total	16067		Total	1004		Total	203		Total	207		Total	1264	

\* Reports to Health Protection Agency and Scottish Centre for Infection and Environmental Health, provisional data

**Table 6: Reports of the most common *Salmonella* Typhimurium definitive types in 2002 in livestock and humans in GB**

Human cases			Cattle			Sheep			Pigs			Poultry		
DT	No. isolations	%	DT	No. incidents	%	DT	No. incidents	%	DT	No. incidents	%	DT	No. incidents	%
104	810	38.5	104	60	42.9	104	5	55.6	193	20	13.6	104	41	56.2
104b	153	7.3	U302	15	10.7	U302	2	22.2	104	19	12.9	8	8	11.0
193	145	6.9	RDNC	10	7.1				U308a	16	10.9	U302	5	6.8
RDNC	95	4.5	12	6	4.3				U302	13	8.8	30	2	2.7
U302	95	4.5	170	6	4.3				U288	8	5.4			
U310	67	3.2	104b	5	3.6				U308	8	5.4			
193a	50	2.4	208	5	3.6				U310	7	4.8			
U285	49	2.3	120	4	2.9				RDNC	5	3.4			
49	43	1.9	193	3	2.1				193a	3	2.0			
208	41	2.0												
Other DTs	558	26.5	Other DTs	26	18.6	Other DTs	2	22.2	Other DTs	48	32.7	Other DTs	17	23.3
Total	2106		Total	140		Total	9		Total	147		Total	73	

\* Reports to Health Protection Agency and Scottish Centre for Infection and Environmental Health, provisional data

**Table 7: Reports of the most common *Salmonella* Enteritidis phage types in 2002 in livestock and humans in GB**

Human cases*			Cattle			Sheep			Pigs			Poultry		
PT	No. isolations	%	PT	No. incidents	%	PT	No. incidents	%	PT	No. incidents	%	PT	No. incidents	%
4	3771	36.4	4	2	33.3				8	1	100.0	9b	6	26.1
1	1641	15.8	6	2	33.3							4	5	21.7
6a	881	8.5												
6	877	8.5												
14b	699	6.7												
21	656	6.3												
8	313	1.4												
5c	146	1.4												
3	133	1.3												
Other PTs	1248	12.0	Other PTs	2	33.3				Other PTs	0.0	0	Other PTs	12	52.2
Total	10365		Total	6		Total	0		Total	1		Total	23	

\* Reports to Health Protection Agency and Scottish Centre for Infection and Environmental Health, provisional data

**Table 8: *Salmonella* in cattle, sheep, pigs and poultry on all premises**

<i>Salmonella</i> Incidents (Isolations)	1998	1999	2000	2001*	2002
<b>ENTERICA ENTERICA</b>					
Agama	26 ( 39)	36 ( 52)	36 ( 42)	23 ( 31)	24 ( 32)
Agona	12 ( 17)	38 ( 49)	62 ( 71)	66 ( 82)	19 ( 20)
Ajiobo	- ( -)	1 ( 1)	3 ( 3)	1 ( 1)	4 ( 4)
Anatum	20 ( 21)	11 ( 14)	8 ( 13)	10 ( 11)	20 ( 31)
Ank	- ( -)	- ( -)	- ( -)	- ( -)	1 ( 1)
Bovis morbificans	3 ( 3)	5 ( 5)	- ( -)	2 ( 2)	1 ( 1)
Bardo	- ( -)	2 ( 4)	- ( -)	- ( -)	- ( -)
Binza	88 ( 93)	58 ( 77)	51 ( 67)	60 ( 66)	100 ( 134)
Braenderup	4 ( 10)	10 ( 14)	3 ( 3)	1 ( 1)	1 ( 1)
Brandenburg	4 ( 4)	11 ( 13)	4 ( 4)	4 ( 4)	1 ( 1)
Bredenev	25 ( 36)	52 ( 62)	55 ( 60)	6 ( 6)	15 ( 17)
Carmel	- ( -)	1 ( 2)	- ( -)	- ( -)	- ( -)
Carno	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
Cerro	- ( -)	- ( -)	1 ( 1)	- ( -)	- ( -)
Champaign	- ( -)	- ( -)	2 ( 2)	- ( -)	- ( -)
Cholerae-suis	1 ( 1)	- ( -)	1 ( 1)	- ( -)	- ( -)
Cholerae-suis-vk	4 ( 5)	2 ( 2)	- ( -)	1 ( 1)	- ( -)
Cubana	1 ( 1)	2 ( 2)	- ( -)	1 ( 1)	- ( -)
Derby	62 ( 74)	80 ( 109)	81 ( 122)	73 ( 93)	40 ( 45)
Dublin	405 ( 550)	488 ( 657)	684 ( 914)	441 ( 559)	809 ( 1030)
Durham	- ( -)	1 ( 2)	- ( -)	2 ( 2)	- ( -)
Ealing	- ( -)	2 ( 2)	- ( -)	1 ( 1)	- ( -)
Eimsbuettel	- ( -)	4 ( 4)	- ( -)	6 ( 7)	1 ( 1)
Enteritidis	239 ( 347)	89 ( 118)	41 ( 55)	26 ( 27)	30 ( 37)
Fischerkietz	6 ( 6)	2 ( 2)	17 ( 21)	2 ( 3)	1 ( 1)
Fluntern	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
Give	7 ( 8)	36 ( 47)	148 ( 164)	19 ( 19)	32 ( 32)
Goerlitz	2 ( 2)	- ( -)	- ( -)	- ( -)	- ( -)
Goldcoast	14 ( 17)	15 ( 22)	20 ( 29)	10 ( 12)	21 ( 24)
Hadar	32 ( 38)	46 ( 53)	46 ( 60)	8 ( 10)	48 ( 56)
Hato	- ( -)	- ( -)	- ( -)	1 ( 1)	- ( -)
Havana	1 ( 2)	2 ( 2)	1 ( 1)	3 ( 3)	4 ( 6)
Heidelberg	21 ( 23)	49 ( 56)	75 ( 98)	52 ( 60)	24 ( 24)
Idikan	- ( -)	6 ( 6)	- ( -)	1 ( 1)	1 ( 1)
Indiana	42 ( 74)	31 ( 46)	26 ( 34)	34 ( 41)	81 ( 115)
Infantis	2 ( 2)	10 ( 11)	4 ( 5)	5 ( 9)	7 ( 7)
Kedougou	99 ( 117)	114 ( 132)	98 ( 103)	60 ( 68)	74 ( 85)
Kentucky	6 ( 8)	9 ( 18)	16 ( 23)	10 ( 15)	3 ( 4)
Kimuenza	1 ( 1)	- ( -)	- ( -)	- ( -)	1 ( 1)
Kissi	- ( -)	1 ( 1)	- ( -)	- ( -)	- ( -)

**Table 8: *Salmonella* in cattle, sheep, pigs and poultry on all premises**

<i>Salmonella</i> Incidents (Isolations)	1998	1999	2000	2001*	2002
<b>ENTERICA ENTERICA</b>					
Kottbus	3 ( 4)	12 ( 15)	20 ( 21)	18 ( 20)	11 ( 11)
Kubacha	- ( 3)	- ( -)	- ( -)	- ( -)	- ( -)
Larochelle	- ( -)	33 ( 35)	21 ( 24)	2 ( 2)	3 ( 3)
Lexington	- ( -)	1 ( 1)	- ( -)	1 ( 1)	1 ( 1)
Lille	- ( -)	1 ( 1)	- ( -)	1 ( 1)	- ( -)
Liverpool	16 ( 19)	29 ( 33)	31 ( 31)	60 ( 73)	31 ( 35)
Livingstone	36 ( 47)	88 ( 112)	54 ( 68)	75 ( 90)	137 ( 220)
London	5 ( 5)	- ( -)	2 ( 2)	1 ( 1)	5 ( 5)
Manhattan	6 ( 7)	9 ( 18)	2 ( 3)	- ( -)	- ( -)
Mbandaka	74 ( 95)	134 ( 161)	45 ( 56)	60 ( 80)	55 ( 62)
Meleagridis	- ( -)	1 ( 1)	- ( -)	- ( -)	1 ( 1)
Montevideo	130 ( 162)	114 ( 150)	107 ( 170)	114 ( 162)	86 ( 145)
Muenchen	- ( -)	- ( -)	1 ( 1)	- ( -)	1 ( 1)
Muenster	- ( -)	5 ( 5)	- ( -)	- ( -)	- ( -)
Nagoya	- ( -)	- ( -)	- ( -)	1 ( 1)	2 ( 2)
New Brunswick	1 ( 1)	1 ( 1)	- ( -)	1 ( 1)	- ( -)
Newington	6 ( 10)	3 ( 4)	- ( -)	2 ( 2)	- ( -)
Newport	41 ( 55)	58 ( 74)	45 ( 56)	31 ( 35)	42 ( 48)
Ohio	37 ( 60)	75 ( 104)	35 ( 65)	23 ( 27)	38 ( 49)
Orion	8 ( 8)	17 ( 17)	9 ( 11)	11 ( 14)	53 ( 76)
Panama	9 ( 11)	5 ( 6)	4 ( 5)	1 ( 1)	2 ( 2)
Paratyphi B var java	- ( -)	- ( -)	1 ( 1)	- ( -)	- ( -)
Poona	2 ( 2)	4 ( 4)	3 ( 3)	1 ( 1)	- ( -)
Pullorum	8 ( 8)	13 ( 13)	3 ( 3)	4 ( 4)	4 ( 4)
Reading	1 ( 1)	2 ( 3)	3 ( 3)	1 ( 1)	5 ( 5)
Redhill	- ( -)	1 ( 1)	- ( -)	- ( -)	- ( -)
Rubislaw	- ( -)	- ( -)	1 ( 1)	- ( -)	- ( -)
Ruiru	- ( -)	- ( -)	1 ( 2)	- ( -)	- ( -)
Saint Paul	9 ( 9)	4 ( 4)	5 ( 5)	5 ( 5)	5 ( 5)
Schwarzengrund	3 ( 3)	1 ( 1)	7 ( 8)	5 ( 6)	2 ( 4)
Senftenberg	129 ( 181)	187 ( 262)	270 ( 368)	154 ( 274)	117 ( 160)
Shubra	1 ( 2)	- ( -)	- ( -)	- ( -)	- ( -)
Stanley	2 ( 2)	1 ( 1)	- ( -)	- ( -)	3 ( 3)
Stanleyville	- ( -)	1 ( 1)	- ( -)	- ( -)	- ( -)
Stourbridge	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
Taksony	2 ( 2)	1 ( 1)	- ( -)	2 ( 2)	2 ( 2)
Teddington	- ( -)	- ( -)	- ( -)	1 ( 1)	- ( -)
Tees	- ( -)	- ( -)	- ( -)	1 ( 1)	- ( -)
Tennessee	- ( -)	4 ( 4)	- ( -)	1 ( 1)	4 ( 4)
Thomasville	- ( -)	1 ( 1)	- ( -)	1 ( 1)	- ( -)
Thompson	57 ( 63)	79 ( 91)	78 ( 80)	60 ( 60)	35 ( 36)

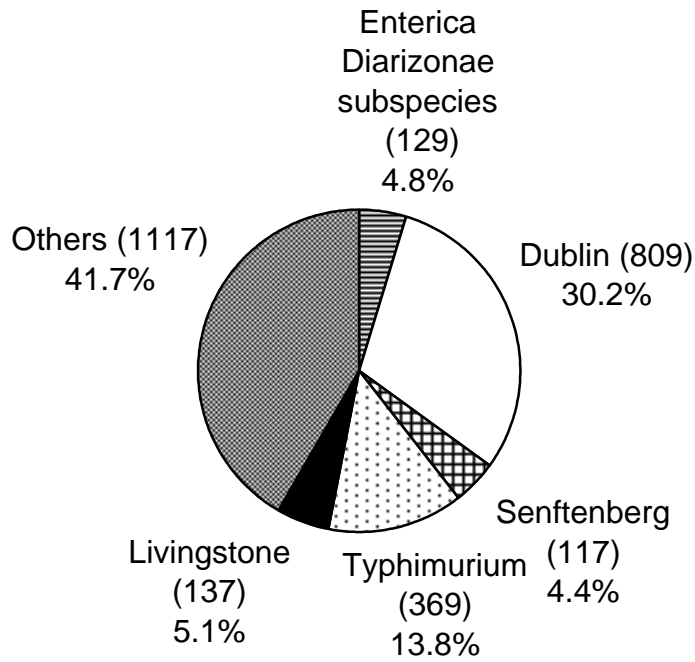
**Table 8: *Salmonella* in cattle, sheep, pigs and poultry on all premises**

<i>Salmonella</i> Incidents (Isolations)	1998	1999	2000	2001*	2002
<b>ENTERICA ENTERICA</b>					
Typhimurium	903 (1244)	700 (1042)	614 (814)	400 (463)	369 (450)
Vejele	- (-)	- (-)	- (-)	- (-)	4 (8)
Virchow	38 (43)	31 (39)	32 (35)	25 (26)	48 (49)
Wangata	- (-)	- (-)	- (-)	- (-)	1 (1)
Worthington	- (-)	1 (1)	3 (3)	1 (1)	- (-)
<b>ENTERICA DIARIZONAE</b>					
61:k:1,5	10 (10)	51 (53)	47 (49)	10 (10)	22 (22)
61:k:1,5,7	24 (24)	17 (17)	50 (50)	24 (26)	78 (80)
61:k:1,7	- (-)	- (-)	- (-)	- (-)	1 (1)
61:-:1,5	4 (4)	8 (8)	11 (11)	3 (3)	24 (26)
61:-:1,5,7	15 (15)	11 (11)	7 (8)	21 (23)	4 (4)
unspecified "arizona" +	17 (17)	1 (1)	- (-)	- (-)	- (-)
<b>ENTERICA HOUTENAE</b>					
43:z4z23	- (-)	- (-)	- (-)	1 (1)	- (-)
<b>UNSPECIFIED</b>					
untypeable	- (-)	- (-)	1 (1)	- (-)	- (-)
structure only	79 (91)	149 (178)	76 (82)	100 (125)	104 (120)
rough strain	10 (10)	10 (10)	11 (12)	11 (11)	10 (10)
untyped	9 (9)	8 (9)	10 (10)	1 (1)	5 (6)
<b>TOTAL</b>	<b>2825 (3729)</b>	<b>3086 (4079)</b>	<b>3093 (3958)</b>	<b>2164 (2725)</b>	<b>2678 (3372)</b>

\* 2001 data may not be comparable due to impact of FMD outbreak

+ antigenic structure not stated

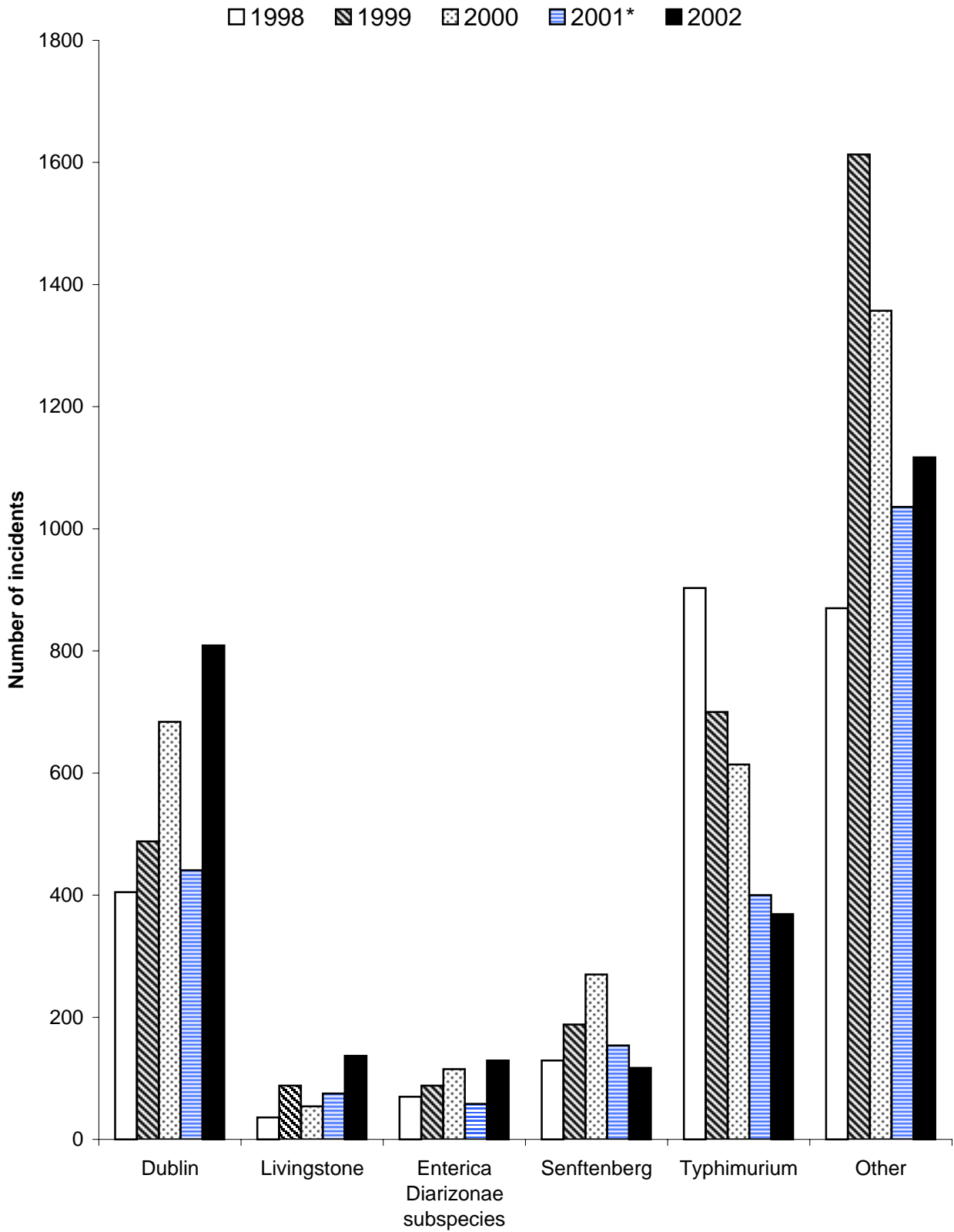
**Fig 2: Incidents of *Salmonella* serotypes in cattle, sheep, pigs & poultry in 2002**



**Table 9: Incidents of the top 5 *Salmonella* serotypes in cattle, sheep, pigs and poultry in 2002 as a % of all incidents compared to previous years**

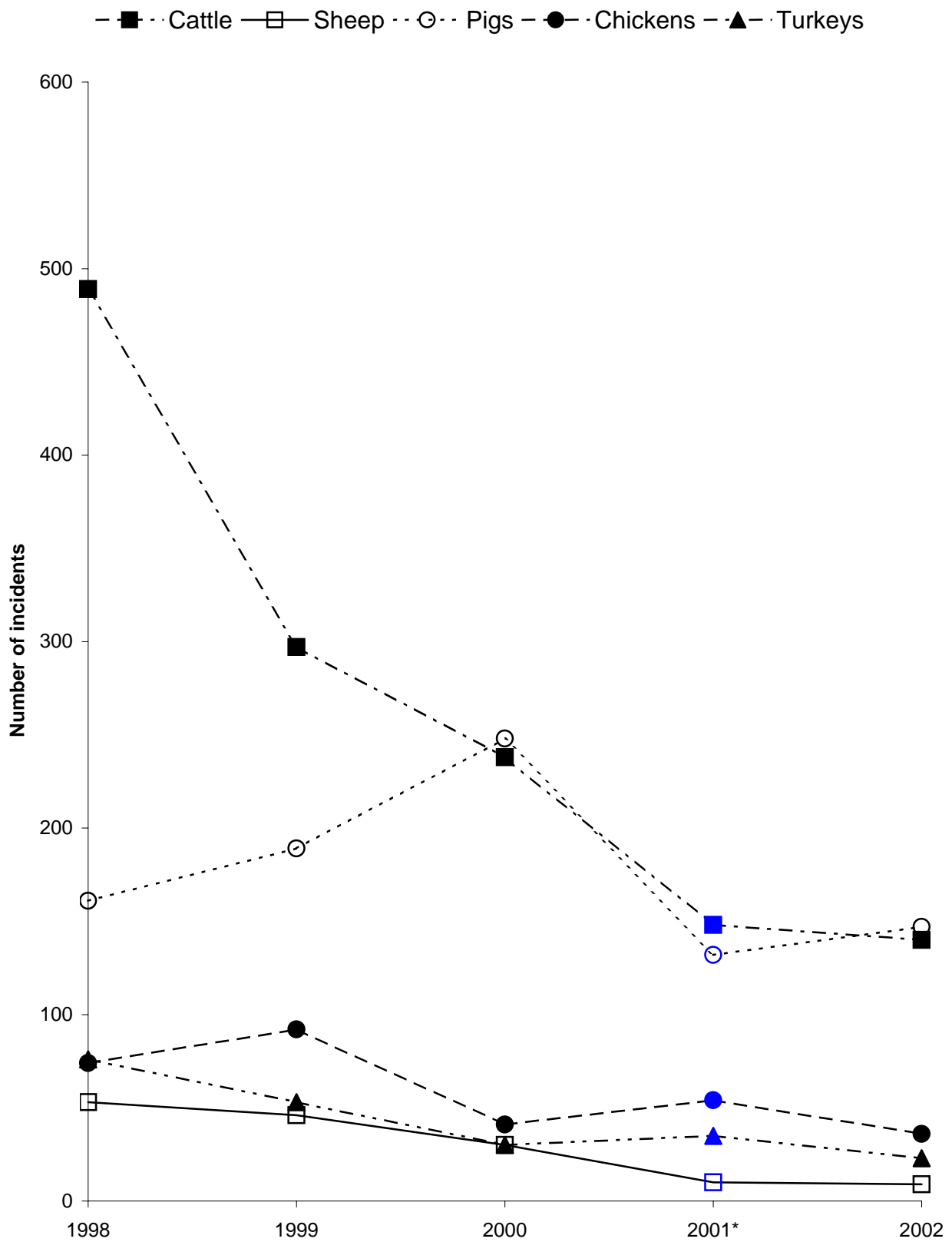
Serotype	1998	1999	2000	2001	2002
S. Dublin %	14.3	15.8	22.1	20.4	30.2
S. Typhimurium %	32.0	22.7	19.9	18.5	13.8
S. Livingstone %	1.3	2.9	1.7	3.5	5.1
S. <i>Enterica Diarizonae</i> subspecies %	2.5	2.9	3.7	2.7	4.8
S. Senftenberg %	4.6	6.1	8.7	7.1	4.4
Total no. incidents	2825	3086	3093	2164	2678

**Fig 3: Incidents of *Salmonella* serotypes in cattle, sheep, pigs & poultry 1998 - 2002**



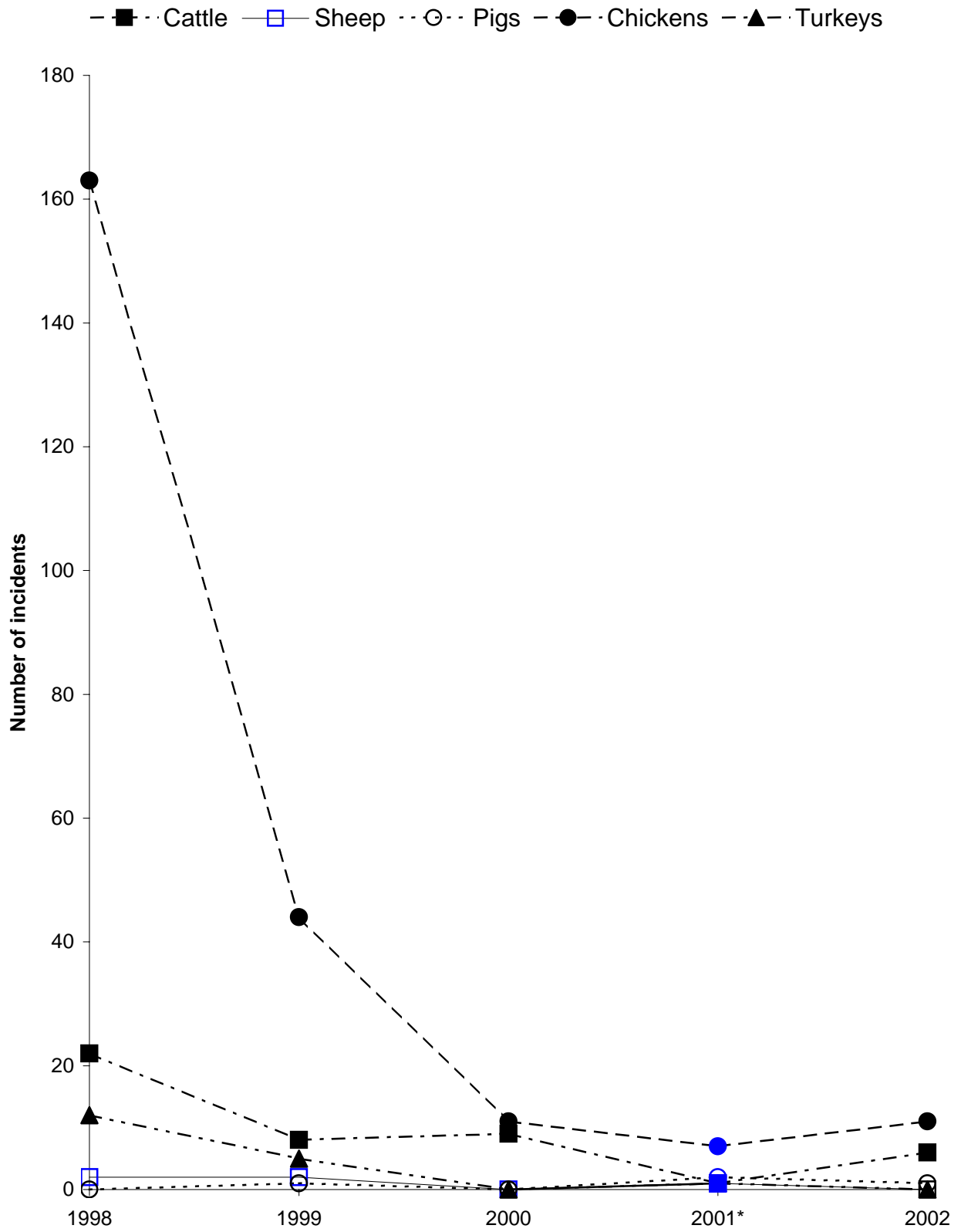
\* 2001 data may not be comparable due to uncertain impact of FMD outbreak

**Fig 4: Number of incident reports of *Salmonella* Typhimurium in livestock (1998 - 2002)**



\* 2001 data may not be comparable due to uncertain impact of FMD outbreak

**Fig 5: Number of incident reports of *Salmonella* Enteritidis in livestock (1998 - 2002)**



\* 2001 data may not be comparable due to uncertain impact of FMD outbreak