

## 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) Centre for Infections (Cfi) and in Scotland to Health Protection Scotland (HPS) (Tables 5 - 7). Clinical microbiology laboratories voluntarily report data and there are a number of factors that influence these reports. These are discussed in the Zoonoses Report UK 2005 (Defra 2006, in press).

In recent years tables have been produced comparing the relative frequency of *Salmonella* serovars in each animal 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 serovars. Similarly, if there is a change in serovar relativity, it is only by examining changes in absolute numbers that we can ascertain the size of any increase or decrease. For example, in 2005 the total number of *Salmonella* incident reports decreased by 2.2% compared with 2004 and decreased by 14.8% compared with 2003. However, this was not consistent across serovars. Reports of *S. Typhimurium* increased by 19.8%, reports of *S. Senftenberg* increased by 74.7% and there was an decrease of 17.1% in the number of reports of *S. Dublin*; there was therefore a change in the distribution of reports between these three serovars. *S. Dublin* was in 2005, the seventh successive year, the serovar most commonly isolated from livestock and was responsible for one fifth of reports, although a smaller proportion than in 2004. *S. Typhimurium* was the second most common serovar (14.3%), *S. Indiana* the third (7.3%), *S. Livingstone* the fourth (6.5%) and *S. enterica diarizonae* subspecies the fifth (5.6%).

Some serovars of *Salmonella* can infect a wide variety of host groups, for example, *S. Typhimurium*. Others tend to be associated with particular animal group, for example, *S. Enteritidis* and poultry,

*S. Dublin* and cattle and *S. enterica diarizonae* subspecies and sheep. Thus the serovar distribution reflects the group distribution of reports. In 2005, 52.0% of reports were from poultry, 27.9% from cattle, 6.1% from pigs and 7.5% from sheep (see Figure 1). There were 44 reports of *Salmonella* from horses in 2005, four reports from deer, one report from goats and no reports from rabbits.

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 epidemic of Foot and Mouth Disease resulting in fewer clinical specimens being submitted for examination.

Tables 8 & 9 and Fig 1 show that in 2005 the total number of incidents of *Salmonella* reported fell by 63 (2.2%) compared with 2004 and by 487 (14.8%) compared with 2003.

The relative frequency of reports of *S. Enteritidis* in 2005 (3.3%) was higher than in 2004 (0.8%); and there were six reports of *S. Enteritidis* in cattle, 23 in chickens and 63 in ducks.

The frequency of reports of *S. Typhimurium* rose to 14.3% of all reports in 2005. The relative frequency of *S. Typhimurium* was reduced in chickens and turkeys, increased in cattle and sheep and unchanged in pigs. The frequency of *S. Typhimurium* DT104 reports in cattle increased to 59.7% of all STM reports in 2005 compared with 50.8% in 2004. There were two new definitive types of *S. Typhimurium* reported in cattle in 2005, DT2a and DT170b, neither of which have been previously reported. *Salmonella* Typhimurium DTs 67, 104c and 108 were isolated in cattle for the first time in 2000 and DT135 was isolated for the first time since 1999.

The number of incidents of *S. Dublin* reported in cattle decreased by 12.1 % in 2005, much of which was due to a fall in reports from calves. The proportion of incidents of *S. Dublin* in cattle also decreased in 2005 although this serovar was again the most common reported in cattle (66.4%).

*Salmonella* Virchow was the third most common serovar isolated from human cases of salmonellosis in Great Britain in 2005, but is less frequently isolated from livestock and only 17 incident reports were recorded in 2005 (0.6% of all *Salmonella* incidents in livestock) compared with 43 incidents (1.5%) in 2004 (Table 8).

Reports of *S. enterica* subspecies *diarizonae* (mainly from sheep) fell

by 15.1% and for the seventh year running *S. enterica* subspecies *diarizonae* 61:k:1,5(7) and variants were most common serovars isolated from sheep (66.8%).

The three most common serovars reported from humans in 2005 were *S. Enteritidis* (57% of all reports), *S. Typhimurium* (13.4% of all reports) and *S. Virchow* (3.0% of all reports). By contrast the most common serovars reported from livestock during this period were *S. Dublin* (20.4% of all reports), *S. Typhimurium* (14.3% of reports) and *S. Indiana* (7.3% of reports). There were very few reports of *S. Virchow* from livestock which accounted for 0.6% of all reports in 2005. The most frequently reported phage types of *S. Typhimurium* in humans during 2005 were DT104 and DT193 (34.1% and 10.0% of all *S. Typhimurium* reports respectively) and the most common phage types of *S. Enteritidis* reported from humans were PT4 and PT1 (26.4% and 21.2% of all *S. Enteritidis* reports respectively). In livestock, DT104 was the most common phage type of *S. Typhimurium* in cattle and sheep and DT193 was the second most common in pigs. In 2005 PT4 was the fourth most common phage type of *S. Enteritidis* (9.3%) in poultry and there were two reports in cattle, while PT1 featured on isolated occasions in livestock, with single reports in cattle and in poultry.

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

Table 5 ranks the most common *Salmonella* serovars isolated from livestock in Great Britain in 2005 against the most common serovars 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 serovars 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 9.6% in 2005.

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 2005 again saw a depressed livestock industry.

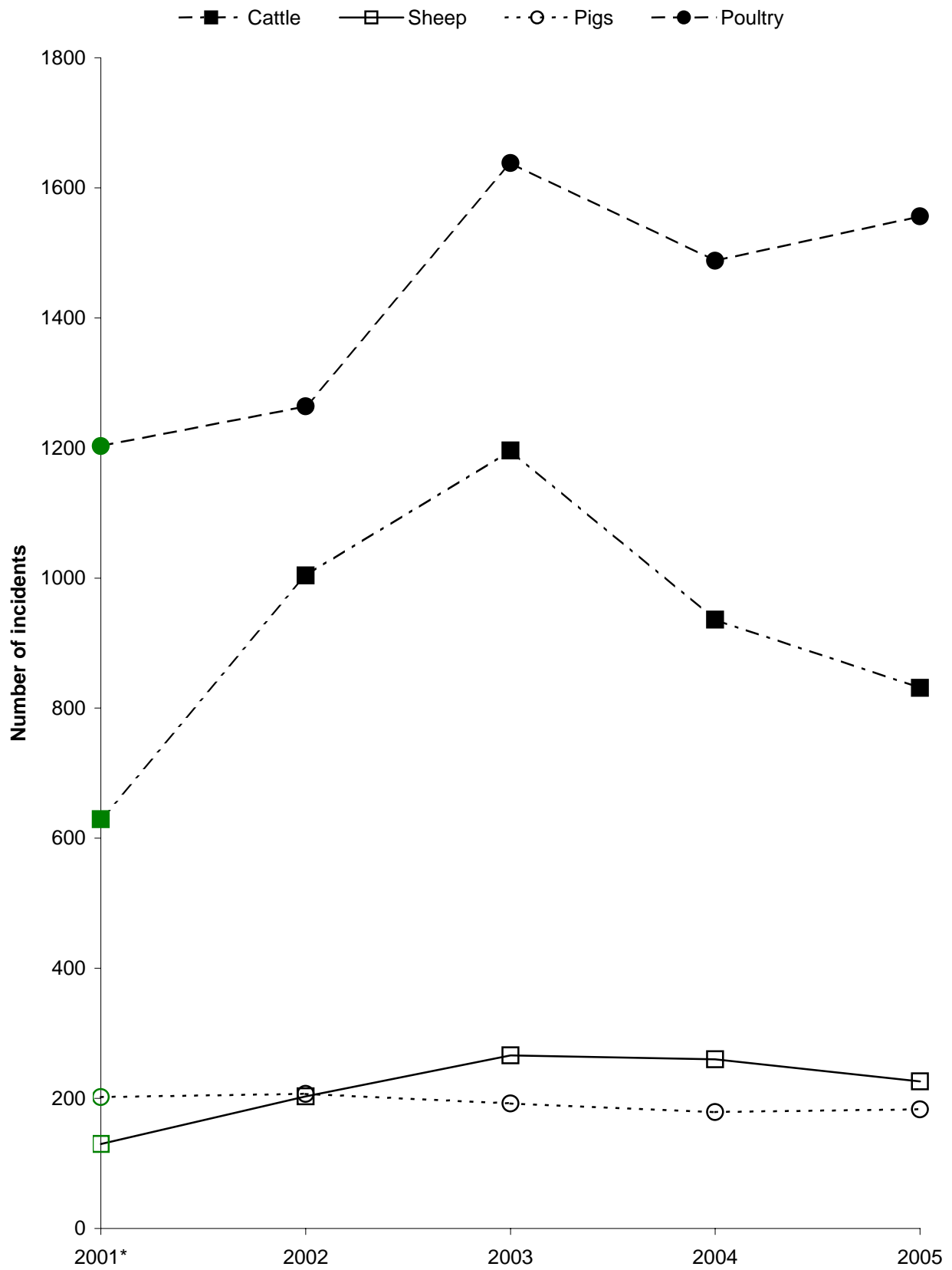
Diagnostic submissions to the Veterinary Laboratories Agency (VLA) and the Scottish Agricultural College (SAC) have declined in recent years and were particularly affected in 2001 by the epidemic of Foot and Mouth Disease during which the testing of carcase samples from all areas and all samples from infected areas was suspended for a number of months (see Introduction). The total number of diagnostic submissions received in 2005 decreased by 11.7% compared with 2005. Additionally as most of the data from species other than poultry relate to clinical investigations, the prevalence of subclinical infection in these species of livestock is not usually known.

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. Turkey 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. Of particular note is the continued increase in surveillance of duck flocks for *Salmonella* over the past two years. The assessment of submission rates in poultry is further complicated by the large proportion of *Salmonella* testing undertaken by private laboratories.

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.

**Fig 1: Number of incident reports of *Salmonella* in livestock (2001 - 2005)**



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

**Table 5: Reports of the most common *Salmonella* serotypes in 2005 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	7164	57.1	Dublin	552	66.4	<i>Enterica diarizonae</i> subsp	151	66.8	Typhimurium	127	69.4	Indiana	204	13.1
Typhimurium	1680	13.4	Typhimurium	144	17.3	Typhimurium	24	10.6	Derby	23	12.6	Livingstone	181	11.6
Virchow	373	3.0	Anatum	30	3.6	Dublin	16	7.1	Reading	9	4.9	Senftenberg	137	8.8
Newport	200	1.6	Agama	16	1.9	Montevideo	10	4.4	Hadar	6	3.3	Typhimurium	105	6.7
Hadar	177	1.4	Montevideo	14	1.7	Agama	6	2.7	Kedougou	5	2.7	Kottbus	88	5.7
Stanley	170	1.4										Enteritidis	86	5.5
Goldcoast	160	1.3										Kedougou	79	5.1
Infantis	121	1.0										Derby	61	3.9
Kentucky	101	0.8										Binza	56	3.6
Agona	89	0.7										Newport	34	2.2
Other serotypes	2307	18.4	Other serotypes	75	9.0	Other serotypes	19	8.4	Other serotypes	13	7.1	Other serotypes	525	33.7
Total	12542		Total	831		Total	226		Total	183		Total	1556	

\* Reports to Health Protection Agency and Health Protection Scotland, provisional data

**Table 6: Reports of the most common *Salmonella* Typhimurium definitive types in 2005 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	471	34.1	104	86	59.7	104	15	62.5	U288	52	40.9	8	61	58.1
193	138	10.0	12	9	6.3				193	29	22.8	104	26	24.8
120	85	6.2	104b	9	6.3				U302	9	7.1	30	6	5.7
104b	71	5.1	193	6	4.2				104b	8	6.3	41	2	1.9
56	41	3.0	135	5	3.5							U302	2	1.9
U288	38	2.8	49	4	2.8									
1	37	2.7	U302	4	2.8									
8	35	2.5												
49	33	2.4												
U311	32	2.3												
Other DTs	399	29.0	Other DTs	21	14.6	Other DTs	9	37.5	Other DTs	29	22.8	Other DTs	8	7.6
Total	1380		Total	144		Total	24		Total	127		Total	105	

\* Reports to Health Protection Agency and Health Protection Scotland, provisional data

**Table 7: Reports of the most common *Salmonella* Enteritidis phage types in 2005 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	1891	26.4	4	2	33.3							6a	31	36.0
1	1522	21.3	6a	2	33.3							9b	12	14.0
8	611	8.5	1	1	16.7							6	9	10.5
14b	610	8.5	NOPT	1	16.7							14b	9	10.5
21	510	8.5										4	8	9.3
6	504	7										7	3	3.5
6a	251	3.5										4b	2	2.3
12	115	1.6										12	2	2.3
24	93	1.3										1	1	1.2
1e	65	0.9										3	1	1.2
												5a	1	1.2
												NOPT	1	1.2
												UNTY	6	6.9
Other PTs	992	13.8	Other PTs	0		Other PTs	0		Other PTs	0		Other PTs	0	
Total	7164		Total	6		Total	0		Total	0		Total	86	

\* Reports to Health Protection Agency and Health Protection Scotland, provisional data

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

<i>Salmonella</i> Incidents (Isolations)	2001*	2002	2003	2004	2005
<b>ENTERICA ENTERICA</b>					
Agama	23 ( 31)	24 ( 32)	36 ( 37)	25 ( 25)	26 ( 27)
Agona	66 ( 82)	19 ( 20)	38 ( 39)	28 ( 28)	25 ( 25)
Ajiobo	1 ( 1)	4 ( 4)	2 ( 2)	6 ( 6)	1 ( 1)
Anatum	10 ( 11)	20 ( 31)	43 ( 46)	36 ( 38)	43 ( 43)
Ank	- ( -)	1 ( 1)	- ( -)	- ( -)	- ( -)
Berta	- ( -)	- ( -)	- ( -)	1 ( 1)	- ( -)
Binza	60 ( 66)	100 ( 134)	79 ( 89)	93 ( 96)	56 ( 59)
Bovis morbificans	2 ( 2)	1 ( 1)	- ( -)	1 ( 1)	3 ( 4)
Bradford	- ( -)	- ( -)	- ( -)	1 ( 1)	- ( -)
Braenderup	1 ( 1)	1 ( 1)	2 ( 2)	1 ( 1)	- ( -)
Brandenburg	4 ( 4)	1 ( 1)	11 ( 18)	21 ( 23)	- ( -)
Bredeney	6 ( 6)	15 ( 17)	18 ( 18)	3 ( 3)	1 ( 1)
Carno	- ( -)	- ( -)	1 ( 1)	- ( -)	1 ( 1)
Choleraesuis	- ( -)	- ( -)	- ( -)	1 ( 1)	1 ( 1)
Choleraesuis-vk	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
Coeln	- ( -)	- ( -)	- ( -)	- ( -)	1 ( 1)
Corvallis	- ( -)	- ( -)	3 ( 3)	6 ( 6)	1 ( 1)
Cubana	1 ( 1)	- ( -)	1 ( 1)	- ( -)	1 ( 1)
Derby	73 ( 93)	40 ( 45)	76 ( 95)	58 ( 64)	88 ( 93)
Dublin	441 ( 559)	809 ( 1030)	944 ( 1213)	686 ( 820)	569 ( 688)
Duesseldorf	- ( -)	- ( -)	- ( -)	- ( -)	- ( 1)
Durham	2 ( 2)	- ( -)	2 ( 2)	1 ( 1)	1 ( 1)
Ealing	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
Eimsbuettel	6 ( 7)	1 ( 1)	- ( -)	- ( -)	- ( -)
Enteritidis	26 ( 27)	30 ( 37)	66 ( 75)	24 ( 29)	92 ( 102)
Fischerkietz	2 ( 3)	1 ( 1)	- ( -)	2 ( 2)	- ( -)
Gallinarum	- ( -)	- ( -)	- ( -)	- ( -)	4 ( 9)
Give	19 ( 19)	32 ( 32)	30 ( 31)	47 ( 47)	25 ( 25)
Gloucester	- ( -)	- ( -)	- ( -)	- ( -)	1 ( 1)
Goldcoast	10 ( 12)	21 ( 24)	21 ( 22)	11 ( 11)	11 ( 11)
Hadar	8 ( 10)	48 ( 56)	53 ( 56)	60 ( 66)	27 ( 27)
Hato	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
Havana	3 ( 3)	4 ( 6)	18 ( 18)	10 ( 10)	9 ( 9)
Heidelberg	52 ( 60)	24 ( 24)	3 ( 3)	- ( -)	- ( -)
Idikan	1 ( 1)	1 ( 1)	1 ( 1)	3 ( 3)	11 ( 11)
Indiana	34 ( 41)	81 ( 115)	165 ( 176)	168 ( 170)	205 ( 214)
Infantis	5 ( 9)	7 ( 7)	11 ( 11)	20 ( 21)	8 ( 8)
Jangwani	- ( -)	- ( -)	- ( -)	- ( -)	- ( 4)
Kedougou	60 ( 68)	74 ( 85)	92 ( 96)	95 ( 95)	86 ( 87)

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

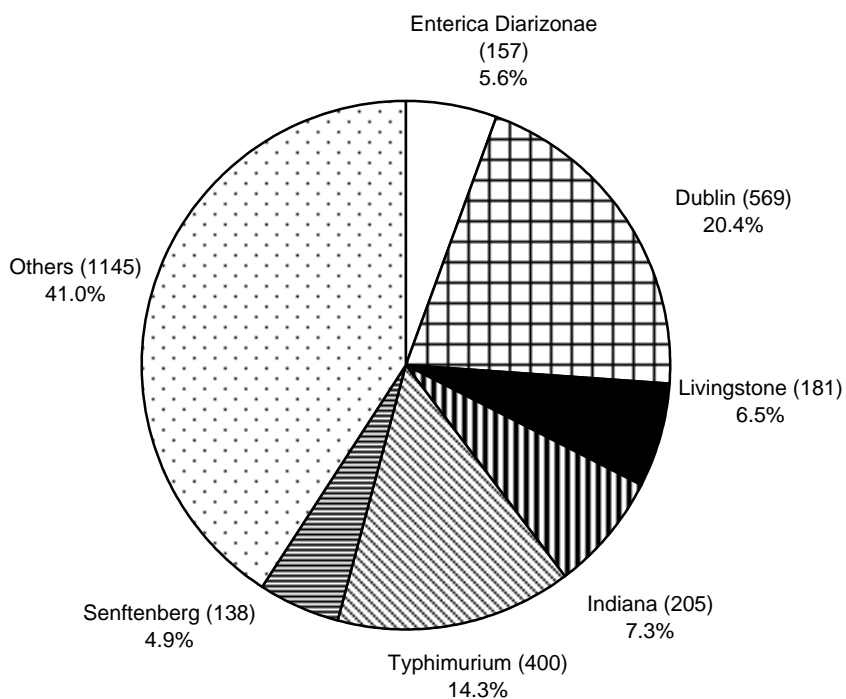
<i>Salmonella</i> Incidents (Isolations)	2001*	2002	2003	2004	2005
<b>ENTERICA ENTERICA</b>					
Kentucky	10 ( 15)	3 ( 4)	- ( -)	6 ( 6)	2 ( 2)
Kiambu	- ( -)	- ( -)	- ( -)	- ( 1)	- ( -)
Kimuenza	- ( -)	1 ( 1)	3 ( 4)	1 ( 1)	- ( -)
Kokomlemle	- ( -)	- ( -)	- ( -)	- ( -)	1 ( 1)
Kottbus	18 ( 20)	11 ( 11)	38 ( 42)	38 ( 39)	89 ( 92)
Larochelle	2 ( 2)	3 ( 3)	1 ( 1)	1 ( 1)	1 ( 1)
Lexington	1 ( 1)	1 ( 1)	- ( -)	10 ( 10)	3 ( 3)
Lille	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
Liverpool	60 ( 73)	31 ( 35)	27 ( 27)	47 ( 48)	17 ( 17)
Livingstone	75 ( 90)	137 ( 220)	193 ( 199)	244 ( 246)	181 ( 182)
London	1 ( 1)	5 ( 5)	2 ( 3)	9 ( 10)	5 ( 5)
Manhattan	- ( -)	- ( -)	2 ( 2)	- ( -)	- ( -)
Mbandaka	60 ( 80)	55 ( 62)	50 ( 54)	25 ( 26)	28 ( 28)
Meleagridis	- ( -)	1 ( 1)	2 ( 2)	1 ( 1)	3 ( 3)
Menston	- ( -)	- ( -)	1 ( 1)	- ( -)	2 ( 2)
Montevideo	114 ( 162)	86 ( 145)	141 ( 156)	47 ( 74)	53 ( 66)
Muenchen	- ( -)	1 ( 1)	- ( -)	- ( -)	- ( -)
Nagoya	1 ( 1)	2 ( 2)	2 ( 2)	- ( -)	- ( -)
New Brunswick	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
Newington	2 ( 2)	- ( -)	- ( -)	- ( -)	- ( -)
Newport	31 ( 35)	42 ( 48)	47 ( 48)	58 ( 59)	51 ( 52)
Ohio	23 ( 27)	38 ( 49)	32 ( 32)	31 ( 31)	27 ( 27)
Orion	11 ( 14)	53 ( 76)	51 ( 51)	42 ( 43)	45 ( 47)
Oslo	- ( -)	- ( -)	6 ( 6)	1 ( 1)	1 ( 1)
Panama	1 ( 1)	2 ( 2)	- ( -)	- ( -)	- ( -)
Paratyphi B var java	- ( -)	- ( -)	3 ( 3)	- ( -)	- ( -)
Poona	1 ( 1)	- ( -)	1 ( 1)	2 ( 2)	1 ( 1)
Pullorum	4 ( 4)	4 ( 4)	4 ( 5)	3 ( 4)	- ( 1)
Reading	1 ( 1)	5 ( 5)	7 ( 7)	8 ( 8)	0 ( 1)
Rissen	- ( -)	- ( -)	- ( -)	2 ( 2)	5 ( 5)
Saint Paul	5 ( 5)	5 ( 5)	3 ( 3)	5 ( 5)	27 ( 27)
Schwarzengrund	5 ( 6)	2 ( 4)	2 ( 2)	6 ( 6)	1 ( 1)
Senftenberg	154 ( 274)	117 ( 160)	71 ( 74)	79 ( 80)	138 ( 140)
Stanley	- ( -)	3 ( 3)	2 ( 2)	2 ( 2)	- ( -)
Stourbridge	- ( -)	- ( -)	3 ( 3)	2 ( 2)	3 ( 3)
Sundsvall	- ( -)	- ( -)	- ( -)	- ( -)	1 ( 1)
Taksony	2 ( 2)	2 ( 2)	- ( -)	- ( -)	- ( -)
Teddington	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
Tees	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
Tennessee	1 ( 1)	4 ( 4)	7 ( 7)	2 ( 2)	2 ( 2)

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

<i>Salmonella</i> Incidents (Isolations)	2001*	2002	2003	2004	2005
<b>ENTERICA ENTERICA</b>					
Thomasville	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
Thompson	60 ( 60)	35 ( 36)	15 ( 16)	40 ( 40)	21 ( 23)
Typhimurium	400 ( 463)	369 ( 450)	367 ( 433)	334 ( 375)	400 ( 440)
Uganda	- ( -)	- ( -)	- ( -)	- ( -)	1 ( 1)
Vejle	- ( -)	4 ( 8)	4 ( 4)	8 ( 8)	- ( -)
Virchow	25 ( 26)	48 ( 49)	87 ( 92)	43 ( 43)	17 ( 18)
Wangata	- ( -)	1 ( 1)	- ( -)	- ( -)	- ( -)
Worthington	1 ( 1)	- ( -)	1 ( 1)	- ( -)	- ( -)
Yoruba	- ( -)	- ( -)	1 ( 1)	1 ( 1)	2 ( 2)
<b>ENTERICA DIARIZONAE</b>					
61:k:1,5	10 ( 10)	22 ( 22)	- ( 9)	0 ( 1)	- ( -)
61:k:1,5,7	24 ( 26)	78 ( 80)	121 ( 122)	136 ( 139)	105 ( 105)
61:k:1,7	- ( -)	1 ( 1)	- ( -)	- ( -)	4 ( 4)
61:-:1,5	3 ( 3)	24 ( 26)	2 ( 2)	- ( -)	- ( -)
61:-:1,5,7	21 ( 23)	4 ( 4)	30 ( 30)	49 ( 49)	48 ( 48)
61:-:1,7	- ( -)	- ( -)	1 ( 1)	- ( -)	- ( -)
<b>ENTERICA HOUTENAE</b>					
43:z4z23	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
<b>UNSPECIFIED</b>					
untypeable	- ( -)	- ( -)	- ( 2)	- ( -)	- ( -)
structure only	100 ( 125)	104 ( 120)	222 ( 228)	161 ( 166)	178 ( 180)
rough strain	11 ( 11)	10 ( 10)	- ( 3)	- ( 2)	8 ( 8)
untyped	1 ( 1)	5 ( 6)	- ( -)	- ( -)	- ( -)
<b>TOTAL</b>	<b>2164 (2725)</b>	<b>2678 (3372)</b>	<b>3283 (3758)</b>	<b>2859 (3112)</b>	<b>2795 (3024)</b>

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

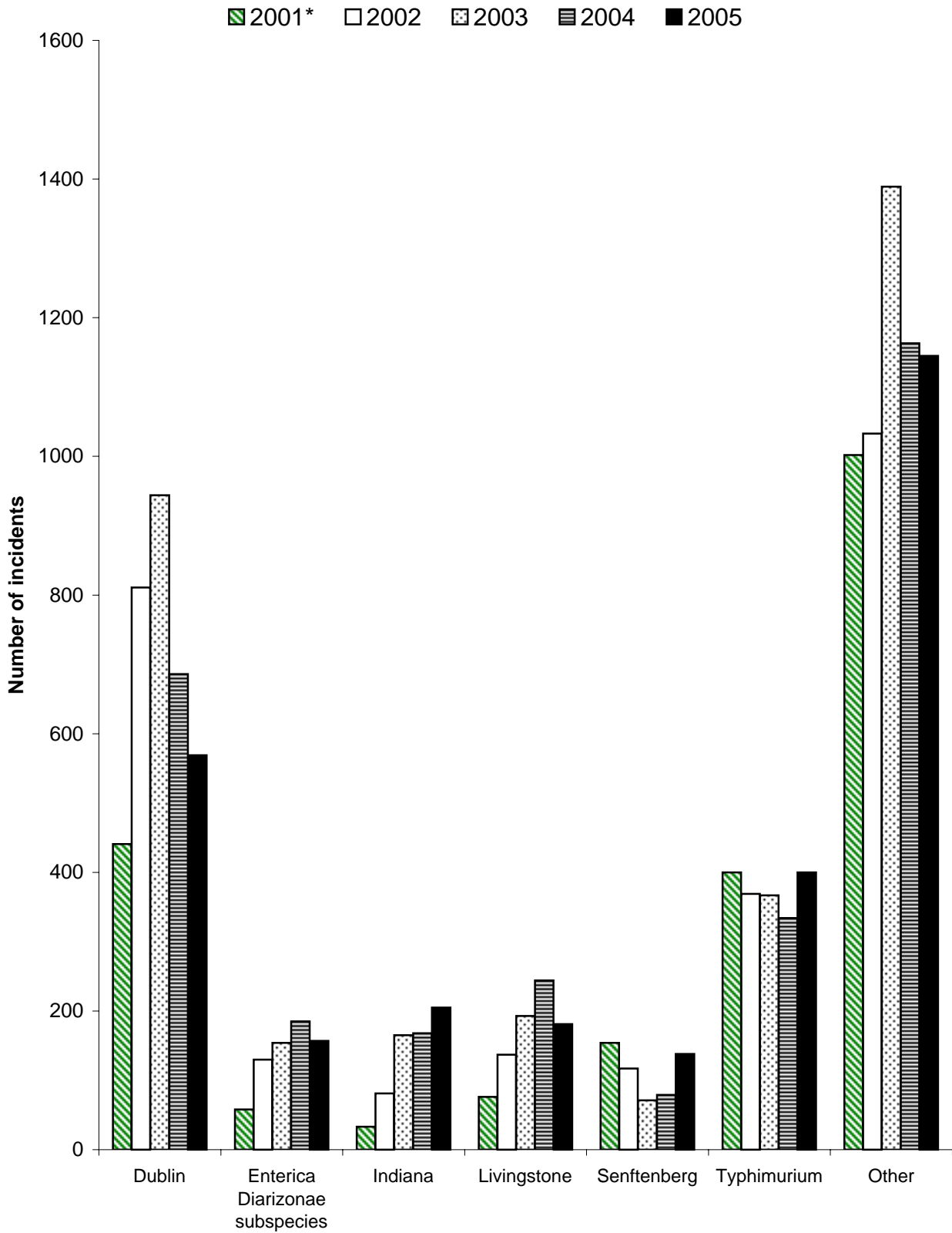
**Fig 2: Incidents of *Salmonella* serotypes in cattle, sheep, pigs & poultry in 2005**



**Table 9: Incidents of the top 5 *Salmonella* serotypes in cattle, sheep, pigs and poultry in 2005 as a % of all incidents compared to previous years**

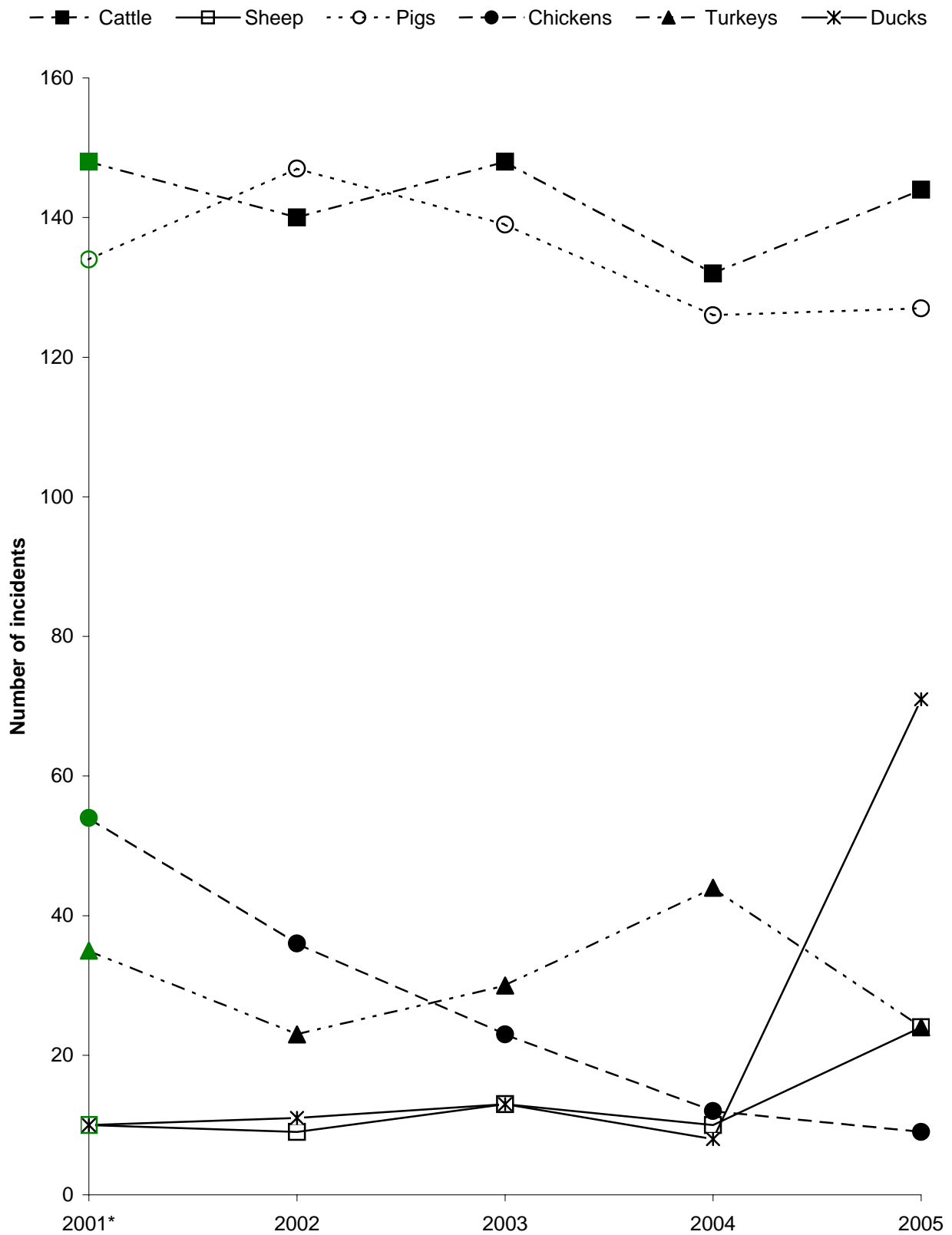
Serotype	2001	2002	2003	2004	2005
S. Dublin %	20.4	30.2	28.8	24.0	20.4
S. Typhimurium %	18.5	13.8	11.2	11.7	14.3
S. Indiana %	1.6	3.0	5.0	5.9	7.3
S. Livingstone %	3.5	5.1	5.9	8.5	6.5
S. <i>Enterica Diarizonae</i> subspecies %	2.7	4.8	4.7	6.5	5.6
Total no. incidents	2164	2678	3283	2859	2795

**Fig 3: Incidents of *Salmonella* serotypes in cattle, sheep, pigs & poultry 2001 - 2005**



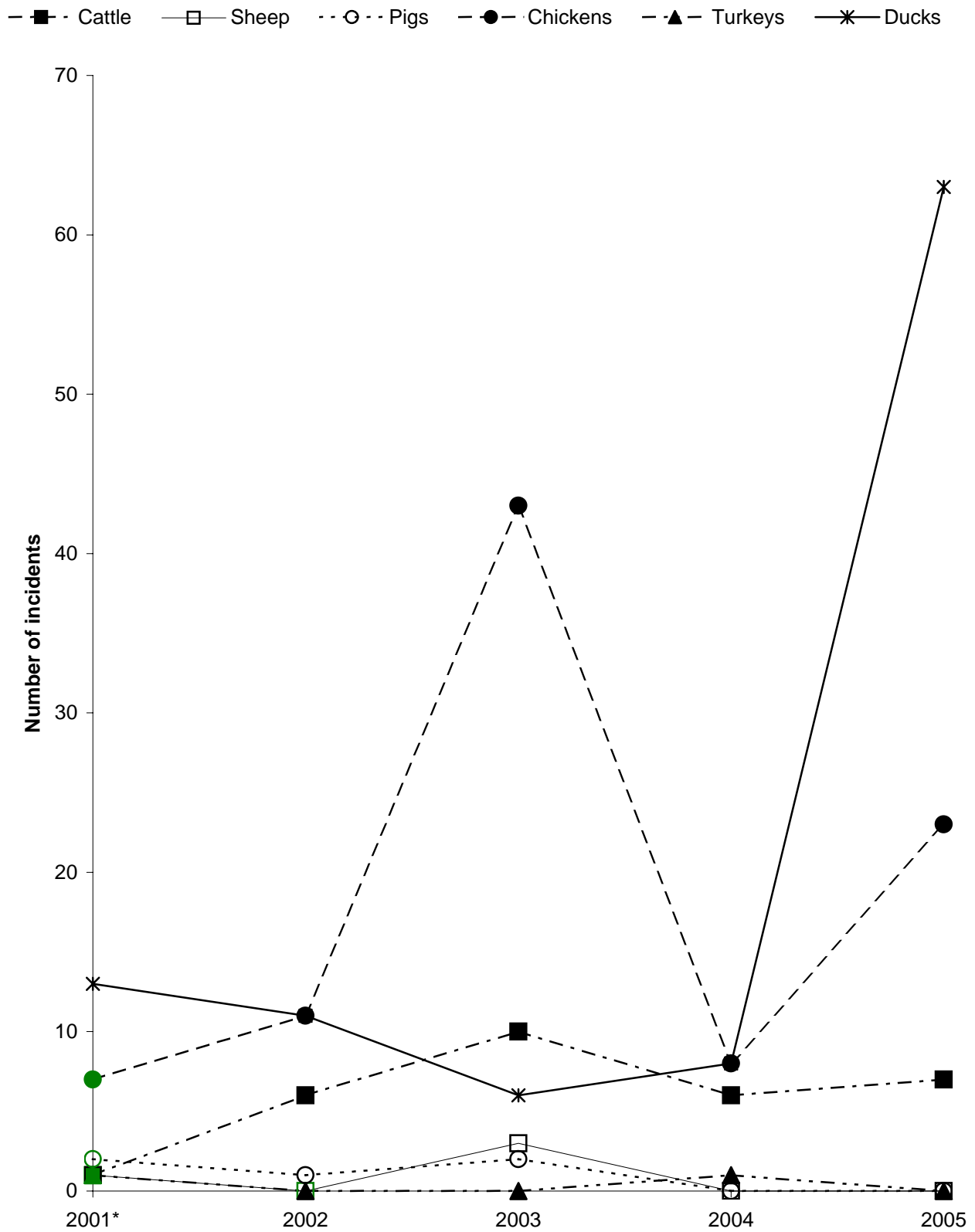
\* 2001 data may not be comparable due to uncertain impact of FMD epidemic

**Fig 4: Number of incident reports of *Salmonella* Typhimurium in livestock (2001 - 2005)**



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

**Fig 5: Number of incident reports of *Salmonella* Enteritidis in livestock (2001 - 2005)**



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