

Chapter 2.2

REPORTS OF *SALMONELLA* IN SHEEP AND GOATS

Sheep

33.6 million sheep were kept in GB in 2003, which is roughly equal to the number recorded in June 2002. In general the number of diagnostic submissions from sheep reported to the VIDA database has decreased in recent years, but slightly more samples were submitted in 2003 (10,728) than in 2002 (9,165). This reflects a significant increase in submissions over 2001 (6,545) when many sheep were slaughtered for control and welfare reasons during FMD, and is approaching the number recorded in 2000 (11,000).

There was a 56% increase in the number of *Salmonella* incidents reported in sheep in 2002 compared with 2001, back to similar levels observed in the years preceding the FMD epidemic. This trend was continued in 2003, with a 35% increase in *Salmonella* incidents in sheep over the number reported in 2002. The number of incidents in sheep in 2003 (274) is the highest recorded, although this may be partly due to the way in which incidents are allocated by the new system. The majority (91%) of the reports originated from diagnostic submissions and most of them (99%) were from sheep on farms (Table 1, Chapter 1).

Salmonella enterica* subspecies *diarizonae

Salmonella enterica subspecies *diarizonae* serovar 61:k:1,5,7 (and associated incomplete antigenic structures) continues to be the most common serovar reported in sheep, constituting 57% of all incidents in 2003, compared to 62% in 2002 (Table 25). Half of the 70 abortion incidents involving *Salmonella* in 2003 were associated with *S. diarizonae*. *Salmonella diarizonae* is associated with diarrhoea and abortions, but can be isolated from sheep with other infections (eg coccidiosis, *Nematodirus*, and fluke) and from healthy sheep.

***Salmonella* Dublin**

As observed in cattle, reports of *S. Dublin* remain high (15% of ovine incidents), but the proportion has reduced from the 19% of incidents observed in 2002 (Table 25, Figure 19). This serovar has been the second most common *Salmonella* isolated from sheep in recent years. These incidents have occurred in different counties in Great Britain. Sixteen incidents of *S. Dublin* with a presenting sign of ovine abortion were

reported in 2003. The other 26 incidents of *S. Dublin* were associated with other clinical signs, most commonly diarrhoea. Incidents have occurred throughout GB, but particularly in the North and West with the highest number in Wales. There was a small decrease in the proportion of abortions that were attributed to *S. Dublin* in 2003 (1.8%) compared with 2002 (2.5%) (VIDA 2003). Several outbreaks due to *S. Dublin* were associated with significant morbidity and mortality in ewes and lambs. In some of these incidents *S. Dublin* had been isolated from cattle on the same premises in previous years, but other outbreaks have occurred in sheep kept without any known contact with cattle.

***Salmonella* Typhimurium**

The proportion of incidents due to *S. Typhimurium* continued to fall (4% in 2003; Figure 19) due to low numbers of DT104 compared with the number of incidents reported in the 1990s. However, DT104 remains the most common (6 of 11 incidents) definitive type (Figure 20). In one incident, multiresistant DT104 was isolated from the intestines of week-old lambs, 50 of which had died. Definitive types 40, 41 and U288 were reported in sheep in 2003 for the first time in five years. *S. Typhimurium* is generally more commonly associated with sudden death and diarrhoea than abortion.

Other serovars

There continue to be changes in the relative frequency of other serovars. *Salmonella* Montevideo was isolated from 26 incidents, double the number in 2002, of which 16 were associated with abortion. No clinical disease was reported to be associated with this serovar in 2002. *Salmonella* Agama was reported thirteen times and *S. Derby* eleven times in 2003, the latter compared with only once in 2002; these serovars are also associated with ovine abortion. One incident of *S. Derby* was associated with enteritis in lambs, which were kept in a building which had previously housed pigs. *Salmonella* Give, *S. Nagoya* and *S. Oslo* were isolated for the first time in sheep. There were three isolations of *S. Enteritidis* (PTs 1, 11 and 14b), and one each of *S. Newport* and *S. Thompson*. *Salmonella* Livingstone, which is more commonly isolated from poultry, was recovered from a group of two-to-three month-old lambs with intermittent diarrhoea and ill-thrift. *Salmonella* Durham, a serovar more commonly associated with wildlife, was isolated from a group of aborting ewes. There have been no reports of *S. Hadar*, *S. Virchow*, *S. Amsterdam*, *S. Mbandaka*, *S. Reading*, *S. Rubislaw* or *S. Stourbridge* in sheep in the last five years.

Goats

86,000 goats were kept in Great Britain in 2003. There were no incidents of salmonellosis recorded in goats in 2003. There was a decrease in the number of diagnostic submissions from goats in 2003 (588) compared to 2002 (668), with numbers remaining lower than in previous years (eg 873 in 1998; 752 in 2000; [VIDA 2003]).

Table 24: *Salmonella* in sheep on all premises

<i>Salmonella</i> Incidents (Isolations)	1999	2000	2001*	2002	2003
ENTERICA ENTERICA					
Agama	12 (15)	8 (8)	7 (9)	10 (12)	13 (15)
Agona	1 (1)	3 (4)	1 (1)	1 (1)	3 (4)
Ajiobo	- (-)	- (-)	1 (1)	- (-)	- (-)
Bovis morbificans	1 (1)	- (-)	- (-)	- (-)	- (-)
Brandenburg	1 (1)	- (-)	1 (1)	1 (1)	- (-)
Bredeney	1 (1)	- (-)	- (-)	- (-)	- (-)
Derby	5 (6)	6 (7)	6 (9)	1 (1)	11 (14)
Dublin	13 (14)	10 (12)	19 (19)	38 (42)	42 (46)
Durham	- (-)	- (-)	1 (1)	- (-)	1 (1)
Enteritidis	2 (4)	- (-)	1 (1)	- (-)	3 (3)
Give	- (-)	- (-)	- (-)	- (-)	1 (1)
Goldcoast	- (-)	1 (2)	- (-)	1 (1)	- (-)
Indiana	3 (4)	2 (3)	- (-)	1 (5)	- (-)
Infantis	2 (3)	- (-)	- (-)	- (-)	- (-)
Kottbus	- (-)	- (-)	- (-)	1 (1)	- (-)
Livingstone	1 (2)	1 (1)	- (-)	- (-)	1 (1)
Manhattan	- (-)	- (-)	- (-)	- (-)	- (-)
Montevideo	12 (13)	15 (21)	22 (27)	13 (14)	26 (30)
Nagoya	- (-)	- (-)	- (-)	- (-)	1 (1)
Newington	- (-)	- (-)	1 (1)	- (-)	- (-)
Newport	- (-)	1 (1)	1 (2)	- (-)	1 (1)
Oslo	- (-)	- (-)	- (-)	- (-)	1 (1)
Poona	1 (1)	- (-)	- (-)	- (-)	- (-)
Schwarzengrund	- (-)	- (-)	2 (2)	- (-)	- (-)
Thompson	1 (1)	1 (1)	- (-)	- (-)	1 (1)
Typhimurium	46 (63)	30 (54)	10 (12)	9 (12)	11 (14)
SUBTOTAL	102 (130)	78 (114)	73 (86)	76 (90)	116 (133)
ENTERICA DIARIZONAE					
61:k:1,5	49 (51)	47 (49)	10 (10)	22 (22)	9 (9)
61:k:1,5,7	17 (17)	48 (48)	24 (26)	77 (79)	117 (119)
61:k:1,7	- (-)	- (-)	- (-)	1 (1)	- (-)
61:-:1,5	8 (8)	11 (11)	3 (3)	23 (25)	1 (1)

Table 24: *Salmonella* in sheep on all premises

<i>Salmonella</i> Incidents (Isolations)	1999	2000	2001*	2002	2003
61:-:1,5,7	10 (10)	7 (8)	20 (22)	3 (3)	29 (30)
61:-:1,7	- (-)	- (-)	- (-)	- (-)	1 (1)
unspecified "arizona" +	1 (1)	- (-)	- (-)	- (-)	- (-)
SUBTOTAL	85 (87)	113 (116)	57 (61)	126 (130)	157 (160)
UNSPECIFIED					
structure only	- (-)	3 (3)	- (-)	- (-)	- (-)
rough strain	- (-)	- (-)	- (-)	1 (1)	1 (1)
TOTAL	187 (217)	194 (233)	130 (147)	203 (221)	274 (294)

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

+ antigenic structure not stated

Fig 18: Incidents of *Salmonella* serotypes in sheep in 2003

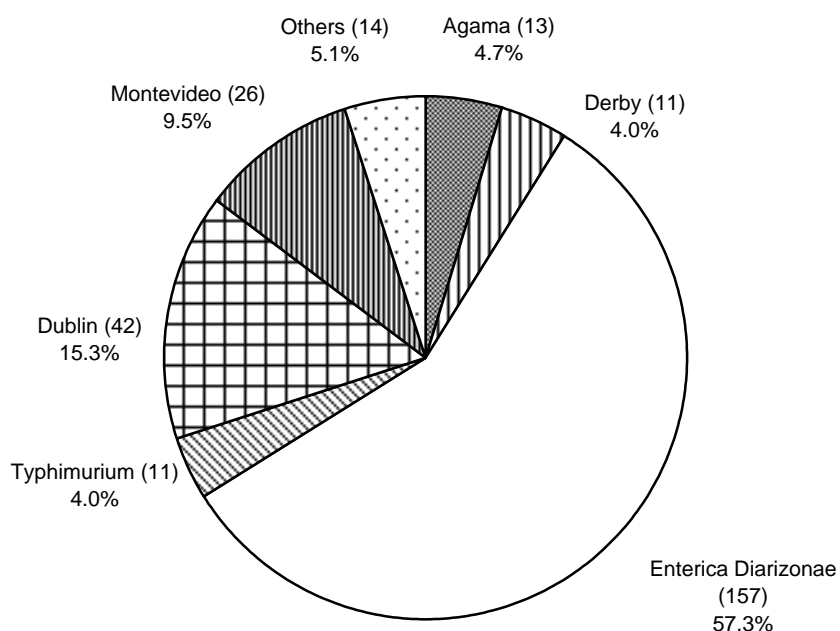
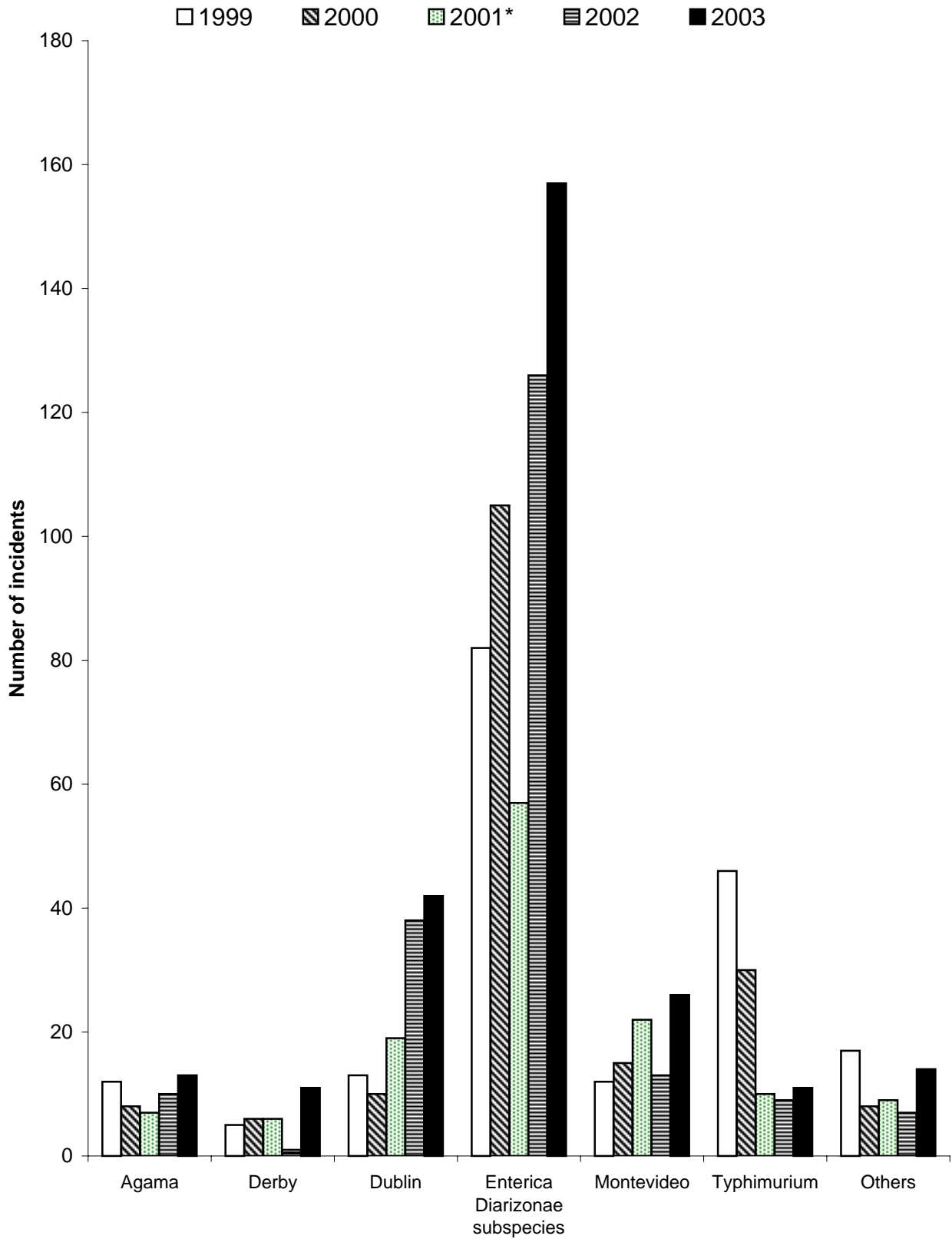


Table 25: Incidents of the top 5 *Salmonella* serotypes in sheep in 2003 as a % of all incidents compared to previous years

Serotype	1999	2000	2001	2002	2003
<i>S. Enterica Diarizonae</i> subspecies %	45.5	58.2	43.8	62.1	57.3
<i>S. Dublin</i> %	7.0	5.2	14.6	18.7	15.3
<i>S. Montevideo</i> %	6.4	7.7	16.9	6.4	9.5
<i>S. Agama</i> %	6.4	4.1	5.4	4.9	4.7
<i>S. Derby</i> %	2.7	3.1	4.6	0.5	4.0
<i>S. Typhimurium</i> %	24.6	15.5	7.7	4.4	4.0
Total no. incidents	187	194	130	203	274

Fig 19: Incidents of *Salmonella* serotypes in sheep (1999 - 2003)



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

Table 26: S. Typhimurium in sheep on all premises

Definitive Types Incidents (Isolations)	1999	2000	2001*	2002	2003
7	1 (1)	- (-)	- (-)	- (-)	- (-)
12	3 (4)	- (-)	- (-)	- (-)	- (-)
40	- (-)	- (-)	- (-)	- (-)	1 (1)
41	- (-)	- (-)	2 (2)	- (-)	3 (3)
104	27 (38)	20 (34)	4 (6)	5 (6)	6 (9)
104b	1 (1)	1 (1)	- (-)	1 (2)	- (-)
120	1 (1)	1 (6)	- (-)	- (-)	- (-)
193	3 (6)	- (1)	1 (1)	- (-)	- (-)
193a	2 (4)	- (-)	- (-)	- (-)	- (-)
208	- (-)	1 (1)	- (-)	- (-)	- (-)
U288	- (-)	- (-)	- (-)	- (-)	1 (1)
U302	1 (1)	3 (6)	1 (1)	2 (3)	- (-)
U308a	- (-)	- (-)	1 (1)	- (-)	- (-)
RDNC	- (-)	1 (1)	- (-)	- (-)	- (-)
NOPT	1 (1)	- (-)	- (-)	- (-)	- (-)
UNTY	5 (5)	3 (4)	1 (1)	1 (1)	- (-)
Untyped	1 (1)	- (-)	- (-)	- (-)	- (-)
TOTAL	46 (63)	30 (54)	10 (12)	9 (12)	11 (14)

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

Fig 20: Incidents of *Salmonella* Typhimurium definitive types in sheep in 2003

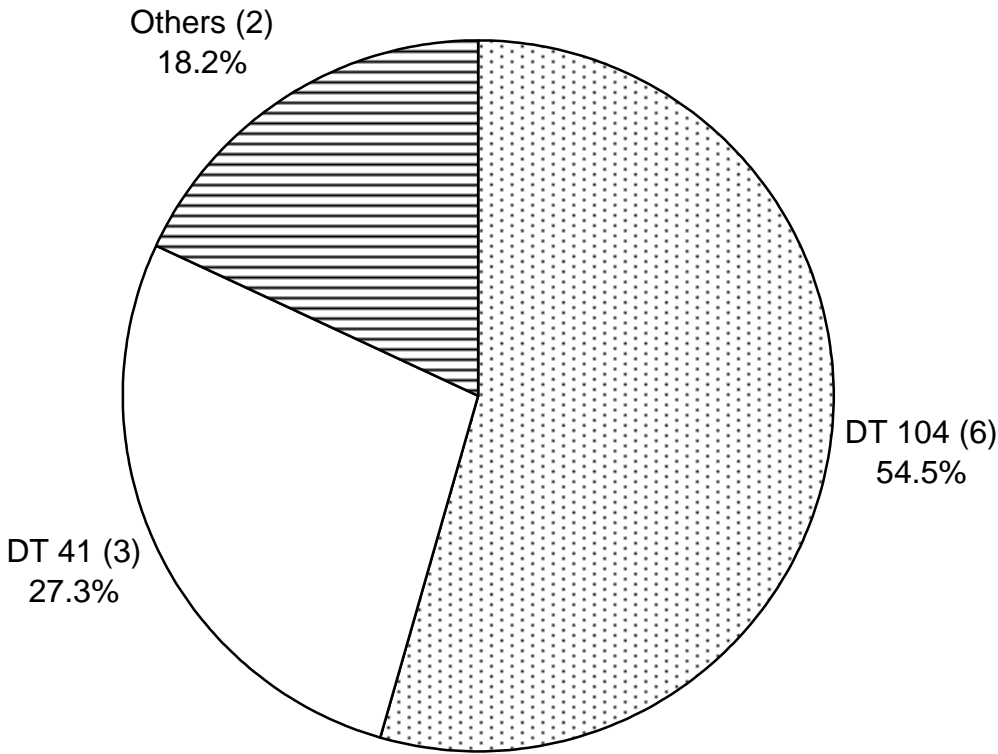
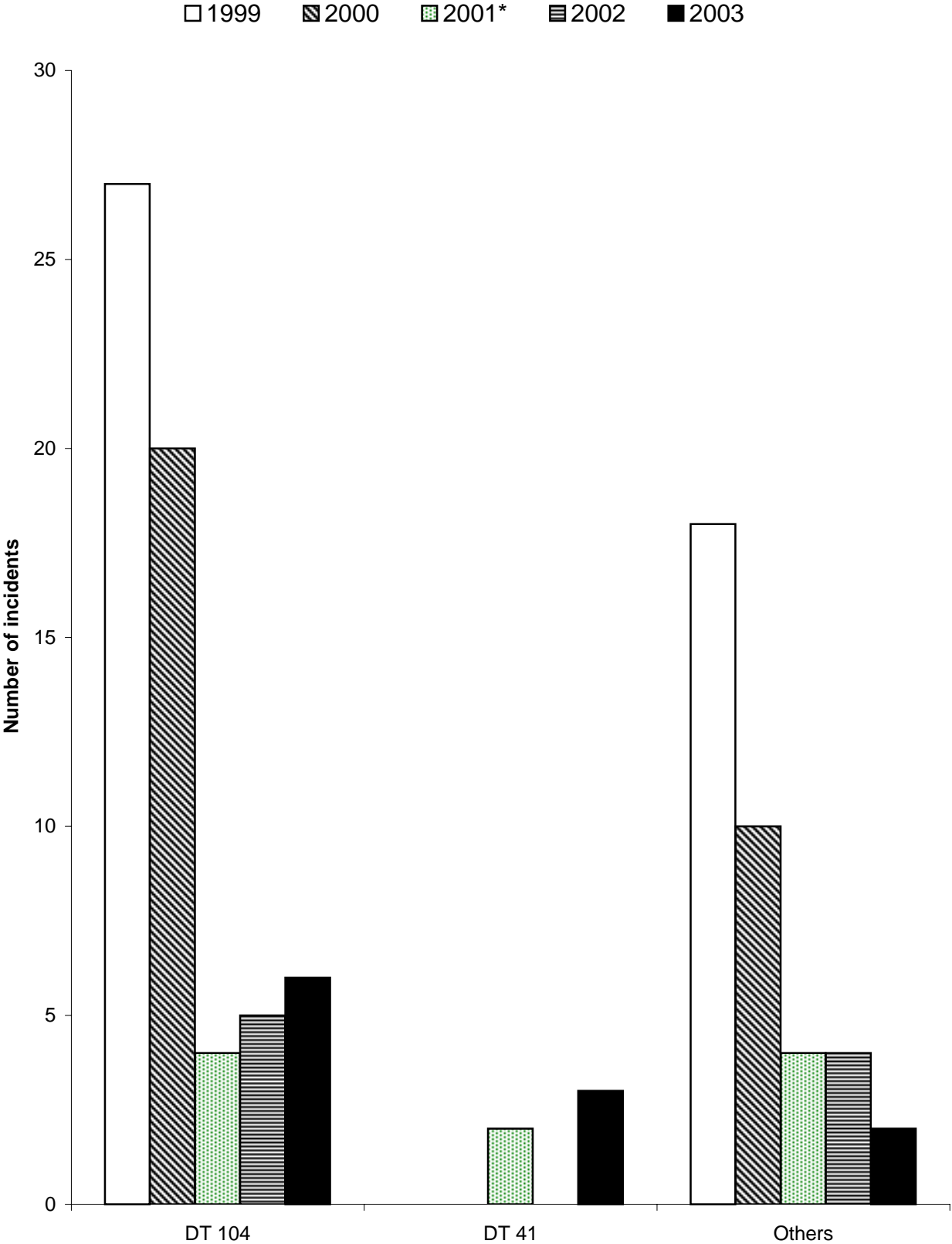


Fig 21: Incidents of *Salmonella* Typhimurium definitive types in sheep (1999 - 2003)



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

Fig 22: *S. Enteritidis*, *S. Typhimurium* and *S. Enterica Diarizonae* as a proportion of all incident reports in sheep (1985 - 2003)

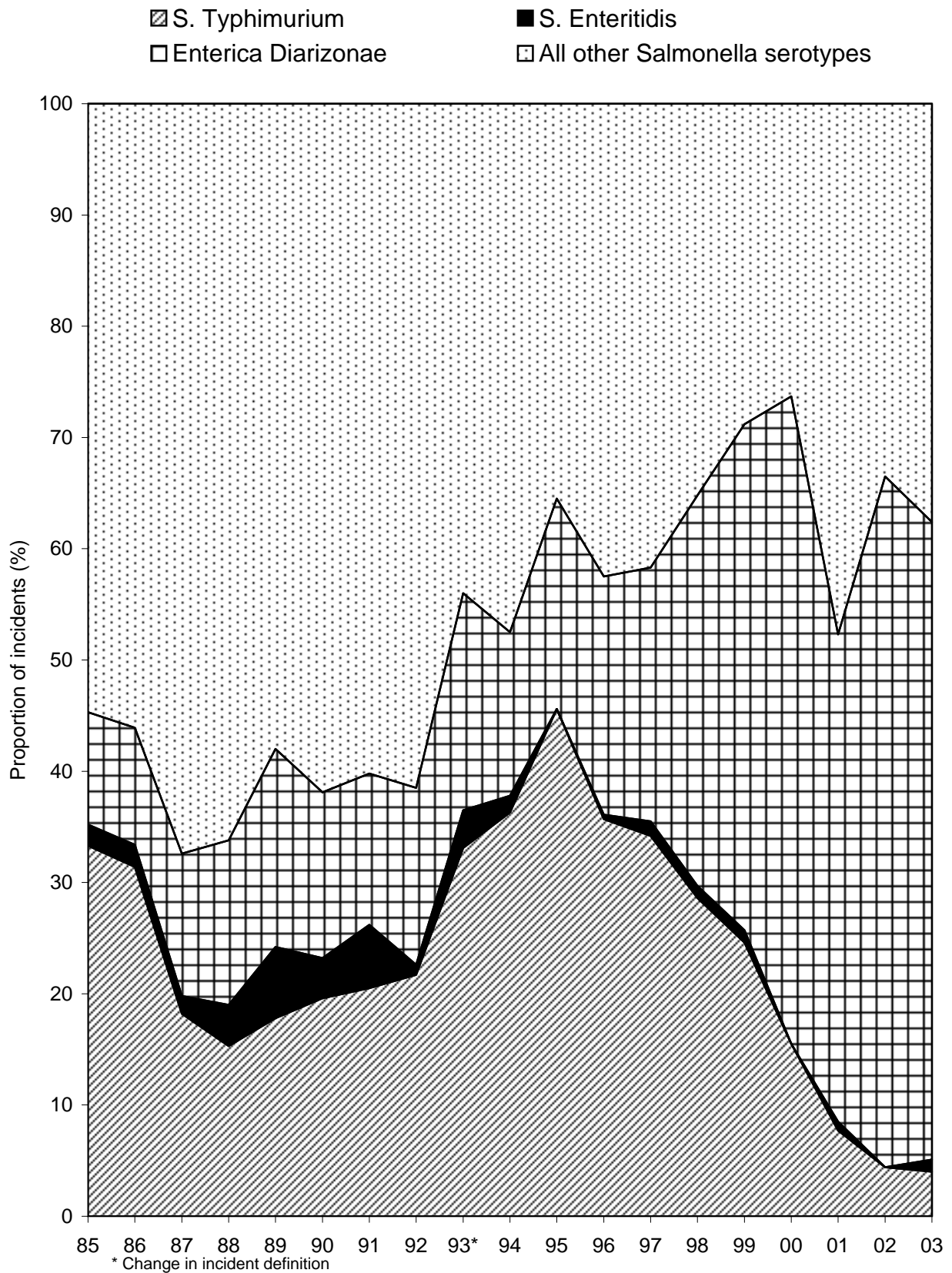


Table 27: S. Enteritidis in sheep on all premises

Phage Types Incidents (Isolations)	1999	2000	2001*	2002	2003
1	- (-)	- (-)	- (-)	- (-)	1 (1)
6	1 (3)	- (-)	- (-)	- (-)	- (-)
8	1 (1)	- (-)	- (-)	- (-)	- (-)
11	- (-)	- (-)	- (-)	- (-)	1 (1)
14b	- (-)	- (-)	1 (1)	- (-)	1 (1)
TOTAL	2 (4)	- (-)	1 (1)	- (-)	3 (3)

Table 28: S. Thompson in sheep on all premises

Phage Types Incidents (Isolations)	1999	2000	2001*	2002	2003
1	- (-)	1 (1)	- (-)	- (-)	1 (1)
NOPT	1 (1)	- (-)	- (-)	- (-)	- (-)
Totals	1 (1)	1 (1)	- (-)	- (-)	1 (1)

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

Table 29: *Salmonella* in goats on all premises

<i>Salmonella</i> Incidents (Isolations)	1999	2000	2001*	2002	2003
ENTERICA ENTERICA					
Agona	- (-)	1 (3)	- (-)	- (-)	- (-)
Dublin	- (-)	1 (1)	- (-)	1 (2)	- (-)
Eastbourne	1 (1)	- (-)	- (-)	- (-)	- (-)
Newport	1 (1)	- (-)	- (-)	- (-)	- (-)
Poona	1 (1)	- (-)	- (-)	- (-)	- (-)
Typhimurium	2 (4)	1 (1)	- (-)	- (-)	- (-)
TOTAL	5 (7)	3 (5)	- (-)	1 (2)	- (-)

Table 30: *S. Typhimurium* in goats on all premises

Definitive Types Incidents (Isolations)	1999	2000	2001*	2002	2003
104	1 (3)	- (-)	- (-)	- (-)	- (-)
U302	1 (1)	- (-)	- (-)	- (-)	- (-)
UNTY	- (-)	1 (1)	- (-)	- (-)	- (-)
TOTAL	2 (4)	1 (1)	- (-)	- (-)	- (-)

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