

## Chapter 2.2

### REPORTS OF *SALMONELLA* IN SHEEP AND GOATS

#### Sheep

31.8 million sheep were kept in Great Britain in 2007, 2.6% lower than 2006 (32.6 million). There were 9,569 sheep diagnostic submissions in 2007, a decrease of 14.1% compared with 11,143 in 2006.

There was a 16% decrease in the number of *Salmonella* incidents in sheep in 2007 (194) compared with 2006 (232), largely due to fewer incidents of *Salmonella* Typhimurium (13 in 2007 compared with 24 in 2006) and *S. enterica* subspecies *diarizonae* (128 in 2007 compared with 155 in 2006). All incidents were from farms and premises other than slaughterhouses.

#### ***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 66.0% of all incidents in 2007. This is similar to previous years (66.8% in 2006 and 63.3% in 2005) – Table 24. This organism may be associated with abortion and diarrhoea but is also recognised as being an incidental isolate from sheep with concurrent disease, as well as being isolated from healthy sheep. In 2007, about one third of *S. enterica* subspecies *diarizonae* abortion incidents had another cause of abortion recorded and in non-abortion incidents, including enteric, renal and respiratory disease, just over half had another condition diagnosed.

#### ***Salmonella* Dublin**

*Salmonella* Dublin was the second most common serovar isolated from sheep in 2007, representing 8.8% of incidents. One incident involving a group of 60 ewes in an outdoor lambing flock, described abortions and diarrhoea in 20 ewes, with eleven ewe deaths. Although the source of infection was unclear, carrier cattle were considered a possible source as the sheep were grazing downstream from other farms with cattle. It was noted that healthy ewes were still shedding *S. Dublin* in faeces four weeks after the outbreak started.

## ***Salmonella* Montevideo**

*Salmonella* Montevideo was the third most common serovar recorded in sheep in 2007, representing 8.2% of incidents. Between 2003 and 2006, *Salmonella* incidents due to this serovar have ranged between 5.6% (2006) and 11.2% (2004) of total incidents. In one incident involving a group of 1350 ewes, 18 ewes died and 35 aborted or delivered stillborn lambs. At a follow up farm investigation it was found that *S. Montevideo* was present in starling droppings collected from the shed in which the ewes were housed, although this is more likely to be a secondary infection of the starlings or contamination of faeces in the shed. Previously the shed had been used to feed store lambs, to which large numbers of starlings had been attracted.

## ***Salmonella* Typhimurium**

There were fewer incidents of *Salmonella* Typhimurium in 2007 (6.7%) compared with 2006 (10.3%). This remains much lower than the peak of *S. Typhimurium* incidents recorded in the 1990s (Fig 25). Definitive phage type DT104 accounted for 77% of *S. Typhimurium* incidents, similar to 2006 (75%). Case reports of disease associated with *S. Typhimurium* DT104 described high morbidity and mortality of ewes and lambs during the lambing period. Physiological stress during late pregnancy, parturition and early lactation may increase susceptibility to infection and ewes in infected flocks may be exposed to higher levels of environmental contamination when housed. Single incidents of DT56 (a wild-bird related strain) and DT193 were also recorded during 2007 – having been previously isolated in 2006 and 2005 respectively.

## **Other serovars**

Among the other serovars isolated from sheep were *Salmonella* Agama, *Salmonella* Durham and *Salmonella* Newport; all three may be found in badgers. *Salmonella* Agama was isolated from a flock that also had isolates of this serovar in 2006. Clinical disease with abortions and ewe deaths had been apparent during 2006 and 2007, although the severity of disease was reduced in 2007. *S. Agama* has been associated with wildlife. Sampling showed widespread environmental contamination with *S. Agama* isolated from wild duck droppings and from duck ponds on site. There were two reports of *Salmonella* Durham from sheep, the first time this serotype has been reported in sheep since 2005. Both reports were from abortions in sheep on different holdings with no direct connection but geographically very close and sharing a small river. In between the two farms was a third holding where sheep from one of the positive holdings had been over-wintered, which may have provided closer contact. *Salmonella* Newport is a recognised isolate from sheep

and in 2007 there were three incidents, more than the single incident in 2006, but similar to 2004 and 2005.

There were two reports of *Salmonella* Enteritidis from sheep in 2007. One was phage type PT13a, which has only previously been reported in 1996 and the other was untypable. The PT13a report originated from placental tissue, but a potential source of infection was not identified at a follow up farm visit.

There was a single incident of *Salmonella* Schwarzengrund in 2007, which was associated with abortions in housed ewes. Although this serovar is regularly isolated from feedingstuffs, this was the first isolate in sheep since 2001.

Eleven incidents of salmonellosis in sheep were investigated in 2007. Six of the investigation and advisory visits were carried out to follow up reports of *S. Typhimurium* DT104, two were for *S. diarizonae* and there were single visits to follow up reports of *S. Enteritidis* PT13a, *S. Montevideo* and *S. Schwarzengrund*.

## **Goats**

90,184 goats were kept in Great Britain in 2007, 5.6% lower than in 2006 (95,521). There were 680 goat diagnostic submissions in 2007, the same as in 2006. *Salmonella* isolates from goats are notably few and 2007 was no exception, with a single isolate of *Salmonella* Dublin from a goat with nervous signs. *S. Dublin* is recorded sporadically in goats with the last isolate in 2002.

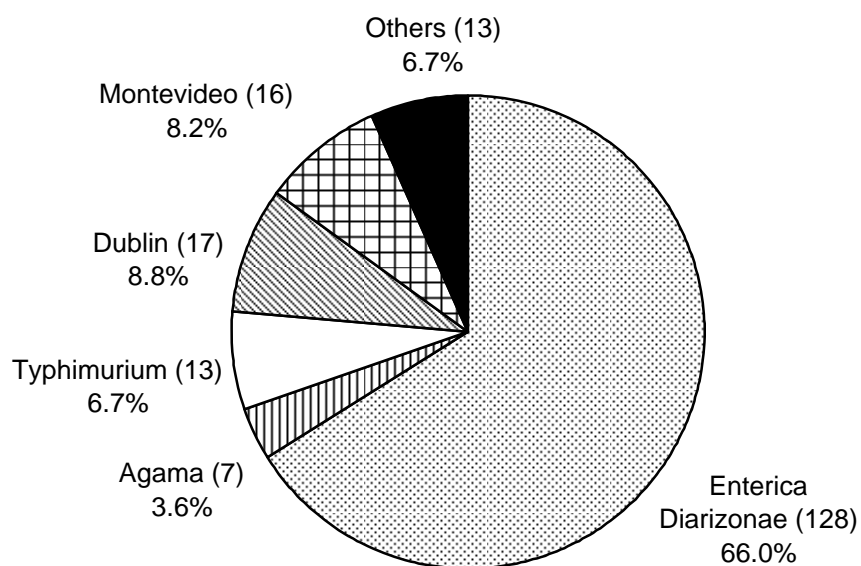
**Table 23: *Salmonella* in sheep on all premises**

<i>Salmonella</i> Incidents (Isolations)	2003		2004		2005		2006		2007	
<b>ENTERICA ENTERICA</b>										
Agama	15	( 15)	5	( 5)	6	( 6)	10	( 12)	7	( 8)
Agona	4	( 4)	-	( -)	-	( -)	-	( -)	-	( -)
Ajiobo	-	( -)	1	( 1)	-	( -)	-	( -)	-	( -)
Anatum	-	( -)	1	( 1)	4	( 4)	1	( 1)	1	( 1)
Berta	-	( -)	-	( 1)	-	( -)	-	( -)	-	( -)
Derby	12	( 14)	10	( 10)	2	( 3)	3	( 3)	1	( 2)
Dublin	47	( 47)	18	( 18)	20	( 20)	16	( 17)	17	( 17)
Duesseldorf	-	( -)	-	( -)	1	( 1)	-	( -)	-	( -)
Durham	1	( 1)	-	( -)	1	( 1)	-	( -)	2	( 2)
Enteritidis	3	( 3)	-	( -)	-	( -)	2	( 2)	2	( 2)
Give	1	( 1)	-	( -)	-	( -)	-	( -)	-	( -)
Goldcoast	-	( -)	-	( -)	1	( 1)	-	( -)	-	( -)
Havana	-	( -)	-	( -)	-	( -)	4	( 4)	-	( -)
Indiana	-	( -)	2	( 2)	2	( 3)	-	( -)	-	( -)
Kottbus	-	( -)	-	( -)	1	( 1)	-	( -)	-	( -)
Livingstone	1	( 1)	-	( -)	-	( -)	-	( -)	-	( -)
Montevideo	27	( 31)	31	( 33)	16	( 21)	13	( 13)	16	( 18)
Nagoya	1	( 1)	-	( -)	-	( -)	-	( -)	-	( -)
Newport	1	( 1)	2	( 3)	3	( 3)	1	( 1)	3	( 3)
Oslo	1	( 1)	1	( 1)	1	( 1)	-	( -)	-	( -)
Schwarzengrund	-	( -)	-	( -)	-	( -)	-	( -)	1	( 1)
Stourbridge	-	( -)	1	( 1)	1	( 1)	1	( 1)	2	( 2)
Thompson	1	( 1)	-	( -)	1	( 1)	1	( 1)	-	( -)
Typhimurium	15	( 15)	10	( 10)	24	( 25)	24	( 25)	13	( 16)
<b>ENTERICA DIARIZONAE</b>										
61:k:1,5	9	( 9)	1	( 1)	-	( -)	2	( 2)	1	( 1)
61:k:1,5,7	120	( 120)	136	( 139)	101	( 101)	87	( 87)	78	( 79)
61:k:1,7	-	( -)	-	( -)	4	( 4)	-	( -)	-	( -)
61:-:1,5	2	( 2)	-	( -)	-	( -)	5	( 5)	1	( 1)
61:-:1,5,7	29	( 29)	48	( 48)	47	( 47)	57	( 58)	48	( 48)
61:-:1,7	1	( 1)	-	( -)	-	( -)	4	( 4)	-	( -)

**Table 23: *Salmonella* in sheep on all premises**

<i>Salmonella</i> Incidents (Isolations)	2003	2004	2005	2006	2007
UNSPECIFIED					
structure only	6 ( 6)	10 ( 10)	4 ( 4)	1 ( 1)	1 ( 1)
rough strain	- ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
TOTAL	297 ( 304)	277 ( 284)	240 ( 248)	232 ( 237)	194 ( 202)

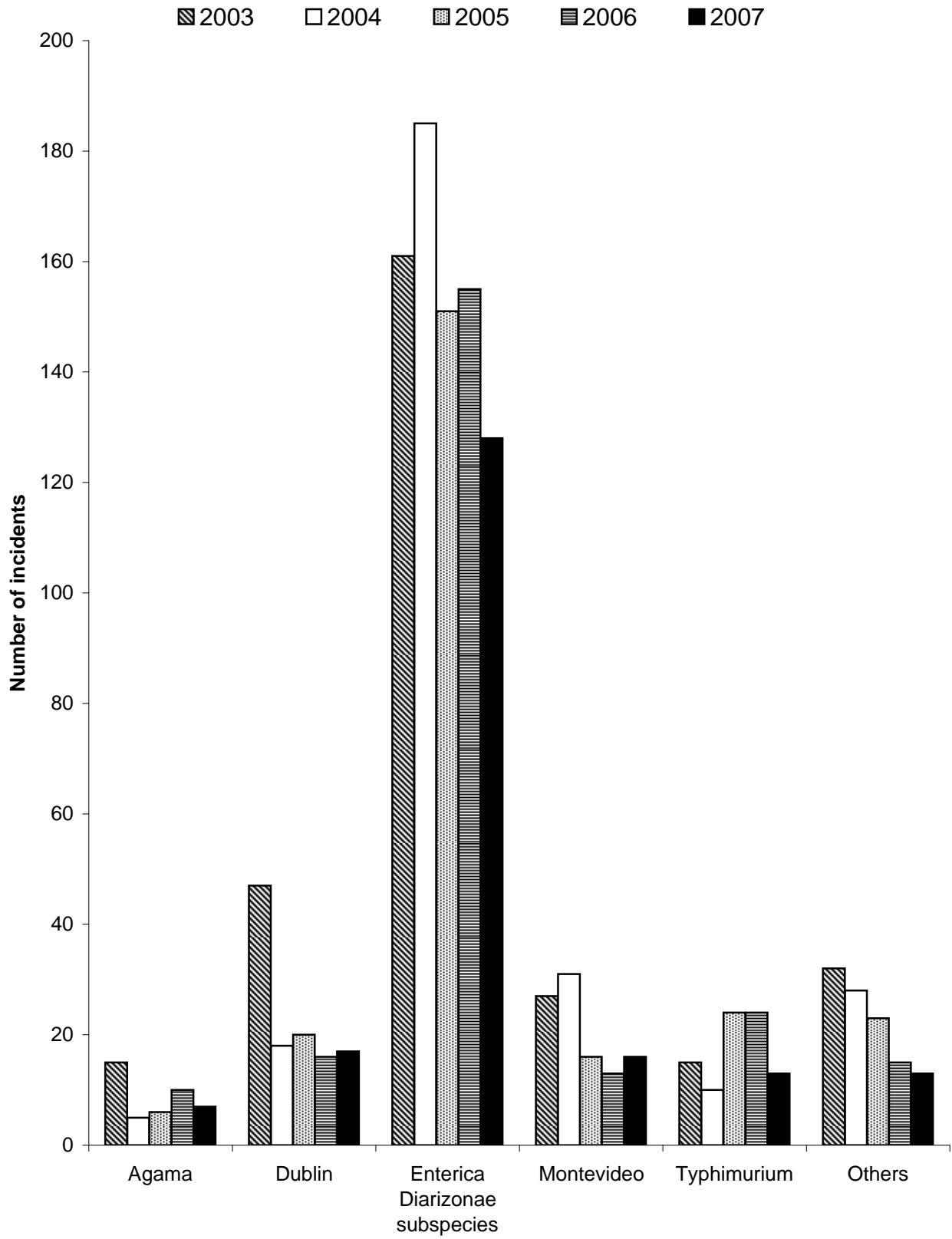
**Fig 21: Incidents of *Salmonella* serotypes in sheep in 2007**



**Table 24: Incidents of the top 5 *Salmonella* serotypes in sheep in 2007 as a % of all incidents compared to previous years**

Serotype	2003	2004	2005	2006	2007
<i>S. Enterica Diarizonae</i> subspecies %	54.2	66.8	63.3	66.8	66.0
<i>S. Dublin</i> %	15.8	6.5	8.3	6.9	8.8
<i>S. Montevideo</i> %	9.1	11.2	6.7	5.6	8.2
<i>S. Typhimurium</i> %	5.1	3.6	10.0	10.3	6.7
<i>S. Agama</i> %	5.1	1.8	2.5	4.3	3.6
Total no. incidents	297	277	240	232	194

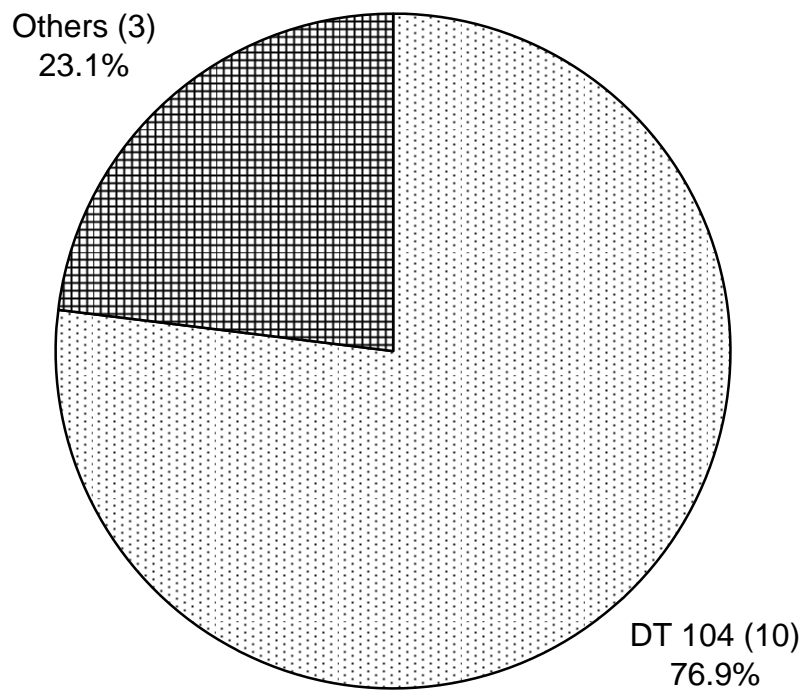
**Fig 22: Incidents of *Salmonella* serotypes in sheep (2003 - 2007)**



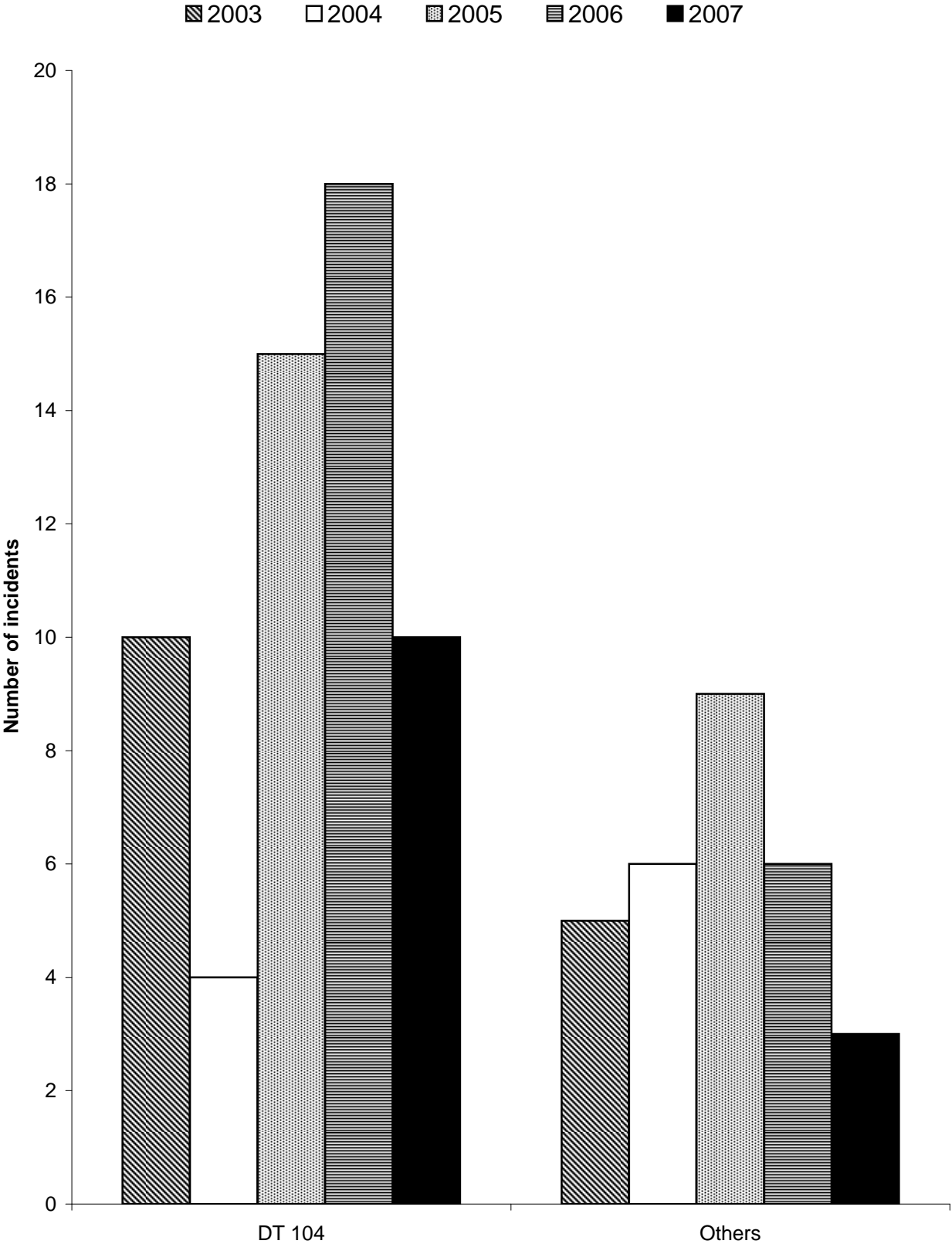
**Table 25: S. Typhimurium in sheep on all premises**

Definitive Types Incidents (Isolations)	2003	2004	2005	2006	2007
8	- ( -)	- ( -)	1 ( 1)	- ( -)	- ( -)
40	1 ( 1)	- ( -)	- ( -)	- ( -)	- ( -)
41	3 ( 3)	- ( -)	- ( -)	1 ( 1)	- ( -)
56	- ( -)	1 ( 1)	- ( -)	1 ( 1)	1 ( 1)
104	10 ( 10)	4 ( 4)	15 ( 15)	18 ( 18)	10 ( 12)
104b	- ( -)	- ( -)	- ( -)	2 ( 2)	1 ( 1)
135	- ( -)	- ( -)	- ( -)	1 ( 1)	- ( -)
170b	- ( -)	1 ( 1)	- ( -)	- ( -)	- ( -)
193	- ( -)	1 ( 1)	1 ( 1)	- ( -)	1 ( 1)
195	- ( -)	- ( -)	1 ( 1)	- ( -)	- ( -)
208	- ( -)	1 ( 1)	- ( -)	- ( -)	- ( -)
U288	1 ( 1)	2 ( 2)	- ( -)	- ( -)	- ( -)
U302	- ( -)	- ( -)	1 ( 1)	1 ( 1)	- ( -)
RDNC	- ( -)	- ( -)	- ( -)	- ( 1)	- ( 1)
UNTY	- ( -)	- ( -)	5 ( 6)	- ( -)	- ( -)
TOTAL	15 ( 15)	10 ( 10)	24 ( 25)	24 ( 25)	13 ( 16)

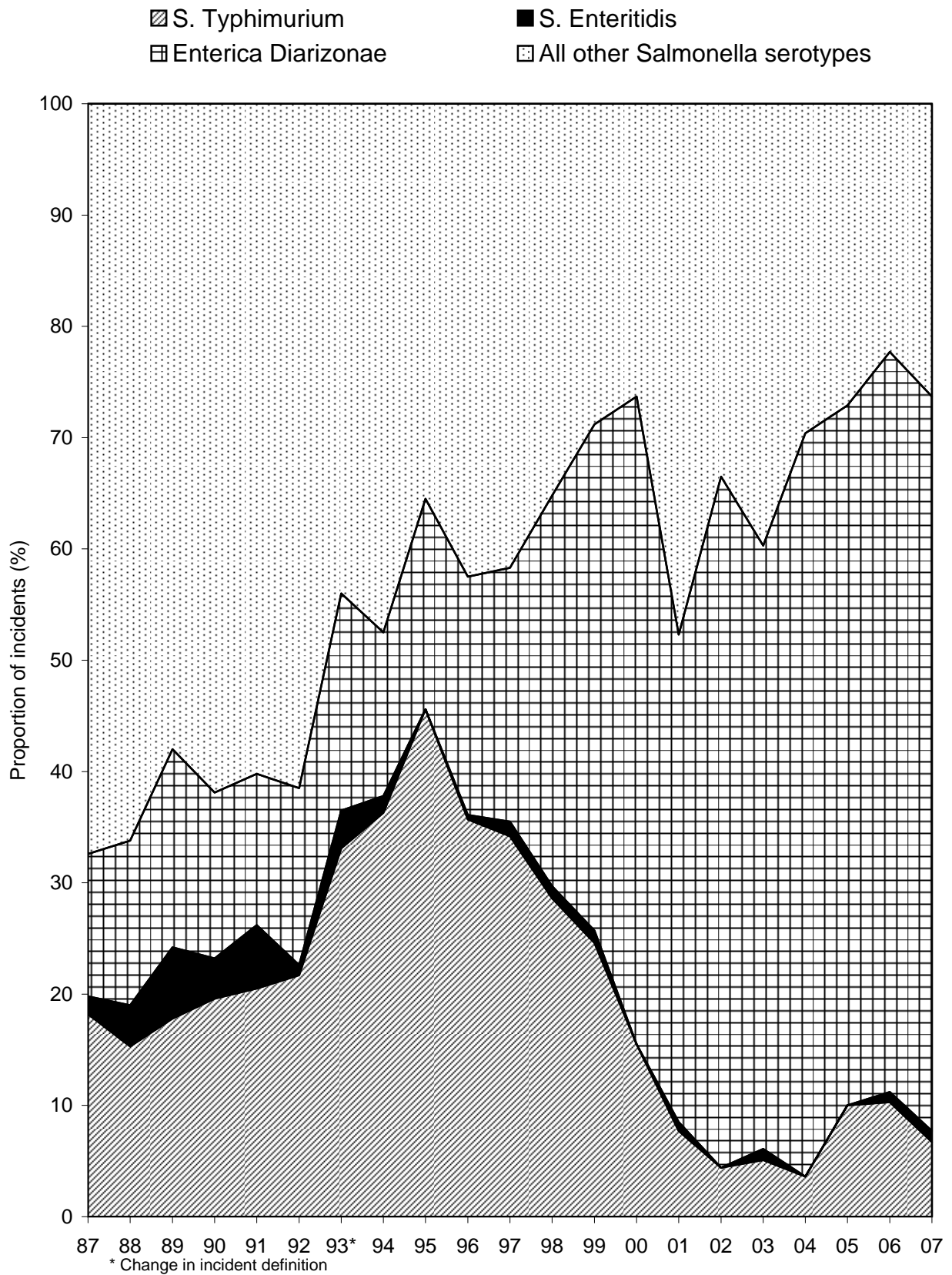
**Fig 23: Incidents of *Salmonella* Typhimurium definitive types in sheep in 2007**



**Fig 24: Incidents of *Salmonella* Typhimurium definitive types in sheep (2003 - 2007)**



**Fig 25: *S. Enteritidis*, *S. Typhimurium* and *S. Enterica Diarizonae* as a proportion of all incident reports in sheep (1987 - 2007)**



**Table 26: S. Enteritidis in sheep on all premises**

Phage Types Incidents (Isolations)	2003		2004		2005		2006		2007	
1	1	( 1)	-	( -)	-	( -)	-	( -)	-	( -)
11	1	( 1)	-	( -)	-	( -)	1	( 1)	-	( -)
13a	-	( -)	-	( -)	-	( -)	-	( -)	1	( 1)
14b	1	( 1)	-	( -)	-	( -)	-	( -)	-	( -)
35	-	( -)	-	( -)	-	( -)	1	( 1)	-	( -)
UNTY	-	( -)	-	( -)	-	( -)	-	( -)	1	( 1)
TOTAL	3	( 3)	-	( -)	-	( -)	2	( 2)	2	( 2)

**Table 27: S. Thompson in sheep on all premises**

Phage Types Incidents (Isolations)	2003		2004		2005		2006		2007	
1	1	( 1)	-	( -)	-	( -)	1	( 1)	-	( -)
untyped	-	( -)	-	( -)	1	( 1)	-	( -)	-	( -)
TOTAL	1	( 1)	-	( -)	1	( 1)	1	( 1)	-	( -)

**Table 28: *Salmonella* in goats on all premises**

<i>Salmonella</i> Incidents (Isolations)	2003	2004	2005	2006	2007
ENTERICA ENTERICA					
Anatum	- (-)	- (-)	- (-)	2 (2)	- (-)
Dublin	- (-)	- (-)	- (-)	- (-)	1 (1)
ENTERICA DIARIZONAE					
61:k:1,5,7	- (-)	- (-)	- (-)	1 (1)	- (-)
61:-:1,5,7	- (-)	- (-)	1 (1)	- (-)	- (-)
TOTAL	- (-)	- (-)	1 (1)	3 (3)	1 (1)