

## Chapter 2.5

### REPORTS OF *SALMONELLA* IN POULTRY

Chickens are subject to statutory *Salmonella* testing programmes in order to fulfil the requirements of EU legislation (European Council Directive 2003/99/EC, Zoonoses Regulation 2160/2003, Commission Regulation (EC) No 1003/2005 and Commission Regulation (EC) No. 1168/2006). In addition to the statutory testing programmes, most major commercial poultry companies carried out additional voluntary testing schemes. This is reflected in the data presented in Table 1 which show that, in contrast to other species, the largest number of reports of *Salmonella* from poultry are the result of surveillance (both statutory and voluntary) activity rather than the investigation of clinical disease. Most incidents in poultry are therefore not associated with clinical disease but with identification of subclinical carriage of *Salmonella*.

The Poultry Breeding Flocks and Hatcheries Order (PBFHO) 1993 has been the legal basis for a monitoring plan which has operated for *Salmonella* in breeding flocks of domestic fowl since 1993. In March 2007 the PBFHO 2007 replaced the PBFHO 1993 and set out the requirements for registration and sampling in a new *Salmonella* National Control Programme (NCP) for chicken breeding flocks. According to the new Order, statutory testing of breeding flocks of domestic fowl during the rearing phase and during the period of production of eggs for hatching takes place only on the breeding flock holdings and an enhanced sampling (boot swabs or composite faeces) and detection method using Modified Semi-Solid Rappaport Vassiliadis culture medium (ISO 6579: Annex D) is used. The PBFHO 2007 was in turn revoked and replaced by the Control of Salmonella in Poultry Order (CSPO) 2007, which came into force on 28<sup>th</sup> January 2008 and included the requirements for the implementation of an NCP in commercial laying flocks which started in February 2008. The NCP for laying flocks sets out the monitoring and controls that primary producers should follow on holdings with rearing and laying flocks of domestic fowl that are kept for the commercial production of eggs for human consumption. In 2009 the Control of Salmonella in Broilers Order (CSBO) came into force. The CSBO included the requirements for the implementation of the NCP in meat production flocks of chickens.

According to the CSPO and the Commission Regulation (EC) 1177/2006, the administration of antimicrobials to any bird of the species *Gallus gallus* as a specific method to control *Salmonella* within the framework of the NCPs is prohibited. The same legislation also prohibits the administration of any live *Salmonella* vaccine to any bird of

the species *Gallus gallus* where the manufacturer does not provide an appropriate method to distinguish bacteriologically wild-type strains of *Salmonella* from vaccine strains. Vaccines against *Salmonella* Enteritidis and *S. Typhimurium* are very widely used in the commercial layer sector and are also used in parent broiler breeders. Their use is considered to have contributed to the control of *Salmonella* in poultry flocks.

The Zoonoses Regulation 2160/2003/EC came into force on the 21<sup>st</sup> December 2003 and requires that EU Member States put into place control plans for the monitoring and reduction of zoonoses at farm level, once the target to reduce the pathogen or infectious agent has been agreed. In order to set targets, standardised prevalence surveys were carried out in each Member State to establish the baseline level of the specified zoonotic agent in poultry and pig food animal populations. The results of mandatory *Salmonella* prevalence surveys carried out in UK holdings of commercial egg-laying flocks in 2005, in UK holdings of broiler flocks in 2006, and in UK holdings of breeding and fattening turkey flocks were reported in previous editions of *Salmonella* in Livestock Production in GB.

Data on positive findings of *Salmonella* in laying and breeding chicken flocks is reported in this Chapter as the number of positive flocks, as required by the legislation for the NCPs, as well as the number of *Salmonella* incidents detected during the year. The number of reported incidents of *Salmonella* in chickens does not equate directly to the overall number of positive flocks that are detected during the year. For the purposes of reporting UK results of the NCPs for each year of implementation, a flock is counted as positive only once, irrespective of the number of incidents occurring and the multiplicity of serovars determined. Details on the number of positive flocks detected under the breeding and laying chicken NCPs for 2008 are given in the relevant sections below.

The numbers of incidents and isolations of *Salmonella* reported from poultry species are shown in Tables 39, 40, 48, 49, 54, 55, 59 and 60. The number of poultry submissions to VLA/SAC laboratories increased by 23.9% in 2008 (4,600 submissions) compared to 2007 (3,714 submissions). These figures include submissions from wild ducks and geese. The increase in poultry submissions was primarily due to a 34.9% increase in the number of chicken submissions received (3,872 submissions in 2008 compared with 2,870 submissions in 2007). The number of Avian Influenza surveillance submissions also increased in 2008 compared with previous years.

## **Chickens**

There were 137.9 million chickens in Great Britain reported in the June 2008 census, compared with 140.7 million in 2007 (a decrease of 2.0%). Table 39 shows the number of reported incidents of *Salmonella* in chickens in 2008 (249), which was 27.0% higher than in 2007 (196). The majority of incidents (53.0%) arose from voluntary surveillance of chicken (mainly broiler) flocks by the poultry industry, while 39.4% arose from the statutory monitoring of chicken breeding and egg laying flocks under the requirements of the relevant NCPs and legislation. Only 0.8% of *Salmonella* reports in chickens were associated with clinical disease investigation.

### ***Salmonella* National Control Programme in chicken breeding flocks**

Regulation (EC) No. 1003/2005 sets a transitional target for the breeding flock sector to ensure that no more than 1% of adult breeding flocks with more than 250 birds remain positive for *Salmonella* serovars of public health significance (SOPHS) by the end of 2009. The EU target for breeding flocks is based on the previous five most frequent serovars in human cases, which were: *S. Enteritidis*, *S. Typhimurium*, *S. Virchow*, *S. Hadar* and *S. Infantis*. The CSPO 2007 implements the National Control Programme (NCP) for Breeding Flocks of chickens – (*Gallus gallus*) required to meet the target for reduction in *Salmonella* prevalence set out in Regulation (EC) No. 1003/2005. The CSPO sets out a schedule of sampling in breeder holdings, which forms the basis for validating achievement of the target (see below) for reduction in *Salmonella* serovars of public health significance (SOPHS). Additional voluntary sampling of hatcher debris in hatcheries at the initiative of the operator does not count towards the target in adult breeding flocks.

During the rearing period, breeding flocks must be sampled on three occasions by the operator – when the birds are chicks (chick box liners and chicks dead on arrival or culls at one day old), when chicks are four weeks old (boot swabs or composite faeces), and again two weeks before moving to the laying phase or laying unit (boot swabs or composite faeces); adult (in-lay) flocks are then sampled by the operator on a two-weekly basis (boot swabs or composite faeces).

In addition to the sampling above, three sets of Official Control Samples (OCS) were collected during 2008 from each breeding flock as follows: a) within four weeks of moving to the laying accommodation, b) in the middle of the lay, and c) within the last eight weeks of production. These OCS consist of pooled faeces or boot swabs.

Data on positive findings of *Salmonella* in breeding chicken flocks is reported as the number of positive flocks, as required by the legislation. The concept of a **positive flock** has been adopted to describe both a flock in which one or more serovars of *Salmonella* have been detected during the year from CSPO (NCP) sampling, or the number of flocks testing for a particular serovar, or group of serovars (e.g. SOPHS). A flock is counted as positive only once, irrespective of the number of incidents occurring and the multiplicity of serovars determined. Where there is more than one flock on the holding, the flock is identified using the house name or number, followed by the month and year the flock was moved into the house. The NCP defines a flock as a single group **or** multiple groups of chickens which share the same production unit (i.e. using the same air-space or range area). Therefore, under the requirements of the NCP, flocks should be sampled on a building-by-building basis unless there are good reasons to the contrary (i.e. minimal sampling requirement should be repeated for each building). Where a building is sub-divided, but each part has separate ventilation and drainage and feeding systems, they should be regarded as separate buildings and sampled separately.

By this definition 22 **flocks** (21 x adult, 1 x in-rear) were determined positive with any *Salmonella* serovar in 2008.

The 21 positive adult flocks (adult flocks testing positive for any *Salmonella* spp.) were located on 12 holdings. Of the 21, all but two were broiler breeder line flocks. There were two Layer Breeder line positive flocks (located on two separate holdings) detected during 2008.

**The number of adult 'positive flocks' testing for SOPHS** (i.e. with a SOPHS serovar alone or with a SOPHS preceding/ following/ in combination with another serovar), was used in the assessment of achievement of the Community target (see below).

When a breeding flock of *Gallus gallus* is suspected of being infected with *Salmonella* Enteritidis or *Salmonella* Typhimurium the flock is placed under official control by the Competent Authority. During the year, there were eight flocks in which such action was taken. Following the placing of official controls, no further eggs could be sent for hatching and no birds or hatching eggs could leave the affected holdings, except under licence issued by the Competent Authority. When infection with *Salmonella* Typhimurium was confirmed, the operators were required to have the birds slaughtered in accordance with Community legislation on food hygiene. Thereafter, the operators were required to carry out cleansing and disinfection of the building where the infected birds were kept before re-stocking could take place. Hatching eggs present in the

hatchery from the time the flocks were suspected to be infected were removed and destroyed.

**Non-SOPHS serovars** were identified in 13 breeding flocks located on ten holdings, and they comprised *S. Mbandaka* (6 flocks), *S. Thompson* (5 flocks) and *S. Dublin* (2 flocks).

The in-rear (immature) flock was positive for both *S. Mbandaka* and *S. Tennessee*.

Using the number of flocks in layer breeder and broiler breeder line categories subject to at least one official test in January to December 2008 as the denominator population, the estimated prevalence of *Salmonella* positive adult flocks across all serovars and production line types, from testing within the NCP, was 1.43% (21/1,469).

Using the number of flocks in layer breeder and broiler breeder line categories subject to at least one official CSPO test in January to December 2008 as the denominator population, **the estimated prevalence of SOPHS in adult breeding flocks in Great Britain for the period was 8/1,469 = 0.54%**. This figure is well below the target for reduction as laid out in the legislation for no more than 1% of adult breeding flocks with more than 250 birds remaining positive for *Salmonella* serovars of public health significance (SOPHS) by the end of 2009.

**A summary of 'positive flocks' and numbers of flocks positive for each serovar is shown in Table 36.**

**Table 36. Details of chicken breeding flocks in GB positive for *Salmonella* spp. under the CSPO in 2008**

| Production type/ status of flocks operated | Flocks tested   | Positive Flocks [any <i>Salmonella</i> spp.] | Positive Flocks [for SOPHS] | <i>Salmonella</i> spp. (no. flocks positive for each serovar)   |
|--|-----------------|--|-----------------------------|---|
| <b>ADULT FLOCKS</b>                        |                 |  |                             |   |
| <b>Layer Breeder (LB)</b>                  |                 |  |                             |   |
| Elite + Grandparent +Parent                | 194             | 2  | 0                           | 2 x <i>S. Thompson</i>  |
| <b>Broiler Breeder (BB)</b>                |                 |  |                             |   |
| Elite + Grandparent + Parent               | 1275            | 19   | 8                           | 8 x <i>S. Typhimurium</i><br>6 x <i>S. Mbandaka</i><br>3 x <i>S. Thompson</i><br>2 x <i>S. Dublin</i> |
| <b>Total Adult Flocks</b>                  |                 |  |                             |   |
| <b>LB + BB</b>                             | <b>1469</b>     | <b>21</b>                                    | <b>8</b>                    | Details as above  |
| <b>IMMATURE FLOCKS</b>                     |                 |  |                             |   |
| E + Gp + P (Broiler Breeder)               | NC <sup>1</sup> | 1  | 0                           | 1 x <i>S. Mbandaka</i><br>1 x <i>S. Tennessee</i>   |

<sup>1</sup> NC- not counted

## ***Salmonella* National Control Programme in chicken egg laying flocks**

Following the successful completion of the EU Survey for the prevalence of *Salmonella* on holdings with commercial layer flocks in 2005, a target was set for the reduction of *S. Enteritidis* and *S. Typhimurium* on layer farms. About 8% of layer flock holdings in the UK were positive for *S. Enteritidis* and/or *S. Typhimurium* in the EU baseline survey of laying hens in 2004/5. A target was set for the UK to reduce this prevalence by 10% each year.

According to the NCP for flocks of laying hens, operators are required to take two pairs of boot swabs (from free range and barn flocks) or two composite faeces samples (from caged flocks) from each adult flock producing eggs for human consumption starting at 22 - 26 weeks of age and then at 15-week intervals. "Flock" is defined as poultry of the same health status kept on the same holding or in the same enclosure and constituting a single epidemiological unit and, in the case of housed poultry, includes all birds sharing the same airspace. In addition, samples are taken by operators during the rearing phase from day-old chicks and two weeks before movement to the laying accommodation. The samples for day-old chicks are chick box liners or hatcher tray liners and chicks found dead on arrival. The samples taken during rear two weeks before the birds move to the laying accommodation consist of two pairs of boot swabs (or equivalent faeces samples).

In addition to the operator samples, routine annual official samples (two pairs of boot swabs or two composite faeces samples and a dust sample) are required to be collected by the Competent Authority once per year from one adult flock from each holding with more than 1,000 birds. Also, if a flock is suspected of being infected with *Salmonella* Enteritidis or *Salmonella* Typhimurium official samples consisting of two pairs of boot swabs or two composite faeces samples, and a dust sample per flock on all other flocks on the holding are taken. Following depopulation of a *S. Enteritidis*/*S. Typhimurium* positive flock another official (post-restocking) sample, which consists of two pairs of boot swabs or two composite faecal samples, and a dust sample, is required in the follow-on flock at 22 - 26 weeks of age.

From 1<sup>st</sup> January 2009 restrictions are required to be put in place on flocks where *S. Enteritidis* or *S. Typhimurium* is confirmed and fresh eggs from positive flocks can no longer be sold direct as table eggs for human consumption (i.e. eggs from positive flocks cannot be used for human consumption unless they are heat treated).

As for the breeding chicken NCP, the concept of a "**positive flock**" has been adopted to describe both a flock in which one or more serovars of

*Salmonella* have been detected during the year from CSPO (NCP) sampling, or the number of flocks testing for a particular serovar, or group of serovars (e.g. *S. Enteritidis* and/or *S. Typhimurium*). From the start of implementation of the NCP in 2008, data on positive findings of *Salmonella* in laying and breeding chicken flocks is reported as the number of positive flocks, as required by the legislation, as well as the number of positive *Salmonella* incidents detected during the year. The number of reported incidents of *Salmonella* in chickens does not equate directly to the overall number of positive flocks that are detected during the year. A flock is counted as positive only once, irrespective of the number of incidents occurring and the multiplicity of serovars determined.

By this definition 81 **positive flocks** (67 x adult, 14 x in-rear) were detected as positive with any *Salmonella* serovar in 2008.

**Of the 67 adult 'positive flocks'**, 49 were positive for *S. Enteritidis*, four for *S. Typhimurium*, one for *S. Virchow*, 15 for non-SOPHS serovars, **and 51 were positive for *S. Enteritidis* and/or *S. Typhimurium*** (2 flocks on the same holding were positive for *S. Enteritidis* and *S. Typhimurium*. These were included in both the *S. Enteritidis* count and the *S. Typhimurium* count above, but only counted once for the overall annual figure used in the assessment of achievement of the Community target (see below).

**Of the 15 adult flocks positive for non-SOPHS serovars**, two were positive for *S. Agona*, two for *S. Livingstone*, two for *S. Agama*, one for *S. Saintpaul*, one for *S. Newport*, one for *S. Anatum*, two for *S. Tennessee*, one for *S. Senftenberg*, one for *S. Ordonez* and two for *Salmonella* rough strains.

**Of the 14 in-rear (immature) 'positive flocks'**, four were positive for *S. Enteritidis*, one for *S. Typhimurium*, ten for non-SOPHS serovars, **and five were positive for *S. Enteritidis* and/or *S. Typhimurium*** (There was one immature flock positive for *S. Enteritidis* and *S. Agama*. This was included once in the *S. Enteritidis*, once in the "other serovars" count, and once in the total count).

**Of the ten in-rear (immature) flocks positive for non-SOPHS serovars**, six flocks were positive for *S. Senftenberg*, one for *S. Poona*, two for *S. Agama* and one for *S. Kedougou*.

In 2008 the Great Britain Poultry Register was used to provide an estimate of the total number of laying flocks in Great Britain that were in production during the year. This was an approximation only, based on the number of registered houses on all the sites where adult laying

flocks were registered at the time. **Using this as the denominator population, the estimated prevalence of *Salmonella*-positive adult commercial egg laying flocks for all serovars and for *S. Enteritidis* and/or *S. Typhimurium* only derived** from testing within the NCP in Great Britain, was 1.25% and 1% respectively. This included flocks on premises where there were less than 1000 birds present – i.e. those not eligible for official sampling but still tested under the requirements of the NCP. This estimated prevalence is not directly applicable to fully assess progress toward the target prevalence for 2008, but the large reduction in prevalence since the baseline survey indicates that substantial improvements have been made.

**A summary of ‘positive flocks’ and numbers of flocks positive for each serovar by status of sampling is shown in Table 37 (adult flocks) and in Table 38 (in-rear flocks).**

During 2008, ten CSPO-trained Veterinary Investigation Officers conducted nineteen visits to holdings with positive *S. Enteritidis*/*S. Typhimurium* flocks of egg laying chickens in an advisory capacity. The epidemiological information collected on these premises where *Salmonella* *Enteritidis* or *Salmonella* *Typhimurium* had been detected in one or more flocks on the premises was collated and summarised. The findings included the following: lack of attention to biosecurity and rodent control, protective clothing was worn by farm personnel on just over half of the farms, although the use of clothing dedicated to each flock was not employed on any farm, and on eight farms, no protective clothing was worn at all. On three farms, there were no footbaths outside the poultry houses, and live or dead rodents were seen on eleven farms with evidence of rodents on a further four. Farmers in general were very helpful throughout the entire process. This advisory work was complemented by research visits to positive farms that aimed at validating clearance of infection following intensive control measures, together with industry education campaigns which included producers meetings and a training DVD which was distributed to owners of all commercial laying holdings with more than 1,000 birds.

**Table 37. Details of adult egg laying flocks of *Gallus gallus* positive for *Salmonella* spp. (February– December 2008)**

| Status of sampling              | S. Enteritidis | S. Typhimurium | S. Infantis | S. Virchow | S. Hadar | Non-SOPHS       | Total     | SE/ST     |
|---------------------------------|----------------|----------------|-------------|------------|----------|-----------------|-----------|-----------|
| Operator                        | 22**           | 3**            | 0           | 1          | 0        | 13 <sup>a</sup> | 37**      | 23**      |
| Official (routine annual)       | 5              | 1              | 0           | 0          | 0        | 0               | 6         | 6         |
| Official (other flocks on site) | 22             | 0              | 0           | 0          | 0        | 1 <sup>~</sup>  | 23        | 22        |
| Official (post restocking)      | 0              | 0              | 0           | 0          | 0        | 1 <sup>°</sup>  | 1         | 0         |
| <b>Total</b>                    | <b>49</b>      | <b>4</b>       | <b>0</b>    | <b>1</b>   | <b>0</b> | <b>15</b>       | <b>67</b> | <b>51</b> |

<sup>a</sup> S. Agona (x2), S. Livingstone (x2), S. Agama (x2), S. Saint Paul (x1), S. Newport (x1), S. Anatum (x1), S. O Rough:g,m:- (x1), S. Senftenberg (x1), S. Ordonez (x1), S. Tennessee (x1)

<sup>~</sup> S. Tennessee (x1)

<sup>°</sup> S. O\_rough:g,m:- (x1)

\*\* 2 flocks on the same holding were positive for SE & ST. These were included twice in the SE count, twice in the ST count, but once in the overall count of positive flocks for SE/ST

**Table 38. Details of in-rear egg laying flocks of *Gallus gallus* positive for *Salmonella* spp. (February– December 2008)**

| Status of sampling              | S. Enteritidis | S. Typhimurium | S. Infantis | S. Virchow | S. Hadar | Non-SOPHS       | Total                 | SE/ST    |
|---------------------------------|----------------|----------------|-------------|------------|----------|-----------------|-----------------------|----------|
| Operator                        | 1              | 1              | 0           | 0          | 0        | 9 <sup>~</sup>  | 11                    | 2        |
| Official (other flocks on site) | 3 <sup>*</sup> | 0              | 0           | 0          | 0        | 1 <sup>*^</sup> | 3 <sup>*</sup>        | 3        |
| <b>Total</b>                    | <b>4</b>       | <b>1</b>       | <b>0</b>    | <b>0</b>   | <b>0</b> | <b>10</b>       | <b>14<sup>*</sup></b> | <b>5</b> |

<sup>~</sup> S. Senftenberg (x6<sup>a</sup>), S. Poona (x1), S. Agama (x1), S. Kedougou (x1)

<sup>a</sup> Five of the six S. Senftenberg positive in-rear flocks resulted from chick-box liner sampling at day old.

<sup>^</sup> S. Agama (x1)

\*There was 1 immature flock positive for S. Enteritidis & S. Agama. That was included once in the SE count, once in the "other serovars" count, and once in the total count.

## **Salmonella incidents reported from chickens in 2008**

### **Salmonella Enteritidis**

The most common serovar reported from chickens in 2008 was *S. Enteritidis* (78 incidents) increasing from 37 in 2007. These represented 31.3% of *Salmonella* incidents in chickens. Numbers of reports of this serovar declined between 1992 and 2004, except for a small increase in reports in 2001 and 2003, but since 2004 they have been increasing (Figure 37). The increase in the reports from chickens in 2008 (249 incidents) compared to 2007 (196 incidents), and especially in *S. Enteritidis*, was unsurprising due to the more sensitive sampling protocol and *Salmonella* detection methods required by the NCP in laying hens and due to voluntary enhanced sampling carried out by the layer industry in GB in 2008 in preparation for the new *Salmonella* National Control Programme in laying hens requirements from 2009. In addition, the increase is also due to *Salmonella* isolated from extensive sampling during on farm Government epidemiological investigations conducted during 2008. As the data in 2008 resulted from a different monitoring system compared with previous years, it is not directly comparable with earlier data. The data in the tabulations (except Tables 36,37 and 38) in the Poultry Chapter refer to *Salmonella* incidents and not *Salmonella* infected flocks, and, with regards to egg laying chickens, it originated from samples collected from all parts of the layer industry including back-yard flocks and pet chickens, and environmental samples not directly derived from flocks or their immediate surroundings. The reported phage types were: PT4 (35 incidents), PT6 (11 incidents), PT7 & PT8 (7 incidents of each), PT6a (5 incidents), PT1 and UNTY (3 incidents of each), PT14b and PT35 (2 incidents of each) and single incident reports of PT5a, PT12 and PT22. Reports of PT4, PT 6, PT6a and PT7 increased in 2008 in comparison with 2007. There was one incident (PT4) in a broiler flock and 77 incidents in egg layer flocks. Recent *S. Enteritidis* phage types reported in 2008 were: PT6a (last reported in 2005), PT12 (last reported in 2005) and PT22 (never reported before from routine surveillance of chickens).

### **Salmonella Typhimurium**

There were 12 incidents of *Salmonella* Typhimurium in 2008, and they were reported from various flock types, including commercial meat production and egg laying flocks, chicken breeding flocks, and a pet/backyard flock. Reports of *S. Typhimurium* represented 4.8% of all reports from chickens. The proportion of this serovar relative to all incident reports in chickens has remained at similar levels in recent years (Fig 37). In 2008 the following types were reported: DT35 and DT41 (two incidents of each), and single incidents of DT2, DT8, DT12a, DT120, DT104, DT104b, DT193 and U302. The pigeon related DT2

was reported from a broiler flock, while DT8 (a duck associated *S. Typhimurium* definitive type) was reported from an egg laying flock. Full details on the reported types by flock type are shown in Table 41. There was a decreasing trend in *S. Typhimurium* DT104 reported from chickens between 2004 and 2008. Rare definitive types of *S. Typhimurium* reported in 2008 were: DT2 (last reported in 2003), DT12a (last reported under routine surveillance in 1996), DT35 (never reported before in chickens), DT41 (last reported in 2004), DT104b (last reported in 2002), DT120 (last reported in 2004) and U302 (last reported in 2003).

### **Other serovars**

The second most common serovar reported from chickens in Great Britain in 2008 was *S. Senftenberg* (24 incidents). The relative proportion of this serovar increased from 8.7% in 2007 to 9.6% in 2008.

The proportion of reports of *S. Mbandaka* increased from 7.1% in 2007 to 8.4% in 2008; this was the third most commonly reported serovar. Other common serovars were *S. Livingstone* and *S. Ohio* (6.4% of all incidents each) and *S. Kedougou* (5.2% of all incidents). In addition, there were four reports of *Salmonella* 6,7:-:- which may be related to *S. Livingstone* (these are not shown separately in Table 39, but are included under “structure only”). The reduction in the number of *S. Livingstone* incidents over the past five years is likely to be linked to the elimination of this serovar from breeding flocks which has further reduced its presence in production flocks. In 2004 the majority (52.4%) of *S. Livingstone* incidents arose from breeding flocks. The proportion of incidents from breeding flocks reduced to 25.5% in 2005, 18.5% in 2006 and since then no further incidents have been reported from breeding flocks.

The number of reports of *S. Virchow* increased from three in 2007 to five in 2008. Of these five incidents, the most common phage types were PT2 and PT54 (two incidents each), and there was also one report of PT26. The reports of PT2 and PT54 were all from broiler flocks. The report of PT26 was from hatcher debris (fluff) sample from a broiler hatch. As this isolate was not derived from sampling under the CSPO and could not be directly linked to an adult breeding flock, it has not been included in the group of isolates contributing to the EU target for reduction of *Salmonella* in adult breeding flocks. *S. Virchow* PT54 has never been reported before in chickens or any other species.

*S. Hadar* was not reported from chicken flocks in 2008, however there were three reported incidents of *S. Infantis* from egg laying flocks. All

three of these incidents were a result of additional voluntary dust sampling by operators.

There were no reports of *S. Pullorum* in 2008. Reports of *S. Thompson* increased from one in 2007 to nine in 2008. The reported phage types were: RDNC (4 reports), PT1a (two reports), and single reports of PT1, PT2 and PT9. *S. Thompson* PT1 was last reported in chickens under voluntary surveillance in 2003, PT2 in 2001, while PT9 has never been reported before in chickens or any other species.

A single report of *S. Newport* was received in 2008, from a layer flock. The isolate was fully sensitive to all the antimicrobials tested against.

There was a decrease in the number of reports of *S. Agama* from 16 in 2007 to five in 2008. *Salmonella* Bredeney and *S. Carno* have not been reported from chickens since 2003. Rare *Salmonella* serovars reported in 2008 were: *S. Nottingham* (last reported in 1993), *S. Orion* (last reported in 2004), *S. Ordonez* (last reported in chickens in 1990), *S. Rissen* (last reported in 2005), *S. Saintpaul* (last reported in 2006) and *S. Tennessee* (last reported in 2005).

There were no incidents of *S. Gallinarum* reported in 2008 compared to six and five incident reports in 2007 and 2006 respectively.

National trends for *Salmonella* in chickens are difficult to interpret since a large proportion of reports of a specific serovar may originate from a small number of large integrated companies.

In 2008 there were six *Salmonella* reports of non-GB origin from domestic fowl: two reports of *S. Kentucky*, two reports of *S. Enteritidis* PT35, one report of *S. Enteritidis* PT7 and one report of *S. Thompson*. These reports are excluded from the tables and figures of this publication.

In 2008 the following *Salmonella* serovars were reported from chickens for reasons other than routine surveillance, for example through research projects, but were not reported through routine surveillance: *S. Aarhus*, *S. Bredeney*, *S. Ituri* and *S. Stourbridge*. These reports are not included in the tabulations of this publication.

## **Turkeys**

The number of incidents of *Salmonella* reported in turkey flocks decreased by 50% in 2008 compared with 2007. The majority (90%) arose through voluntary surveillance activities, while 10% of reports were associated with clinical disease. There was one incident of *S.*

Typhimurium in 2008 (which was from a production meat turkey) compared with 12 incidents in 2007, which represents a reduction in incidents of 91% compared with 2007. This is the lowest number of *S. Typhimurium* incidents reported from turkeys in the past five years. The incident in 2008 was phage-typed and identified as U302, this phage type had not been reported in the previous year from routine surveillance but had been present in 2005 and 2006 (2 incidents each year).

In 2008 there were no reports of the other serotypes of public health significance (*S. Enteritidis*, *S. Hadar*, *S. Infantis* and *S. Virchow*) from turkey flocks.

The most common serovar reported in 2008 was *S. Kedougou*. The relative proportion (39.3% of incidents) of this serovar increased in 2008, compared with 2007 (12.4% of incidents). None of the isolations were from hatcheries, however, one incident was from a breeding flock and 16 of the 22 incidents reported in 2008 were from meat production turkeys from the same company. The second most common serovar reported was *S. Derby*. This serovar represents 35.7% of all incidents from turkeys which is comparable with 2007, in which 32.7% incidents from turkeys were identified as *S. Derby*. *S. Kottbus* and *S. Indiana* were the third and fourth most commonly reported serovars (14.3% and 3.6% of reports, respectively) and all these incidents were from meat production turkeys.

There were no reports of *S. Newport* or *S. Senftenberg* in 2008, compared with 2007 (6.2% and 8.0%, respectively). *S. Ohio* was a serovar that was reported for the first time since 1999.

*S. Agama*, *S. Agona*, *S. Ajiobo*, *S. Mons* and *S. Saintpaul* were all reported in 2007 (one incident each) from turkey flocks but there were no reports of any of these serovars in 2008.

In 2008 there were 18 *Salmonella* incidents of non-GB origin reported from turkeys: 15 reports of *S. Kedougou*, and three reports of *S. Kottbus*. These reports have been excluded from the tables and figures of this publication.

In 2008 the following *Salmonella* serovars were reported from turkeys for reasons other than routine surveillance, for example through research projects: *S. Agama*, *S. Anatum*, *S. Bardo*, *S. Binza*, *S. Durham*, *S. Fischerkietz*, *S. Give*, *S. Livingstone*, *S. Newport*, *S. Nottingham*, *S. Oslo*, *S. Reading*, *S. Senftenberg*, *S. Wagenia* and *S. Typhimurium* definitive types DT15a and DT104b. These reports are not included in the tabulations of this publication.

## Ducks and Geese

There was one report of *Salmonella* from geese in 2008, the same number as in 2007. The serovar reported was *Salmonella* Typhimurium DT8.

The number of reports of *Salmonella* from ducks in 2008 decreased by 23.7% compared with 2007. Reports from ducks represented 15.9% of all *Salmonella* reports in 2008. Most of these incidents are the result of enhanced voluntary surveillance activities by the duck industry (Table 1). Only a very small number of incidents are associated with clinical disease investigation (0.7%).

The most common serovars reported in ducks and geese were *S. Indiana* (34.2%), *S. Orion* (18.0%), *S. Hadar* (12.6%), *S. Mbandaka* (10.1%) and *S. Kedougou* (8.6%). The relative proportion of *S. Indiana* decreased compared with 2007 (40.9%) but the relative proportion of *S. Orion*, *S. Hadar*, *S. Mbandaka* and *S. Kedougou* all increased compared with 2007, when they were 8.8%, 8.2%, 9.9% and 4.1% respectively. The most common *S. Hadar* phage type was PT11, accounting for 45.7% of the *S. Hadar* incidents. Other commonly reported phage types of *S. Hadar* were PT2, PT10 and PT22. *S. Hadar* PT18 was reported in 2008 and was last reported in 2004 (Table 58).

The number of incidents and relative proportions of *S. Give*, *S. Senftenberg* and *S. Binza* decreased in 2008 compared with 2007. *S. Derby*, *S. Heidelberg* and *S. Kottbus* were all reported in 2007 yet there were no incidents of these serovars in 2008.

In 2008, there were five reports of *S. Typhimurium*, an increase of one incident compared with 2007 but still a marked decrease compared with 2006 when there were 34 incident reports. The phage types reported in 2008 were DT8 (3 reports) and DT30 (2 reports).

In 2008, there was one incident report (0.4%) of *S. Enteritidis* compared with 2007 when there were ten incident reports (2.7%). The phage type of the single incident was PT9b (Table 57).

There were four *Salmonella* reports from ducks of non-GB origin in 2008: two reports of *S. Indiana*, one report of *S. Enteritidis* PT4 and one report of *S. Typhimurium* DT8. These reports are excluded from the tables and figures of this publication.

## Game Birds

In 2008 reports of *Salmonella* in game birds (16 reports) decreased by 38.5% compared with 2007 (26 reports). Most reports (12) were associated with clinically diseased pheasants and partridges (Table 1). The most commonly reported serovars were *S. Binza* (7 incident reports; 43.8% of all incident reports) and *S. Typhimurium* (6 incident reports; 37.5% of all incident reports). The relative proportions of these two serovars from game birds increased in 2008 compared with 2007, however the number of incident reports of *S. Binza* decreased (from 8 to 7) whilst the number of *S. Typhimurium* incident reports increased (from 5 to 6). There were two incident reports of *S. Typhimurium* U302 and U310 and single reports of DT2 and DT193. Interestingly, *S. Typhimurium* U302 was last reported in game birds (partridges) in 1998. There were no incident reports of *S. Enteritidis* in game birds in 2008, compared with two incidents in 2007. However, there was one isolation of *S. Enteritidis* from a pheasant but as full information of the phage type was unavailable at the time of data collection it was not reported as an incident. *Salmonella* Stanley has not been reported from game birds since 2002.

There were nine *Salmonella* reports from game birds of non-GB origin in 2008: From partridges three reports of *S. Binza*, one report of *S. Orion* and one report of *S. Typhimurium* UNTY, and from pheasants two reports of *S. Binza* and single reports of *S. Typhimurium* U302 and *S. Pullorum*. These reports are excluded from the tables and figures of this publication.

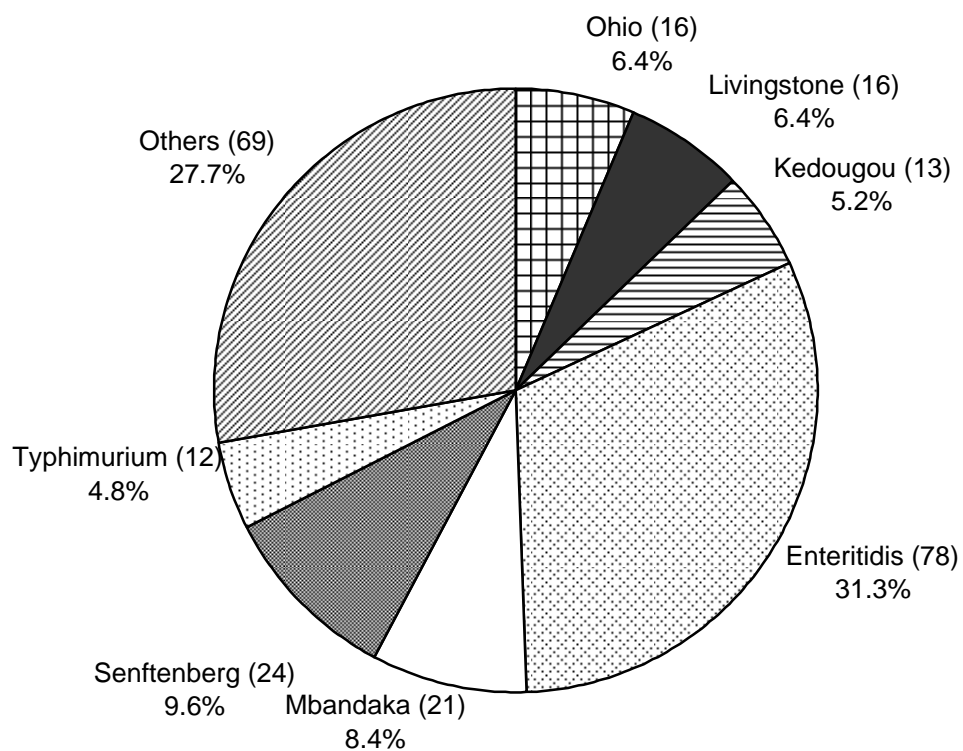
**Table 39: *Salmonella* in chickens on all premises**

| <i>Salmonella</i><br>Incidents (Isolations) | 2004 |        | 2005 |        | 2006 |       | 2007 |       | 2008 |       |
|---|------|--------|------|--------|------|-------|------|-------|------|-------|
| ENTERICA ENTERICA                           |      |        |      |        |      |       |      |       |      |       |
| Agama                                       | 1    | ( 1)   | 3    | ( 3)   | 2    | ( 2)  | 16   | ( 17) | 5    | ( 5)  |
| Agona                                       | 2    | ( 2)   | 5    | ( 5)   | 4    | ( 4)  | 5    | ( 8)  | 7    | ( 7)  |
| Ajiobo                                      | -    | ( -)   | -    | ( -)   | -    | ( -)  | 1    | ( 1)  | -    | ( -)  |
| Anatum                                      | -    | ( -)   | 4    | ( 4)   | 2    | ( 2)  | 1    | ( 1)  | 4    | ( 4)  |
| Binza                                       | 1    | ( 1)   | 1    | ( 1)   | -    | ( -)  | 3    | ( 3)  | 1    | ( 1)  |
| Bovismorbificans                            | -    | ( -)   | -    | ( -)   | -    | ( -)  | 1    | ( 1)  | -    | ( -)  |
| Braenderup                                  | 1    | ( 1)   | -    | ( -)   | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Brandenburg                                 | 19   | ( 22)  | -    | ( -)   | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Cerro                                       | -    | ( -)   | -    | ( -)   | 3    | ( 6)  | -    | ( -)  | -    | ( -)  |
| Cubana                                      | -    | ( -)   | 1    | ( 1)   | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Derby                                       | -    | ( -)   | 1    | ( 1)   | -    | ( -)  | 1    | ( 1)  | 1    | ( 1)  |
| Dublin                                      | 1    | ( 1)   | 1    | ( 1)   | -    | ( -)  | 1    | ( 1)  | 3    | ( 4)  |
| Durham                                      | -    | ( -)   | -    | ( -)   | -    | ( -)  | 1    | ( 2)  | 1    | ( 1)  |
| Enteritidis                                 | 8    | ( 8)   | 21   | ( 21)  | 16   | ( 20) | 37   | ( 44) | 78   | ( 92) |
| Gallinarum                                  | -    | ( -)   | 5    | ( 6)   | 5    | ( 6)  | 6    | ( 16) | -    | ( -)  |
| Give  | 28   | ( 28)  | 5    | ( 5)   | 4    | ( 4)  | 1    | ( 1)  | 1    | ( 1)  |
| Gloucester                                  | -    | ( -)   | 1    | ( 1)   | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Goldcoast                                   | -    | ( -)   | 1    | ( 1)   | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Hadar                                       | -    | ( -)   | -    | ( -)   | 5    | ( 6)  | -    | ( -)  | -    | ( -)  |
| Havana                                      | 5    | ( 5)   | 5    | ( 5)   | 9    | ( 9)  | 4    | ( 4)  | 4    | ( 4)  |
| Heidelberg                                  | -    | ( -)   | -    | ( -)   | -    | ( -)  | 1    | ( 1)  | -    | ( -)  |
| Idikan                                      | 2    | ( 2)   | 11   | ( 11)  | 2    | ( 2)  | -    | ( -)  | -    | ( -)  |
| Indiana                                     | 8    | ( 8)   | 1    | ( 2)   | 3    | ( 3)  | 1    | ( 1)  | 1    | ( 1)  |
| Infantis                                    | 17   | ( 17)  | 4    | ( 4)   | 3    | ( 4)  | 1    | ( 1)  | 3    | ( 4)  |
| Kedougou                                    | 32   | ( 32)  | 33   | ( 34)  | 29   | ( 35) | 14   | ( 15) | 13   | ( 13) |
| Kentucky                                    | 5    | ( 5)   | 1    | ( 1)   | 1    | ( 1)  | 5    | ( 9)  | 1    | ( 1)  |
| Kottbus                                     | 5    | ( 5)   | 4    | ( 4)   | 2    | ( 2)  | 3    | ( 3)  | -    | ( -)  |
| Larochelle                                  | -    | ( -)   | 1    | ( 1)   | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Lexington                                   | 10   | ( 10)  | 3    | ( 3)   | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Liverpool                                   | 38   | ( 47)  | 15   | ( 16)  | 2    | ( 3)  | -    | ( -)  | -    | ( -)  |
| Livingstone                                 | 117  | ( 127) | 147  | ( 155) | 54   | ( 66) | 25   | ( 37) | 16   | ( 16) |
| Mbandaka                                    | 20   | ( 23)  | 20   | ( 24)  | 10   | ( 11) | 14   | ( 16) | 21   | ( 23) |
| Meleagridis                                 | 1    | ( 1)   | 2    | ( 2)   | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Menston                                     | -    | ( -)   | 2    | ( 2)   | -    | ( -)  | -    | ( -)  | -    | ( 1)  |
| Montevideo                                  | 13   | ( 13)  | 15   | ( 15)  | 9    | ( 13) | 1    | ( 1)  | 2    | ( 2)  |
| Newport                                     | 9    | ( 9)   | 2    | ( 2)   | 2    | ( 2)  | 1    | ( 1)  | 1    | ( 1)  |
| Nottingham                                  | -    | ( -)   | -    | ( -)   | -    | ( -)  | -    | ( -)  | 2    | ( 3)  |

**Table 39: *Salmonella* in chickens on all premises**

| <i>Salmonella</i><br>Incidents (Isolations) | 2004       |               | 2005       |               | 2006       |               | 2007       |               | 2008       |               |
|---|------------|---------------|------------|---------------|------------|---------------|------------|---------------|------------|---------------|
| <b>ENTERICA ENTERICA</b>                    |            |               |            |               |            |               |            |               |            |               |
| Ohio  | 31         | ( 31)         | 23         | ( 23)         | 36         | ( 36)         | 6          | ( 6)          | 16         | ( 16)         |
| Orion                                       | 1          | ( 1)          | -          | ( -)          | -          | ( -)          | -          | ( -)          | 1          | ( 1)          |
| Oskarshamn                                  | -          | ( -)          | -          | ( -)          | 1          | ( 1)          | -          | ( -)          | -          | ( -)          |
| Ordenez                                     | -          | ( -)          | -          | ( -)          | -          | ( -)          | -          | ( -)          | 1          | ( 1)          |
| Poona                                       | -          | ( -)          | -          | ( -)          | -          | ( -)          | 4          | ( 4)          | 1          | ( 1)          |
| Pullorum                                    | 3          | ( 3)          | -          | ( -)          | 1          | ( 2)          | -          | ( 1)          | -          | ( -)          |
| Reading                                     | 1          | ( 1)          | -          | ( -)          | -          | ( -)          | -          | ( -)          | -          | ( -)          |
| Rissen                                      | -          | ( -)          | 3          | ( 3)          | -          | ( -)          | -          | ( -)          | 1          | ( 1)          |
| Saint Paul                                  | 2          | ( 2)          | -          | ( -)          | 1          | ( 1)          | -          | ( -)          | 1          | ( 1)          |
| Schwarzengrund                              | -          | ( -)          | -          | ( -)          | 1          | ( 1)          | -          | ( -)          | -          | ( -)          |
| Senftenberg                                 | 60         | ( 65)         | 65         | ( 68)         | 29         | ( 51)         | 17         | ( 37)         | 24         | ( 33)         |
| Stourbridge                                 | -          | ( -)          | -          | ( -)          | 2          | ( 2)          | -          | ( -)          | -          | ( -)          |
| Sundsvall                                   | -          | ( -)          | 1          | ( 1)          | -          | ( -)          | -          | ( -)          | -          | ( -)          |
| Taksony                                     | -          | ( -)          | -          | ( -)          | 1          | ( 1)          | -          | ( -)          | -          | ( -)          |
| Tennessee                                   | 2          | ( 2)          | 1          | ( 1)          | -          | ( -)          | -          | ( -)          | 2          | ( 2)          |
| Thomasville                                 | -          | ( -)          | -          | ( -)          | -          | ( -)          | 1          | ( 1)          | -          | ( -)          |
| Thompson                                    | 35         | ( 35)         | 32         | ( 33)         | 14         | ( 15)         | 1          | ( 2)          | 9          | ( 10)         |
| Typhimurium                                 | 12         | ( 12)         | 9          | ( 9)          | 10         | ( 10)         | 6          | ( 8)          | 12         | ( 20)         |
| Virchow                                     | 28         | ( 29)         | 14         | ( 14)         | 5          | ( 6)          | 3          | ( 8)          | 5          | ( 9)          |
| Worthington                                 | -          | ( -)          | -          | ( -)          | 1          | ( 1)          | -          | ( -)          | -          | ( -)          |
| Yoruba                                      | 1          | ( 1)          | 2          | ( 2)          | -          | ( -)          | 2          | ( 2)          | -          | ( -)          |
| <b>ENTERICA DIARIZONAE</b>                  |            |               |            |               |            |               |            |               |            |               |
| 61:k:1,5,7                                  | -          | ( -)          | 1          | ( 1)          | -          | ( -)          | -          | ( -)          | -          | ( -)          |
| <b>UNSPECIFIED</b>                          |            |               |            |               |            |               |            |               |            |               |
| structure only                              | 64         | ( 108)        | 54         | ( 118)        | 31         | ( 78)         | 7          | ( 19)         | 6          | ( 7)          |
| rough strain                                | 3          | ( 3)          | 11         | ( 11)         | 1          | ( 3)          | 5          | ( 5)          | 5          | ( 5)          |
| <b>TOTAL</b>                                | <b>586</b> | <b>( 661)</b> | <b>531</b> | <b>( 615)</b> | <b>301</b> | <b>( 409)</b> | <b>196</b> | <b>( 248)</b> | <b>249</b> | <b>( 292)</b> |

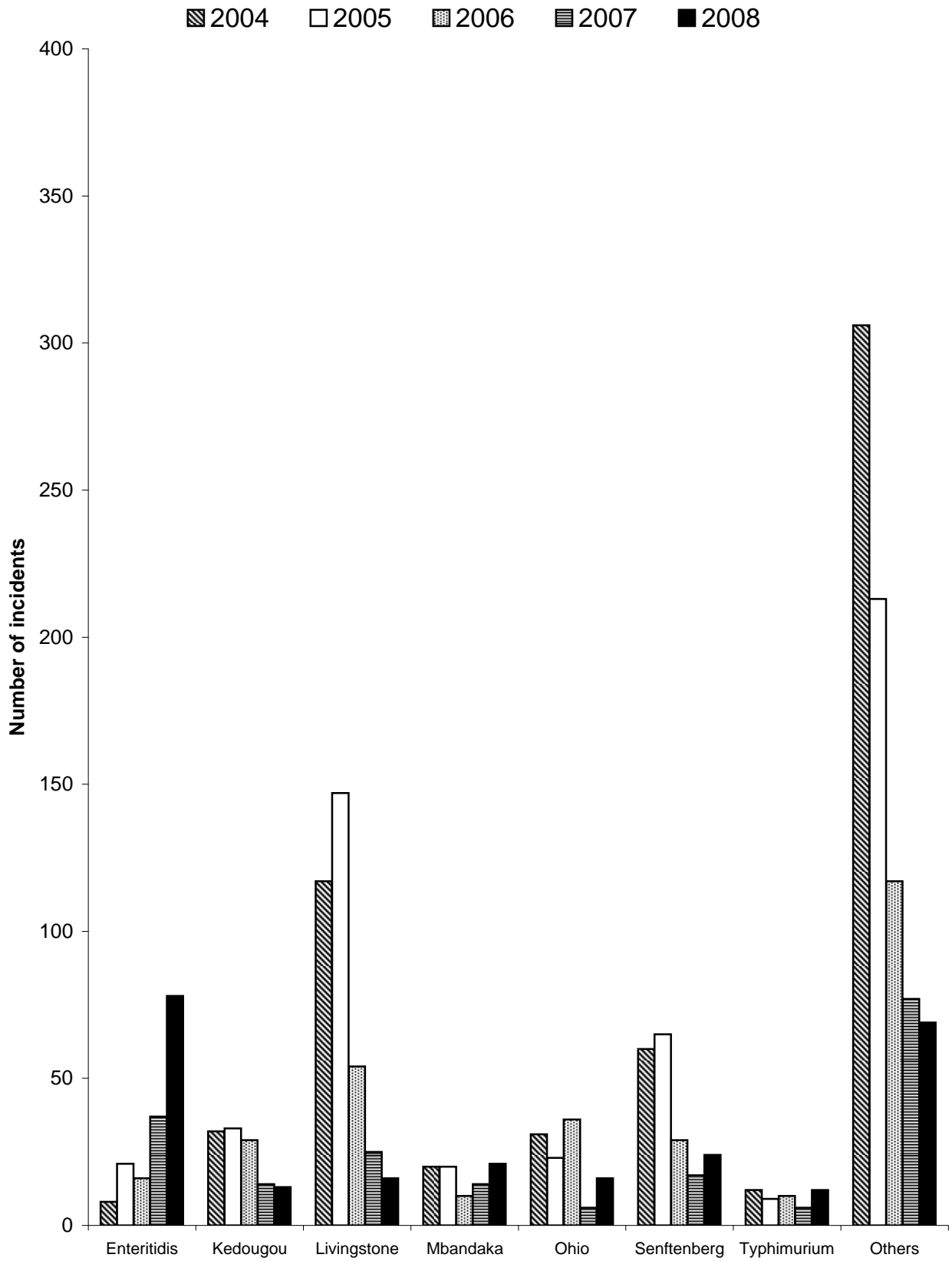
**Fig 31: Incidents of *Salmonella* serovars in chickens in 2008**



**Table 40: Incidents of the top 5 *Salmonella* serovars in chickens in 2008 as a % of all incidents compared to previous years**

| Serotype            | 2004 | 2005 | 2006 | 2007 | 2008 |
|---------------------|------|------|------|------|------|
| S. Enteritidis %    | 1.4  | 4.0  | 5.3  | 18.9 | 31.3 |
| S. Senftenberg %    | 10.2 | 12.2 | 9.6  | 8.7  | 9.6  |
| S. Mbandaka %       | 3.4  | 3.8  | 3.3  | 7.1  | 8.4  |
| S. Livingstone %    | 20.0 | 27.7 | 17.9 | 12.8 | 6.4  |
| S. Ohio %           | 5.3  | 4.3  | 12.0 | 3.1  | 6.4  |
| S. Kedougou %       | 5.5  | 6.2  | 9.6  | 7.1  | 5.2  |
| Total no. incidents | 586  | 531  | 301  | 196  | 249  |

Fig 32: Incidents of *Salmonella* serovars in chickens (2004 - 2008)



**Table 41: *Salmonella* of public health significance in chickens - number of incidents in 2008**

| <b><i>Salmonella</i></b> | <b>Broilers</b> | <b>Broiler Breeders</b> | <b>Layers</b> | <b>Pet/Backyard flock</b> | <b>Total</b> |
|--------------------------|-----------------|-------------------------|---------------|---------------------------|--------------|
| Enteritidis PT1          | 0               | 0                       | 3             | 0                         | 3            |
| Enteritidis PT4          | 1               | 0                       | 34            | 0                         | 35           |
| Enteritidis PT5a         | 0               | 0                       | 1             | 0                         | 1            |
| Enteritidis PT6          | 0               | 0                       | 11            | 0                         | 11           |
| Enteritidis PT6a         | 0               | 0                       | 5             | 0                         | 5            |
| Enteritidis PT7          | 0               | 0                       | 7             | 0                         | 7            |
| Enteritidis PT8          | 0               | 0                       | 7             | 0                         | 7            |
| Enteritidis PT12         | 0               | 0                       | 1             | 0                         | 1            |
| Enteritidis PT14b        | 0               | 0                       | 2             | 0                         | 2            |
| Enteritidis PT22         | 0               | 0                       | 1             | 0                         | 1            |
| Enteritidis PT35         | 0               | 0                       | 2             | 0                         | 2            |
| Enteritidis UNTY         | 0               | 0                       | 3             | 0                         | 3            |
| Infantis                 | 0               | 0                       | 3             | 0                         | 3            |
| Typhimurium DT2          | 1               | 0                       | 0             | 0                         | 1            |
| Typhimurium DT8          | 0               | 0                       | 1             | 0                         | 1            |
| Typhimurium DT12a        | 0               | 0                       | 1             | 0                         | 1            |
| Typhimurium DT35         | 0               | 0                       | 2             | 0                         | 2            |
| Typhimurium DT41         | 0               | 2                       | 0             | 0                         | 2            |
| Typhimurium DT104        | 1               | 0                       | 0             | 0                         | 1            |
| Typhimurium DT104b       | 0               | 1                       | 0             | 0                         | 1            |
| Typhimurium DT120        | 0               | 1                       | 0             | 0                         | 1            |
| Typhimurium DT193        | 0               | 1                       | 0             | 0                         | 1            |
| Typhimurium U302         | 0               | 0                       | 0             | 1                         | 1            |
| Virchow PT2              | 2               | 0                       | 0             | 0                         | 2            |
| Virchow PT26             | 0               | 1                       | 0             | 0                         | 1            |
| Virchow PT54             | 2               | 0                       | 0             | 0                         | 2            |
| Total                    | 7               | 6                       | 84            | 1                         | 98           |

**Table 42: S. Typhimurium in chickens on all premises**

| Definitive Types<br>Incidents (Isolations) | 2004     | 2005   | 2006     | 2007   | 2008     |
|--|----------|--------|----------|--------|----------|
| 2  | - ( -)   | - ( -) | - ( -)   | - ( -) | 1 ( 1)   |
| 8  | - ( -)   | 1 ( 1) | - ( -)   | 2 ( 3) | 1 ( 1)   |
| 12a  | - ( -)   | - ( -) | - ( -)   | - ( -) | 1 ( 1)   |
| 35   | - ( -)   | - ( -) | - ( -)   | - ( -) | 2 ( 2)   |
| 40   | 1 ( 1)   | - ( -) | 3 ( 3)   | - ( -) | - ( -)   |
| 41   | 1 ( 1)   | - ( -) | - ( -)   | - ( -) | 2 ( 8)   |
| 49   | 1 ( 1)   | 1 ( 1) | - ( -)   | - ( -) | - ( -)   |
| 56   | 1 ( 1)   | - ( -) | - ( -)   | - ( -) | - ( -)   |
| 85   | - ( -)   | 1 ( 1) | - ( -)   | - ( -) | - ( -)   |
| 104  | 6 ( 6)   | 6 ( 6) | 5 ( 5)   | 1 ( 2) | 1 ( 2)   |
| 104b                                       | - ( -)   | - ( -) | - ( -)   | - ( -) | 1 ( 1)   |
| 120  | 1 ( 1)   | - ( -) | - ( -)   | - ( -) | 1 ( 1)   |
| 193  | 1 ( 1)   | - ( -) | - ( -)   | 1 ( 1) | 1 ( 1)   |
| 195  | - ( -)   | - ( -) | 1 ( 1)   | - ( -) | - ( -)   |
| U302                                       | - ( -)   | - ( -) | - ( -)   | - ( -) | 1 ( 1)   |
| RDNC                                       | - ( -)   | - ( -) | - ( -)   | - ( -) | - ( 1)   |
| UNTY                                       | - ( -)   | - ( -) | 1 ( 1)   | 2 ( 2) | - ( -)   |
| TOTAL                                      | 12 ( 12) | 9 ( 9) | 10 ( 10) | 6 ( 8) | 12 ( 20) |

Fig 33: Incidents of *Salmonella* Typhimurium definitive types in chickens in 2008

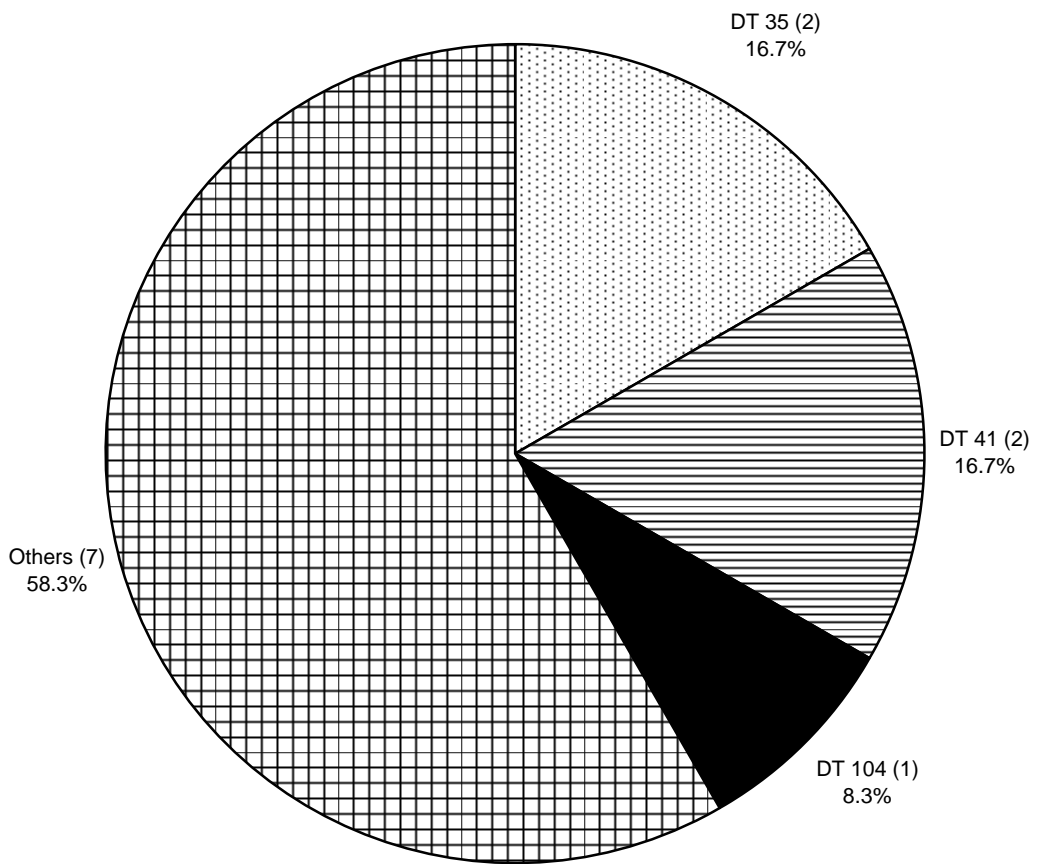
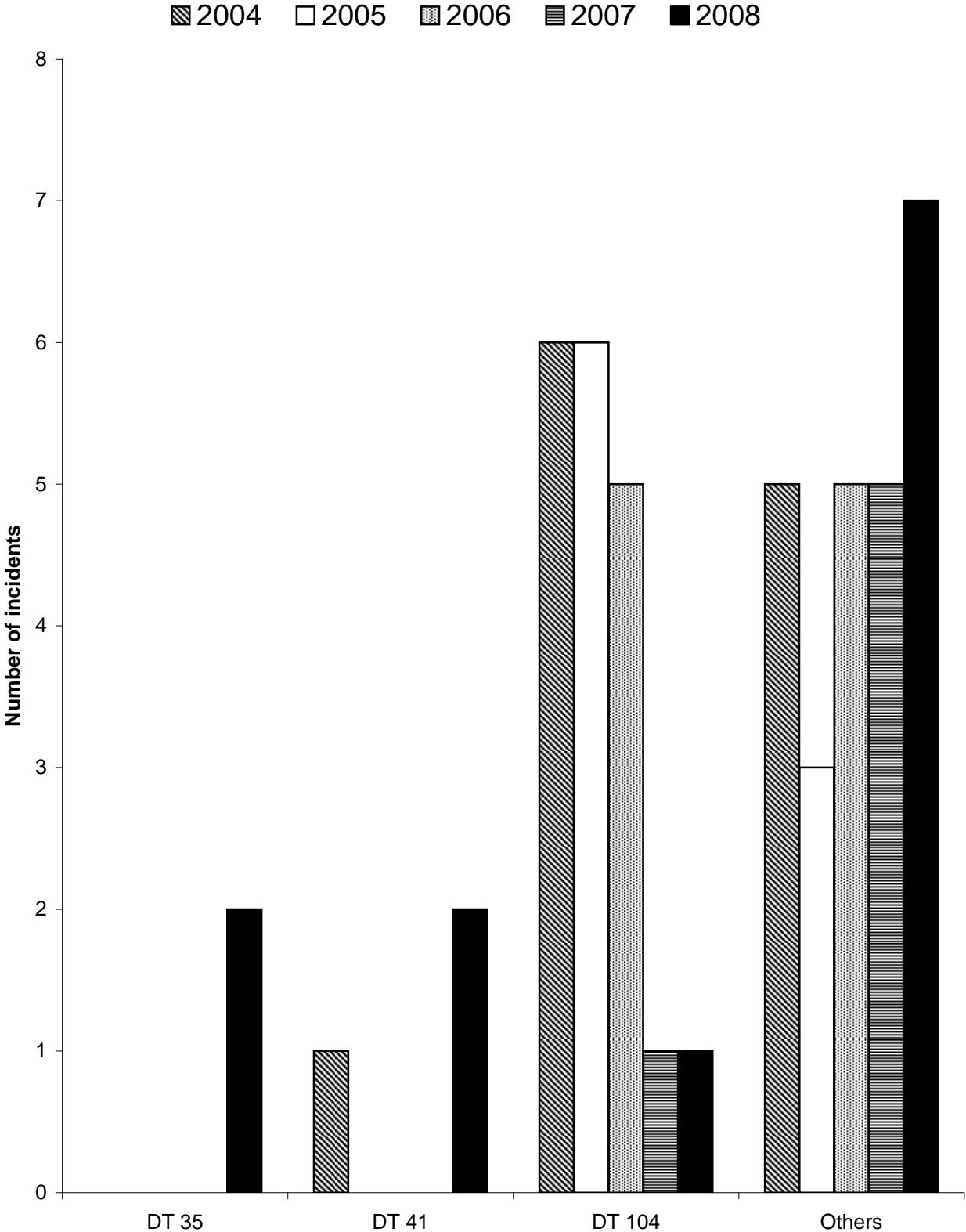


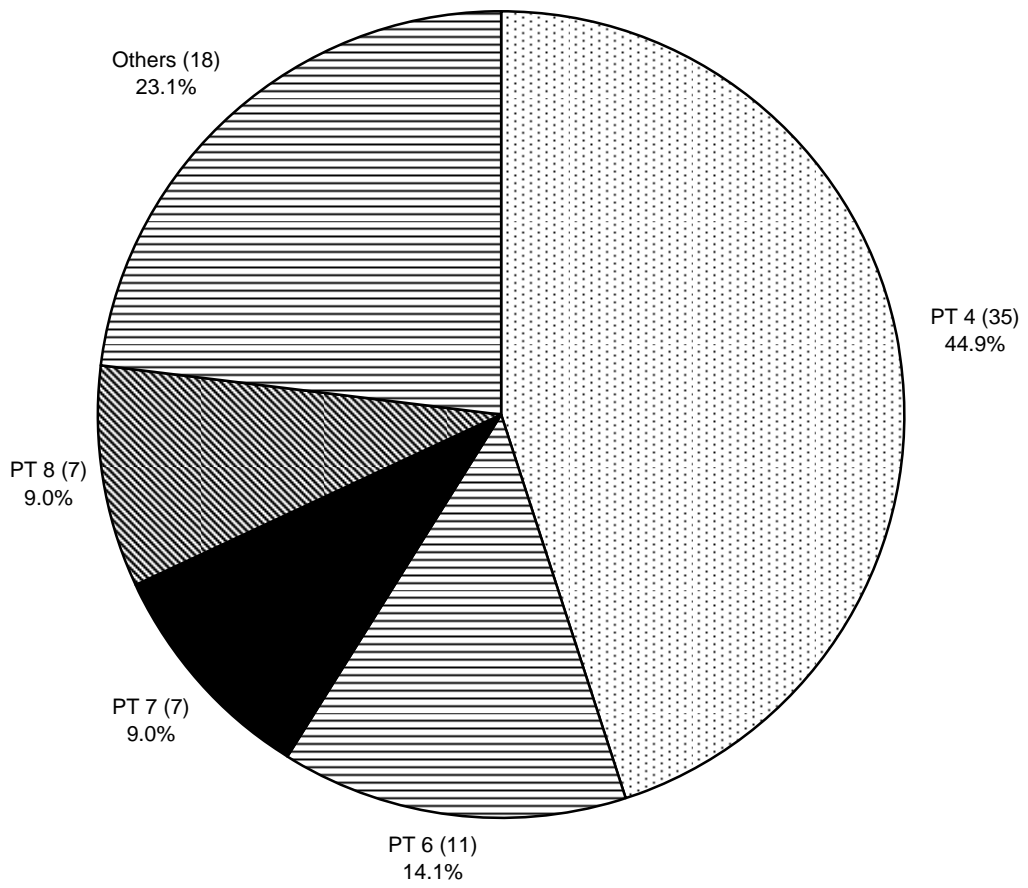
Fig 34: Incidents of *Salmonella* Typhimurium definitive types in chickens (2004 - 2008)



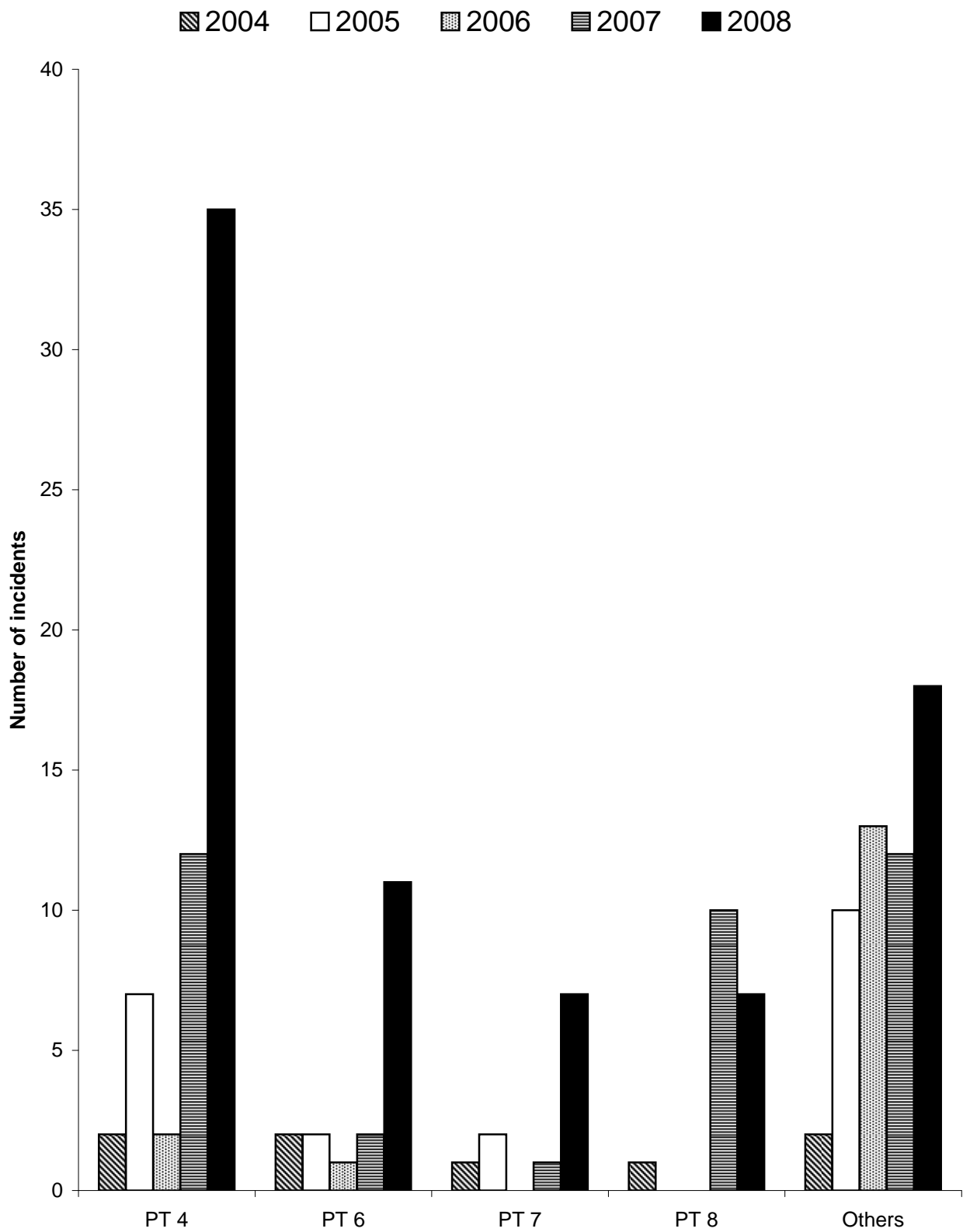
**Table 43: S. Enteritidis in chickens on all premises**

| Phage Types<br>Incidents (Isolations) | 2004 |      | 2005 |       | 2006 |       | 2007 |       | 2008 |       |
|---------------------------------------|------|------|------|-------|------|-------|------|-------|------|-------|
| 1                                     | -    | ( -) | 1    | ( 1)  | 12   | ( 15) | 5    | ( 5)  | 3    | ( 3)  |
| 4                                     | 2    | ( 2) | 7    | ( 7)  | 2    | ( 3)  | 12   | ( 13) | 35   | ( 41) |
| 4b                                    | -    | ( -) | 2    | ( 2)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| 5a                                    | -    | ( -) | 1    | ( 1)  | -    | ( -)  | 1    | ( 1)  | 1    | ( 1)  |
| 6                                     | 2    | ( 2) | 2    | ( 2)  | 1    | ( 1)  | 2    | ( 2)  | 11   | ( 11) |
| 6a                                    | -    | ( -) | 2    | ( 2)  | -    | ( -)  | -    | ( -)  | 5    | ( 6)  |
| 7                                     | 1    | ( 1) | 2    | ( 3)  | -    | ( -)  | 1    | ( 1)  | 7    | ( 11) |
| 8                                     | 1    | ( 1) | -    | ( -)  | -    | ( -)  | 10   | ( 14) | 7    | ( 8)  |
| 9b                                    | -    | ( -) | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| 11                                    | 1    | ( 1) | -    | ( -)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| 12                                    | -    | ( -) | 2    | ( 2)  | -    | ( -)  | -    | ( -)  | 1    | ( 1)  |
| 14b                                   | -    | ( -) | -    | ( -)  | -    | ( -)  | -    | ( 1)  | 2    | ( 2)  |
| 22                                    | -    | ( -) | -    | ( -)  | -    | ( -)  | -    | ( -)  | 1    | ( 1)  |
| 28                                    | -    | ( -) | -    | ( -)  | 1    | ( 1)  | -    | ( -)  | -    | ( -)  |
| 35                                    | 1    | ( 1) | -    | ( -)  | -    | ( -)  | 4    | ( 5)  | 2    | ( 2)  |
| NOPT                                  | -    | ( -) | -    | ( -)  | -    | ( -)  | -    | ( -)  | -    | ( 2)  |
| UNTY                                  | -    | ( -) | 1    | ( 1)  | -    | ( -)  | 2    | ( 2)  | 3    | ( 3)  |
| TOTAL                                 | 8    | ( 8) | 21   | ( 21) | 16   | ( 20) | 37   | ( 44) | 78   | ( 92) |

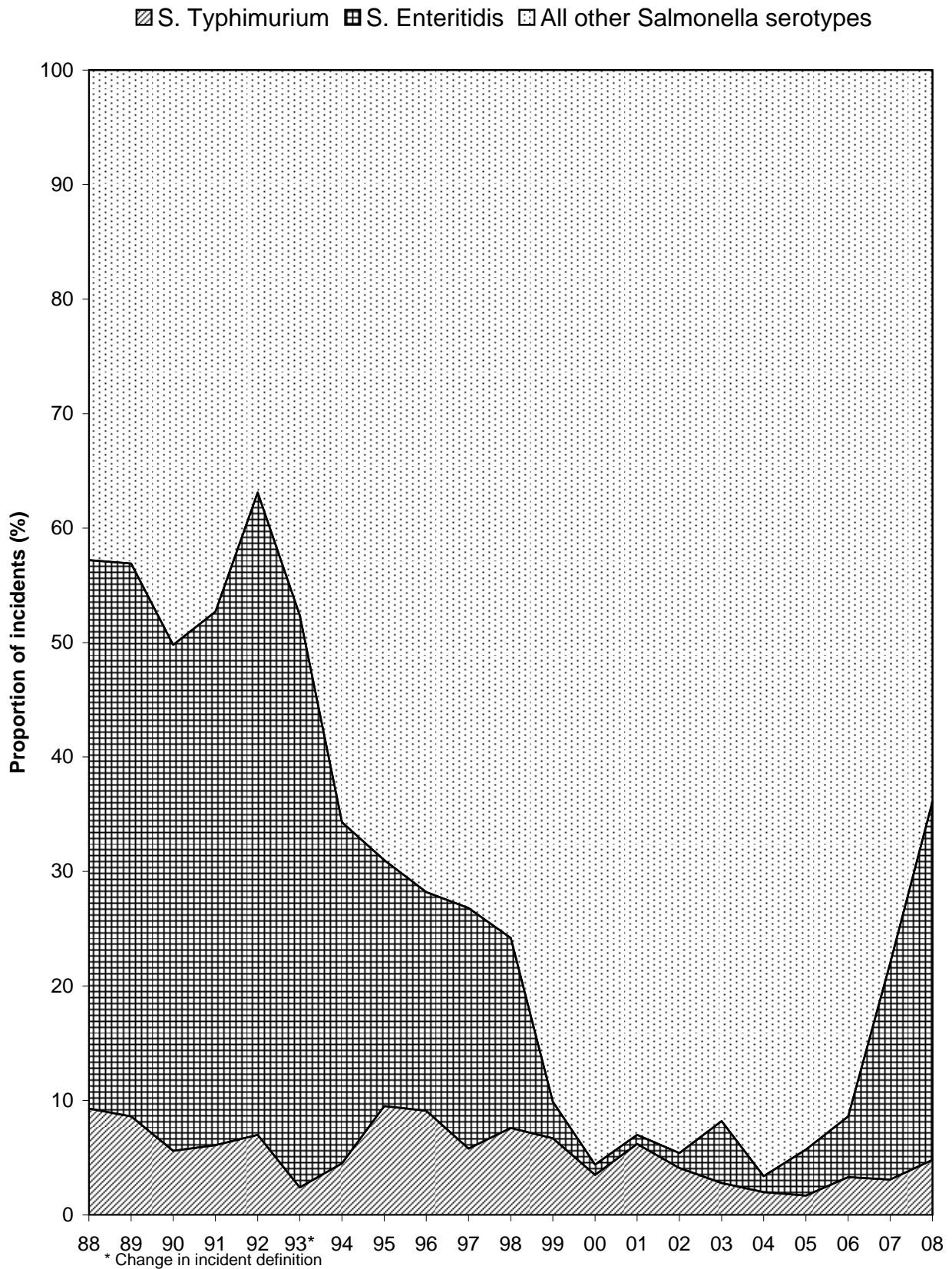
Fig 35: Incidents of *Salmonella* Enteritidis phage types in chickens in 2008



**Fig 36: Incidents of *Salmonella* Enteritidis phage types in chickens (2004 - 2008)**



**Fig 37: *S. Enteritidis* and *S. Typhimurium* as a proportion of all incident reports in chickens (1988 - 2008)**



**Table 44: S. Hadar in chickens on all premises**

| Phage Types<br>Incidents (Isolations) | 2004   | 2005   | 2006   | 2007   | 2008   |
|---------------------------------------|--------|--------|--------|--------|--------|
| 10                                    | - ( -) | - ( -) | 1 ( 2) | - ( -) | - ( -) |
| 22                                    | - ( -) | - ( -) | 3 ( 3) | - ( -) | - ( -) |
| 47                                    | - ( -) | - ( -) | 1 ( 1) | - ( -) | - ( -) |
| TOTAL                                 | - ( -) | - ( -) | 5 ( 6) | - ( -) | - ( -) |

**Table 45: S. Pullorum in chickens on all premises**

| Phage Types<br>Incidents (Isolations) | 2004   | 2005   | 2006   | 2007   | 2008   |
|---------------------------------------|--------|--------|--------|--------|--------|
| 1                                     | 3 ( 3) | - ( -) | - ( -) | - ( -) | - ( -) |
| 17                                    | - ( -) | - ( -) | 1 ( 1) | - ( -) | - ( -) |
| untyped                               | - ( -) | - ( -) | - ( 1) | - ( 1) | - ( -) |
| TOTAL                                 | 3 ( 3) | - ( -) | 1 ( 2) | - ( 1) | - ( -) |

**Table 46: S. Thompson in chickens on all premises**

| Phage Types<br>Incidents (Isolations) | 2004     | 2005     | 2006     | 2007   | 2008    |
|---------------------------------------|----------|----------|----------|--------|---------|
| 1                                     | - ( -)   | - ( -)   | - ( -)   | - ( -) | 1 ( 1)  |
| 1a                                    | 12 ( 12) | 10 ( 11) | 6 ( 7)   | - ( -) | 2 ( 2)  |
| 2                                     | - ( -)   | - ( -)   | - ( -)   | - ( -) | 1 ( 1)  |
| 6                                     | 22 ( 22) | 10 ( 10) | 6 ( 6)   | - ( -) | - ( -)  |
| 9                                     | - ( -)   | - ( -)   | - ( -)   | - ( -) | 1 ( 1)  |
| 11                                    | 1 ( 1)   | - ( -)   | - ( -)   | - ( -) | - ( -)  |
| 14                                    | - ( -)   | 2 ( 2)   | - ( -)   | 1 ( 2) | - ( -)  |
| RDNC                                  | - ( -)   | 1 ( 1)   | 1 ( 1)   | - ( -) | 4 ( 5)  |
| UNTY                                  | - ( -)   | - ( -)   | 1 ( 1)   | - ( -) | - ( -)  |
| untyped                               | - ( -)   | 9 ( 9)   | - ( -)   | - ( -) | - ( -)  |
| TOTAL                                 | 35 ( 35) | 32 ( 33) | 14 ( 15) | 1 ( 2) | 9 ( 10) |

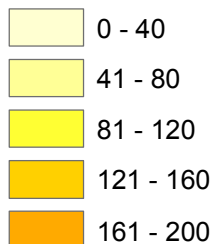
**Table 47: S. Virchow in chickens on all premises**

| Phage Types<br>Incidents (Isolations) | 2004     | 2005     | 2006   | 2007   | 2008   |
|---------------------------------------|----------|----------|--------|--------|--------|
| 2                                     | 19 ( 19) | 12 ( 12) | 4 ( 5) | 2 ( 4) | 2 ( 3) |
| 4                                     | 5 ( 5)   | - ( -)   | - ( -) | - ( 1) | - ( -) |
| 26                                    | 2 ( 2)   | - ( -)   | 1 ( 1) | - ( 1) | 1 ( 1) |
| 31                                    | - ( -)   | 1 ( 1)   | - ( -) | - ( -) | - ( -) |
| 35                                    | 2 ( 2)   | - ( -)   | - ( -) | - ( -) | - ( -) |
| 54                                    | - ( -)   | - ( -)   | - ( -) | - ( -) | 2 ( 2) |
| 57                                    | - ( -)   | 1 ( 1)   | - ( -) | 1 ( 1) | - ( -) |
| RDNC                                  | - ( -)   | - ( -)   | - ( -) | - ( 1) | - ( 3) |
| NOPT                                  | - ( 1)   | - ( -)   | - ( -) | - ( -) | - ( -) |
| TOTAL                                 | 28 ( 29) | 14 ( 14) | 5 ( 6) | 3 ( 8) | 5 ( 9) |

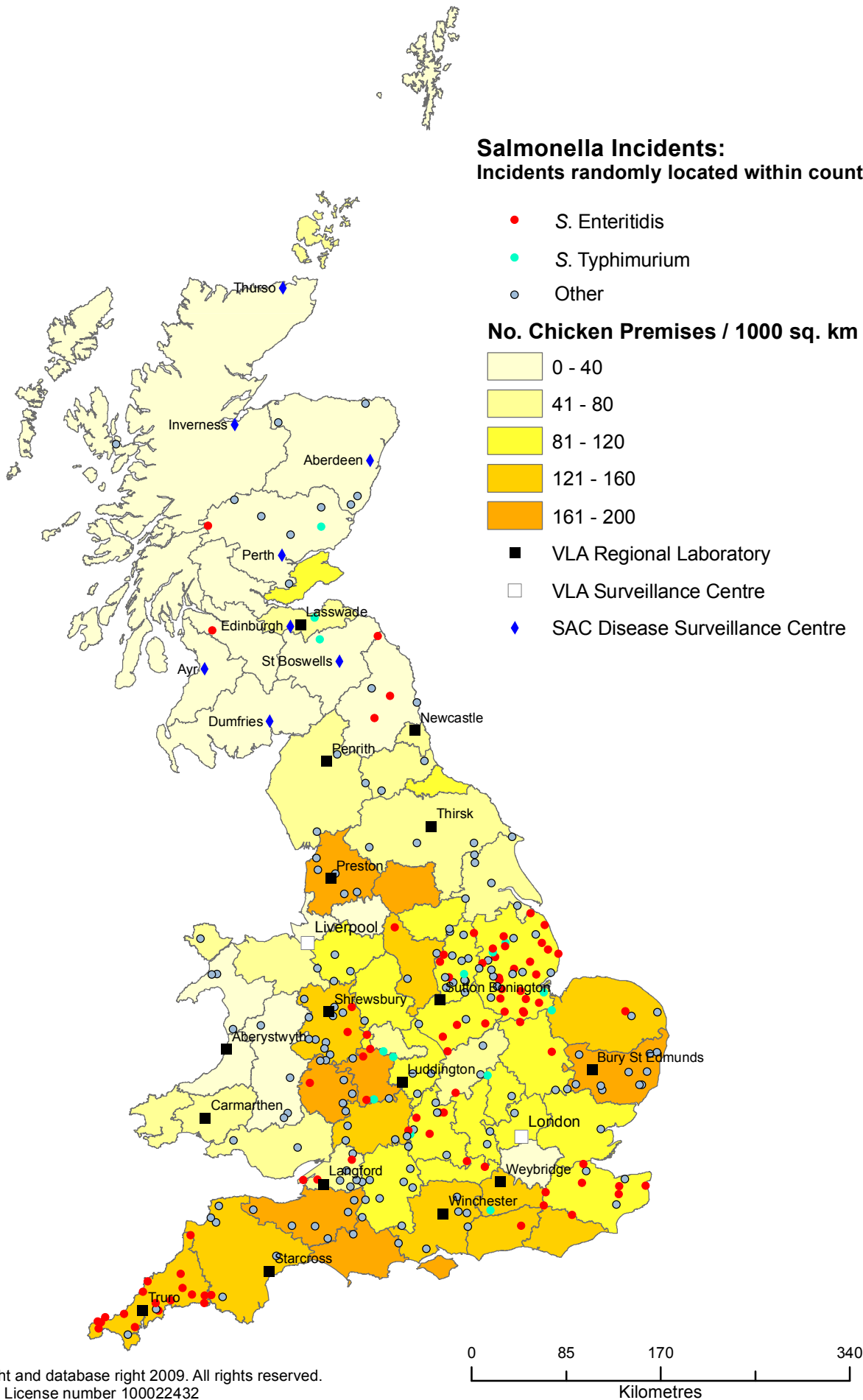
**Salmonella Incidents:**  
Incidents randomly located within counties.

- S. Enteritidis
- S. Typhimurium
- Other

**No. Chicken Premises / 1000 sq. km**



- VLA Regional Laboratory
- VLA Surveillance Centre
- ◆ SAC Disease Surveillance Centre



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DATE: 10 June 2009

Number of *Salmonella* incidents in chickens in each county of Great Britain during January to December 2008, and density of registered chicken premises per 1000 km<sup>2</sup>.  
**NB Dots do not indicate actual locations of incidents**



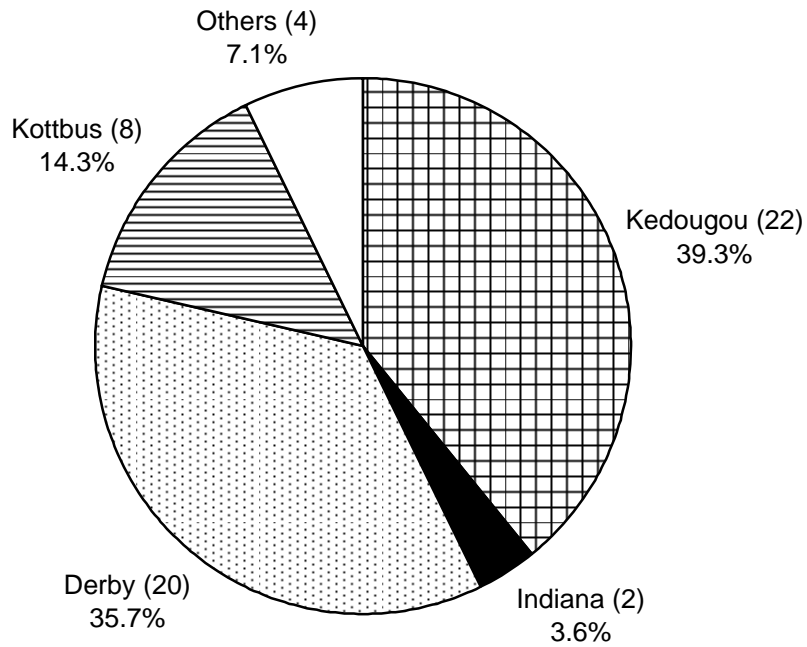
**Table 48: *Salmonella* in turkeys on all premises**

| <i>Salmonella</i><br>Incidents (Isolations) | 2004 |       | 2005 |       | 2006 |       | 2007 |       | 2008 |       |
|---|------|-------|------|-------|------|-------|------|-------|------|-------|
| ENTERICA ENTERICA                           |      |       |      |       |      |       |      |       |      |       |
| Agama                                       | 3    | ( 3)  | -    | ( -)  | 1    | ( 1)  | 1    | ( 1)  | -    | ( -)  |
| Agona                                       | 15   | ( 16) | 19   | ( 19) | 9    | ( 11) | 1    | ( 1)  | -    | ( -)  |
| Ajiobo                                      | 3    | ( 3)  | -    | ( -)  | -    | ( -)  | 1    | ( 1)  | -    | ( -)  |
| Anatum                                      | -    | ( -)  | 2    | ( 2)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Binza                                       | 1    | ( 1)  | -    | ( -)  | 1    | ( 2)  | -    | ( -)  | -    | ( -)  |
| Bredeney                                    | 3    | ( 3)  | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Corvallis                                   | 5    | ( 5)  | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Derby                                       | 21   | ( 21) | 57   | ( 59) | 32   | ( 49) | 37   | ( 48) | 20   | ( 26) |
| Dublin                                      | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Enteritidis                                 | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Fischerkietz                                | 2    | ( 2)  | -    | ( -)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Hadar                                       | 8    | ( 9)  | -    | ( -)  | 1    | ( 1)  | -    | ( -)  | -    | ( -)  |
| Indiana                                     | 21   | ( 21) | 30   | ( 33) | 10   | ( 15) | 3    | ( 3)  | 2    | ( 2)  |
| Kedougou                                    | 15   | ( 15) | 18   | ( 18) | 21   | ( 24) | 14   | ( 22) | 22   | ( 24) |
| Kentucky                                    | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Kottbus                                     | 26   | ( 27) | 43   | ( 46) | 25   | ( 33) | 24   | ( 37) | 8    | ( 8)  |
| Mbandaka                                    | 1    | ( 1)  | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Meleagridis                                 | -    | ( -)  | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Mons  | -    | ( -)  | -    | ( -)  | -    | ( -)  | 1    | ( 1)  | -    | ( -)  |
| Montevideo                                  | 9    | ( 9)  | 15   | ( 15) | 6    | ( 9)  | 2    | ( 2)  | 1    | ( 1)  |
| Newport                                     | 35   | ( 35) | 35   | ( 35) | 14   | ( 19) | 7    | ( 8)  | -    | ( -)  |
| Ohio  | -    | ( -)  | -    | ( -)  | -    | ( -)  | -    | ( -)  | 1    | ( 1)  |
| Orion                                       | 1    | ( 1)  | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Poona                                       | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Rissen                                      | 1    | ( 1)  | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Saint Paul                                  | -    | ( -)  | 2    | ( 2)  | -    | ( -)  | 1    | ( 2)  | -    | ( -)  |
| Senftenberg                                 | -    | ( -)  | 2    | ( 2)  | 1    | ( 1)  | 9    | ( 20) | -    | ( -)  |
| Stourbridge                                 | -    | ( -)  | -    | ( -)  | 1    | ( 1)  | -    | ( -)  | -    | ( -)  |
| Taksony                                     | -    | ( -)  | -    | ( -)  | 2    | ( 2)  | -    | ( -)  | -    | ( -)  |
| Typhimurium                                 | 40   | ( 43) | 27   | ( 27) | 39   | ( 52) | 12   | ( 14) | 1    | ( 1)  |
| Virchow                                     | 9    | ( 9)  | 5    | ( 5)  | 10   | ( 14) | -    | ( -)  | -    | ( -)  |

**Table 48: *Salmonella* in turkeys on all premises**

| <i>Salmonella</i><br>Incidents (Isolations) | 2004       | 2005       | 2006       | 2007       | 2008     |
|---|------------|------------|------------|------------|----------|
| UNSPECIFIED                                 |            |            |            |            |          |
| structure only                              | 13 ( 13)   | 19 ( 19)   | 8 ( 15)    | - ( -)     | 1 ( 1)   |
| rough strain                                | 1 ( 1)     | 1 ( 1)     | 2 ( 2)     | - ( -)     | - ( -)   |
| TOTAL                                       | 237 ( 243) | 281 ( 289) | 183 ( 251) | 113 ( 160) | 56 ( 64) |

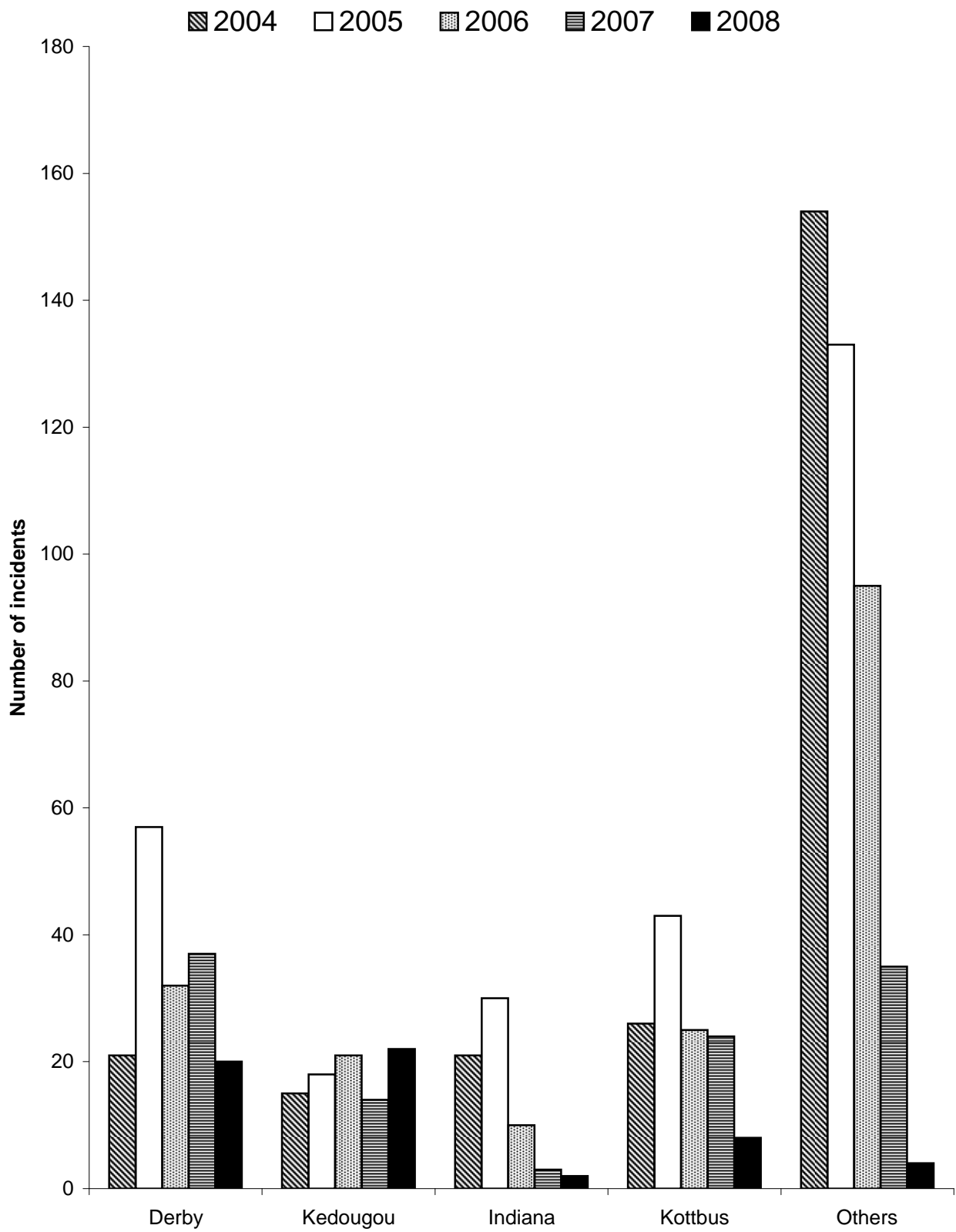
**Fig 38: Incidents of *Salmonella* serovars in turkeys in 2008**



**Table 49: Incidents of the top 4 *Salmonella* serovars in turkeys in 2008 as a % of all incidents compared to previous years**

| Serotype            | 2004 | 2005 | 2006 | 2007 | 2008 |
|---------------------|------|------|------|------|------|
| S. Kedougou %       | 6.3  | 6.4  | 11.5 | 12.4 | 39.3 |
| S. Derby %          | 8.9  | 20.3 | 17.5 | 32.7 | 35.7 |
| S. Kottbus %        | 11.0 | 15.3 | 13.7 | 21.2 | 14.3 |
| S. Indiana %        | 8.9  | 10.7 | 5.5  | 2.7  | 3.6  |
| Total no. incidents | 237  | 281  | 183  | 113  | 56   |

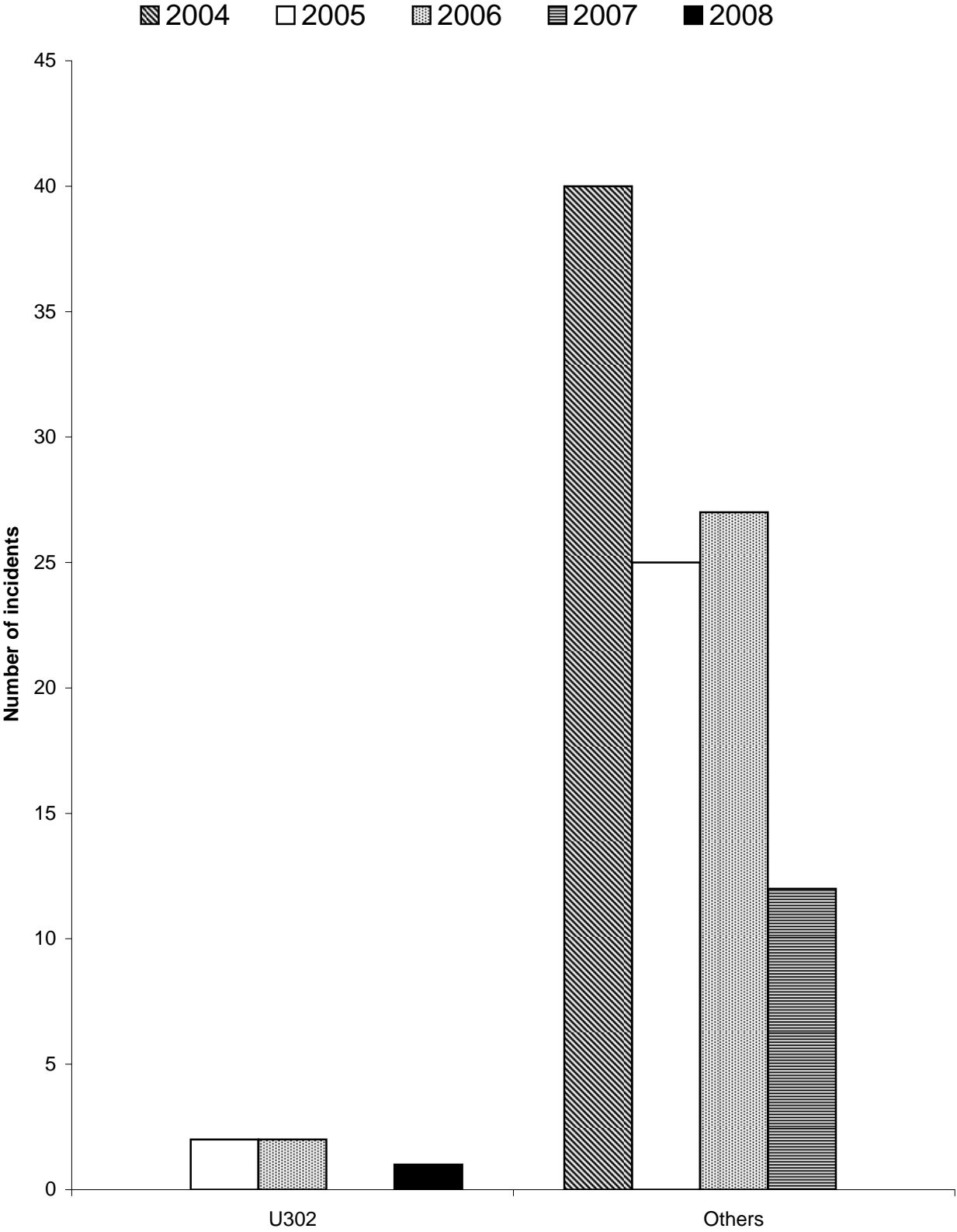
**Fig 39: Incidents of *Salmonella* serovars in turkeys (2004 - 2008)**



**Table 50: S. Typhimurium in turkeys on all premises**

| Definitive Types<br>Incidents (Isolations) | 2004     | 2005     | 2006     | 2007     | 2008   |
|--|----------|----------|----------|----------|--------|
| 8  | - ( -)   | - ( -)   | 1 ( 1)   | - ( -)   | - ( -) |
| 41   | 1 ( 1)   | - ( -)   | - ( -)   | - ( -)   | - ( -) |
| 56   | - ( -)   | 1 ( 1)   | - ( -)   | - ( -)   | - ( -) |
| 99   | 4 ( 5)   | - ( -)   | - ( -)   | - ( -)   | - ( -) |
| 104  | 29 ( 31) | 21 ( 21) | 32 ( 44) | 11 ( 13) | - ( -) |
| 104b                                       | - ( -)   | 2 ( 2)   | 1 ( 1)   | 1 ( 1)   | - ( -) |
| 120  | 5 ( 5)   | - ( -)   | 1 ( 1)   | - ( -)   | - ( -) |
| 193  | - ( -)   | - ( -)   | - ( 1)   | - ( -)   | - ( -) |
| U288                                       | - ( -)   | 1 ( 1)   | - ( -)   | - ( -)   | - ( -) |
| U302                                       | - ( -)   | 2 ( 2)   | 2 ( 2)   | - ( -)   | 1 ( 1) |
| UNTY                                       | 1 ( 1)   | - ( -)   | 2 ( 2)   | - ( -)   | - ( -) |
| TOTAL                                      | 40 ( 43) | 27 ( 27) | 39 ( 52) | 12 ( 14) | 1 ( 1) |

**Fig 40: Incidents of *Salmonella* Typhimurium definitive types in turkeys (2004 - 2008)**



**Table 51: S. Enteritidis in turkeys on all premises**

| Phage Types<br>Incidents (Isolations) | 2004   | 2005   | 2006   | 2007   | 2008   |
|---------------------------------------|--------|--------|--------|--------|--------|
| UNTY                                  | 1 ( 1) | - ( -) | - ( -) | - ( -) | - ( -) |
| TOTAL                                 | 1 ( 1) | - ( -) | - ( -) | - ( -) | - ( -) |

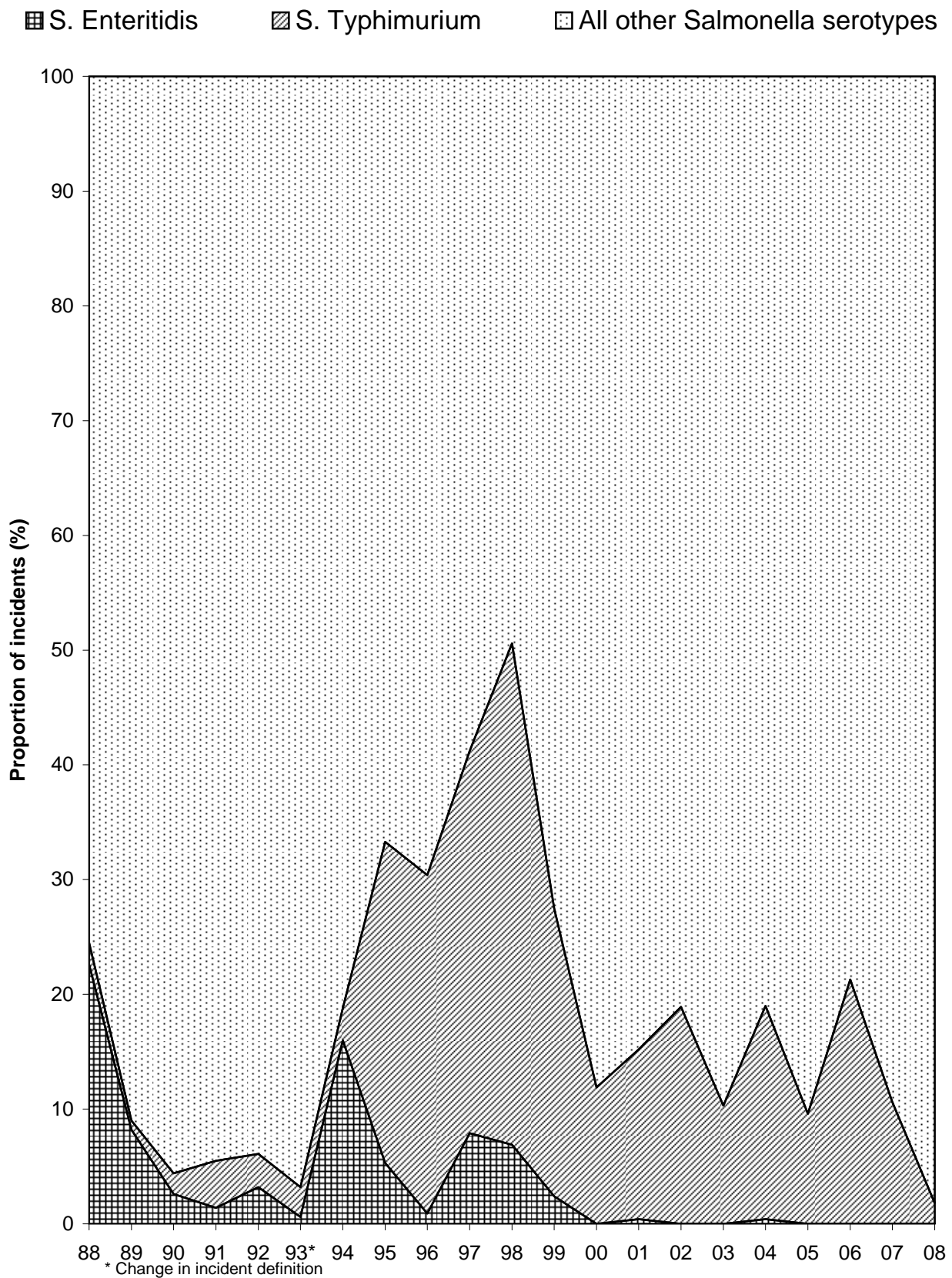
**Table 52: S. Hadar in turkeys on all premises**

| Phage Types<br>Incidents (Isolations) | 2004   | 2005   | 2006   | 2007   | 2008   |
|---------------------------------------|--------|--------|--------|--------|--------|
| 1                                     | - ( -) | - ( -) | 1 ( 1) | - ( -) | - ( -) |
| 10                                    | 8 ( 8) | - ( -) | - ( -) | - ( -) | - ( -) |
| untyped                               | - ( 1) | - ( -) | - ( -) | - ( -) | - ( -) |
| TOTAL                                 | 8 ( 9) | - ( -) | 1 ( 1) | - ( -) | - ( -) |

**Table 53: S. Virchow in turkeys on all premises**

| Phage Types<br>Incidents (Isolations) | 2004   | 2005   | 2006     | 2007   | 2008   |
|---------------------------------------|--------|--------|----------|--------|--------|
| 19                                    | 1 ( 1) | - ( -) | - ( -)   | - ( -) | - ( -) |
| 26                                    | 8 ( 8) | 3 ( 3) | - ( -)   | - ( -) | - ( -) |
| 30                                    | - ( -) | - ( -) | 5 ( 9)   | - ( -) | - ( -) |
| 31                                    | - ( -) | 2 ( 2) | 5 ( 5)   | - ( -) | - ( -) |
| TOTAL                                 | 9 ( 9) | 5 ( 5) | 10 ( 14) | - ( -) | - ( -) |

**Fig 41 : S. Enteritidis and S. Typhimurium as a proportion of all reports in turkeys (1988 - 2008)**

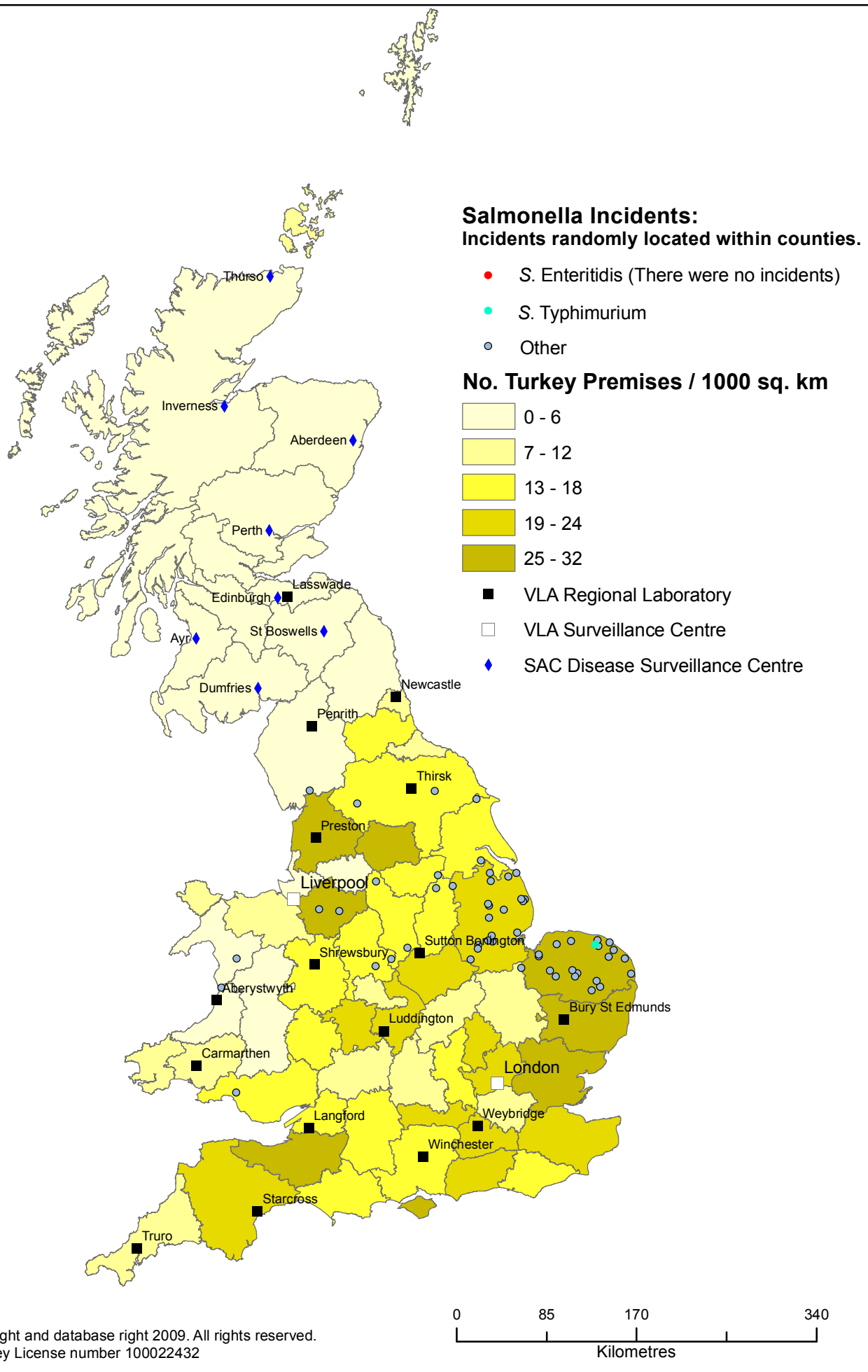


**Table 54: *Salmonella* in ducks & geese on all premises**

| <i>Salmonella</i><br>Incidents (Isolations) | 2004 |        | 2005 |        | 2006 |        | 2007 |        | 2008 |        |
|---|------|--------|------|--------|------|--------|------|--------|------|--------|
| ENTERICA ENTERICA                           |      |        |      |        |      |        |      |        |      |        |
| Agama                                       | -    | ( -)   | -    | ( -)   | 1    | ( 2)   | -    | ( -)   | -    | ( -)   |
| Agona                                       | 3    | ( 3)   | -    | ( -)   | -    | ( -)   | -    | ( -)   | -    | ( -)   |
| Anatum                                      | 3    | ( 3)   | 1    | ( 1)   | 1    | ( 1)   | -    | ( -)   | 1    | ( 1)   |
| Binza                                       | 81   | ( 84)  | 43   | ( 46)  | 37   | ( 49)  | 42   | ( 49)  | 19   | ( 22)  |
| Bredeney                                    | -    | ( -)   | -    | ( -)   | 1    | ( 1)   | -    | ( -)   | -    | ( -)   |
| Derby                                       | 2    | ( 2)   | 5    | ( 5)   | 7    | ( 10)  | 1    | ( 1)   | -    | ( -)   |
| Durham                                      | -    | ( -)   | -    | ( -)   | 1    | ( 1)   | -    | ( -)   | -    | ( -)   |
| Enteritidis                                 | 7    | ( 7)   | 66   | ( 68)  | 16   | ( 33)  | 10   | ( 17)  | 1    | ( 2)   |
| Give  | 15   | ( 15)  | 15   | ( 15)  | 12   | ( 13)  | 17   | ( 20)  | 10   | ( 11)  |
| Goldcoast                                   | 2    | ( 2)   | -    | ( -)   | 2    | ( 2)   | -    | ( -)   | -    | ( -)   |
| Hadar                                       | 52   | ( 57)  | 26   | ( 27)  | 22   | ( 24)  | 30   | ( 30)  | 35   | ( 39)  |
| Havana                                      | 5    | ( 5)   | 3    | ( 3)   | 3    | ( 4)   | 2    | ( 3)   | 2    | ( 2)   |
| Heidelberg                                  | -    | ( -)   | -    | ( -)   | -    | ( -)   | 1    | ( 1)   | -    | ( -)   |
| Idikan                                      | 1    | ( 1)   | -    | ( -)   | -    | ( -)   | -    | ( -)   | -    | ( -)   |
| Indiana                                     | 132  | ( 135) | 177  | ( 184) | 146  | ( 204) | 149  | ( 187) | 95   | ( 115) |
| Kedougou                                    | 32   | ( 33)  | 28   | ( 28)  | 38   | ( 69)  | 15   | ( 32)  | 24   | ( 57)  |
| Kentucky                                    | -    | ( -)   | -    | ( -)   | 1    | ( 1)   | -    | ( -)   | -    | ( -)   |
| Kottbus                                     | 5    | ( 5)   | 45   | ( 45)  | 21   | ( 34)  | 2    | ( 2)   | -    | ( -)   |
| Livingstone                                 | 97   | ( 97)  | 12   | ( 12)  | 8    | ( 12)  | 6    | ( 6)   | -    | ( 1)   |
| Mbandaka                                    | -    | ( -)   | -    | ( -)   | 17   | ( 26)  | 36   | ( 42)  | 28   | ( 34)  |
| Newport                                     | 1    | ( 1)   | -    | ( -)   | 1    | ( 1)   | -    | ( -)   | 1    | ( 2)   |
| Ohio  | -    | ( -)   | 2    | ( 2)   | 2    | ( 2)   | 1    | ( 1)   | 3    | ( 3)   |
| Orion                                       | 39   | ( 40)  | 42   | ( 43)  | 36   | ( 49)  | 32   | ( 38)  | 50   | ( 55)  |
| Poona                                       | -    | ( -)   | 1    | ( 1)   | -    | ( -)   | -    | ( -)   | -    | ( -)   |
| Reading                                     | -    | ( -)   | 4    | ( 4)   | -    | ( -)   | -    | ( -)   | -    | ( -)   |
| Saintpaul                                   | 3    | ( 3)   | 24   | ( 24)  | 11   | ( 13)  | -    | ( -)   | -    | ( -)   |
| Schwarzengrund                              | -    | ( -)   | 1    | ( 1)   | -    | ( -)   | -    | ( -)   | -    | ( -)   |
| Senftenberg                                 | 1    | ( 1)   | 60   | ( 62)  | 17   | ( 31)  | 10   | ( 13)  | 1    | ( 1)   |
| Typhimurium                                 | 8    | ( 9)   | 71   | ( 71)  | 34   | ( 64)  | 4    | ( 5)   | 5    | ( 6)   |
| Yoruba                                      | -    | ( -)   | -    | ( -)   | 1    | ( 1)   | -    | ( -)   | -    | ( -)   |

**Table 54: *Salmonella* in ducks & geese on all premises**

| <i>Salmonella</i><br>Incidents (Isolations) | 2004       | 2005       | 2006       | 2007       | 2008       |
|---|------------|------------|------------|------------|------------|
| UNSPECIFIED                                 |            |            |            |            |            |
| structure only                              | 20 ( 21)   | 24 ( 24)   | 21 ( 24)   | 5 ( 5)     | 3 ( 3)     |
| rough strain                                | - ( -)     | - ( -)     | 6 ( 6)     | 1 ( 1)     | - ( 1)     |
| untyped                                     | - ( -)     | - ( -)     | 1 ( 1)     | - ( -)     | - ( -)     |
| untypable                                   | - ( -)     | - ( -)     | 1 ( 1)     | - ( -)     | - ( -)     |
| TOTAL                                       | 509 ( 524) | 650 ( 666) | 465 ( 679) | 364 ( 453) | 278 ( 355) |

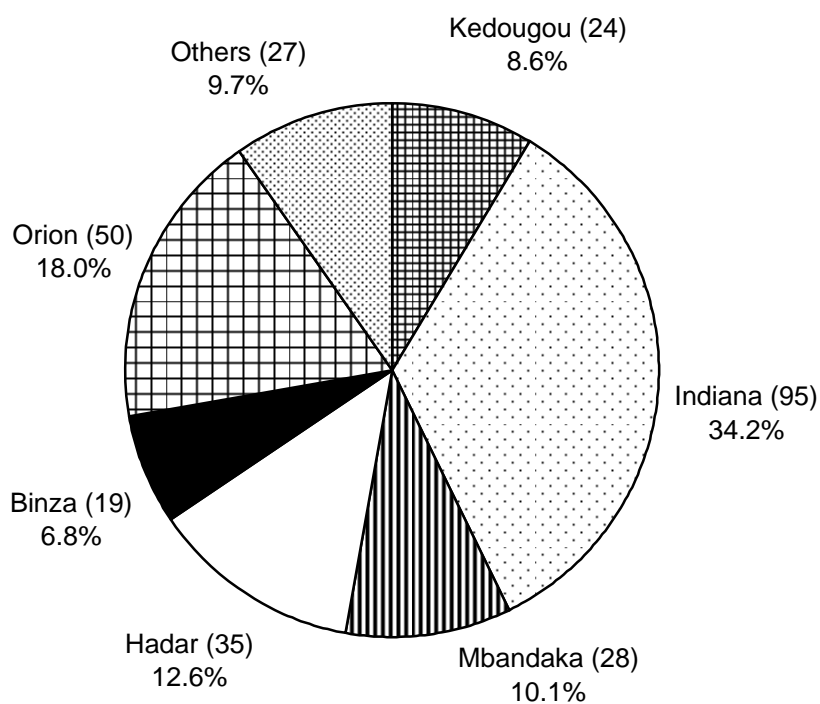


CREATOR: CERA GIS Team  
DATE: 10 June 2009

Number of *Salmonella* incidents in turkeys in each county of Great Britain during January to December 2008, and density of registered turkey premises per 1000 km<sup>2</sup>.  
**NB Dots do not indicate actual locations of incidents**



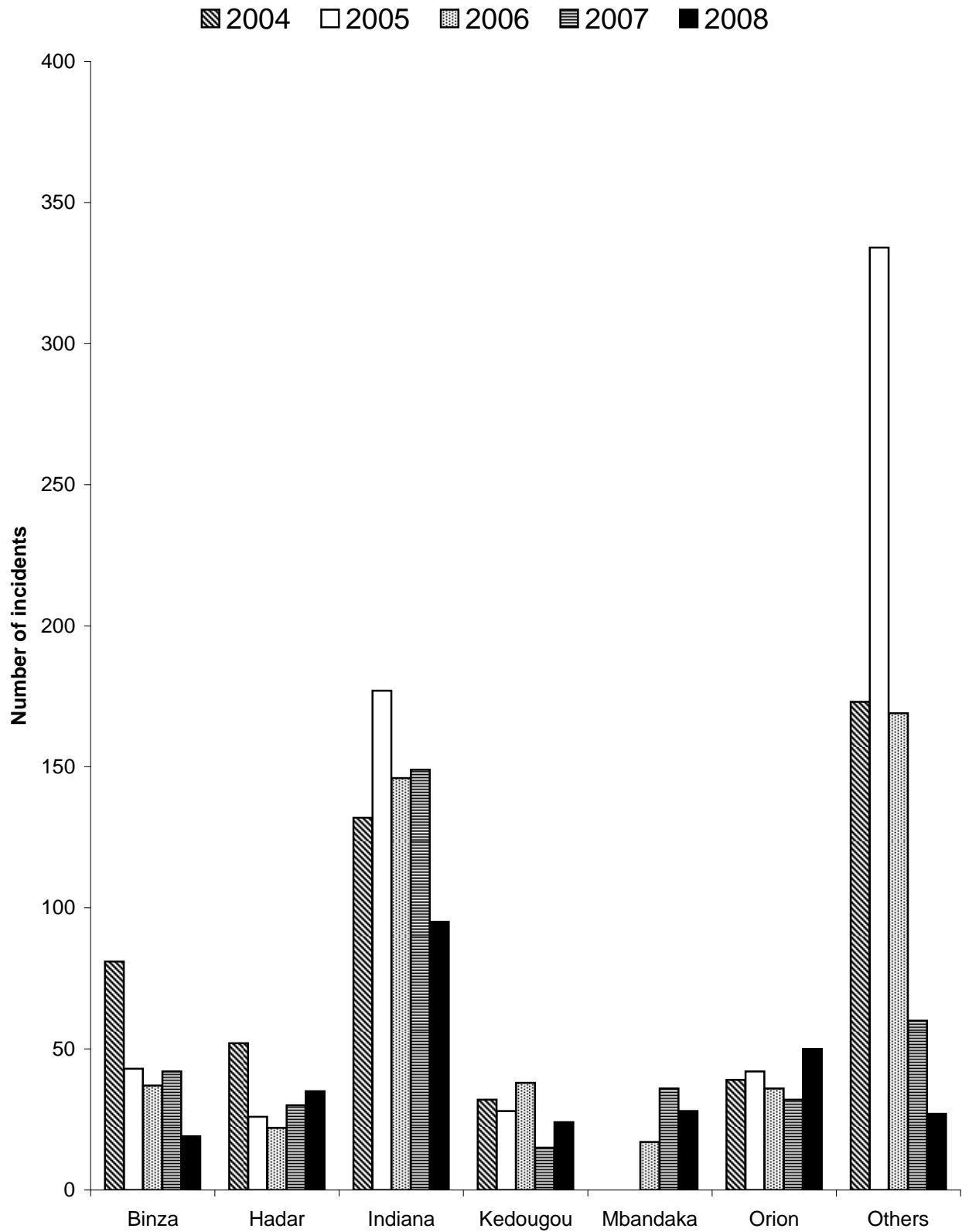
**Fig 42: Incidents of *Salmonella* serovars in ducks and geese in 2008**



**Table 55: Incidents of the top 5 *Salmonella* serovars in ducks & geese in 2008 as a % of all incidents compared to previous years**

| Serotype            | 2004 | 2005 | 2006 | 2007 | 2008 |
|---------------------|------|------|------|------|------|
| S. Indiana %        | 25.9 | 27.2 | 31.4 | 40.9 | 34.2 |
| S. Orion %          | 7.7  | 6.5  | 7.7  | 8.8  | 18.0 |
| S. Hadar %          | 10.2 | 4.0  | 4.7  | 8.2  | 12.6 |
| S. Mbandaka %       | 0    | 0    | 3.7  | 9.9  | 10.1 |
| S. Kedougou %       | 6.3  | 4.3  | 8.2  | 4.1  | 8.6  |
| Total no. incidents | 509  | 650  | 465  | 364  | 278  |

**Fig 43: Incidents of *Salmonella* serovars in ducks and geese (2004 - 2008)**



**Table 56: S. Typhimurium in ducks & geese on all premises**

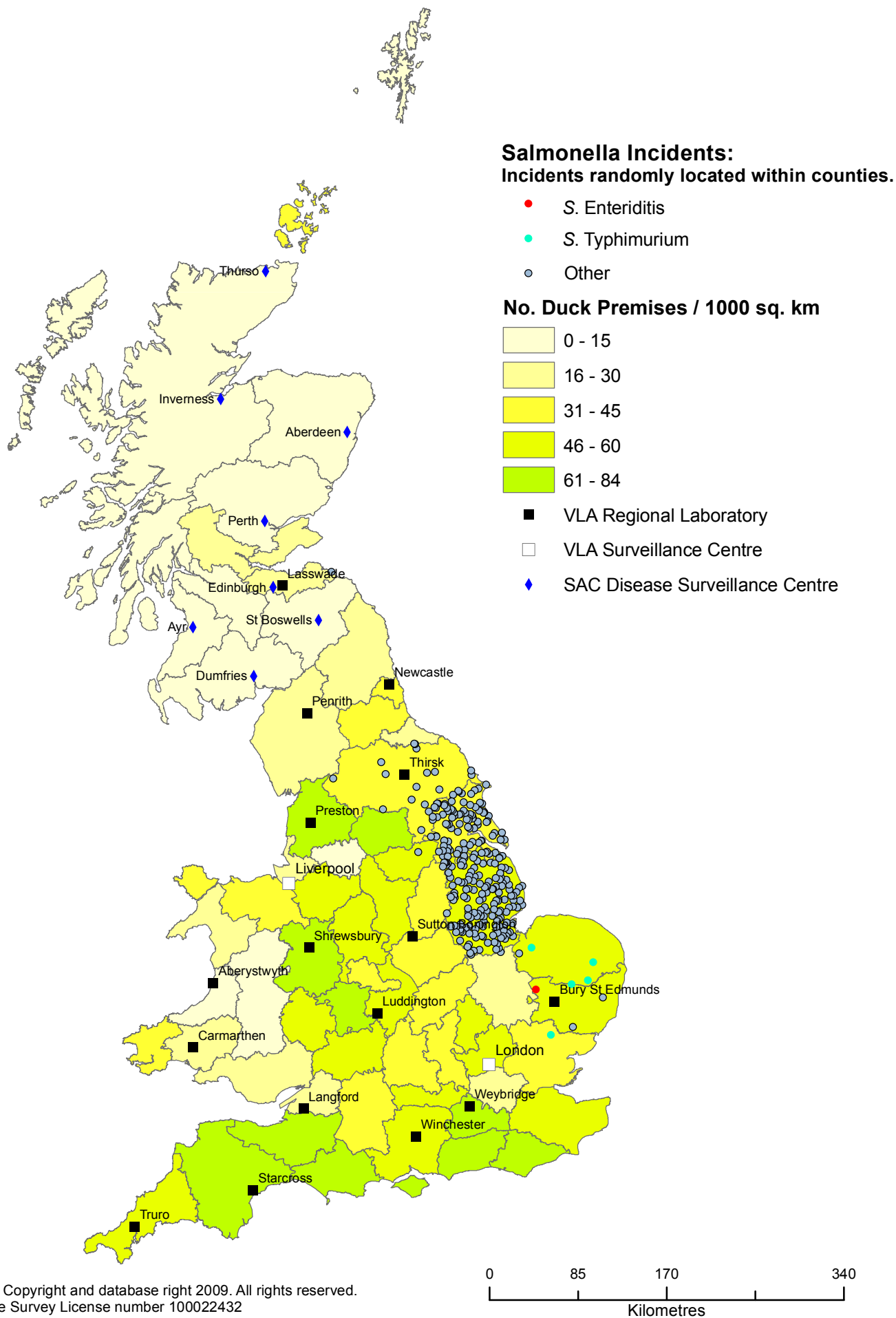
| Definitive Types<br>Incidents (Isolations) | 2004   | 2005     | 2006     | 2007   | 2008   |
|--|--------|----------|----------|--------|--------|
| 2  | - ( -) | - ( -)   | - ( 2)   | - ( -) | - ( -) |
| 8  | 5 ( 5) | 60 ( 60) | 17 ( 39) | 1 ( 2) | 3 ( 4) |
| 30   | 1 ( 1) | 6 ( 6)   | 6 ( 6)   | - ( -) | 2 ( 2) |
| 41   | 2 ( 2) | 2 ( 2)   | 3 ( 3)   | - ( -) | - ( -) |
| 66   | - ( -) | 1 ( 1)   | - ( -)   | - ( -) | - ( -) |
| 99   | - ( -) | - ( -)   | - ( -)   | 2 ( 2) | - ( -) |
| 193  | - ( -) | - ( -)   | 1 ( 1)   | - ( -) | - ( -) |
| 195  | - ( -) | - ( -)   | 5 ( 5)   | - ( -) | - ( -) |
| U288                                       | - ( -) | - ( -)   | 1 ( 2)   | - ( -) | - ( -) |
| U309                                       | - ( -) | - ( -)   | 1 ( 1)   | - ( -) | - ( -) |
| RDNC                                       | - ( 1) | - ( -)   | - ( 1)   | - ( -) | - ( -) |
| NOPT                                       | - ( -) | - ( -)   | - ( 3)   | - ( -) | - ( -) |
| UNTY                                       | - ( -) | 2 ( 2)   | - ( -)   | 1 ( 1) | - ( -) |
| untyped                                    | - ( -) | - ( -)   | - ( 1)   | - ( -) | - ( -) |
| TOTAL                                      | 8 ( 9) | 71 ( 71) | 34 ( 64) | 4 ( 5) | 5 ( 6) |

**Table 57: S. Enteritidis in ducks & geese on all premises**

| Phage Types<br>Incidents (Isolations) | 2004   | 2005     | 2006     | 2007     | 2008   |
|---------------------------------------|--------|----------|----------|----------|--------|
| 1                                     | 3 ( 3) | - ( -)   | - ( -)   | - ( -)   | - ( -) |
| 3                                     | - ( -) | 1 ( 1)   | 1 ( 1)   | - ( -)   | - ( -) |
| 4                                     | 1 ( 1) | - ( -)   | - ( -)   | - ( -)   | - ( -) |
| 6                                     | - ( -) | 7 ( 7)   | 2 ( 3)   | 1 ( 1)   | - ( -) |
| 6a                                    | - ( -) | 31 ( 32) | 4 ( 10)  | - ( -)   | - ( -) |
| 7                                     | - ( -) | - ( -)   | 1 ( 1)   | - ( -)   | - ( -) |
| 8                                     | - ( -) | - ( -)   | - ( -)   | 3 ( 4)   | - ( -) |
| 9b                                    | 2 ( 2) | 12 ( 12) | 6 ( 12)  | 3 ( 3)   | 1 ( 2) |
| 13a                                   | - ( -) | 1 ( 1)   | - ( 1)   | - ( 6)   | - ( -) |
| 14b                                   | - ( -) | 9 ( 9)   | - ( 1)   | - ( -)   | - ( -) |
| 23                                    | - ( -) | - ( -)   | - ( -)   | 2 ( 2)   | - ( -) |
| 35                                    | 1 ( 1) | - ( -)   | - ( -)   | - ( -)   | - ( -) |
| NOPT                                  | - ( -) | - ( 1)   | - ( -)   | - ( -)   | - ( -) |
| UNTY                                  | - ( -) | 5 ( 5)   | 2 ( 4)   | 1 ( 1)   | - ( -) |
| TOTAL                                 | 7 ( 7) | 66 ( 68) | 16 ( 33) | 10 ( 17) | 1 ( 2) |

**Table 58: S. Hadar in ducks & geese on all premises**

| Phage Types<br>Incidents (Isolations) | 2004     | 2005     | 2006     | 2007     | 2008     |
|---------------------------------------|----------|----------|----------|----------|----------|
| 2                                     | 7 ( 7)   | 3 ( 3)   | 3 ( 3)   | 8 ( 8)   | 5 ( 5)   |
| 9                                     | 1 ( 1)   | - ( -)   | - ( -)   | - ( -)   | - ( -)   |
| 10                                    | 5 ( 5)   | 5 ( 6)   | 6 ( 6)   | 8 ( 8)   | 6 ( 6)   |
| 11                                    | 8 ( 8)   | 3 ( 3)   | 3 ( 3)   | 6 ( 6)   | 16 ( 20) |
| 18                                    | 1 ( 1)   | - ( -)   | - ( -)   | - ( -)   | 1 ( 1)   |
| 22                                    | 26 ( 28) | 8 ( 8)   | 9 ( 10)  | 4 ( 4)   | 4 ( 4)   |
| 46                                    | - ( -)   | - ( -)   | - ( -)   | 1 ( 1)   | - ( -)   |
| 51                                    | 1 ( 1)   | - ( -)   | - ( -)   | - ( -)   | - ( -)   |
| 62                                    | 2 ( 2)   | 5 ( 5)   | - ( -)   | - ( -)   | - ( -)   |
| RDNC                                  | - ( 1)   | - ( -)   | - ( -)   | - ( -)   | - ( -)   |
| NOPT                                  | - ( -)   | - ( -)   | - ( 1)   | - ( -)   | - ( -)   |
| UNTY                                  | 1 ( 1)   | 2 ( 2)   | 1 ( 1)   | 3 ( 3)   | 3 ( 3)   |
| untyped                               | - ( 2)   | - ( -)   | - ( -)   | - ( -)   | - ( -)   |
| TOTAL                                 | 52 ( 57) | 26 ( 27) | 22 ( 24) | 30 ( 30) | 35 ( 39) |



CREATOR: CERA GIS Team  
DATE: 10 June 2009

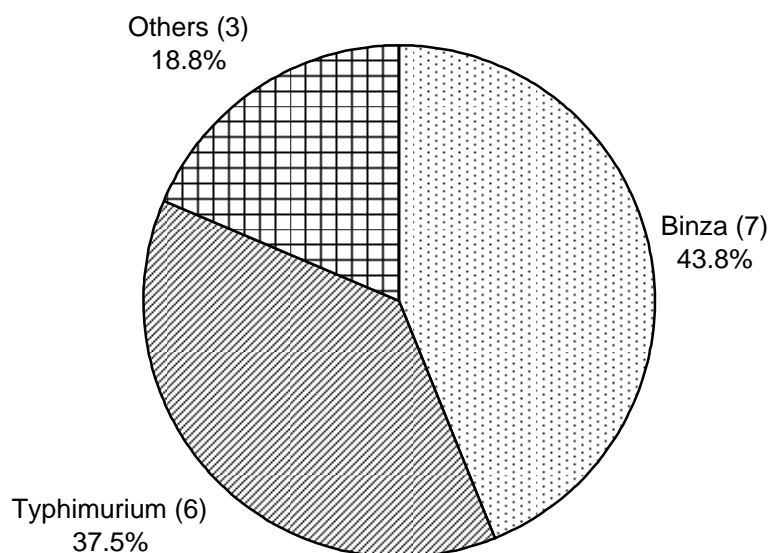
Number of *Salmonella* incidents in ducks in each county of Great Britain during January to December 2008, and density of registered duck premises per 1000 km<sup>2</sup>.  
**NB Dots do not indicate actual locations of incidents**



**Table 59: *Salmonella* in game birds on all premises**

| <i>Salmonella</i><br>Incidents (Isolations) | 2004 |       | 2005 |       | 2006 |       | 2007 |       | 2008 |       |
|---|------|-------|------|-------|------|-------|------|-------|------|-------|
| ENTERICA ENTERICA                           |      |       |      |       |      |       |      |       |      |       |
| Binza                                       | 6    | ( 6)  | 12   | ( 13) | 26   | ( 29) | 8    | ( 8)  | 7    | ( 9)  |
| Derby                                       | 1    | ( 1)  | -    | ( -)  | 1    | ( 1)  | 2    | ( 2)  | 1    | ( 1)  |
| Dublin                                      | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  | 1    | ( 1)  |
| Enteritidis                                 | -    | ( -)  | -    | ( -)  | -    | ( -)  | 2    | ( 4)  | -    | ( 1)  |
| Havana                                      | -    | ( -)  | -    | ( -)  | -    | ( -)  | 1    | ( 1)  | -    | ( -)  |
| Indiana                                     | -    | ( -)  | 1    | ( 1)  | -    | ( 2)  | 1    | ( 3)  | -    | ( -)  |
| Infantis                                    | 1    | ( 1)  | -    | ( -)  | -    | ( -)  | -    | ( -)  | -    | ( -)  |
| Kedougou                                    | -    | ( -)  | -    | ( -)  | 6    | ( 7)  | -    | ( -)  | -    | ( -)  |
| Kottbus                                     | -    | ( -)  | -    | ( -)  | 1    | ( 2)  | 2    | ( 2)  | 1    | ( 1)  |
| Orion                                       | 2    | ( 2)  | 3    | ( 3)  | 3    | ( 3)  | 3    | ( 3)  | -    | ( -)  |
| Pullorum                                    | -    | ( 1)  | -    | ( 1)  | -    | ( 1)  | -    | ( -)  | -    | ( -)  |
| Regent                                      | -    | ( -)  | -    | ( -)  | 1    | ( 1)  | -    | ( -)  | -    | ( -)  |
| Rissen                                      | -    | ( -)  | -    | ( -)  | 1    | ( 1)  | 1    | ( 1)  | -    | ( -)  |
| Senftenberg                                 | -    | ( -)  | -    | ( -)  | 2    | ( 2)  | -    | ( -)  | -    | ( -)  |
| Typhimurium                                 | 3    | ( 3)  | 4    | ( 4)  | 34   | ( 42) | 5    | ( 5)  | 6    | ( 6)  |
| UNSPECIFIED                                 |      |       |      |       |      |       |      |       |      |       |
| structure only                              | -    | ( -)  | 1    | ( 1)  | 1    | ( 1)  | 1    | ( 1)  | -    | ( -)  |
| TOTAL                                       | 14   | ( 15) | 21   | ( 23) | 76   | ( 92) | 26   | ( 30) | 16   | ( 19) |

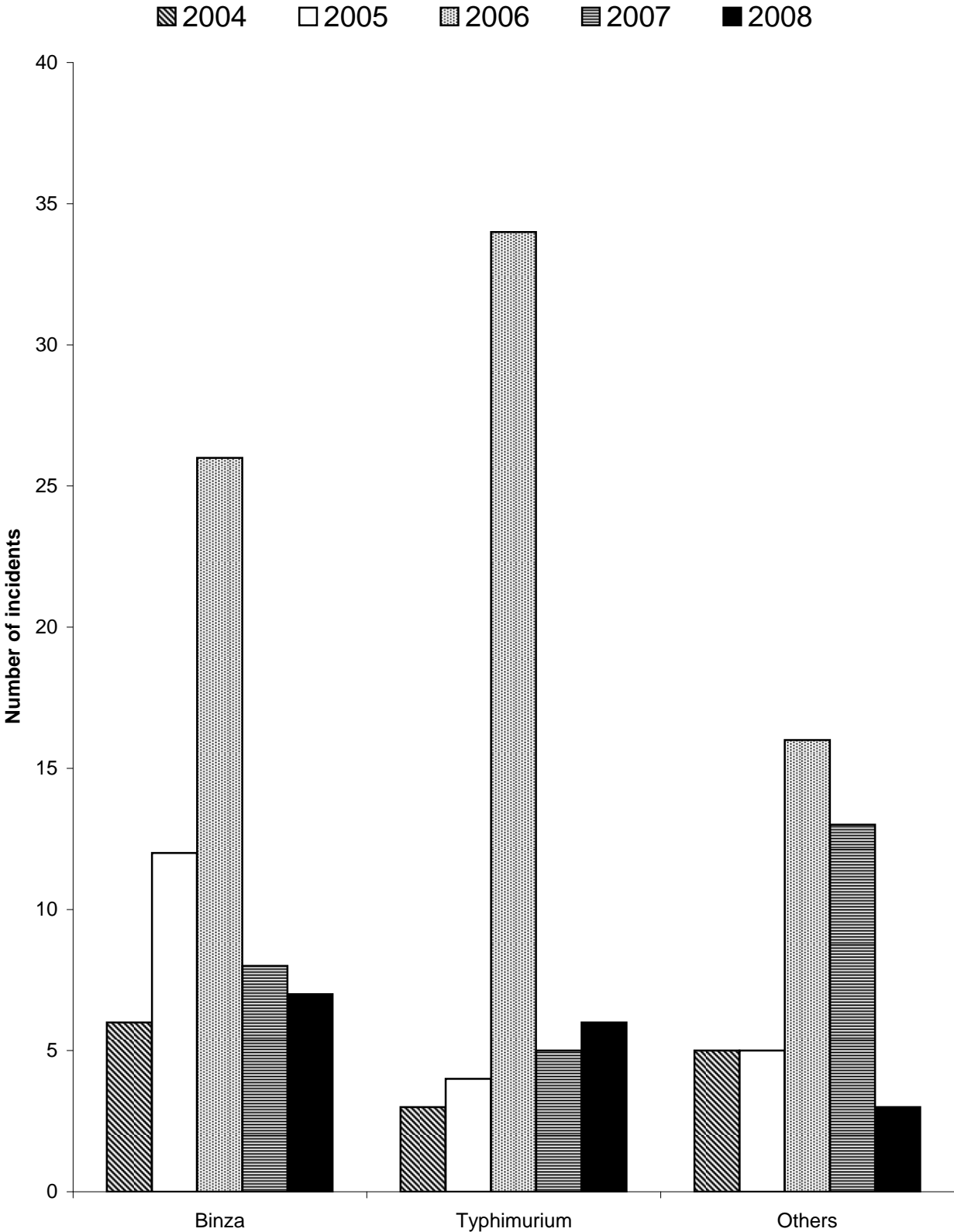
**Fig 44: Incidents of *Salmonella* serovars in game birds in 2008**



**Table 60: Incidents of the top 3 *Salmonella* serovars in game birds in 2008 as a % of all incidents compared to previous years**

| Serotype            | 2004 | 2005 | 2006 | 2007 | 2008 |
|---------------------|------|------|------|------|------|
| S. Binza %          | 42.9 | 57.1 | 34.2 | 30.8 | 43.8 |
| S. Typhimurium %    | 21.4 | 19.0 | 44.7 | 19.2 | 37.5 |
| S. Derby %          | 7.1  | 0    | 1.3  | 7.7  | 6.3  |
| S. Dublin %         | 7.1  | 0    | 0    | 0    | 6.3  |
| S. Kottbus %        | 0    | 0    | 1.3  | 7.7  | 6.3  |
| Total no. incidents | 14   | 21   | 76   | 26   | 16   |

**Fig 45: Incidents of *Salmonella* serovars in game birds (2004 - 2008)**



**Table 61: S. Typhimurium in game birds on all premises**

| Definitive Types<br>Incidents (Isolations) | 2004   | 2005   | 2006     | 2007   | 2008   |
|--|--------|--------|----------|--------|--------|
| 2  | - ( -) | 1 ( 1) | 5 ( 5)   | 1 ( 1) | 1 ( 1) |
| 8  | - ( -) | - ( -) | 2 ( 2)   | 1 ( 1) | - ( -) |
| 41   | - ( -) | 1 ( 1) | - ( -)   | - ( -) | - ( -) |
| 56   | - ( -) | - ( -) | 1 ( 1)   | - ( -) | - ( -) |
| 104  | 1 ( 1) | 1 ( 1) | - ( -)   | - ( -) | - ( -) |
| 135  | - ( -) | - ( -) | 4 ( 5)   | - ( -) | - ( -) |
| 193  | 1 ( 1) | 1 ( 1) | - ( -)   | 1 ( 1) | 1 ( 1) |
| 195  | - ( -) | - ( -) | 22 ( 23) | 2 ( 2) | - ( -) |
| U302                                       | - ( -) | - ( -) | - ( -)   | - ( -) | 2 ( 2) |
| U310                                       | 1 ( 1) | - ( -) | - ( -)   | - ( -) | 2 ( 2) |
| RDNC                                       | - ( -) | - ( -) | - ( 2)   | - ( -) | - ( -) |
| UNTY                                       | - ( -) | - ( -) | - ( 1)   | - ( -) | - ( -) |
| untyped                                    | - ( -) | - ( -) | - ( 3)   | - ( -) | - ( -) |
| TOTAL                                      | 3 ( 3) | 4 ( 4) | 34 ( 42) | 5 ( 5) | 6 ( 6) |

**Table 62: S. Enteritidis in game birds on all premises**

| Phage Types<br>Incidents (Isolations) | 2004   | 2005   | 2006   | 2007   | 2008   |
|---------------------------------------|--------|--------|--------|--------|--------|
| 13a                                   | - ( -) | - ( -) | - ( -) | 2 ( 4) | - ( -) |
| untyped                               | - ( -) | - ( -) | - ( -) | - ( -) | - ( 1) |
| TOTAL                                 | - ( -) | - ( -) | - ( -) | 2 ( 4) | - ( 1) |

**Table 63: S. Pullorum in game birds on all premises**

| Phage Types<br>Incidents (Isolations) | 2004   | 2005   | 2006   | 2007   | 2008   |
|---------------------------------------|--------|--------|--------|--------|--------|
| NOPT                                  | - ( -) | - ( -) | - ( 1) | - ( -) | - ( -) |
| untyped                               | - ( 1) | - ( 1) | - ( -) | - ( -) | - ( -) |
| TOTAL                                 | - ( 1) | - ( 1) | - ( 1) | - ( -) | - ( -) |