Chapter 1

OVERVIEW OF *SALMONELLA* IN LIVESTOCK AND PEOPLE

This chapter provides information on *Salmonella* isolated from livestock from samples taken on all premises, including farms, hatcheries, veterinary practices, zoos and slaughterhouses. An overview of the number of isolations of *Salmonella* reported in farm animal species is given in Table 1.1; poultry refers to reports from chickens, turkeys and ducks. However, it should be noted that data from turkeys are only included from 2010 when the turkey National Control Programme (NCP) was implemented.

It is important to note that data for the different species are not directly comparable. Most *Salmonella* reports from cattle, sheep and pigs result from the investigation of clinically diseased animals whereas reports from chickens and turkeys are mostly from statutory surveillance. However, trends over time within species are largely comparable, especially for chickens and turkeys since the introduction of the NCPs.

For comparison purposes, data have been reproduced here on the number of laboratory reports of human isolations of *Salmonella* reported in England and Wales to Public Health England, Colindale and in Scotland to Health Protection Scotland (Figures 1.1 – 1.3). There are a number of factors that influence the reporting of these data by clinical microbiology laboratories. These are discussed in the Zoonoses Report UK 2013 (Defra 2014, in press).

Figure 1.1 shows the most common *Salmonella* serovars isolated from livestock in Great Britain in 2013 alongside the most common serovars isolated from human cases of salmonellosis in Great Britain. Figures 1.2 and 1.3 provide similar data for phage types of *S. Typhimurium* and *S. Enteritidis* in both livestock and humans. Apart from *Salmonella Typhimurium* (including monophasic variants) and *Salmonella Enteritidis*, serovars commonly associated with human cases are reported relatively rarely from British livestock. *S. Newport* was the only other serovar that occurred amongst the ‘top 10’ serovars in both humans and livestock in 2013. The monophasic *S. Typhimurium* variants *Salmonella* 4,5,12:i:- and *Salmonella* 4,12:i:-, which have become prominent in pigs and cattle, are reported as monophasic strains in the human surveillance data, as the data for these two variants are combined and cannot currently be separated; therefore, to ease comparisons, Figure 1.1 also shows these two variants combined into ‘monophasic *S. Typhimurium*’ for the livestock species. The total number of *Salmonella* isolation reports to PHE and HPS from human cases of salmonellosis in 2013 was 4.0% lower than in 2012.
Figures are included showing the relative frequency of the most common *Salmonella* serovars in each animal species during 2013 (Figure 1.1). These data should be considered alongside absolute numbers of isolations, as the relative proportions may remain similar despite a change in number of isolations, in which case we assume that the change in number of isolations is likely to be constant across serovars. Similarly, if there is a change in serovar relativity, it is only by examining changes in absolute numbers that we can ascertain the size of any increase or decrease. For example, in 2013 the total number of *Salmonella* isolation reports from cattle, sheep, pigs and poultry decreased by 3.2% compared with 2012 (Table 1.1). However, this was not consistent across serovars; for example, reports of *S. Bovismorbificans* increased by 44.4% and reports of *S. Indiana* increased by 30.3%, whereas reports of *S. Derby* and *S. Montevideo* decreased by 65.8% and 22.5%, respectively, compared with 2012.

Perhaps the most important factor which may bias the number of *Salmonella* reports from species not covered by NCPs (i.e. species other than chickens and turkeys) is the submission rate. This report presents numerator data but the denominator, in most cases, is unknown and may change over time. Since most *Salmonella* reports from cattle, sheep and pigs result from the investigation of clinically diseased animals and economic factors may exert a strong influence on diagnostic practices, such as whether a veterinary surgeon is consulted and whether samples are submitted for laboratory examination, the *Salmonella* data from these species is likely to be most influenced by changes in submission rate.

The number of diagnostic submissions to the Animal Health and Veterinary Laboratories Agency (AHVLA) and Scotland’s Rural College (SRUC) decreased by 9.2% in 2013 compared to 2012. This decrease was seen for all species. This is in contrast to 2012 when increases were seen in all species except pigs and poultry. As most of the data from species other than poultry relate to clinical investigations, the prevalence of subclinical infection in these species of livestock is not known. Most sample submissions from poultry are associated with statutory or voluntary surveillance activities. Although trends in *Salmonella* reports from species not covered by NCPs can be compared with diagnostic submission rates to AHVLA/SRUC, it should be remembered that not all submissions will have been examined for *Salmonella*. Private laboratories also report the isolation of *Salmonella* and the total number of submissions to these laboratories is unknown.

There were 2,982 isolations of *Salmonella* in 2013 which represents an increase of 1.9% compared with 2012 (2,925 isolations). These
comprised 2,818 isolations from species covered by the statutory reporting requirements of the Zoonoses Order 1989 (1,216 isolations from chickens, 604 isolations from cattle, 343 isolations from turkeys, 333 isolations from ducks, 127 isolations from pigs, 112 isolations from sheep, 44 isolations from horses, 18 isolations from pheasants, ten isolations from partridges, eight isolations from pigeons, two isolations from quail and one isolation from geese) plus 164 isolations from non-statutory species.

Relative to 2012, there were fewer isolations from pigeons (61.9% less) turkeys (56.5% less), partridges (33.3% less) and pigs (31.7% less), but increases in the number of reports from ducks (97.0% higher), chickens (19.9% higher), sheep (12.0% higher) and cattle (6.7% higher).

The surveillance data for 2013 shows that only a small proportion of the isolations of Salmonella reported to Defra have been responsible for outbreaks of clinical disease in livestock (30.8%, which is similar to previous years). This contrasts with data for Salmonella in humans where reports usually originate from cases of clinical disease.

The majority of the isolations reported from chicken and turkey flocks (74.4% and 92.1%, respectively) during 2013 were the result of statutory surveillance activities due to the NCPs that are in place for these sectors (further information on these NCPs is included in Chapter 6 and Chapter 7). This differs from years prior to the introduction of the NCPs when the majority of chicken and turkey isolations originated from voluntary surveillance.

Voluntary Salmonella surveillance of healthy flocks is common practice in the duck industry; in 2013, isolations reported as a result of voluntary surveillance comprised 99.7% of all duck isolations. By contrast, the majority of Salmonella isolations reported from other species are the result of examinations carried out to diagnose clinical disease, although the Salmonella found may not always be the primary cause.

The number of S. Typhimurium isolations from cattle, sheep, pigs and poultry decreased by 26.6% in 2013 (102 isolations) relative to 2012 (139 isolations). This decrease was most marked in pigs, from which there were 53.3% fewer isolations than in 2012. At the same time, isolations of the monophasic strain S. 4,5,12:i:- remained comparable with 2012 and isolations of S. 4,12:i:- decreased by 15.8%.
Highlights

Cattle
- The number of *Salmonella* isolations from cattle increased by 6.7% compared with 2012 (Table 2.1).

*Salmonella* Dublin was, once again, the most commonly reported serovar (438 isolations; 72.5% of total cattle isolations).

- The second most common serovar was *S. Mbandaka* (45 isolations; 7.5% of total cattle isolations).

- There were 30 isolations of *S. Typhimurium* (5.0% of total cattle isolations) and a third of these were DT104.

- Three isolations of *S. Enteritidis* were reported, all of which were associated with clinical disease.

- Reports of the monophasic variants of *S. Typhimurium* were only marginally lower than in the previous year, with 17 isolations of *S. 4,5,12:i:-* and four isolations of *S. 4,12:i:-* compared with 19 isolations and seven isolations in 2012, respectively

Small ruminants
- *Salmonella enterica* subspecies *diarizonae* serovar 61:k:1,5,(7) (and variants) remained the most common serovar in sheep (41 reports; 36.6% of total sheep isolations). However, this was a substantial decrease compared to 2012 when this serovar made up 75.0% of all sheep isolations.

- *Salmonella* Montevideo was the second most commonly reported serovar (36 isolations; 32.1% of total sheep isolations). This was a considerable increase compared with 2012, when there were only four isolations (4.0% of total sheep isolations), and also higher than in 2011 when this serovar made up 22.5% of all sheep isolations.

- There were no reports of *Salmonella* in goats for the third year running.

Pigs
- The number of *Salmonella* isolations from pigs fell by 31.7% compared with 2012 (Table 4.1).
• *Salmonella* Typhimurium was the most common serovar reported in pigs (42 isolations; 33.1% of total pig isolations). The most common phage type reported was U288 (17 isolations; 40.5% of total *S.* Typhimurium isolations in pigs). Phage types DT193 and U302 were the second most commonly reported phage types (eight isolations of each; 19.0% of total *S.* Typhimurium isolations in pigs).

• The number of *S.* 4,5,12:i:- reports decreased slightly compared with 2012 (31 vs. 35 reports) although it was responsible for a greater proportion of all porcine *Salmonella* isolations (24.4% vs. 18.8% of total pig isolations). The most common phage type was DT193 (22 isolations).

• A similar trend was observed for *Salmonella* 4,12:i:- with 24 isolations (18.9% of total pig isolations) in 2013, compared with 28 isolations (15.1% of total pig isolations) in 2012. The most common phage type was also DT193 (18 isolations).

• More than 600 pigs were sampled at 14 abattoirs between January and May 2013 as part of a multi-agency study to investigate the prevalence of *Salmonella* in UK slaughter pigs. Levels of *Salmonella* carriage were found to be significantly higher than in the previous baseline survey carried out in 2006/7 (30.5% vs. 21.9%) whereas significantly fewer carcase swabs tested positive (9.6% vs. 15.1%). The most common serovars reported were monophasic *Salmonella* 4,[5],12:i:- and *S.* Typhimurium, followed by *S.* Derby and *S.* Bovismorbificans.

**Deer, Horses and Rabbits**

• There were no reports of *Salmonella* from deer or rabbits during 2013.

• The number of isolations from horses in 2013 (n=44) was similar to that in 2012 (n=42).

• The most common serovars reported from horses were *Salmonella* 4,5,12:i:- (eleven isolations; 25.0% of total horse isolations), *S.* 4,12:i:- (nine isolations; 20.5% of total horse isolations) and *S.* Typhimurium (nine isolations; 20.5% of total horse isolations). The monophasic strains were therefore responsible for almost half of all horse isolations in 2013 compared to less than 15% in recent years.
Chickens
- Including both NCP and non-statutory surveillance data, isolations of *Salmonella* from chickens increased by 19.9% compared with 2012.

- The most commonly reported serovars were:
  - *S*. Mbandaka (230 isolations; 18.9% of total chicken isolations).
  - *S*. Senftenberg (198 isolations; 16.3% of total chicken isolations).
  - *S*. Montevideo (189 isolations; 15.5% of total chicken isolations).
  - *S*. Kedougou (153 isolations; 12.6% of total chicken isolations).
  - *S*. 13,23:i:- (132 isolations; 10.9% of total chicken isolations).

- There were ten isolations of *S*. Enteritidis (0.8% of total chicken isolations) in 2013 compared with five isolations (0.5% of total chicken isolations) in 2012.

- Information and data are given in Chapter 6 (Reports of *Salmonella* in Chickens) on the National Control Programmes (NCPs) for *Salmonella* in breeding flocks of chickens, laying hen flocks and chicken broiler flocks. The estimated prevalence of regulated serovars in all three NCPs was well below the EU targets (0.00% for breeders, 0.08% for layers and 0.05% for broilers).

Turkeys
- Including both NCP and non-statutory surveillance data, isolations of *Salmonella* from turkeys decreased by 56.5% in 2013 compared with 2012.

- As in previous years, the most common serovar reported from turkeys in 2013 was *S*. Derby (163 isolations; 47.5% of total turkey isolations). However, there were 67.7% fewer isolations of this serovar than in 2012 (504 isolations).

- Information and data are given in Chapter 7 (Reports of *Salmonella* in Turkeys) on the National Control Programme (NCP) for *Salmonella* in turkey flocks. Neither *S*. Enteritidis nor *S*. Typhimurium were isolated in 2013 and only a single fattening flock was detected with *Salmonella* 4,5,12:i:-. Consequently, the estimated prevalence of regulated serovars was well below the EU target (0.04% for fatteners and 0.00% for breeders).

Ducks and Geese
- There were 333 isolations of *Salmonella* from ducks in 2013 compared with 169 isolations in 2012, largely due to increased voluntary *Salmonella* monitoring in duck flocks.
• The most commonly isolated serovars in ducks were S. Indiana (130 isolations; 39.0% of total duck isolations), S. Orion (36 isolations; 10.8% of total duck isolations) and S. Give (35 isolations; 10.5% of total duck isolations).

• There was a single isolation of Salmonella (S. Ajiobo) from geese in 2013.

Other Statutory Birds (as specified in the Zoonoses Order)
• There were fewer reports of Salmonella from game birds (guinea fowl, partridges, pheasants and quail) in 2013 (30 isolations) than in 2012 (36 isolations). Isolations from partridges fell (from 15 to 10) whereas isolations from both pheasants and quail remained stable. There have been no reports from guinea fowl since 2010.

• The most commonly reported serovar in game birds was S. Typhimurium (14 isolations; 46.7% of total game bird isolations).

• There were eight Salmonella isolations from pigeons in 2013, six (75.0%) of which were S. Typhimurium.

• Salmonella 4,12:i:- was reported from pigeons for the first time.

Wildlife
• There were three isolations of Salmonella from wildlife during 2013, all of which were from badgers (S. Agama, S. Cotham and S. 6,8:e,h:-).

• There were no isolations of Salmonella from wild birds during 2013.

Feedingstuffs
• During 2013, 1.2% of tests carried out under the Animal By-Products Regulations (ABPR) and Defra Codes of Practice were positive for Salmonella. This is slightly higher than during 2012 when the percentage positive was 0.7%.

• There were 24 isolations of regulated Salmonella serovars from animal feedingstuffs during 2013 compared with eight during 2012.

• The most commonly reported serovar from animal feedingstuffs and compound feed during 2013 was S. Mbandaka (76 isolations).
The isolation rate of *Salmonella* from domestic processed animal protein decreased to 0.7% in 2013 compared with 3.2% in 2012 and 1.7% in 2011.

**Antimicrobial Susceptibility Testing**

- Of the 2,886 *Salmonella* cultures examined during 2013, 64.2% were susceptible to all 16 antimicrobial drugs tested.

- A total of 165 cultures of *Salmonella* Typhimurium were examined in 2013, of which 30.3% were susceptible to all the antimicrobials tested against. This is an increase compared with 2012 when 27.2% were susceptible to all antimicrobials tested.

- 2,328 isolates of serovars other than *S.* Dublin or *S.* Typhimurium were tested in 2013 and 61.2% of these were susceptible to all the antimicrobials tested.

Full details of the above highlights can be found in the individual chapters.
Figure 1.1: Isolations of the most common serovars in livestock and people in GB 2013

**People (n=8,306)**

- Enteritidis: 27.7%
- Typhimurium: 11.0%
- Monophasic STM*: 10.1%
- Infantis: 3.0%
- Newport: 2.6%
- Virchow: 2.3%
- Stanley: 1.8%
- Paratyphi B var. Java: 1.5%
- Kentucky: 1.6%
- Other serovars: 38.2%

**Cattle (n=604)**

- Dublin: 72.5%
- Montevideo: 17.1%
- Typhimurium: 11.0%
- Monophasic STM*: 10.1%
- Mbandaka: 7.5%
- Agama: 1.7%
- Anatum: 1.0%
- Other serovars: 4.5%

**Sheep (n=112)**

- Montevideo: 32.1%
- Other serovars: 8.9%
- Dublin: 11.6%
- Agama: 8.9%

**Pigs (n=127)**

- London: 1.6%
- Montevideo: 33.1%
- Typhimurium: 33.1%
- Others: 5.5%

**Chickens** (n=1,216)

- Derby: 47.5%
- Newport: 14.9%
- Kedougou: 9.9%
- Kottbus: 9.0%
- Indiana: 2.3%
- Senftenberg: 1.7%
- Ohio: 1.2%
- Others: 12.0%

**Turkeys** (n=343)

- Derby: 47.5%
- Other serovars: 12.0%
- Ohio: 1.2%
- Senftenberg: 1.7%
- Indiana: 2.3%
- Kottbus: 9.0%
- Kedougou: 9.9%

* Includes both S. 4,5,12:i:- and S. 4,12:i:-

** Includes both statutory and non-statutory data
Figure 1.1: Isolations of the most common serovars in livestock and people in GB 2013 (continued)

<table>
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Ducks (n=333)
Table 1.1: *Salmonella* isolations in cattle, sheep, pigs and poultry† on all premises in Great Britain, including statutory and non-statutory results

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† Poultry includes chickens, turkey and ducks. Data for turkeys are only included from 2010 onwards (since the NCP was in place).
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† Poultry includes chickens, turkey and ducks. Data for turkeys are only included from 2010 onwards (since the NCP was in place).
Table 1.1: *Salmonella* isolations in cattle, sheep, pigs and poultry on all premises in Great Britain, including statutory and non-statutory results (continued)

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† Poultry includes chickens, turkey and ducks. Data for turkeys are only included from 2010 onwards (since the NCP was in place).

** S. Binza is now recorded as S. Orion var. 15+, but is reported in the table under S. Orion for 2009.

*** S. Newbrunswick is now recorded as S. Give var. 15+.

**** S. Thomasville is now recorded as S. Orion var. 15+ 34+.
Figure 1.2: Isolations of the most common S. Typhimurium phage types in livestock and people 2013†

* Including both statutory and non-statutory data

† N.B. There were no STM isolations from sheep or turkeys in 2013
Figure 1.3: Isolations of the most common S. Enteritidis phage types in livestock and people 2013†

* Including both statutory and non-statutory testing

† N.B. There were no SE isolations from ducks, pigs, sheep or turkeys in 2013
Figure 1.4: Isolations of S. Enteritidis in livestock in GB 2011 - 2013

Figure 1.5: Isolations of S. Typhimurium in livestock in GB 2011 - 2013

* Inc. both statutory and non-statutory testing
Figure 1.6: Isolations of S. 4,5,12:i:- in livestock in GB 2011 - 2013

- Cattle
- Chickens*
- Ducks
- Pigs
- Sheep
- Turkeys*

* Inc. both statutory and non-statutory testing

Figure 1.7: Isolations of S. 4,12:i:- in livestock in GB 2011 - 2013

- Cattle
- Chickens*
- Ducks
- Pigs
- Sheep
- Turkeys*

* Inc. both statutory and non-statutory testing