Chapter 7

REPORTS OF SALMONELLA IN TURKEYS

According to the June 2016 Agricultural Census, there were 4.02 million turkeys in Great Britain, compared with 4.15 million in 2015 and 3.58 million in 2014.

In January 2010, the National Control Programme (NCP) to control Salmonella in turkeys was implemented across the European Union. Breeding turkey farms with more than 250 adult birds on the holding and fattening turkey flocks with more than 500 birds are eligible for Salmonella testing under the NCP. Since 2010, Salmonella reports from turkeys have largely originated from samples taken under the National Control Programme and therefore cannot be compared with data from previous years.

As described in Chapter 6 for chickens, two different systems of reporting are used in this chapter and therefore the interpretation of the results has to be made bearing this in mind.

- The first part of this chapter describes all isolations of Salmonella, including samples originating from statutory surveillance, voluntary surveillance, investigations into clinical disease and investigations carried out under the Zoonoses Order. If two submissions from the same group of birds on different dates give the same serovar, this is reported as two isolations.
- The second part of this chapter describes results obtained within the National Control Programmes (NCPs), i.e. results from statutory surveillance only. Results from the NCPs are reported to the European Commission in a way that ensures that every flock with a Salmonella-positive result is counted only once. Numbers of positive flocks reported within the NCP are therefore expected to differ from the number of reported isolations. Some flocks may be positive for more than one serovar, in which case they are still only counted once as positive flocks under the NCP, but are counted as more than one isolation.

There were 345 turkey submissions to APHA/ SRUC laboratories in 2016; compared to 392 submissions in 2015, this represents a decrease of 12%. Since 2011, when 515 submissions were received, this represents a 33% decrease. In 2009, before the introduction of the National Control Programme for Salmonella in turkeys, the number of submissions was significantly lower (n=240).
A total of 607 *Salmonella* isolations were reported from turkeys in 2016 (Table 7.1). This was very similar to 2015, when 619 *Salmonella* isolations were reported. Compared to 2014, when 193 isolations were recorded, this represents a more than three-fold increase. In 2009, before the introduction of the National Control Programme, only 88 isolations were recorded. The considerable increase in isolations in subsequent years can be explained by more sensitive and regular statutory testing of turkey flocks under the NCP, which has led to the identification of positive flocks which otherwise might not have been detected through voluntary surveillance. After a peak in 2012, when 789 isolations were reported, numbers steadily declined until 2014, when 193 isolations were recorded. However, 2015 and 2016 have shown a significant increase in the number of isolations, which is mainly due to an increase in S. Derby reports.

The total number of isolations in 2016 was distributed between the following categories according to the reason for submission:

- Statutory surveillance: 552 (90.9%)
- Voluntary surveillance: 54 (8.9%)
- Investigations of clinical disease: 1 (0.2%)
- Investigations under the Zoonoses Order: 0 (0.0%)

Fourteen different serovars of *Salmonella* were isolated in 2016, accounting for 598 of the 607 isolations. The remaining nine isolations involved untypable and rough *Salmonella* strains.

Since the beginning of 2016, due to the high number of S. Derby isolates received from turkey holdings, the decision was taken to only partially serotype the majority of presumptive S. Derby isolates rather than fully serotype them. This partial serotyping slide agglutination method still allows for any serovars which are regulated under EU legislation (i.e. S. Enteritidis, S. Typhimurium and monophasic strains of S. Typhimurium) to be identified/excluded. Both presumptive S. Derby and fully serotyped S. Derby are recorded under the category of S. Derby to enable comparisons with previous years.

Table 7.1 shows the absolute numbers of all *Salmonella* serovars isolated from turkeys from 2012 to 2016, and Figure 7.1 shows the relative percentages of the most common serovars. *Salmonella* Derby continued to be the predominant serovar in turkeys in 2016, accounting for 501 isolations (82.5% of all isolations). This was the highest relative percentage of S. Derby isolates ever observed. The absolute number of S. Derby isolates was only slightly higher in 2012, when 504 isolations were reported. The total number of other serovars was lower in 2016 compared to previous years, with S. Kedougou being the second most
common serovar (56 isolations, 9.2% of total), followed by S. Agona (10 isolations, 1.6% of total) and S. Indiana (7 isolations, 1.2% of total). Four isolations of Salmonella 4,5,12:i:-, two isolations of S. Typhimurium and one isolation of Salmonella 4,12:i:- were reported in 2016. Reductions in the number of isolations of S. Newport and S. Senftenberg were observed in 2016 compared to previous years, and for the first year, S. Kottbus was not isolated at all.

Salmonella Derby has been the most common serovar in turkeys since 2007. However, the number of S. Derby isolates has fluctuated significantly over the past few years, ranging between 46 in 2014 and 504 in 2012. In 2013 and 2014, a significant reduction of S. Derby isolates was observed, but a steady increase has been seen since 2014.

Salmonella Kedougou, S. Kottbus and S. Newport have been among the most common serovars since at least 2004 and seemed to have become established in the turkey industry; however, no S. Kottbus isolates and only five S. Newport isolates were reported in 2016. Salmonella Mbandaka, which is thought to be mainly feed-related, was the second most common serovar in 2012, but has almost disappeared since 2013 (only one isolation in 2016). Salmonella Senftenberg, which is mainly a hatchery-related serovar, but is also able to colonise feed-mills, has accounted for around 15 to 20 isolations each year over the past five years, but accounted for only three isolations in 2016.

The prevalence of S. Typhimurium, which was the most commonly reported serovar in 2006, accounting for 20.7% of isolations at the time, has reduced considerably over the past few years, and in 2016, only two isolations of biphasic S. Typhimurium strains were reported (Figure 7.2). Monophasic strains of S. Typhimurium, namely Salmonella 4,5,12:i:- and Salmonella 4,12:i:-, were first seen in turkeys in 2011. While numbers were low until 2013, with a maximum of five isolations of monophasic strains per year, reports peaked in 2014 with a total of 20 isolations. In 2016, five isolations of monophasic strains of S. Typhimurium were reported from turkeys, of which four were Salmonella 4,5,12:i:- and one Salmonella 4,12:i:- (Figures 7.3 and 7.4).

Salmonella Enteritidis was not reported from turkeys between 2004 and 2016, with the exception of 2015, when six isolations were reported, all of which were linked to an outbreak of S. Enteritidis PT21 in broiler chickens.

National Control Programme for Salmonella in fattening and breeding turkeys
The NCP for *Salmonella* in fattening and breeding turkeys came into effect on 1\(^{st}\) January 2010 and has been implemented to comply with Regulation (EC) No. 2160/2003 and Regulation (EC) No. 1190/2012\(^1\). These regulations aim to protect public health through a reduction in levels of *Salmonella* in turkey flocks.

All holdings with 250 or more breeding turkeys and turkey fattening flocks with 500 or more fattening turkeys are included in the NCP, unless exempted according to Regulation (EC) No. 2160/2003 under Article 1.3, i.e. fattening birds produced for private domestic consumption, or where there is direct supply of small quantities of products to the final consumer or to local retail establishments directly supplying the primary products to the final consumer.

The NCP is implemented via the Control of *Salmonella* in Turkey Flocks Order 2009 (CSTO) which came into force in England on the 1\(^{st}\) January 2010\(^2\). There is separate national legislation for Scotland\(^3\) and Wales\(^4\) although there has been close collaboration throughout the development of the legislative proposals and implementation.

**Positive flocks identified in the NCP for fattening turkeys in 2016**

In Great Britain, 396 fattening turkey flocks, originating from 62 individual holdings, were positive for *Salmonella* spp. in 2016.

Three flocks were positive for the monophasic strain of *S. Typhimurium*, *Salmonella* 4,5,12:i:-. Two of those flocks were identified through operator sampling and one was identified through annual routine official sampling. One flock was positive for *Salmonella* 4,12:i-: identified through annual routine official sampling. Two flocks on the same premises were positive for *S. Typhimurium*; one tested positive in an annual routine official sample and the second one tested positive during “official sampling of other flocks on site”.

A total of three hundred and ninety (390) flocks tested positive for serovars other than *S. Enteritidis* and *S. Typhimurium* (including monophasic strains). Three hundred and eighty-nine (389) flocks were identified through samples taken by the food business operator. Of those, three hundred and thirty-five (335) tested positive for *S. Derby*, of

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which two hundred and sixty-six (266) were presumptive S. Derby, thirty-three (33) for S. Kedougou, six (6) for S. Indiana, five (5) for S. Bovismorbificans, four (4) for S. Agona, three (3) for S. O'Rough,f,g:-, one (1) for S. Gloucester, one (1) for S. Newport, and one (1) for S. Senftenberg. An additional two (2) flocks were identified through samples taken during routine official annual visits; one (1) was positive for S. Derby, and one (1) for S. 4,5,12:b:-. One (1) flock tested positive for two non-regulated serovars and is only included once in the total overall count of positive flocks.

Salmonella Derby continued to be the most commonly isolated serovar from turkey flocks in 2016, and the number of flocks has further increased since 2015. After a substantial increase in the number of flocks positive for S. Derby in 2015 (213 flocks) compared to 2014 (38 flocks), numbers increased further in 2016 and reached similar levels previously seen in 2012 (390 flocks). Thirty-three (33) flocks were positive for S. Kedougou, which is a slight reduction compared to 2015, when 36 flocks were positive for S. Kedougou. S. Kottbus, which had been one of the most prevalent serovars for many years, was not detected in 2016. The number of S. Newport reports decreased further, and only one positive flock was detected in 2016, compared to six in 2015. Salmonella Gloucester, which had never been reported from turkeys before, was isolated from one flock. Salmonella Typhimurium U288, a strain commonly seen in pigs, was isolated from a flock at a farm which only rears turkeys prior to Christmas.

A total of two thousand two hundred and seventy (2,270) fattening flocks were in production in GB in 2016 and were included in the NCP. The estimated prevalence for regulated serovars was therefore 0.26% (6/2,270), which is well below the EU target of a maximum of 1% of flocks positive for regulated serovars. The estimated prevalence of all Salmonella serovars was 17.44% (396/ 2,270).

The prevalence of turkey fattening flocks testing positive for regulated Salmonella serovars decreased in 2016 (0.26%) compared to 2015 (0.34%). The prevalence of turkey fattening flocks positive for all serovars increased in 2016 to 17.44% compared to 2015 (10.20%), exceeding levels seen in 2014 (3.69%) and 2013 (8.8%). This increase was mainly due to an increase in S. Derby reports.

Positive flocks identified in the NCP for breeding turkeys 2016
A total of five turkey breeding flocks tested positive for Salmonella serovars in 2016. Two adult turkey breeding flocks tested positive for S. Senftenberg, identified by routine annual official sampling at the hatchery. Three flocks were positive for S. Derby, identified by routine
operator sampling. No regulated serovars were detected in turkey breeding flocks in 2016.

A total of 223 adult breeding flocks were in production in England, Wales and Scotland in 2016 and were included in the NCP. The estimated prevalence for regulated serovars was therefore 0% (0/223) which is well below the EU target of 1% of flocks positive for S. Enteritidis and/or S. Typhimurium (including monophasic strains). The estimated prevalence for all serovars was 2.24% (5/223). This is similar to 2015, when the prevalence for regulated serovars was 0% and the prevalence for Salmonella spp. was 2.04%.

Since the introduction of National Control Programmes for turkeys in 2010, no regulated serovars have been identified in breeding turkeys.
Table 7.1: *Salmonella* in turkeys on all premises in Great Britain. (Positive flocks from statutory testing; isolations from both statutory and non-statutory testing)

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* Including presumptive S. Derby (266 flocks and 388 isolations)

† Fifteen flocks tested positive for two different *Salmonella* serovars in 2012. These flocks are included in the table under both serovars but only once in the overall total.

‡ Four flocks tested positive for two different *Salmonella* serovars in 2013. These flocks are included in the table under both serovars but only once in the overall total.

‡‡ One flock tested positive for two different *Salmonella* serovars in 2014. This flock is included in the table under both serovars but only once in the overall total.

†† Five flocks tested positive for two different *Salmonella* serovars in 2015. These flocks are included in the table under both serovars but only once in the overall total.

††† One flock tested positive for two different *Salmonella* serovars in 2016. This flock is included in the table under both serovars but only once in the overall total.
Figure 7.1: The most common serovars in turkeys by number of isolations* in GB 2012 - 2016

2012 (n=789)
- Derby 63.9%
- Mbandaka 7.0%
- Kedougou 6.7%
- Newport 6.5%
- Kottbus 3.3%
- Senftenberg 2.0%
- Other serovars 4.3%

2013 (n=343)
- Derby 47.5%
- Newport 14.9%
- Kedougou 9.9%
- Kottbus 9.0%
- Indiana 2.3%
- Senftenberg 1.7%
- Ohio 1.2%
- Other serovars 12.0%

2014 (n=193)
- Newport 11.4%
- Kottbus 15.0%
- Senftenberg 7.8%
- 4,5,12:i:- 8.8%
- Kedougou 17.1%
- Derby 23.8%
- Other serovars 10.9%

2015 (n=619)
- Derby 69.5%
- Newport 4.2%
- Kedougou 14.4%
- Enteritidis 1.0%
- Kottbus 0.8%
- Other serovars 5.3%
- Senftenberg 3.6%
- 4,5,12:i:- 1.3%

2016 (n=607)
- Derby 82.5%
- Kedougou 9.2%
- Indiana 1.2%
- Agona 1.6%
- 4,5,12:i:- 0.7%
- Other serovars 3.1%
- Newport 0.8%
- Bovis-morbillicans 0.8%

* Derived from statutory and non-statutory testing.
Figure 7.2: S. Typhimurium phage types in turkeys in GB 2012-2016

Figure 7.3: *Salmonella* 4,5,12:i:- phage types in turkeys in GB 2012-2016

Figure 7.4: *Salmonella* 4,12:i:- phage types in turkeys in GB 2012-2016
Figure 7.5: S. Enteritidis phage types in turkeys in GB 2012 - 2016†

† Flocks from statutory testing; isolations from both statutory and non-statutory testing
The absolute number of breeder flocks eligible for NCP testing and positive for Salmonella is relatively small and should thus be borne in mind when interpreting the trends in this figure.

* The absolute number of breeder flocks eligible for NCP testing and positive for Salmonella is relatively small and should thus be borne in mind when interpreting the trends in this figure.
Table 7.2: Turkey fattening flocks in GB - number of flocks reported positive for each *Salmonella* serovar, NCP testing 2012 - 2016*

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<td>3</td>
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<td>36</td>
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<td>Kottbus</td>
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<td>4,5,12:i:-</td>
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<td>4</td>
<td>Newport</td>
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<tr>
<td></td>
<td>Kedougou</td>
<td>33</td>
<td>5</td>
<td>Kottbus</td>
<td>26</td>
<td>5</td>
<td>O Rough:f,g:-††</td>
<td>6</td>
<td>5</td>
<td>Agona</td>
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<td>O rough:e,h:1,6</td>
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<td></td>
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<td>9</td>
<td>Agama</td>
<td>1</td>
<td>9</td>
<td>13,23:i:-</td>
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<td>8</td>
<td>Gloucester</td>
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<td>10</td>
<td>Durham</td>
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<td>10</td>
<td>13,23:i:-</td>
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<td>8</td>
<td>Newport</td>
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<td>11</td>
<td>Orion var. 15'</td>
<td>1</td>
<td>11</td>
<td>4,5:12:b:-</td>
<td>1</td>
<td>7</td>
<td>Senftenberg</td>
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</tr>
<tr>
<td></td>
<td>4,5,12:i:-</td>
<td>1</td>
<td>12</td>
<td>Senftenberg</td>
<td>1</td>
<td>12</td>
<td>4,12:i:-</td>
<td>1</td>
<td>6</td>
<td>Senftenberg</td>
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<td></td>
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<tr>
<td></td>
<td>4,5,12:i:-</td>
<td>1</td>
<td>13</td>
<td>6,7:z16*-</td>
<td>1</td>
<td>13</td>
<td>6,7:z16*-</td>
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<td>6</td>
<td>Durham</td>
<td>1</td>
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</tr>
</tbody>
</table>

Prevalence all serovars = 17.07%

Prevalence all serovars = 8.83%

Prevalence all serovars = 3.69%

Prevalence all serovars = 10.20%

Prevalence all serovars = 17.44%

Prevalence regulated serovars = 0.03%

Prevalence regulated serovars = 0.04%

Prevalence regulated serovars = 0.38%

Prevalence regulated serovars = 0.34%

Prevalence regulated serovars = 0.26%

* For details of turkey fattening flocks reported positive in 2010 and 2011 see the 2014 edition of *Salmonella* in Livestock Production in GB

† Including presumptive S. Derby (266 flocks)

** Four flocks tested positive for both S. Derby and S. Indiana, four flocks tested positive for both S. Derby and S. Kedougou, two flocks tested positive for S. Derby and S. Mbandaka, two flocks tested positive for S. Derby and S. O Rough:f,g:-, two flocks tested positive for S. Indiana and S. Kottbus and one flock tested positive for S. Derby and S. Kottbus. Each flock was only counted once in the overall figure to calculate prevalence.

*** Three flocks tested positive for both S. Derby and S. Mbandaka and one flock tested positive for both S. Kedougou and S. Newport. Each flock was counted only once in the overall figure to calculate prevalence.

†† One flock tested positive for both S. 4,5,12:i:- and S. Typhimurium. This flock was counted only once in the overall figure to calculate prevalence.

††† Four flocks tested positive for both S. Derby and S. O Rough:f,g:- and one flock tested positive for both S. Derby and S. Kedougou. Each flock was counted only once in the overall figure to calculate prevalence.
Figure 7.8: The most common serovars identified in turkey fattening flocks in GB 2011 - 2016 reported from NCP testing

2011 (478 positive flocks*)

- Derby 58.2%
- Kedougou 16.8%
- Newport 8.1%
- Kottbus 8.3%
- Other serovars 4.5%
- Indiana 4.1%

2012 (550 positive flocks*)

- Derby 68.1%
- Newport 4.1%
- Mbandaka 6.4%
- Kedougou 8.3%
- Indiana 8.3%

2013 (247 positive flocks*)

- Derby 62.2%
- Kedougou 10.0%
- Newport 9.2%
- Kottbus 8.4%
- Other serovars 6.8%
- Indiana 3.6%

2014 (116 positive flocks*)

- Derby 32.5%
- Kedougou 22.2%
- Newport 6.8%
- 4,5,12:i:- 10.3%
- Other serovars 5.1%
- Kottbus 23.1%

2015 (272 positive flocks*)

- Derby 76.8%
- Kedougou 13.2%
- Newport 2.2%
- 4,5,12:i:- 2.9%
- Other serovars 2.6%
- 0 rough: f,g:- 2.2%

2016 (396 positive flocks*)

- Derby 84.6%
- Newport 1.0%
- Bovis-morbillicans 1.3%
- Agona 1.0%
- Other serovars 3.3%
- Indiana 1.5%
- Kedougou 8.3%

* 15 flocks positive for 2 serovars (these are counted only once in the total)

* 15 flocks positive for 2 serovars (these are counted only once in the total)

* 4 flocks positive for 2 serovars (these are counted only once in the total)

* 1 flocks positive for 2 serovars (this is counted only once in the total)

* 5 flocks positive for 2 serovars (these are counted only once in the total)

* 1 flock positive for 2 serovars (this are counted only once in the total)
Table 7.3: Turkey breeding flocks in GB - number of adult flocks reported positive for each *Salmonella* serovar, NCP testing 2011 - 2016*

<table>
<thead>
<tr>
<th>RANK</th>
<th>SEROVAR</th>
<th>N</th>
<th>RANK</th>
<th>SEROVAR</th>
<th>N</th>
<th>RANK</th>
<th>SEROVAR</th>
<th>N</th>
<th>RANK</th>
<th>SEROVAR</th>
<th>N</th>
<th>RANK</th>
<th>SEROVAR</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Derby</td>
<td>4</td>
<td>1</td>
<td>Kedougou</td>
<td>2</td>
<td>1</td>
<td>Senftenberg</td>
<td>11</td>
<td>1</td>
<td>Derby</td>
<td>4</td>
<td>1</td>
<td>Derby</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Mbandaka</td>
<td>1</td>
<td>2</td>
<td>Derby</td>
<td>1</td>
<td>1</td>
<td>Dublin</td>
<td>2</td>
<td>2</td>
<td>Senftenberg</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prevalence all serovars = 1.95%  
Prevalence all serovars = 1.40%  
Prevalence all serovars = 4.91%  
Prevalence all serovars = 2.04%  
Prevalence all serovars = 2.24%

Prevalence regulated serovars = 0.00%  
Prevalence regulated serovars = 0.00%  
Prevalence regulated serovars = 0.00%  
Prevalence regulated serovars = 0.00%  
Prevalence regulated serovars = 0.00%

*For details of turkey breeding flocks reported positive in 2010 and 2011 see the 2014 edition of *Salmonella* in Livestock Production in GB*
Figure 7.9: Serovars identified in adult turkey breeding flocks in GB 2011 - 2016 reported from NCP testing

2011 (29 positive flocks)
- Senftenberg 91.7%
- Kottbus 24.1%
- Kitovideo 6.9%
- Derby 10.3%
- Mbandaka 3.4%
- Bardo 3.4%

2012 (5 positive flocks)
- Mbandaka 20.0%
- Derby 80.0%

2013 (3 positive flocks)
- Derby 33.3%
- Kedougou 66.7%

2014 (11 positive flocks)
- Senftenberg 100.0%

2015 (5 positive flocks)
- Dublin 20.0%
- Derby 60.0%

2016 (5 positive flocks)
- Senftenberg 40.0%
- Derby 60.0%