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## **Third and Fourth Quarter Results for Serotyping of Salmonellae from Meat and Poultry Products**

**July-December 2006**

The Food Safety and Inspection Service (FSIS) issued the Pathogen Reduction; Hazard Analysis and Critical Control Point (PR/HACCP) Systems, Final Rule on July 25, 1996: Federal Register, Vol. 61, No. 144, pp. 38805-38989 (<http://www.fsis.usda.gov/OPPDE/rdad/FRPubs/93-016F.pdf>). The PR/HACCP rule sets *Salmonella* performance standards for establishments slaughtering selected classes of food animals or producing selected classes of raw ground products to verify that industry systems are effective in controlling the contamination of raw meat and poultry products with disease-causing bacteria. Raw products with established performance standards include: carcasses of cows/bulls, steers/heifers, market hogs, and broilers. Processed products measured by performance standards include: ground beef, ground chicken, and ground turkey. The performance standards for these product classes are based on the prevalence of *Salmonella* as determined from the Agency's nationwide microbiological baseline studies conducted before PR/HACCP was implemented. In addition, turkey carcass sampling for *Salmonella* was initiated June 2006. Guidance using young turkey carcass baseline levels can be found in Federal Register, Vol.70, No. 32, pp.8058-8060 (<http://www.fsis.usda.gov/OPPDE/rdad/FRPubs/02-046N.pdf>).

In February 2006, FSIS announced, in the Federal Register, Vol. 71, No. 38, pp. 9772-9777, (<http://www.fsis.usda.gov/Frame/FrameRedirect.asp?main=http://www.fsis.usda.gov/OPPDE/rdad/FRPubs/04-026N.htm>) that quarterly results from *Salmonella* verification testing would be posted and that the Agency would be providing individual test results to establishments before completion of a set. The Agency began publishing quarterly reports of *Salmonella* results ([http://www.fsis.usda.gov/Science/Q1\\_2006\\_Salmonella\\_Testing/index.asp](http://www.fsis.usda.gov/Science/Q1_2006_Salmonella_Testing/index.asp); [http://www.fsis.usda.gov/Science/Q2\\_2006\\_Salmonella\\_Testing/index.asp](http://www.fsis.usda.gov/Science/Q2_2006_Salmonella_Testing/index.asp)) in 2006 and began a procedure to notify establishments of individual results (<http://www.fsis.usda.gov/OPPDE/rdad/FSISNotices/36-06.pdf>) on June 29, 2006. In addition, the Agency began the quarterly reporting of *Salmonella* serotype data as such data provides an opportunity to examine, still further, the association among salmonellae isolated on-farm, from meat and poultry products, and from human cases of salmonellosis. The Agency recognizes that serotyping information alone does not provide definitive associations.

Prior to 2006, there were two phases of the FSIS regulatory program for *Salmonella* in raw products: non-targeted and targeted testing. Non-targeted or "A" set samples were collected at establishments randomly selected from the population of eligible establishments, with a goal of scheduling every eligible establishment at least once a



year. Other codes (such as "B", "C", and "D") represented sample sets collected from establishments targeted for follow-up testing following a failed set.

Beginning June 2006, establishments were scheduled based on new criteria ([http://www.fsis.usda.gov/pdf/scheduling\\_criteria\\_salmonella\\_sets.pdf](http://www.fsis.usda.gov/pdf/scheduling_criteria_salmonella_sets.pdf) (PDF only) that are risk-based, not random, and are designed to focus FSIS resources on establishments with the most samples positive for *Salmonella* and the greatest number of samples with serotypes most frequently associated with human salmonellosis, as defined by the Center for Disease Control and Prevention (CDC) (<http://www.cdc.gov/ncidod/dbmd/phlisdata/salmonella.htm>). While the first quarterly report included only "A" set data, this report summarizes data from all sets. The graphs in this report include all samples from July 2005 forward so that this report is consistent with the 2006 third quarter progress report on *Salmonella* testing ([http://www.fsis.usda.gov/Science/Q3\\_2006\\_Salmonella\\_Testing/index.asp](http://www.fsis.usda.gov/Science/Q3_2006_Salmonella_Testing/index.asp)). Given the changes made to the testing program in 2006 and recovery of only a few isolates of a particular serotype during the quarter, trends in quarter-to-quarter results should be interpreted with caution.

## Results

- The number of isolates of each serotype, the percent of isolates out of total positive, and the percent of isolates of total samples collected are displayed in Tables 1-8 (July through September [3<sup>rd</sup> Quarter]) and Tables 9-16 (October through December [4<sup>th</sup> Quarter]) 2006.
- The ten most commonly isolated serotypes for each product class during each quarter are identified by name, while less commonly identified serotypes are included in the "other serotypes" category. Where there is more than one serotype in tenth place, all serotypes in tenth place are listed.
- Included in the tables are entries classified as "unidentified" isolates for which a single specific serotype could not be determined.
- Figures 1-6 show quarterly, by product class, data for the top six serotypes associated with human illness in 2005 (<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5514a2.htm>). The figures display the percent of isolates identified out of total isolates serotyped for each product class by quarter from July 2005.
- Serotype data for Turkey carcasses is reported in Table 8 and 16.
- The y-axis, representing the serotype percentage varies from graph to graph because the level of different serotypes by commodity varies greatly and year-to-year variations in percentages are difficult to discern on one scale of high value.



Table 1  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Broilers  
All Samples – 3rd Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Kentucky	298	53.99	6.45
Enteritidis	64	11.59	1.38
Heidelberg	63	11.41	1.36
Typhimurium	20	3.62	0.43
Typhimurium (var. Copenhagen)	19	3.44	0.41
4,5,12:i:-	18	3.26	0.39
Montevideo	9	1.63	0.19
Mbandaka	7	1.27	0.15
4,12;i:-	6	1.09	0.13
Schwarzengrund	6	1.09	0.13
Other serotypes	39	7.07	0.84
Unidentified	3	0.54	0.06
Total positive	552		11.94
Total number of analyzed samples	4622		



Table 2  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Market Hogs  
All Samples – 3rd Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Derby	19	19.79	0.91
Anatum	16	16.67	0.77
Anatum var. 15+	10	10.42	0.48
Saint-Paul	9	9.38	0.43
Johannesburg	7	7.29	0.34
Typhimurium (var. Copenhagen)	6	6.25	0.29
Infantis	5	5.21	0.24
Adelaide	3	3.13	0.14
Agona	3	3.13	0.14
Typhimurium	3	3.13	0.14
Other serotypes	15	15.63	0.72
Total positive	96		4.62
Total number of analyzed samples		2080	



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Table 3  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Cows/Bulls  
All Samples – 3rd Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Cerro	1	20.00	0.15
Kentucky	1	20.00	0.15
Meleagridis	1	20.00	0.15
Montevideo	1	20.00	0.15
Muenster	1	20.00	0.15
Other serotypes	0		
Total positive	5		0.76
Total number of analyzed samples	655		



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Table 4  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Steers/Heifers  
All Samples – 3rd Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Newport	2	33.33	0.18
Adelaide	1	16.67	0.09
Montevideo	1	16.67	0.09
Muenster	1	16.67	0.09
Saint-Paul	1	16.67	0.09
Other serotypes	0		
Total positive	6		0.55
Total number of analyzed samples	1100		



Table 5  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Ground Beef  
All Samples – 3rd Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Montevideo	22	19.47	0.63
Newport	10	8.85	0.29
Reading	9	7.96	0.26
Anatum	8	7.08	0.23
Cerro	7	6.19	0.20
Muenster	7	6.19	0.20
Agona	6	5.31	0.17
Kentucky	5	4.42	0.14
Meleagridis	5	4.42	0.14
Senftenberg	5	4.42	0.14
Other serotypes	29	25.66	0.84
Total positive	113		3.26
Total number of analyzed samples		3466	



Table 6  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Ground Chicken  
All Samples – 3rd Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Heidelberg	8	29.63	11.43
Kentucky	7	25.93	10.00
Enteritidis	6	22.22	8.57
4,5,12:i:-	1	3.70	1.43
Berta	1	3.70	1.43
Infantis	1	3.70	1.43
Thompson	1	3.70	1.43
Other serotypes	0		
Unidentified	2	7.41	2.86
Total positive	27		38.57
Total number of analyzed samples		70	





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Table 7  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Ground Turkey  
All Samples – 3rd Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Hadar	2	100	7.41
Other serotypes	0		
Total positive	2		7.41
Total number of analyzed samples	27		



Table 8  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Turkeys  
All Samples – 3rd Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Hadar	39	32.50	2.86
Heidelberg	21	17.50	1.54
Reading	7	5.83	0.51
Saint-Paul	7	5.83	0.51
Agona	6	5.00	0.44
Schwarzengrund	6	5.00	0.44
Anatum	4	3.33	0.29
Senftenberg	4	3.33	0.29
Muenster	3	2.50	0.22
Albany	2	1.67	0.15
Muenchen	2	1.67	0.15
Worthington	2	1.67	0.15
Other serotypes	14	11.67	1.03
Unidentified	3	2.50	0.22
Total positive	120		8.81
Total number of analyzed samples		1362	



Table 9  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Broilers  
All Samples – 4th Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Kentucky	127	45.20	4.75
Enteritidis	41	14.59	1.53
Heidelberg	26	9.25	0.97
Typhimurium (var. Copenhagen)	18	6.41	0.67
4,5,12:i:-	14	4.98	0.52
Typhimurium	10	3.56	0.37
Infantis	8	2.85	0.30
4,12;i:-	5	1.78	0.19
Mbandaka	4	1.42	0.15
Schwarzengrund	4	1.42	0.15
Other serotypes	23	8.19	0.86
Unidentified	1	0.36	0.04
Total positive	281		10.51
Total number of analyzed samples	2673		



Table 10  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Market Hogs  
All Samples – 4th Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Derby	12	20.69	0.77
Johannesburg	8	13.79	0.51
Anatum	7	12.07	0.45
Typhimurium (var. Copenhagen)	6	10.34	0.39
Manhattan	3	5.17	0.19
Hadar	2	3.45	0.13
Infantis	2	3.45	0.13
London	2	3.45	0.13
Saint-Paul	2	3.45	0.13
Agona	1	1.72	0.06
Adelaide	1	1.72	0.06
Alachua	1	1.72	0.06
Anatum var. 15+, 34+	1	1.72	0.06
Berta	1	1.72	0.06
Cholerasuis	1	1.72	0.06
Kentucky	1	1.72	0.06
Mbandaka	1	1.72	0.06
Newport	1	1.72	0.06
Ohio	1	1.72	0.06
Typhimurium	1	1.72	0.06
Thompson	1	1.72	0.06
Uganda	1	1.72	0.06
Other serotypes	0		
Unidentified	1	1.72	0.06
Total positive	58		3.73
Total number of analyzed samples	1554		



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Table 11  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Cows/Bulls  
All Samples – 4th Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Montevideo	2	66.67	0.45
Dublin	1	33.33	0.23
Other serotypes	0		
Total positive	3		0.68
Total number of analyzed samples	443		



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Table 12  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Steers/Heifers  
All Samples – 4th Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Bere	1	50.00	0.09
Reading	1	50.00	0.09
Other serotypes	0		
Total positive	2		0.17
Total number of analyzed samples	1148		



Table 13  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Ground Beef  
All Samples – 4th Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Montevideo	14	17.50	0.51
Anatum	7	8.75	0.25
Typhimurium	6	7.50	0.22
Newport	6	7.50	0.22
Cerro	4	5.00	0.15
Dublin	4	5.00	0.15
Kentucky	4	5.00	0.15
Muenster	4	5.00	0.15
Reading	4	5.00	0.15
Mbandaka	3	3.75	0.11
Typhimurium (var. Copenhagen)	3	3.75	0.11
Other serotypes	20	25.00	0.73
Unidentified	1	1.25	0.04
Total positive	80		2.90
Total number of analyzed samples	2758		



Table 14  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Ground Chicken  
All Samples – 4th Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Kentucky	11	30.56	13.58
Enteritidis	7	19.44	8.64
Heidelberg	6	16.67	7.41
4,5,12:i:-	2	5.56	2.47
Typhimurium	2	5.56	2.47
Anatum	1	2.78	1.23
Berta	1	2.78	1.23
Infantis	1	2.78	1.23
Mbandaka	1	2.78	1.23
Montevideo	1	2.78	1.23
Schwarzengrund	1	2.78	1.23
Typhimurium (var. Copenhagen)	1	2.78	1.23
Other serotypes	0		
Unidentified	1	2.78	1.23
Total positive	36		44.44
Total number of analyzed samples		81	





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Table 15  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Ground Turkey  
All Samples – 4th Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Hadar	3	37.50	9.09
Agona	2	25.00	6.06
Albany	1	12.50	3.03
Reading	1	12.50	3.03
Saint-Paul	1	12.50	3.03
Other serotypes	0		
Total positive	8		24.24
Total number of analyzed samples	33		

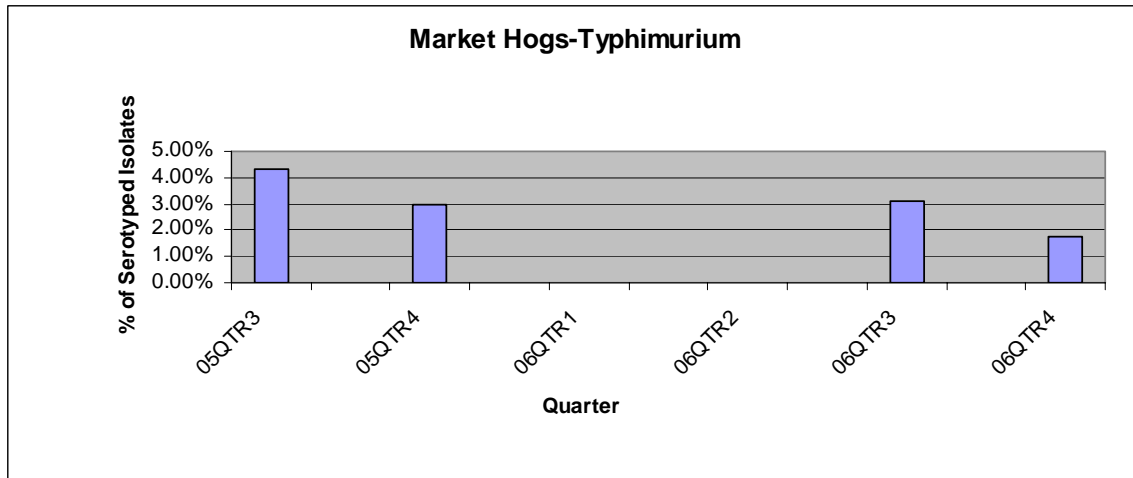
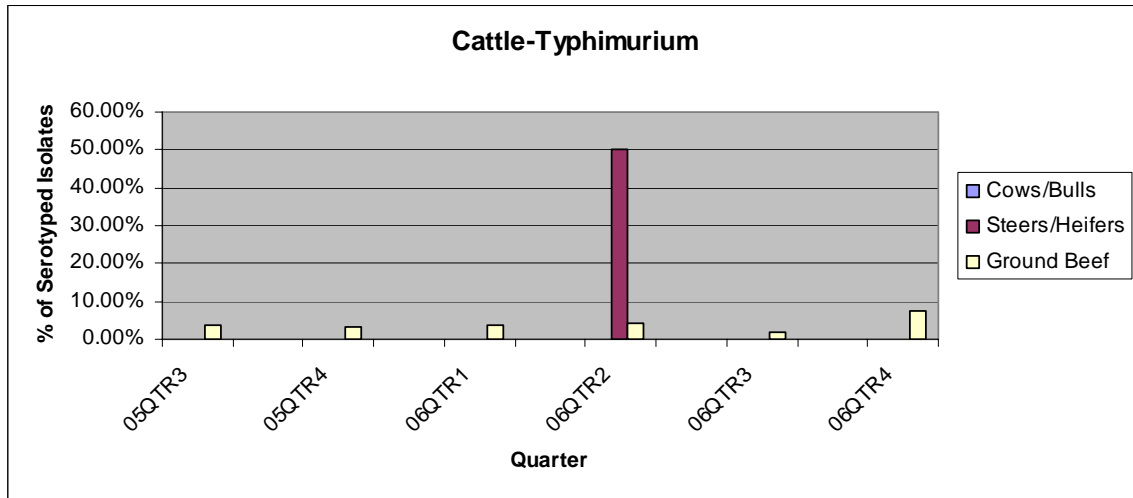
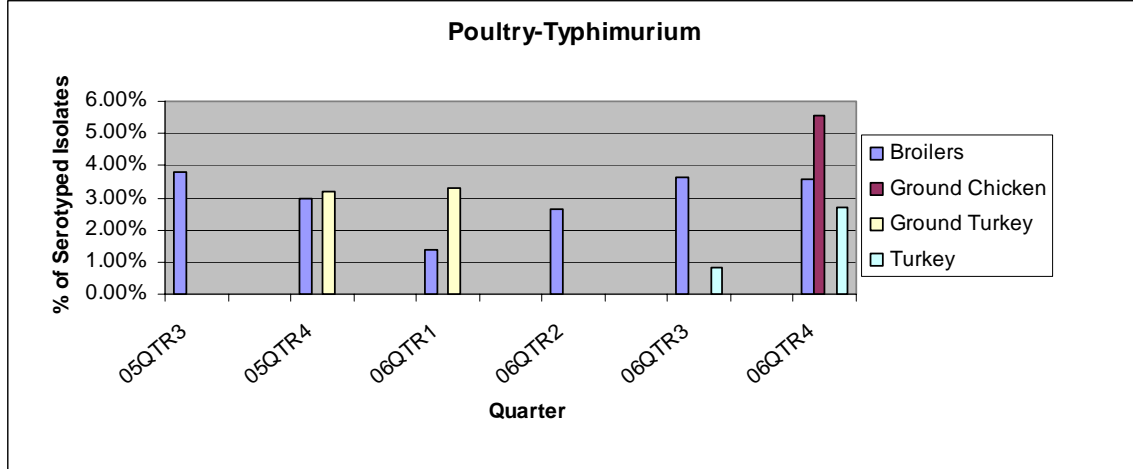


Table 16  
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.  
Turkeys  
All Samples – 4th Quarter 2006

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Hadar	10	27.03	0.98
Reading	6	16.22	0.59
Schwarzengrund	3	8.11	0.30
Senftenberg	3	8.11	0.30
Heidelberg	2	5.41	0.20
Kentucky	2	5.41	0.20
Saint-Paul	2	5.41	0.20
Agona	1	2.70	0.10
Cubana	1	2.70	0.10
Derby	1	2.70	0.10
Montevideo	1	2.70	0.10
Muenchen	1	2.70	0.10
Newport	1	2.70	0.10
Orion	1	2.70	0.10
Typhimurium	1	2.70	0.10
Other serotypes	0		
Unidentified	1	2.70	0.10
Total positive	37		3.64
Total number of analyzed samples		1016	



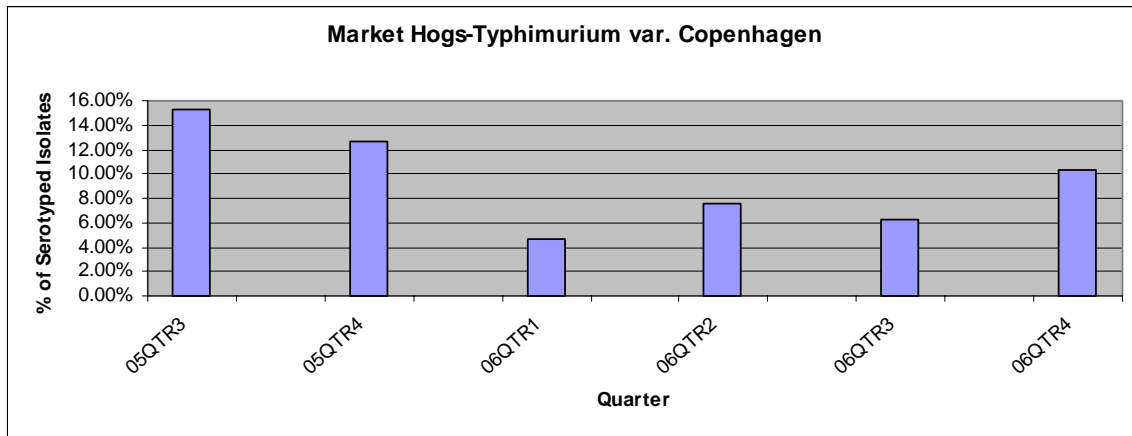
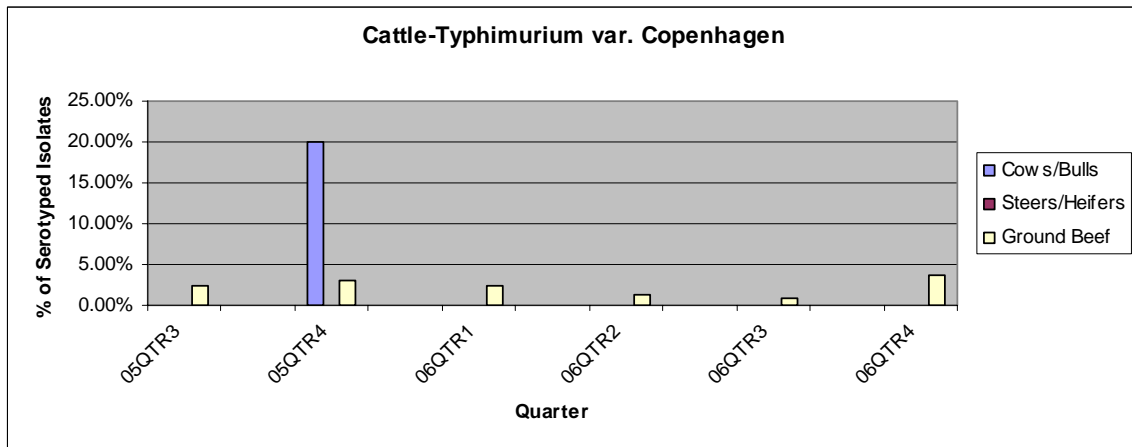
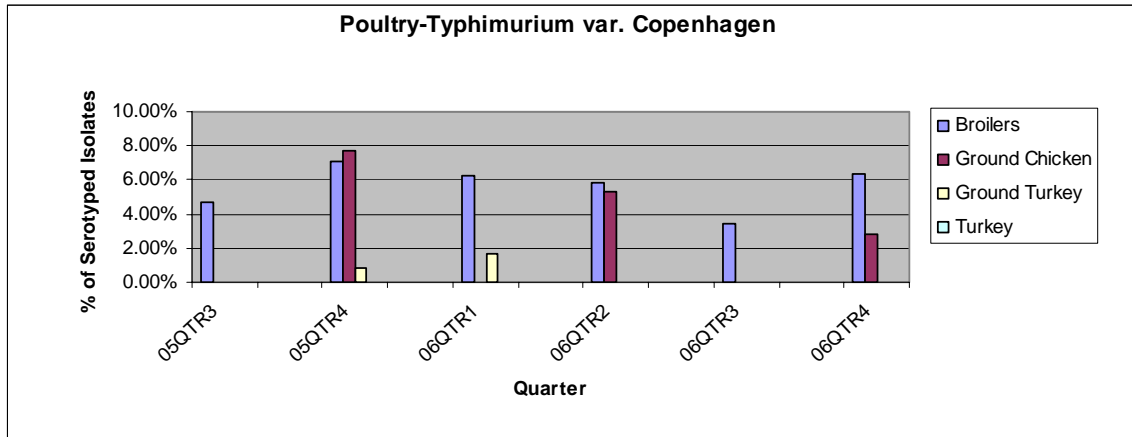
Figure 1  
Typhimurium – USDA, FSIS, PR/HACCP Verification Sampling by Quarter\*  
All Samples



\*Please note that the y-axis % varies from graph to graph.



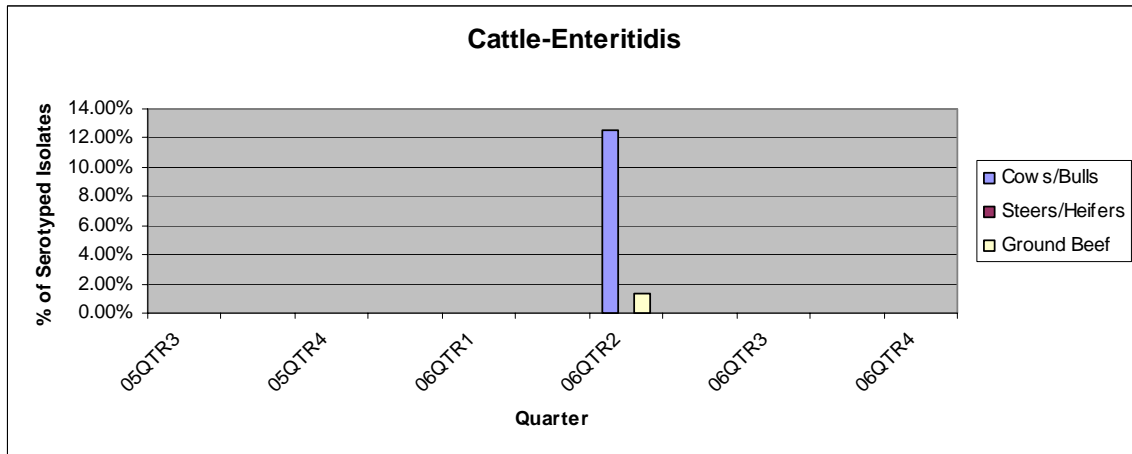
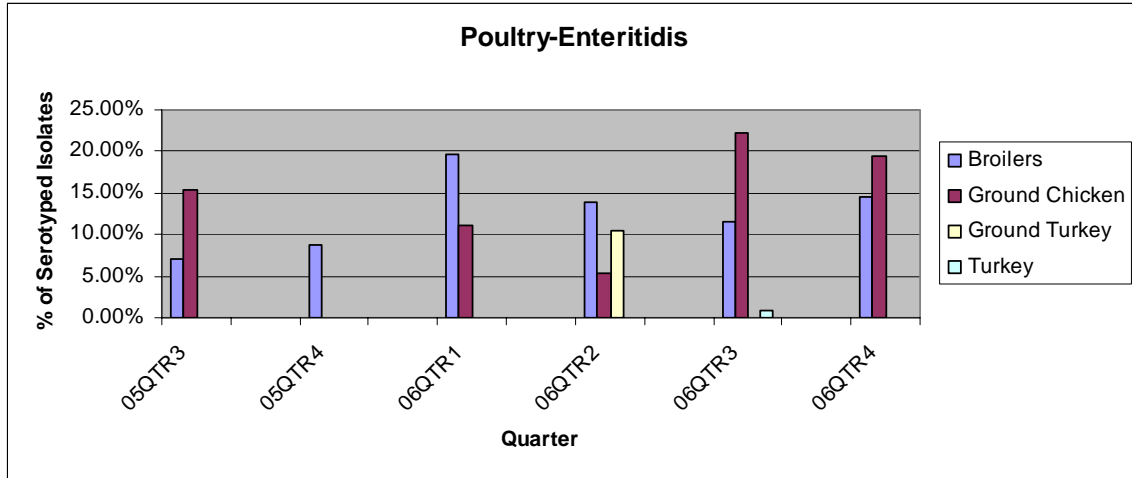
Figure 2  
Typhimurium var. Copenhagen – USDA, FSIS, PR/HACCP Verification Sampling by  
Quarter\*  
All Samples



\*Please note that the y-axis % varies from graph to graph.



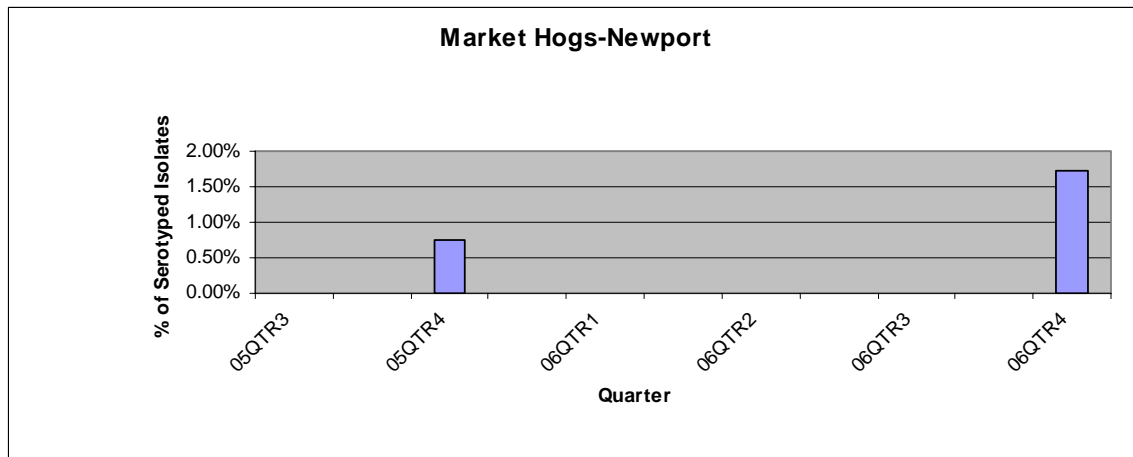
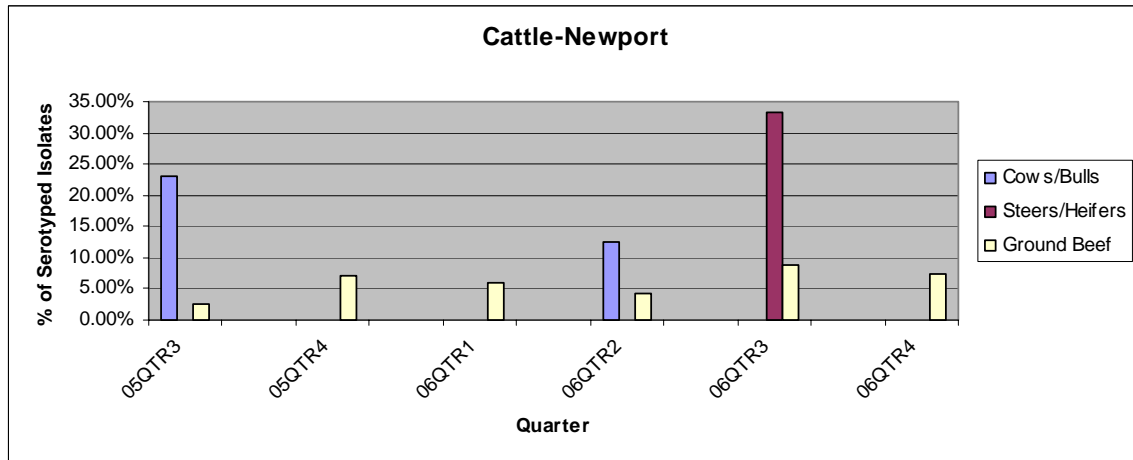
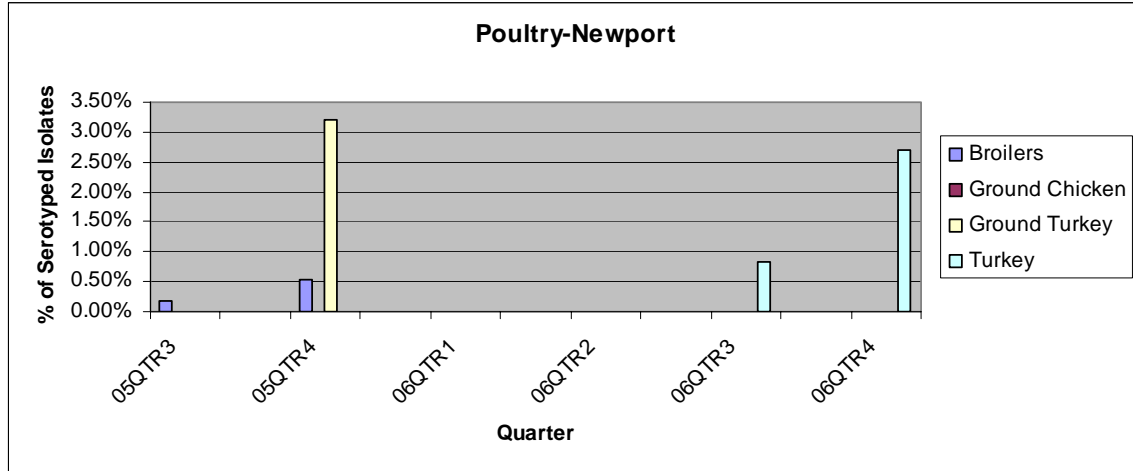
Figure 3  
Enteritidis – USDA, FSIS, PR/HACCP Verification Sampling by Quarter\*  
All Samples



\*Please note that the y-axis % varies from graph to graph. There were no Enteritidis isolates recovered for the time period in market hogs.



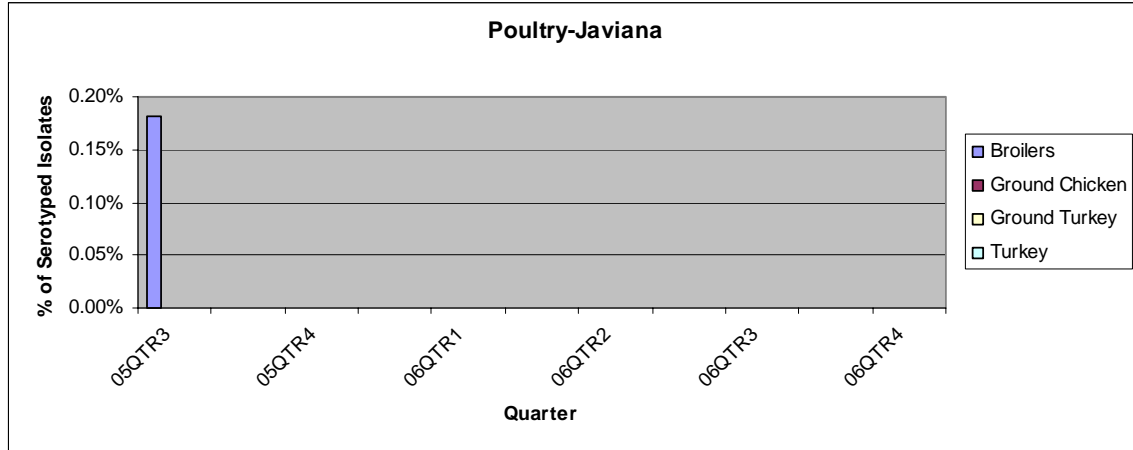
Figure 4  
Newport – USDA, FSIS, PR/HACCP Verification Sampling by Quarter\*  
All Samples



\*Please note that the y-axis % varies from graph to graph.



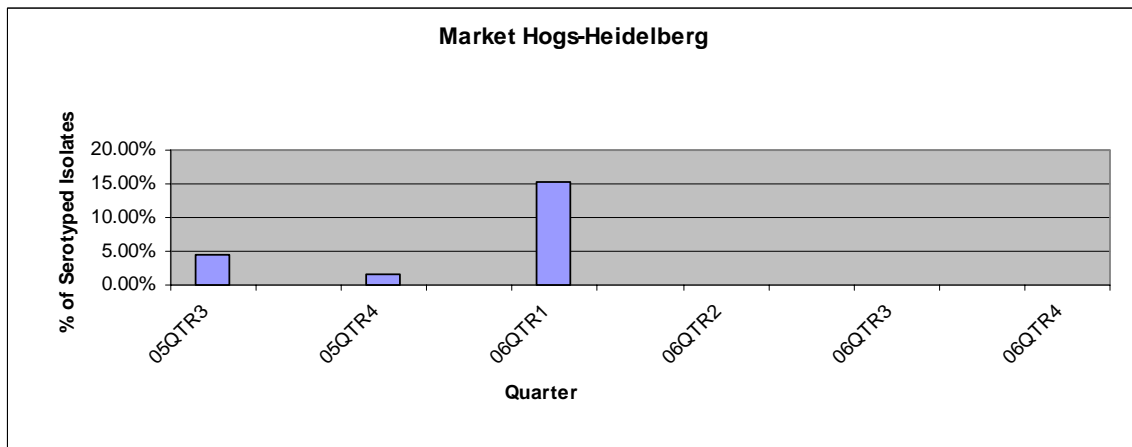
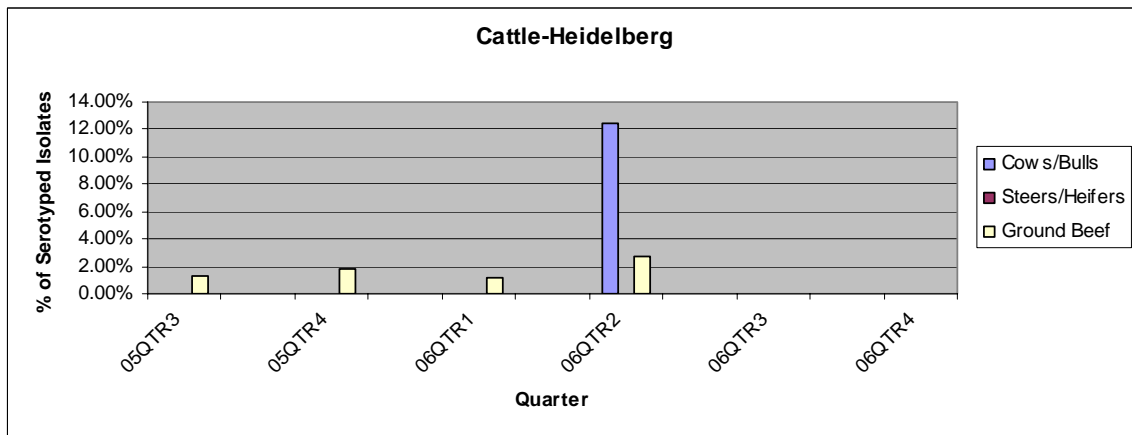
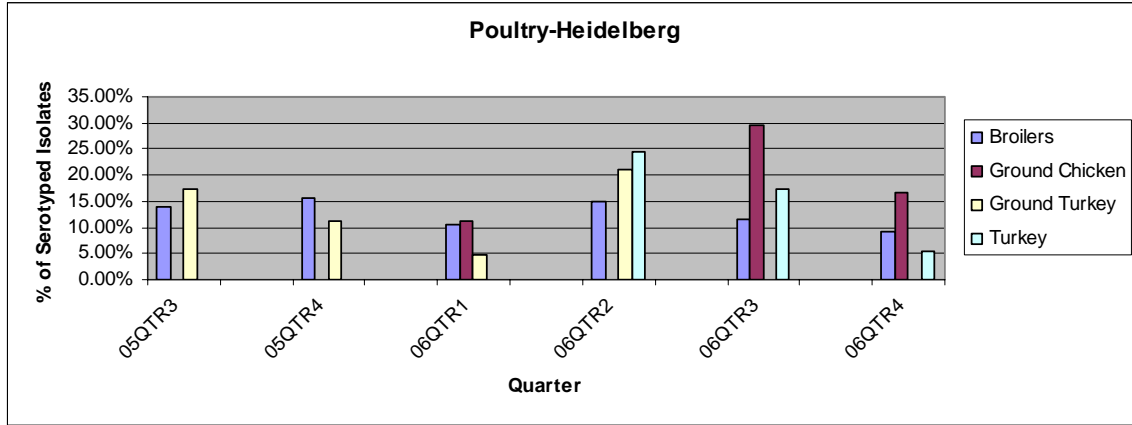
Figure 5  
Javiana – USDA, FSIS, PR/HACCP Verification Sampling by Quarter\*  
All Samples



\* There were no Javiana isolates recovered for the time period in cattle and market hogs.



Figure 6  
Heidelberg – USDA, FSIS, PR/HACCP Verification Sampling by Quarter\*  
All Samples



\*Please note that the y-axis % varies from graph to graph.