



United States
Department of
Agriculture

Food Safety
And Inspection
Service

First and Second Quarter Results for Serotyping of Salmonellae from Meat and Poultry Products

January – June 2007

Background

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 that slaughter or produce selected classes of food animals or raw ground products. Under PR/HACCP, performance standards were established for carcasses of cows/bulls, steers/heifers, market hogs, and broilers and ground beef, ground chicken, and ground turkey based on nationwide microbiological baseline studies conducted before the rule was implemented. In June 2006, FSIS began sampling turkey carcasses for *Salmonella*. Guidance on turkey carcass levels can be found in the Federal Register, Vol.70, No. 32, pp.8058-8060 (<http://www.fsis.usda.gov/OPPDE/rdad/FRPubs/02-046N.pdf>).

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. FSIS replaced the targeted/non-targeted approach with risk-based scheduling in 2006. The Serotype data here are from all sample sets.

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 provide individual test results to establishments before completion of a set. The Agency has published quarterly *Salmonella* results since 2006 (http://www.fsis.usda.gov/Science/Q1_2007_Salmonella_Testing/index.asp; http://www.fsis.usda.gov/Science/Q2_2007_Salmonella_Testing/index.asp).

In June 2006, FSIS developed new criteria for scheduling establishments (http://www.fsis.usda.gov/pdf/scheduling_criteria_salmonella_sets.pdf, PDF only) that are risk-based and designed to focus FSIS resources on establishments that have the most samples positive for *Salmonella* and the greatest number of samples with serotypes most frequently associated with human salmonellosis as defined by the Centers for Disease Control and Prevention (CDC) (<http://www.cdc.gov/ncidod/dbmd/phlisdata/salmonella.htm>). Establishments are no longer randomly selected under the new criteria. The collection of serotype data is not designed for trend analysis. One of the goals of the revised risk-based program is to identify the source of serotypes of the greatest human health concern and to report those findings directly to establishments as they become available. FSIS also now ensures that all pathogens of public health concern are identified regarding both their subtype (serotype and PFGE pattern) and their drug resistance profiles.



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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 (January through March of the 1st Quarter) and Tables 9-16 (April through June of the 2nd Quarter).

The ten most commonly isolated serotypes for each product class during each quarter are identified by name. Less commonly identified serotypes are included in the “other serotypes” category. When there is more than one serotype in tenth place, all serotypes in tenth place are listed.

The tables include entries classified as “unidentified” isolates. A single, specific serotype could not be determined for these isolates.

Tables 8 and 16 show serotype data for turkey carcasses. Turkey carcass testing began in the 2nd quarter of 2006.

Figures 1-8 display the percent of isolates identified out of total isolates serotyped for each product class by quarter from July 2005 forward for the top eight serotypes associated with human illness in 2006 (for consistency in the graphs, data collected prior to the 2006 revisions was updated to include results from all sets)

(http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5614a4.htm?s_cid=mm5614a4_e).

For Figures 1-8, 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.

Limitations

FSIS can not determine how the revised *Salmonella* testing program affects the distribution of serotypes from positive samples. Thus, comparisons of results from 2006 onward to previous years are inappropriate. Similarly, the changes to the verification program prevent valid comparisons of testing results over time (e.g., quarter-to quarter or year-to-year trends). For such comparisons, the results of upcoming nationwide baseline studies can be used to provide valid estimates of the prevalence of certain pathogens of public health concern and permit valid statistical comparisons to be made over time. A 12-month Young Chicken (Broiler) Baseline Study is currently in progress, and additional baseline studies are under development.

Salmonella verification testing is conducted to establish regulatory compliance (http://www.fsis.usda.gov/Science/Scheduling_Criteria_Salmonella_Sets/index.asp), not to establish prevalence of either *Salmonella* or specific serotypes of *Salmonella*. Data reported here are not intended to be reflective of national trends in prevalence of serotypes.



Table 1
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Broilers
All Samples – 1st Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Kentucky	138	50.92	4.91
Heidelberg	36	13.28	1.28
Enteritidis	26	9.59	0.93
Typhimurium (var. Copenhagen)	19	7.01	0.68
Typhimurium	8	2.95	0.28
4,5,12:i:-	5	1.85	0.18
Infantis	5	1.85	0.18
Berta	4	1.48	0.14
4,12;i:-	3	1.11	0.11
Mbandaka	3	1.11	0.11
Schwarzengrund	3	1.11	0.11
Other serotypes	18	6.64	0.64
Unidentified	3	1.11	0.11
Total positive	271		9.64
Total number of analyzed samples		2810	



Table 2
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Market Hogs
All Samples – 1st Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Typhimurium (var. Copenhagen)	10	21.74	0.57
Derby	5	10.87	0.29
Johannesburg	5	10.87	0.29
London	5	10.87	0.29
Hadar	4	8.70	0.23
Anatum	2	4.35	0.11
Typhimurium	2	4.35	0.11
Agona	1	2.17	0.06
Anatum var. 15+, 34+	1	2.17	0.06
Berta	1	2.17	0.06
Bovismorbificans	1	2.17	0.06
Choleraesuis (var. Kunzendorf)	1	2.17	0.06
Muenchen	1	2.17	0.06
Saint-Paul	1	2.17	0.06
Schwarzengrund	1	2.17	0.06
Uganda	1	2.17	0.06
Worthington	1	2.17	0.06
Other serotypes	0		
Unidentified	3	6.52	0.17
Total positive	46		2.63
Total number of analyzed samples	1747		



Table 3
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Cows/Bulls
All Samples – 1st Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Anatum	3	20.00	0.25
Cerro	3	20.00	0.25
Newport	2	13.33	0.17
3,10:e,h:-	1	6.67	0.08
Enteritidis	1	6.67	0.08
Kentucky	1	6.67	0.08
Meleagridis	1	6.67	0.08
Montevideo	1	6.67	0.08
Saint-Paul	1	6.67	0.08
Other serotypes	1	6.67	0.08
Total positive	15		1.24
Total number of analyzed samples	1206		



Table 4
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Steers/Heifers
All Samples – 1st Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Unidentified	1	100.00	0.07
Total positive	1		0.07
Total number of analyzed samples	1337		



Table 5
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Ground Beef
All Samples – 1st Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Montevideo	7	15.22	0.25
Dublin	6	13.04	0.21
Meleagridis	4	8.70	0.14
Reading	4	8.70	0.14
Anatum	2	4.35	0.07
Enteritidis	2	4.35	0.07
Give	2	4.35	0.07
Havana	2	4.35	0.07
Infantis	2	4.35	0.07
4,5,12:i:-	1	2.17	0.04
Agona	1	2.17	0.04
Adelaide	1	2.17	0.04
Amsterdam	1	2.17	0.04
Bovismorbificans	1	2.17	0.04
Cubana	1	2.17	0.04
Fresno	1	2.17	0.04
III48:1,v:	1	2.17	0.04
Kentucky	1	2.17	0.04
Lille	1	2.17	0.04
Mbandaka	1	2.17	0.04
Minnesota	1	2.17	0.04
Muenster	1	2.17	0.04
Newport	1	2.17	0.04
Typhimurium (var. Copenhagen)	1	2.17	0.04
Other serotypes	0		
Total positive	46		1.64
Total number of analyzed samples	2807		



Table 6
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Ground Chicken
All Samples – 1st Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Kentucky	17	28.33	12.23
Enteritidis	13	21.67	9.35
Heidelberg	13	21.67	9.35
4,5,12:i:-	4	6.67	2.88
Infantis	2	3.33	1.44
Schwarzengrund	2	3.33	1.44
6,7:-:1,5	1	1.67	0.72
Berta	1	1.67	0.72
Hadar	1	1.67	0.72
Mbandaka	1	1.67	0.72
Minnesota	1	1.67	0.72
Thompson	1	1.67	0.72
Uganda	1	1.67	0.72
Other serotypes	0		
Unidentified	2	3.33	1.44
Total positive	60		43.17
Total number of analyzed samples		139	



Table 7
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Ground Turkey
All Samples – 1st Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Hadar	6	40.00	7.89
Agona	3	20.00	3.95
4,12:d:-	1	6.67	1.32
Anatum var 15+, 34+	1	6.67	1.32
III 18:z4,z23:-	1	6.67	1.32
Mbandaka	1	6.67	1.32
Newport	1	6.67	1.32
Typhimurium	1	6.67	1.32
Other serotypes	0		
Total positive	15		19.74
Total number of analyzed samples	76		



Table 8
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Turkeys
All Samples – 1st Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Hadar	20	43.48	2.23
Saint-Paul	5	10.87	0.56
Heidelberg	4	8.70	0.45
Berta	3	6.52	0.34
Newport	3	6.52	0.34
Agona	2	4.35	0.22
Montevideo	2	4.35	0.22
Muenchen	2	4.35	0.22
4,5,12:i:-	1	2.17	0.11
Schwarzengrund	1	2.17	0.11
Senftenberg	1	2.17	0.11
Worthington	1	2.17	0.11
Other serotypes	0		
Unidentified	1	2.17	0.11
Total positive	46		5.14
Total number of analyzed samples	895		



Table 9
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Broilers
All Samples – 2nd Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Kentucky	117	45.17	3.18
Enteritidis	30	11.58	0.82
Heidelberg	28	10.81	0.76
Typhimurium (var. Copenhagen)	21	8.11	0.57
Typhimurium	13	5.02	0.35
4,12;i:-	11	4.25	0.30
4,5,12:i:-	9	3.47	0.24
Montevideo	7	2.70	0.19
Infantis	5	1.93	0.14
Oranienburg	3	1.16	0.08
Schwarzengrund	3	1.16	0.08
Other serotypes	10	3.86	0.27
Unidentified	3	1.16	0.08
Total positive	259		7.04
Total number of analyzed samples		3678	



Table 10
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Market Hogs
All Samples – 2nd Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Derby	12	22.64	0.61
Typhimurium (var. Copenhagen)	8	15.09	0.41
Infantis	6	11.32	0.31
Anatum	5	9.43	0.25
Johannesburg	5	9.43	0.25
Typhimurium	5	9.43	0.25
London	4	7.55	0.20
Hadar	2	3.77	0.10
Saint-Paul	2	3.77	0.10
Adelaide	1	1.89	0.05
Brandenburg	1	1.89	0.05
Krefeld	1	1.89	0.05
Manhattan	1	1.89	0.05
Other serotypes	0		
Total positive	53		2.70
Total number of analyzed samples		1747	



Table 11
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Cows/Bulls
All Samples – 2nd Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Cerro	2	40.00	0.24
Anatum	1	20.00	0.12
Infantis	1	20.00	0.12
Montevideo	1	20.00	0.12
Other serotypes	0		
Total positive	5		0.59
Total number of analyzed samples	847		



Table 12
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Steers/Heifers
All Samples – 2nd Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Dublin	1	50.00	0.11
Kentucky	1	50.00	0.11
Other serotypes	0		
Total positive	2		0.21
Total number of analyzed samples	941		



Table 13
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Ground Beef
All Samples – 2nd Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Montevideo	21	21.65	0.44
Muenster	10	10.31	0.21
Dublin	8	8.25	0.17
Mbandaka	8	8.25	0.17
Cerro	7	7.22	0.15
Typhimurium	6	6.19	0.13
Kentucky	5	5.15	0.11
Meleagridis	4	4.12	0.08
Newport	4	4.12	0.08
Typhimurium (var. Copenhagen)	3	3.09	0.06
Other serotypes	20	20.62	0.42
Unidentified	1	1.03	0.02
Total positive	97		2.05
Total number of analyzed samples	4739		



Table 14
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Ground Chicken
All Samples – 2nd Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Enteritidis	14	50.00	8.86
Kentucky	7	25.00	4.43
4,5,12:i:-	2	7.14	1.27
Heidelberg	2	7.14	1.27
Infantis	1	3.57	0.63
Tennessee	1	3.57	0.63
Thompson	1	3.57	0.63
Other serotypes	0		
Total positive	28		17.72
Total number of analyzed samples	158		



Table 15
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Ground Turkey
All Samples – 2nd Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Hadar	13	31.71	4.73
Heidelberg	6	14.63	2.18
Saint-Paul	5	12.20	1.82
Reading	4	9.76	1.45
Agona	3	7.32	1.09
Newport	3	7.32	1.09
Albert	1	2.44	0.36
Anatum	1	2.44	0.36
Berta	1	2.44	0.36
Infantis	1	2.44	0.36
Schwarzengrund	1	2.44	0.36
Typhimurium	1	2.44	0.36
Uganda	1	2.44	0.36
Other serotypes	0		
Total positive	41		14.91
Total number of analyzed samples	275		

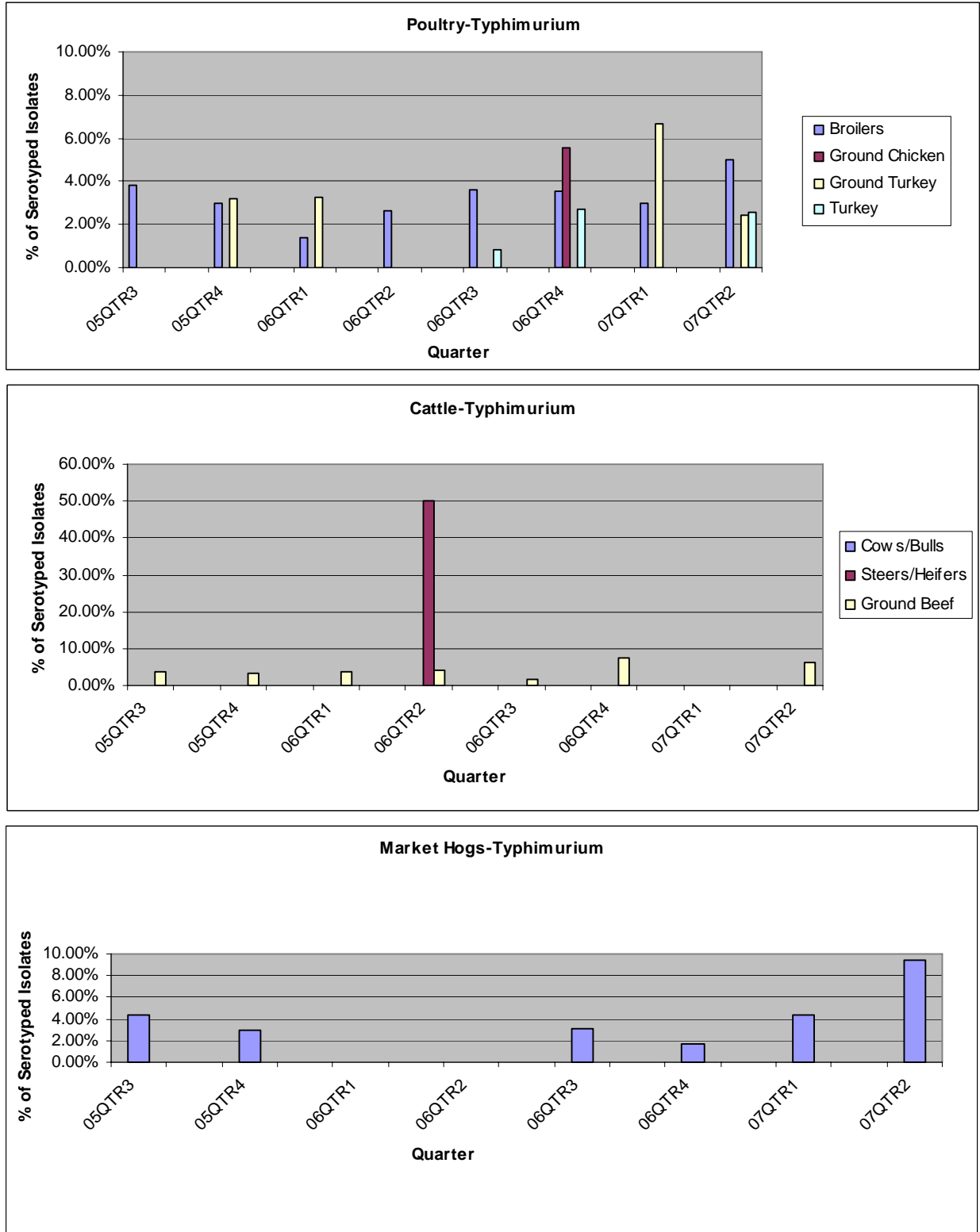


Table 16
Serotypes Profile of Analyzed PR/HACCP Verification Samples by Quarter.
Turkeys
All Samples – 2nd Quarter 2007

Serotypes	# Isolates	% of Total Positive	% Analyzed Samples
Hadar	25	64.10	4.63
Newport	2	5.13	0.37
Reading	2	5.13	0.37
Saint-Paul	2	5.13	0.37
Cerro	1	2.56	0.19
Cubana	1	2.56	0.19
Heidelberg	1	2.56	0.19
Montevideo	1	2.56	0.19
Schwarzengrund	1	2.56	0.19
Senftenberg	1	2.56	0.19
Typhimurium (var. Copenhagen)	1	2.56	0.19
Typhimurium	1	2.56	0.19
Other serotypes	0		
Total positive	39		7.22
Total number of analyzed samples	540		



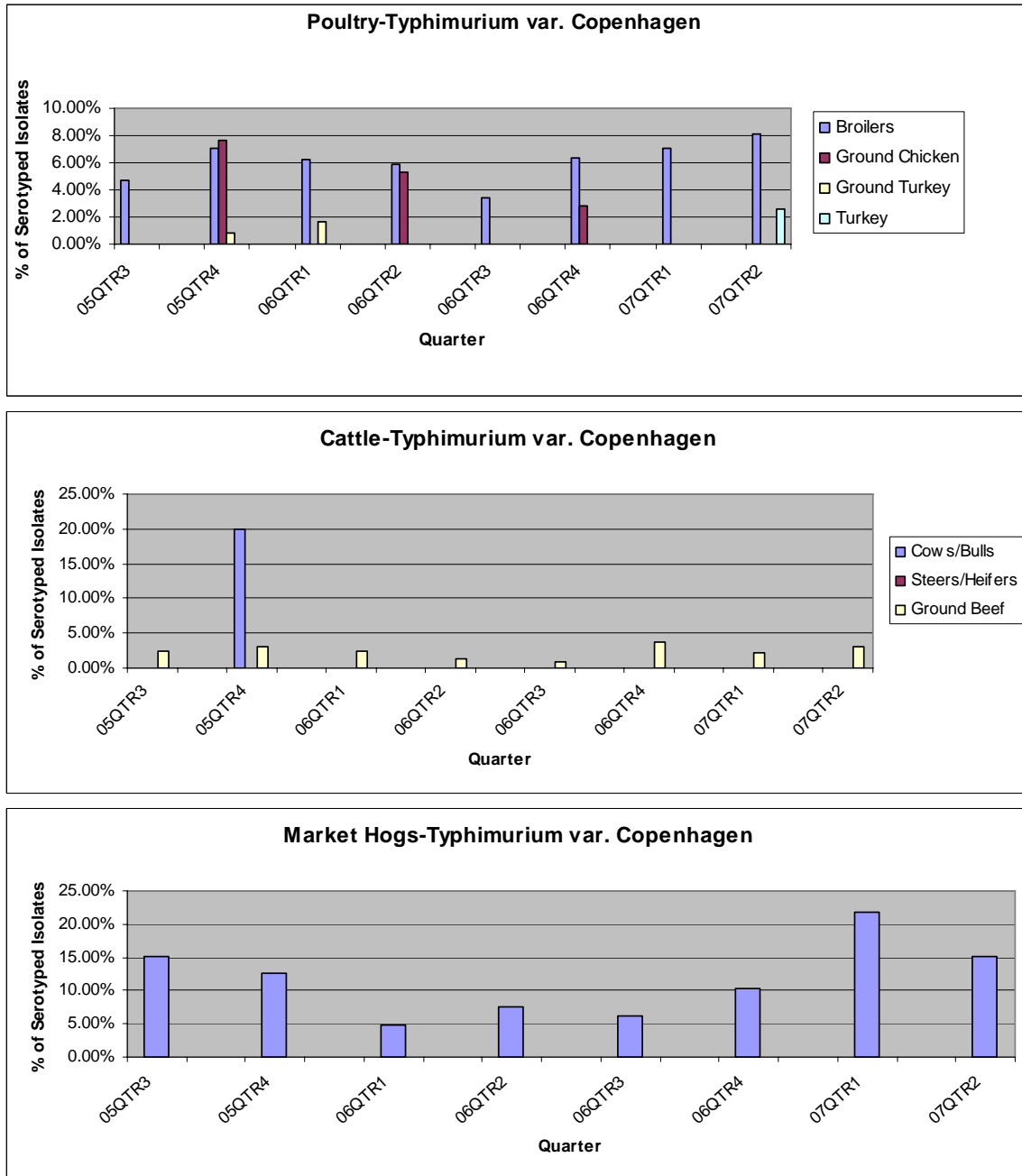
Figure 1
Typhimurium – USDA, FSIS, PR/HACCP Verification Sampling by Quarter*
All Samples



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



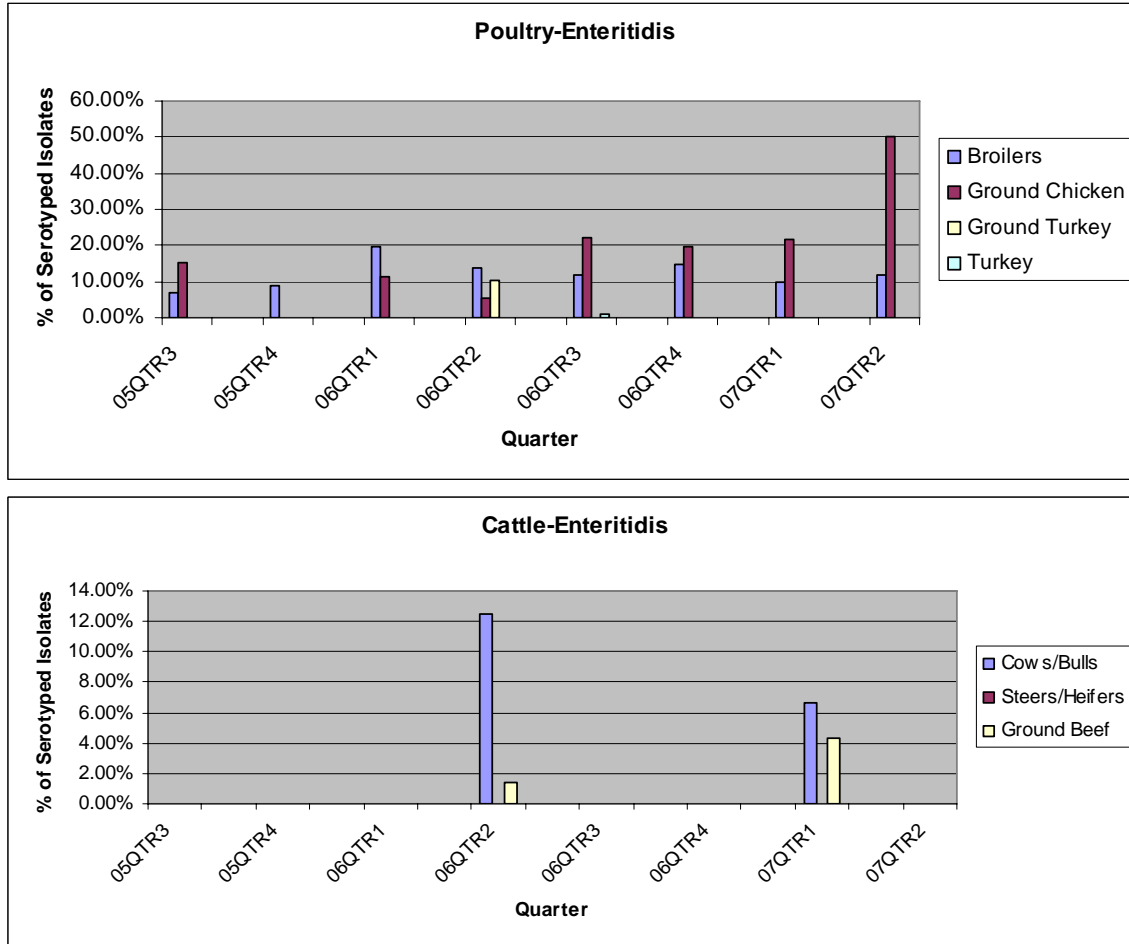
Figure 2
Typhimurium var. Copenhagen – USDA, FSIS, PR/HACCP Verification Sampling by Quarter*
All Samples



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



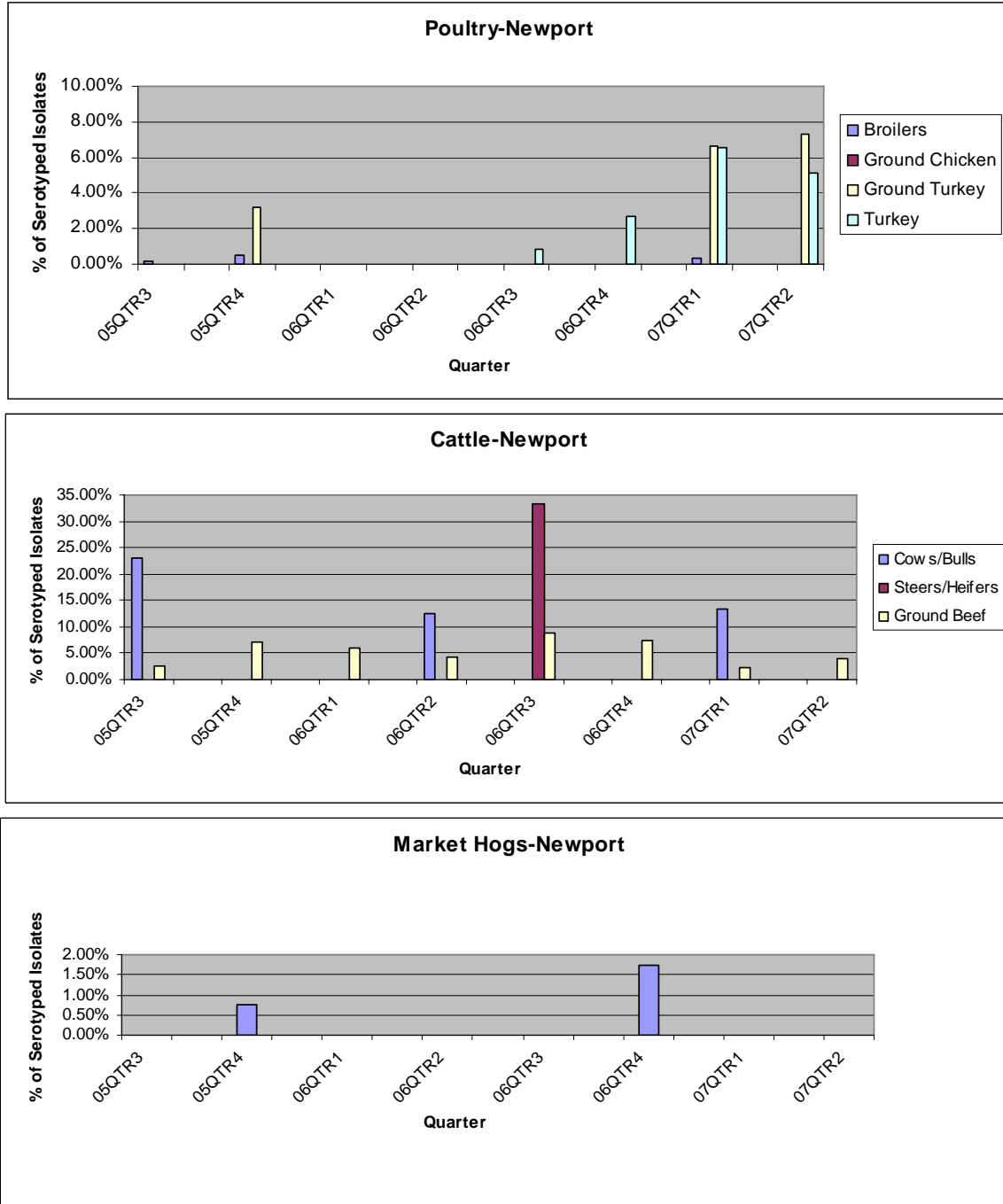
Figure 3
Enteritidis – USDA, FSIS, PR/HACCP Verification Sampling by Quarter*
All Samples



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



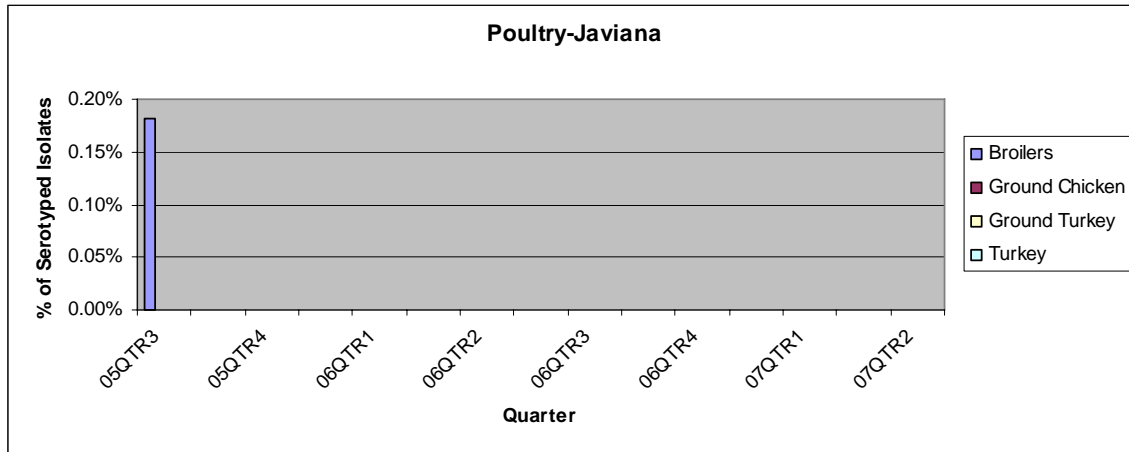
Figure 4
Newport – USDA, FSIS, PR/HACCP Verification Sampling by Quarter*
All Samples



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



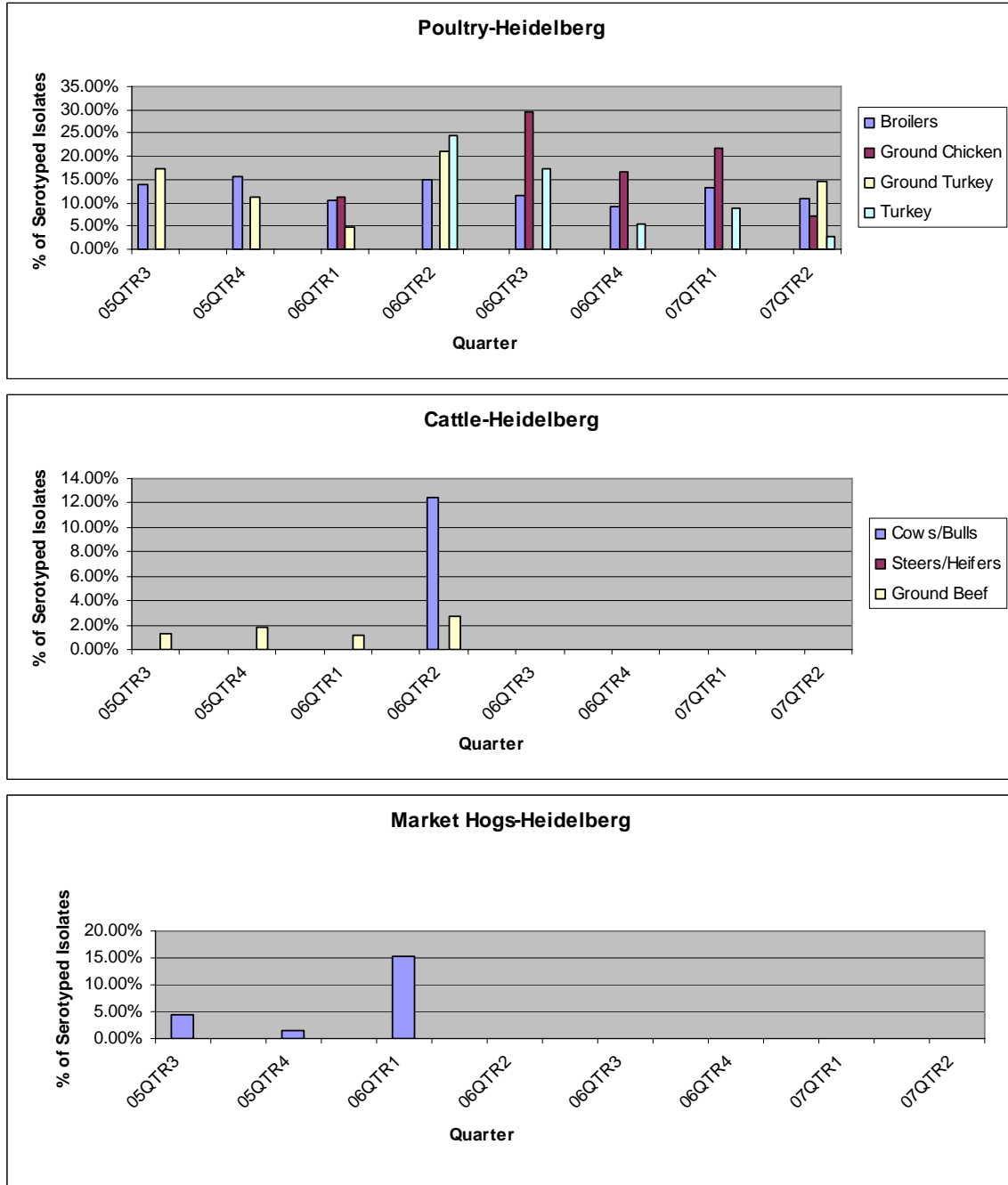
Figure 5
Javiana – USDA, FSIS, PR/HACCP Verification Sampling by Quarter*
All Samples



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



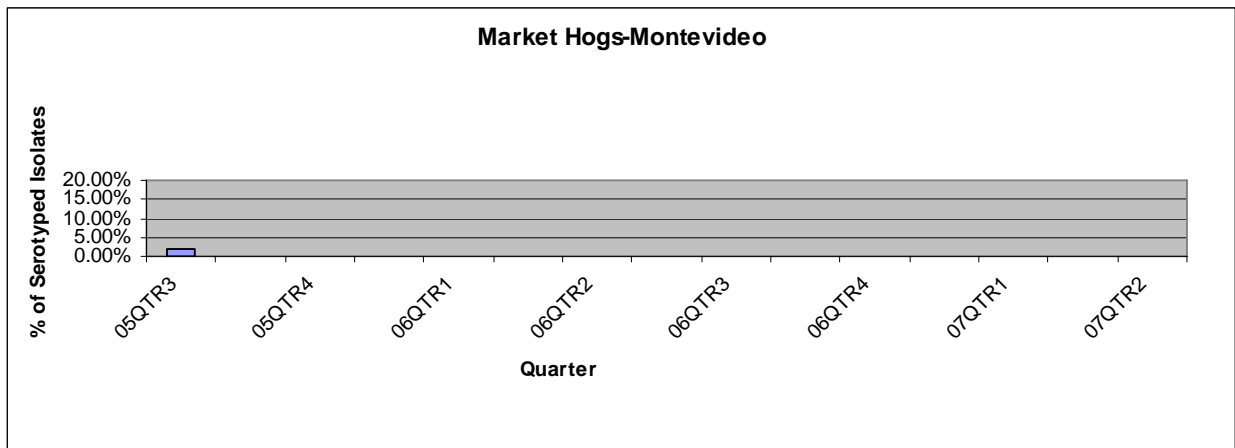
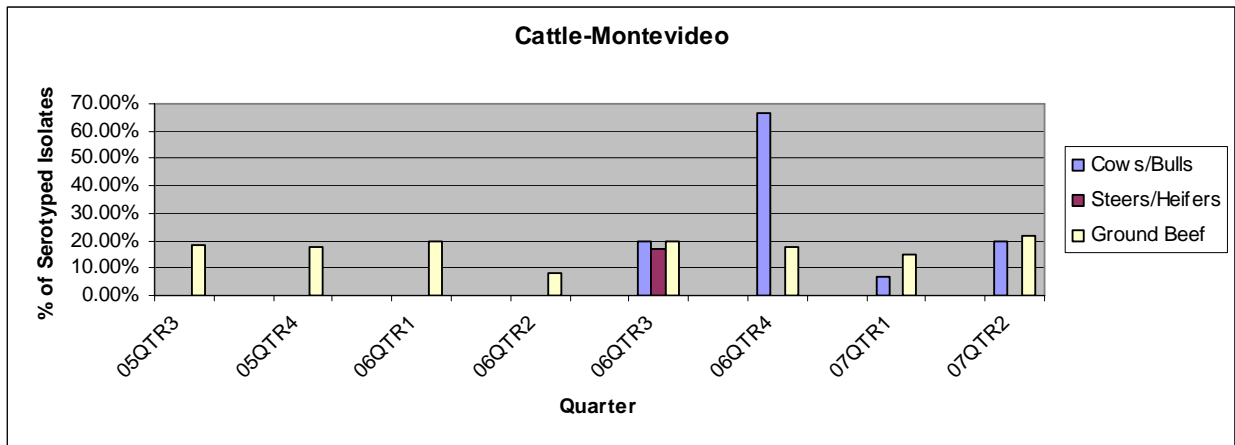
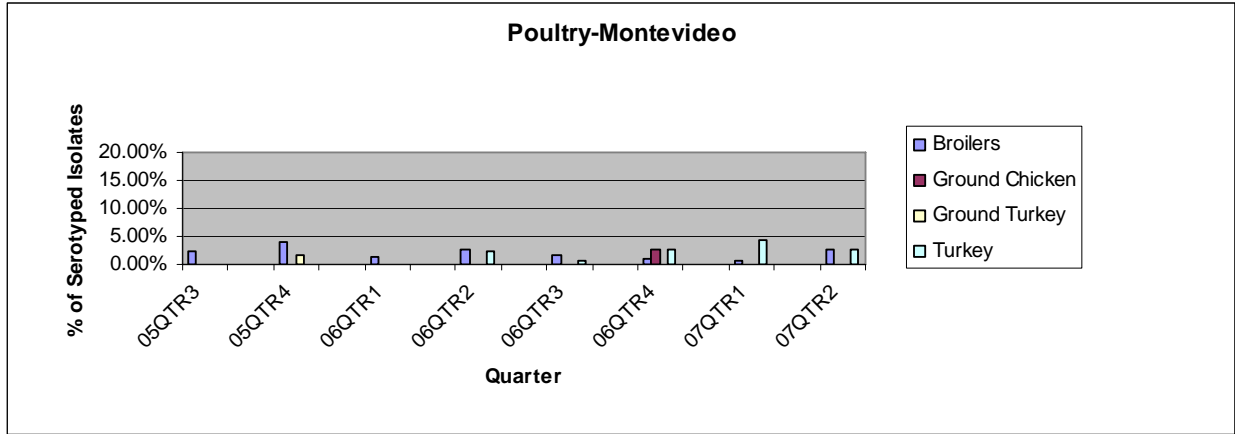
Figure 6
Heidelberg – USDA, FSIS, PR/HACCP Verification Sampling by Quarter*
All Samples



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



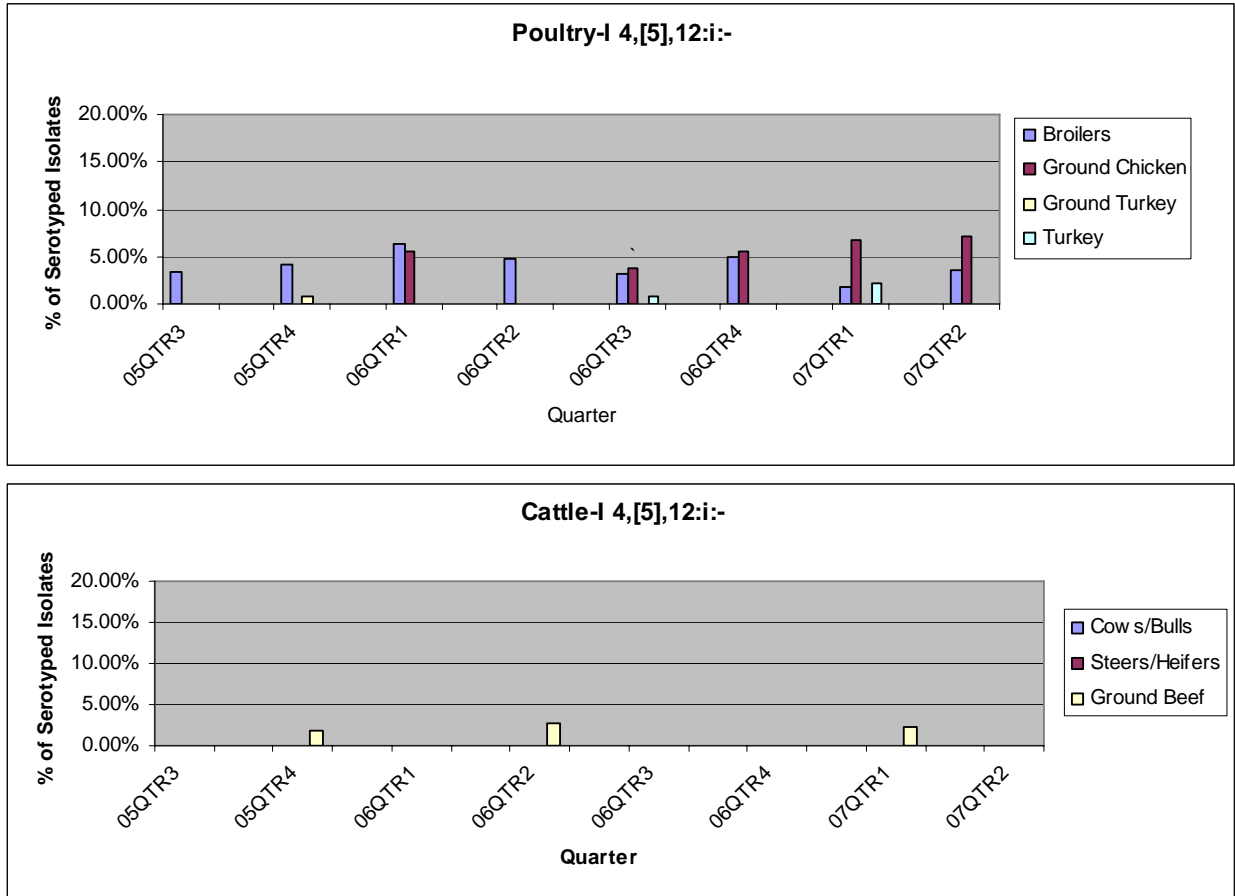
Figure 7
Montevideo – USDA, FSIS, PR/HACCP Verification Sampling by Quarter*
All Samples



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



Figure 8
I 4,[5],12:1:- – USDA, FSIS, PR/HACCP Verification Sampling by Quarter*
All Samples



* There were no I 4,[5],12:i:- isolates recovered for the time period in market hogs.