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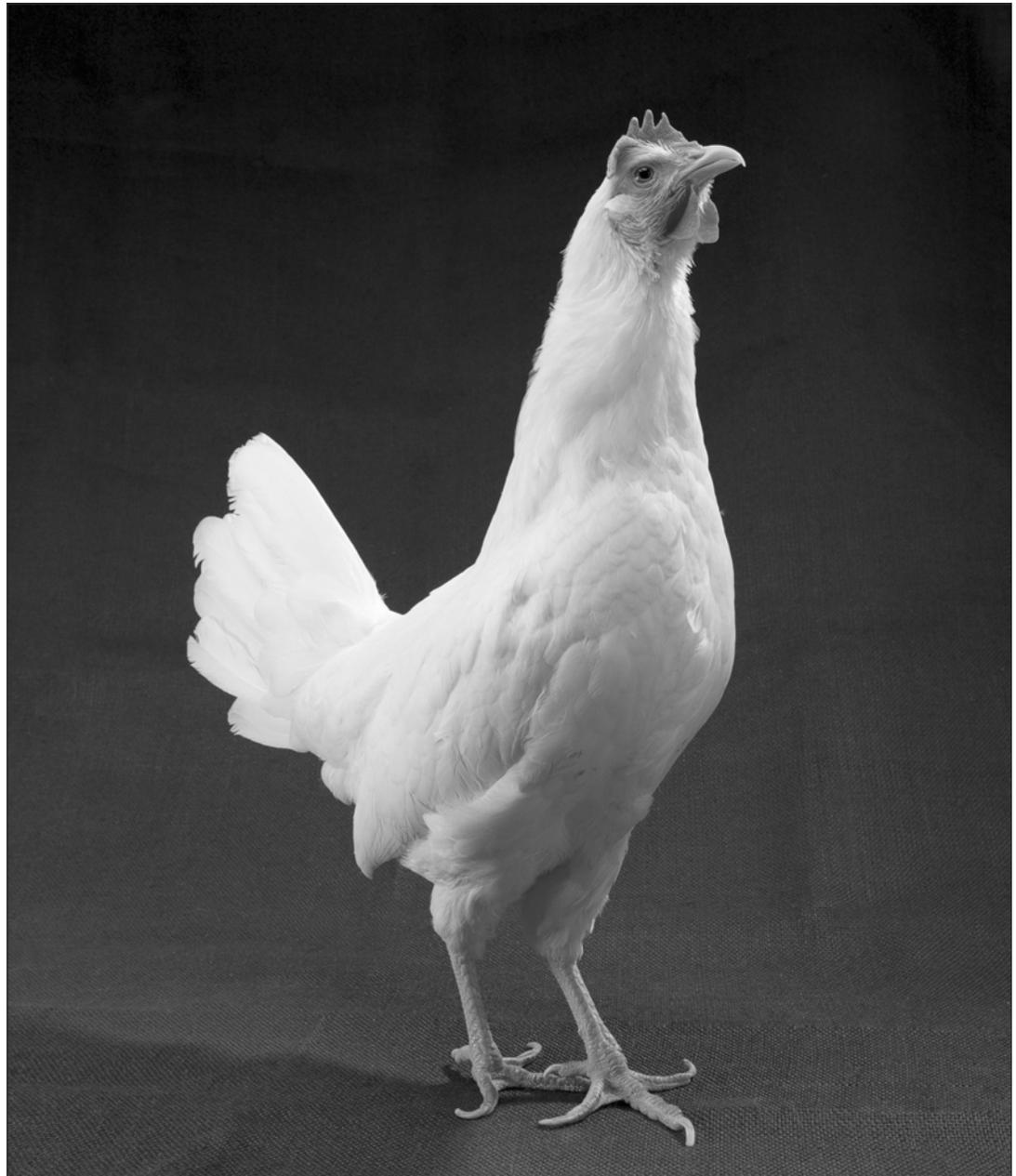
National  
Animal Health  
Monitoring  
System

April 2006



# Poultry '04

## Part III: Reference of Management Practices in Live-Poultry Markets in the United States, 2004



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All participants are to be commended, particularly the live-poultry market owners whose voluntary efforts made this study possible.

José R. Díez

A handwritten signature in cursive script that reads "José R. Díez".

Director  
Centers for Epidemiology and Animal Health

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## Introduction

The National Animal Health Monitoring System (NAHMS) is a nonregulatory division of the United States Department of Agriculture (USDA) designed to help meet the Nation's animal-health information needs.

Layers '99 was NAHMS' first national study on poultry baseline health and management. Layers '99 estimated the prevalence and associated risk factors of *Salmonella enterica* enteritidis in U.S. layer flocks.

Poultry '04 is NAHMS' second study of the U.S. poultry industry. For Poultry '04, NAHMS conducted a thorough assessment to determine the information needs of the poultry industry, researchers, and Federal and State governments. This needs assessment indicated a need for information regarding bird health, bird movement, and biosecurity practices of nontraditional poultry industries, such as backyard flocks, gamefowl, and live poultry markets.

Part I: Reference of Health and Management of Backyard/Small Production Flocks in the United States, 2004 is the first in a series of reports containing national information from the Poultry '04 study. Data for Part I were collected via a questionnaire administered to owners of backyard flocks located within 1 mile of a sample of commercial poultry operations in 18 major poultry producing States.

Part II: Reference of Health and Management of Gamefowl Breeder Flocks in the United States, 2004, is the second report from the Poultry '04 study. A questionnaire was mailed to members of United Gamefowl Breeder Association (UGBA) State affiliates and to members of State associations not affiliated with UGBA. Gamefowl breeders from 34 States responded to the survey.

**Part III: Reference of Management Practices in Live-Poultry Markets in the United States, 2004**, focuses on bird movement, and cleaning and disinfection practices at live-poultry markets in California, Florida, New England, New Jersey, New York, Pennsylvania, and Texas. Data for Part III were collected via a questionnaire administered to live-poultry market operators by State and Federal veterinary medical officers or animal health technicians. The reported data from the selected sample were weighted so that the population estimates provided in Section I represent all live-poultry markets in the respective areas (States) in the study. Section II provides avian influenza test results from samples taken at the markets over a 12-month period.

Part IV: Reference of Health and Management of Backyard/Small Production Flocks and Gamefowl Breeder Flocks in the United States, 2004, compares information collected from backyard flock producers and gamefowl breeders reported in respective parts I and II of the Poultry '04 study. This report is provided to facilitate comparison of selected observations from the two studies.

The methods used and the number of respondents in the study can be found at the end of this report.

Further information on NAHMS studies and reports is available online at: [www.aphis.usda.gov/vs/ceah/ncahs](http://www.aphis.usda.gov/vs/ceah/ncahs)

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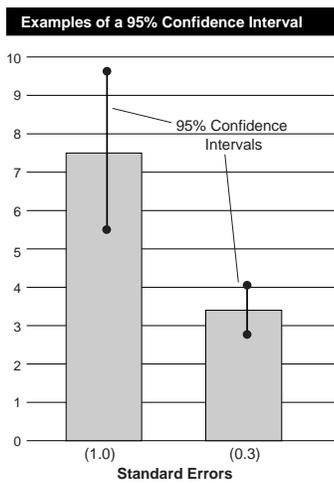
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## Terms Used In This Report

**Case:** Markets with two or more positive tests for avian influenza (AI) H5/H7 between March 2004 and March 2005.

**Control:** Markets tested for AI two or more times between March 2004 and March 2005 with all test results negative for H5/H7.

**Odds ratio:** The likelihood or odds of markets with a certain characteristic being positive for AI H5/H7, compared to markets lacking that characteristic. The 95-percent confidence interval for this odds ratio is the range (lowest to highest value of the odds ratio) within which we can be 95-percent certain the true odds ratio falls.



**Population estimates:** Estimates in this report are provided with a measure of precision called the standard error. A 95-percent confidence interval can be created with bounds equal to the estimate, plus or minus two standard errors. If the only error is sampling error, the confidence intervals created in this manner will contain the true population mean 95 out of 100 times. In the example to the left, an estimate of 7.5 with a standard error of 1.0 results in limits of 5.5 to 9.5 (two times the standard error above and below the estimate). The second estimate of 3.4 shows a standard error of 0.3 and results in limits of 2.8 and 4.0. Alternatively, the 90-percent confidence interval would be created by multiplying the standard error by 1.65 instead of 2.0. In general, when comparing point estimates between categories, estimates with confidence levels that overlap are not considered different. Most estimates in this report are rounded to the nearest tenth. If rounded to 0, the standard error was reported (0.0). If there were no reports of the event, no standard error was reported (--). Differences identified in this report are at the 95-percent confidence level.

**Regions**

**North:** New York, New Jersey, New England, Pennsylvania

**South:** California, Florida, Texas

## Section I: Population Estimates

**A. Market Characteristics** **NOTE: No standard errors or confidence intervals were generated for the South region because all markets in the region were selected for the survey and there was a 100-percent response rate.**

### 1. Birds present on day of interview

More than 4 out of 10 markets (44.9 percent) had 100 to 499 birds present on the day of the interview. Only 5.5 percent of markets had no birds, while 13.3 percent had 1,000 or more birds.

a. Percentage of markets by number of birds present on day of interview and by region:

Number of Birds	Percent Markets					
	Region					
	North		South		All	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
0	7.2	(0.2)	2.7	(--)	5.5	(0.2)
1 to 99	2.4	(0.0)	25.3	(--)	10.9	(0.0)
100 to 499	46.9	(0.8)	41.3	(--)	44.9	(0.5)
500 to 999	31.0	(0.8)	16.0	(--)	25.4	(0.5)
1,000 or more	12.5	(0.3)	14.7	(--)	13.3	(0.2)
Total	100.0		100.0		100.0	

## 2. Birds sold per week

In the North region, 61.6 percent of markets sold 1,000 or more birds per week during summer, and 69.5 percent of markets sold 1,000 or more birds per week during winter. Less than 20 percent of markets in the North region sold fewer than 500 birds per week in summer and winter (19.0 percent and 16.0 percent, respectively). In the South region, 29.7 percent and 30.6 percent of markets sold 1,000 or more birds per week in summer and winter, respectively. Over half of markets in the South region sold fewer than 500 birds per week in summer and winter (58.1 percent and 54.7 percent, respectively).

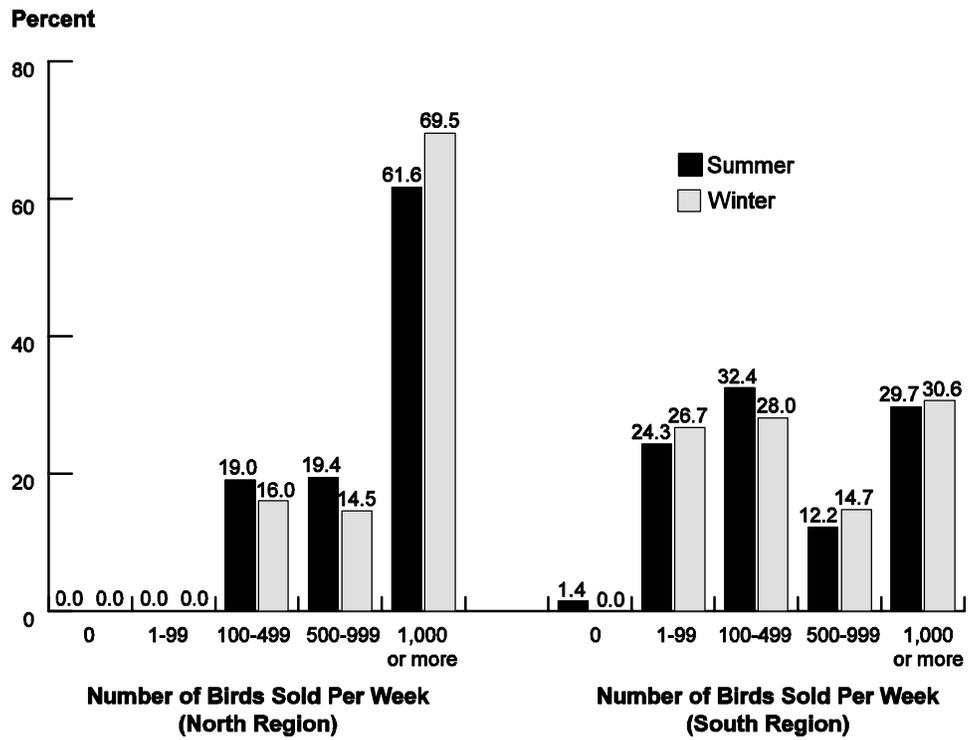
a. Percentage of markets by number of birds sold per week in **summer** and by region:

Number of Birds Sold (Per Week)	Percent Markets					
	Region					
	North		South		All	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
0	0.0	(--)	1.4	(--)	0.5	(0.0)
1 to 99	0.0	(--)	24.3	(--)	9.0	(0.0)
100 to 499	19.0	(0.2)	32.4	(--)	24.0	(0.1)
500 to 999	19.4	(0.3)	12.2	(--)	16.7	(0.2)
1,000 or more	61.6	(0.3)	29.7	(--)	49.8	(0.2)
Total	100.0		100.0		100.0	

b. Percentage of markets by number of birds sold per week in *winter* and by region:

Number of Birds Sold (Per Week)	Percent Markets					
	North		South		All	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
0	0.0	(--)	0.0	(--)	0.0	(--)
1 to 99	0.0	(--)	26.7	(--)	9.9	(0.0)
100 to 499	16.0	(0.6)	28.0	(--)	20.4	(0.4)
500 to 999	14.5	(0.3)	14.7	(--)	14.6	(0.2)
1,000 or more	69.5	(0.5)	30.6	(--)	55.1	(0.3)
Total	100.0		100.0		100.0	

**Percentage of Markets by Number of Birds Sold Per Week in Summer and Winter, and by Region**



### 3. Bird types

Overall, 92.2 percent of markets had broilers or roasters onsite in the previous 30 days, ranging from 80.0 percent of markets in the South region to 99.2 percent in the North region. More markets in the North region had spent laying hens onsite (93.1 percent) and spent broiler breeders (73.5 percent) than markets in the South region (66.7 and 34.7 percent, respectively). In the North region, 89.6 percent of markets had ducks and 3.4 percent of markets had geese, while in the South region 58.7 percent of markets had ducks and 20.0 percent had geese. Very few markets in the North region had pet birds or other bird species. In the South region, 14.7 percent of markets had pet birds and 38.7 percent had other bird species. Other reported bird species included pigeon and squab.

a. Percentage of markets that had the following bird types onsite in the previous 30 days, by region:

Bird Type	Percent Markets					
	Region					
	North		South		All	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Spent laying hens	93.1	(0.7)	66.7	(--)	83.4	(0.4)
Spent broiler breeders	73.5	(0.7)	34.7	(--)	59.2	(0.5)
Broilers or roasters	99.2	(0.1)	80.0	(--)	92.2	(0.1)
Gamefowl	6.1	(0.7)	10.7	(--)	7.8	(0.4)
Other chickens	27.7	(0.4)	36.0	(--)	30.7	(0.2)
Ducks	89.6	(0.2)	58.7	(--)	78.2	(0.1)
Guinea fowl	91.4	(0.2)	52.0	(--)	76.9	(0.1)
Turkeys	44.7	(0.4)	24.0	(--)	37.1	(0.2)
Pheasants	6.5	(0.2)	12.0	(--)	8.5	(0.1)
Quail	40.0	(0.4)	50.7	(--)	43.9	(0.2)
Chukars/partridges	27.7	(0.4)	14.7	(--)	22.9	(0.2)
Geese	3.4	(0.1)	20.0	(--)	9.5	(0.1)
Peafowl	1.8	(0.0)	6.7	(--)	3.6	(0.0)
Pet birds (parrots, parakeets, canaries, etc.)	0.8	(0.1)	14.7	(--)	5.9	(0.1)
Other bird species	0.8	(0.1)	38.7	(--)	14.7	(0.1)

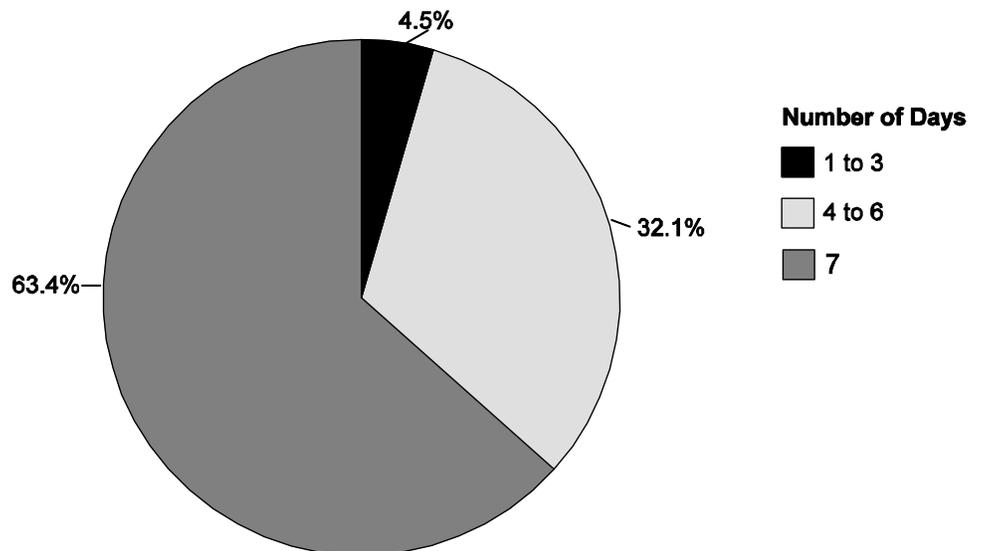
**4. Days open**

Overall, 63.4 percent of markets were open 7 days per week. Only 4.5 percent of markets were open fewer than 4 days per week.

a. Percentage of all markets by number of days per week market was open and by region:

Percent Markets						
Region						
	North		South		All	
Number of Days	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
1 to 3	3.1	(0.1)	6.8	(--)	4.5	(0.1)
4 to 6	31.2	(0.7)	33.8	(--)	32.1	(0.5)
7	65.7	(0.8)	59.4	(--)	63.4	(0.5)
Total	100.0		100.0		100.0	

**Percentage of All Markets by Number of Days Per Week Market was Open**



For markets that sold 500 or more birds per week, over two-thirds (68.6 percent) were open 7 days per week. For markets that sold fewer than 500 birds per week, 51.2 percent were open 7 days per week.

b. Percentage of markets by number of days per week market was open and by number of birds sold per week:

<b>Percent Markets</b>				
<b>Number of Birds Sold (Per Week)</b>				
<b>Number of Days</b>	<b>Fewer Than 500</b>		<b>500 or More</b>	
	<b>Percent</b>	<b>Std. Error</b>	<b>Percent</b>	<b>Std. Error</b>
1 to 3	3.3	(0.0)	4.9	(0.1)
4 to 6	45.5	(1.5)	26.5	(0.3)
7	51.2	(1.5)	68.6	(0.3)
Total	100.0		100.0	

#### 5. Days empty of birds

Overall, 41.8 percent of markets were empty of birds 1 or more days per week, ranging from 30.7 percent of markets in the South region to 48.7 percent in the North region.

a. Percentage of markets empty of birds 1 or more days per week, by region:

<b>Percent Markets</b>					
<b>Region</b>					
<b>North</b>		<b>South</b>		<b>All</b>	
<b>Percent</b>	<b>Std. Error</b>	<b>Percent</b>	<b>Std. Error</b>	<b>Percent</b>	<b>Std. Error</b>
48.7	(0.8)	30.7	(--)	41.8	(0.5)

For markets that sold fewer than 500 birds per week, 38.7 percent were empty of birds 1 or more days per week. For markets that sold 500 or more birds per week, 43.1 percent were empty of birds 1 or more days per week.

b. Percentage of markets empty of birds 1 or more days per week, by number of birds sold per week:

<b>Percent Markets</b>			
<b>Number of Birds Sold (Per Week)</b>			
<b>Fewer Than 500</b>		<b>500 or More</b>	
<b>Percent</b>	<b>Std. Error</b>	<b>Percent</b>	<b>Std. Error</b>
38.7	(1.5)	43.1	(0.4)

For markets open fewer than 7 days per week, half (50.1 percent) were empty of birds 1 or more days per week. For markets open 7 days per week, approximately one-third (37.2 percent) were empty of birds 1 or more days per week. Markets may have been open to sell other products or may have routinely “sold down” to empty the market of birds.

c. Percentage of markets empty of birds 1 or more days per week, by days open per week:

<b>Percent Markets</b>			
<b>Days Open (Per Week)</b>			
<b>1 to 6</b>		<b>7</b>	
<b>Percent</b>	<b>Std. Error</b>	<b>Percent</b>	<b>Std. Error</b>
50.1	(0.7)	37.2	(0.4)

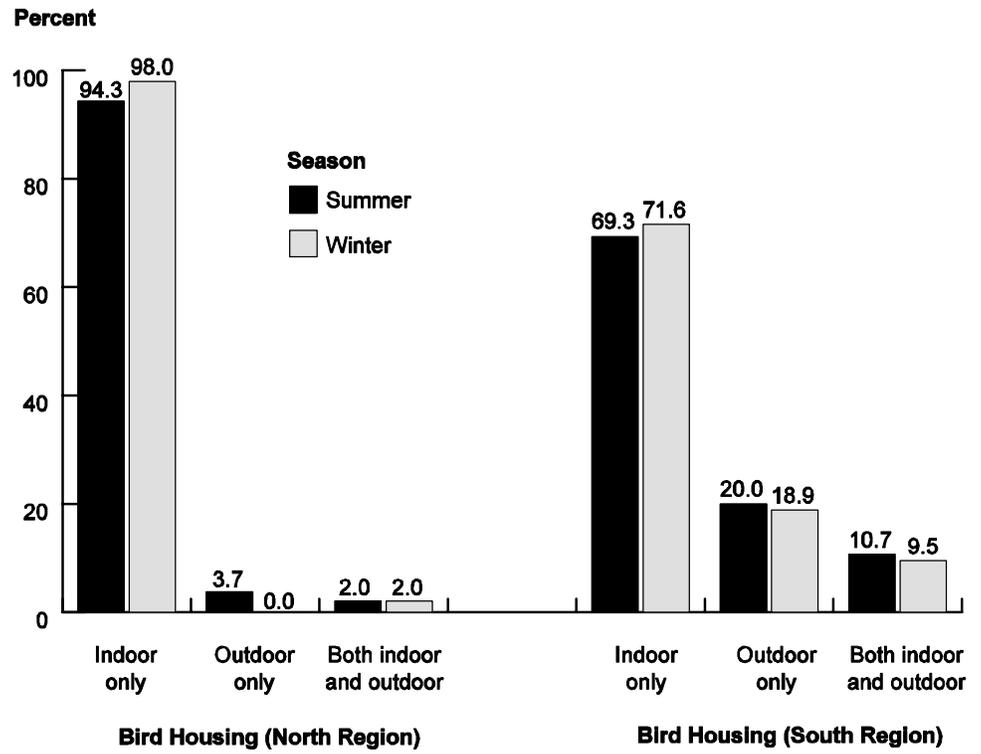
## 6. Bird housing

In the North region, nearly all markets typically housed birds only indoors during summer and winter (94.3 percent and 98.0 percent of markets, respectively). In the South region, 69.3 percent of markets housed birds only indoors in summer, and 71.6 percent housed birds only indoors during winter.

a. Percentage of markets by typical bird housing during summer and winter, and by region:

Bird Housing	Percent Markets					
	Region					
	North		South		All	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Summer						
Indoor only	94.3	(0.7)	69.3	(--)	85.0	(0.4)
Outdoor only	3.7	(0.0)	20.0	(--)	9.8	(0.0)
Both indoor and outdoor	2.0	(0.7)	10.7	(--)	5.2	(0.4)
Total	100.0		100.0		100.0	
Winter						
Indoor only	98.0	(0.7)	71.6	(--)	88.1	(0.4)
Outdoor only	0.0	(--)	18.9	(--)	7.1	(0.0)
Both indoor and outdoor	2.0	(0.7)	9.5	(--)	4.8	(0.4)
Total	100.0		100.0		100.0	

**Percentage of Markets by Typical Bird Housing During Summer and Winter, and by Region**



**B. Animals at Market****1. Animals other than birds**

Overall, 76.4 percent of markets had animals other than birds onsite during the previous 30 days, ranging from 84.5 percent of markets in the North region to 62.7 percent of markets in the South region. Overall, the majority of markets (67.4 percent) had rabbits onsite during the previous 30 days. However, regional differences were apparent, with 81.3 percent of markets in the North region and 44.0 percent of markets in the South region reporting rabbits onsite. Only 1.9 percent of markets in the North region and 8.0 percent of markets in the South region had pigs onsite during the previous 30 days. Other animals included reptiles, rodents (guinea pigs and mice), and horses.

a. Percentage of markets by type of animals onsite during the previous 30 days and by region:

Animal	Percent Markets					
	North		South		All	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Rabbits	81.3	(0.8)	44.0	(--)	67.4	(0.5)
Pigs	1.9	(0.0)	8.0	(--)	4.1	(0.0)
Cattle/steers	5.1	(0.2)	13.3	(--)	8.1	(0.1)
Sheep	21.0	(0.4)	22.7	(--)	21.6	(0.2)
Goats	21.0	(0.4)	29.3	(--)	24.1	(0.2)
Dogs	0.0	(--)	10.7	(--)	4.0	(0.0)
Cats	5.3	(0.1)	16.0	(--)	9.3	(0.1)
Other animals not including birds	0.0	(--)	13.3	(--)	5.0	(0.0)
Any of the above	84.5	(0.7)	62.7	(--)	76.4	(0.5)

## 2. Wild birds loose in market

Most market operators (74.9 percent) reported they never saw wild birds loose in the market.

a. Percentage of markets by frequency that market operators saw wild birds loose in the market and by region:

Frequency	Percent Markets					
	Region					
	North		South		All	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Usually	0.0	(--)	8.0	(--)	3.0	(0.0)
Sometimes	11.6	(0.7)	2.7	(--)	8.3	(0.5)
Rarely	13.3	(0.3)	14.7	(--)	13.8	(0.2)
Never	75.1	(0.8)	74.6	(--)	74.9	(0.5)
Total	100.0		100.0		100.0	

## 3. Wild rodents loose in market

The frequency of wild rodent sightings was similar in markets in the North and South regions. Overall, 63.8 percent of market operators never saw wild rodents loose in the market.

a. Percentage of markets by frequency that market operators saw wild rodents (rats and mice) loose in the market and by region:

Frequency	Percent Markets					
	Region					
	North		South		All	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Usually	0.0	(--)	1.3	(--)	0.5	(0.0)
Sometimes	14.1	(0.3)	13.3	(--)	13.8	(0.2)
Rarely	20.6	(0.3)	24.0	(--)	21.9	(0.2)
Never	65.3	(0.4)	61.4	(--)	63.8	(0.2)
Total	100.0		100.0		100.0	

**4. Rabbits for sale**

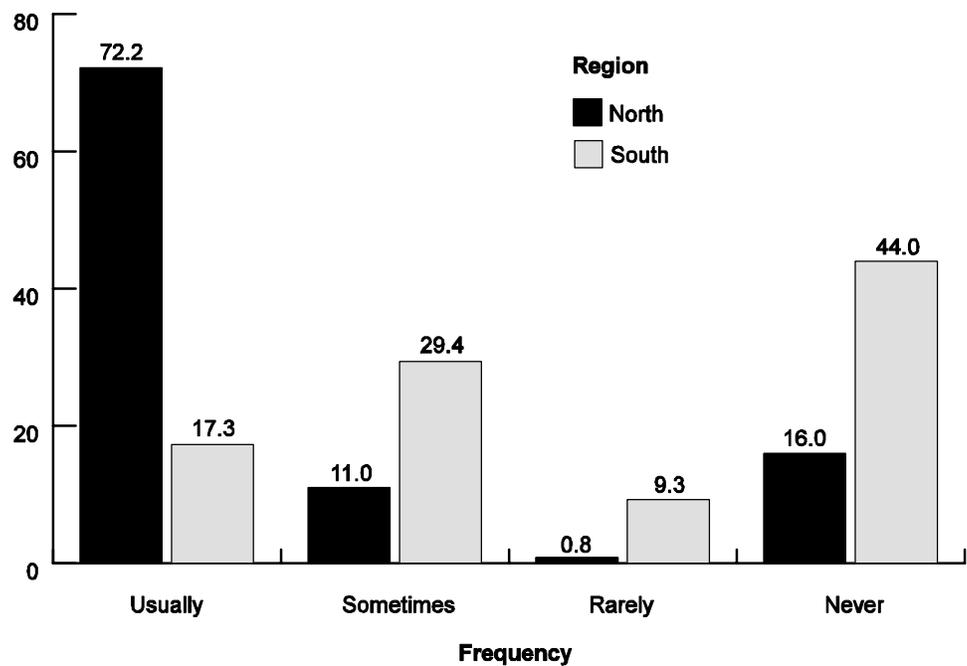
A higher percentage of markets in the North region (83.2 percent) reported usually or sometimes having rabbits for sale than markets in the South region (46.7 percent).

a. Percentage of markets by frequency that rabbits were for sale and by region:

Percent Markets						
Region						
	North		South		All	
Frequency	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Usually	72.2	(0.8)	17.3	(--)	52.1	(0.5)
Sometimes	11.0	(0.2)	29.4	(--)	17.7	(0.1)
Rarely	0.8	(0.0)	9.3	(--)	3.9	(0.0)
Never	16.0	(0.7)	44.0	(--)	26.3	(0.5)
Total	100.0		100.0		100.0	

**Percentage of Markets by Frequency that Rabbits were For Sale and by Region**

Percent



**C. Cleaning and Disinfecting**

**1. Frequency of cleaning and disinfecting\***

Overall, 60.3 percent of markets had cleaned and disinfected market floors 30 or more times in the previous 30 days. Most markets (73.9 percent) had cleaned and disinfected the entire market at least once in the previous 30 days.

a. Percentage of markets by number of times the following areas in the market were cleaned and disinfected in the previous 30 days:

Percent Markets												
Area												
Frequency	Floors		Walls		Cages		Ceiling		Office		Entire Market**	
	Pct.	Std. Err.	Pct.	Std. Err.	Pct.	Std. Err.	Pct.	Std. Err.	Pct.	Std. Err.	Pct.	Std. Err.
0	0.5	(0.1)	2.5	(0.1)	2.2	(0.0)	20.9	(0.2)	5.1	(0.1)	26.1	(0.2)
1	0.5	(0.0)	5.5	(0.1)	5.6	(0.1)	21.8	(0.5)	7.5	(0.2)	32.6	(0.5)
2 to 5	16.2	(0.5)	32.3	(0.5)	29.7	(0.5)	29.9	(0.2)	26.0	(0.2)	27.8	(0.2)
6 to 15	14.3	(0.2)	22.7	(0.2)	17.9	(0.2)	9.3	(0.2)	7.2	(0.2)	8.7	(0.1)
16 to 29	8.2	(0.1)	6.9	(0.1)	5.3	(0.1)	1.3	(0.4)	2.8	(0.1)	1.0	(0.1)
30 or more	60.3	(0.5)	30.1	(0.5)	32.2	(0.5)	16.8	(0.2)	31.7	(0.2)	3.8	(0.4)
No office/cages	N/A		N/A		7.1	(0.1)	N/A		19.7	(0.1)	N/A	

\*Clean first with a detergent cleaner, removing all manure, dust, etc., before applying a disinfectant.

\*\*Floors, walls, cages, and ceiling at the same time

## 2. Disinfectant used

For markets that cleaned and disinfected in the previous 30 days, 9 out of 10 (90.3 percent) used bleach, and 7 out of 10 (72.8 percent) used a phenol compound. Compounds in the “other disinfectant” category included novalsan and lime. A few respondents were unaware of the name, type, or ingredients of the disinfectant used.

a. For markets that cleaned and disinfected in the previous 30 days, percentage of markets that used the following disinfectants:

Disinfectant	Percent Markets	
	Percent	Standard Error
Bleach (Clorox®)	90.3	(0.1)
Phenol (One stroke®, Zep165®)	72.8	(0.0)
Pine cleaner (Pinesol®)	51.8	(0.2)
Ammonium	21.0	(0.2)
Other disinfectant	7.7	(0.0)

### 3. Bird handling practices during complete cleaning and disinfection

In the North region, 81.0 percent of markets were depleted of birds before complete cleaning and disinfection. In the South region, 16.2 percent of markets were depleted of birds before complete cleaning and disinfection, and nearly half of markets (47.3 percent) left birds/animals in the market during complete cleaning and disinfection.

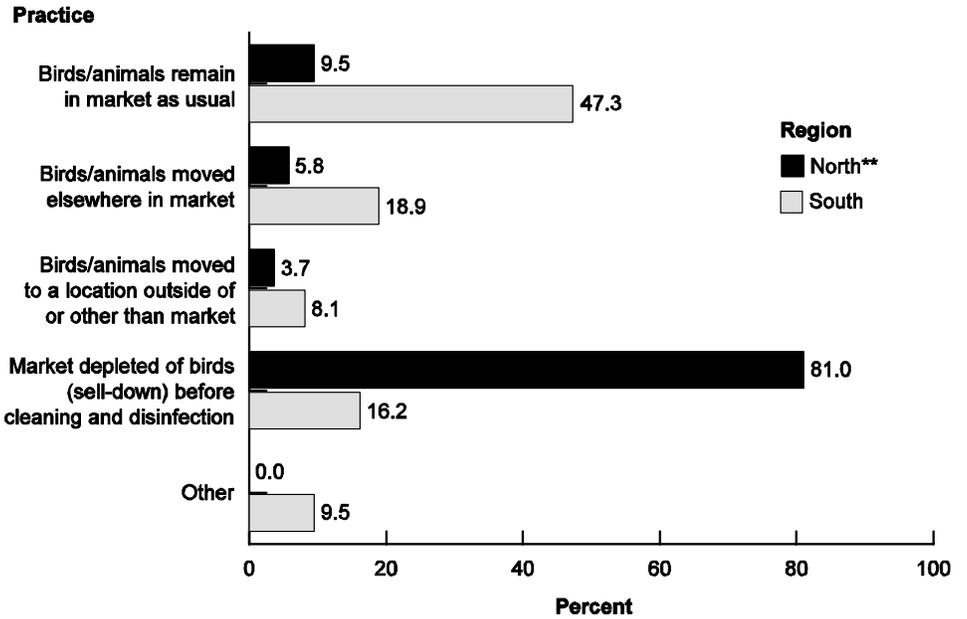
a. Percentage of markets by bird handling practice in the market during complete cleaning and disinfection\* and by region:

Practice	Percent Markets					
	Region					
	North**		South		All	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Birds/animals remain in the market as usual	9.5	(1.8)	47.3	(--)	23.4	(1.5)
Birds/animals moved elsewhere in the market	5.8	(1.8)	18.9	(--)	10.6	(1.2)
Birds/animals moved to a location outside of or other than the market	3.7	(0.3)	8.1	(--)	5.4	(0.2)
Market depleted of birds (sell-down) before cleaning and disinfection	81.0	(2.8)	16.2	(--)	57.1	(2.5)
Other	0.0	(--)	9.5	(--)	3.5	(0.2)
Total	100.0		100.0		100.0	

\*Complete cleaning and disinfection refers to the periodic major cleaning and disinfecting done in the market, as opposed to routine daily cleaning.

\*\*Since it is illegal in New York and New Jersey to remove live birds from live-poultry markets, the reported percentage of markets in the North region that removed live-birds is likely a minimum estimation.

**Percentage of Markets by Bird Handling Practice in the Market During Complete Cleaning and Disinfecting\* and by Region**



\*Complete cleaning and disinfection refers to the periodic major cleaning and disinfecting done in the market, as opposed to routine daily cleaning.

\*\*Since it is illegal in New York and New Jersey to remove live birds from live-poultry markets, the reported percentage of markets in the North region that removed birds is likely a minimum estimation.

#### 4. Crate storage

About half of markets in the South region (48.7 percent) stored crates in the bird room prior to washing them, compared to 5.3 percent of markets in the North region. Half of markets in the North region (53.2 percent) listed “other” as their bird-crate storage location. The “other” category included no crate use and removal of crates after bird unloading.

a. Percentage of markets by bird-crate storage location and by region:

Crate Storage Location*	Percent Markets					
	Region					
	North		South		All	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
In bird room	5.3	(0.7)	48.7	(--)	21.6	(0.5)
In a different room in the market	9.6	(0.2)	18.9	(--)	13.1	(0.1)
Outside the market	31.9	(0.3)	18.9	(--)	27.0	(0.2)
Other	53.2	(0.8)	13.5	(--)	38.3	(0.5)
Total	100.0		100.0		100.0	

\*Location stored prior to washing

**D. Biosecurity****1. New arrivals**

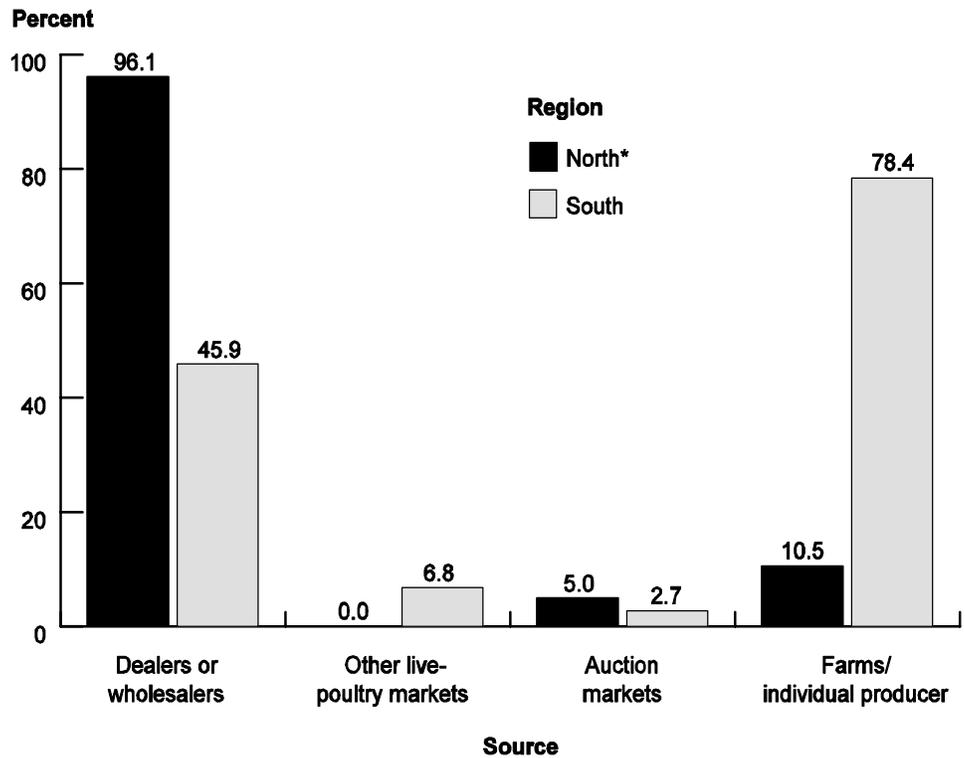
Most markets in the North region (96.1 percent) received birds from dealers or wholesalers, while 10.5 percent received birds from farms or individual producers. In the South region, most markets (78.4 percent) received birds from farms or individual producers, while less than half of markets (45.9 percent) received birds from a dealer or wholesaler.

a. Percentage of markets that received birds directly from the following sources in the previous 12 months, by region:

Source	Percent Markets					
	Region					
	North*		South		All	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Dealers or wholesalers	96.1	(1.0)	45.9	(--)	77.3	(1.3)
Other live-poultry markets	0.0	(--)	6.8	(--)	2.5	(0.1)
Auction markets	5.0	(0.8)	2.7	(--)	4.2	(0.5)
Farms/individual producer	10.5	(1.5)	78.4	(--)	36.0	(2.0)
Other source	0.0	(--)	2.7	(--)	1.0	(0.0)

\*In New York, licensed dealers or wholesalers are the only legal source of birds for live-poultry markets. Therefore, the reported percentage of markets in the North region that obtained birds from a different source is likely a minimum estimation.

**Percentage of Markets that Received Birds Directly from the Following Sources in the Previous 12 Months, by Region**



\*In New York, licensed dealers or wholesalers are the only legal source of birds for live-poultry markets. Therefore, the reported percentage of markets in the North region that obtained birds from a different source is likely a minimum estimation.

On average, markets that received birds directly from farms had approximately five different sources. Markets that received birds from dealers or wholesalers reported an average of about two different sources.

b. For markets that received birds directly from the following sources in the previous 12 months, average number of sources:

Source	Average Number	Standard Error
Dealers or wholesalers	2.3	(0.2)
Other live-poultry markets	1.3	(0.0)
Auction markets	1.2	(0.1)
Farms/individual producer	4.7	(0.1)
Other source	--	(--)

For markets that received birds directly from farms, delivery by the farm was the most common way birds reached the market.

c. For markets that received birds directly from farms, percentage of markets by delivery method:

<b>Delivery Method</b>	<b>Percent Markets</b>	<b>Standard Error</b>
Farm delivers to the market	81.7	(1.7)
Market picks up from the farm	27.8	(1.0)
Independent trucker	24.3	(1.3)

A higher percentage of markets in the South region (61.4 percent) never added new arrivals to cages with birds already at the market compared to markets in the North region (37.9 percent).

d. Percentage of markets by frequency that new arrivals were added to cages with birds already at the market and by region:

<b>Frequency</b>	<b>Percent Markets</b>					
	<b>Region</b>					
	<b>North</b>		<b>South</b>		<b>All</b>	
	<b>Percent</b>	<b>Std. Error</b>	<b>Percent</b>	<b>Std. Error</b>	<b>Percent</b>	<b>Std. Error</b>
Usually	10.9	(0.3)	17.3	(--)	13.3	(0.2)
Sometimes	26.9	(0.4)	12.0	(--)	21.4	(0.2)
Rarely	24.3	(0.3)	9.3	(--)	18.8	(0.2)
Never	37.9	(0.4)	61.4	(--)	46.5	(0.2)
Total	100.0		100.0		100.0	

Nearly one-quarter of markets in the South region (24.7 percent) reported that suppliers accept live-bird returns, while no markets in the North region reported this practice.

e. Percentage of markets whose suppliers accept returns of live birds that have been in the market, by region: (This includes birds held in the market in delivery crates but NOT birds rejected off the truck that never entered the market.)

Percent Markets					
Region					
North*		South		All	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
0.0	(--)	24.7	(--)	9.1	(0.4)

\* Since it is illegal in New York and New Jersey for live birds to leave a live-poultry market, suppliers could not legally accept live-bird returns.

**2. Worker contact with birds other than market birds**

The majority of all markets (86.3 percent) reported that no workers had regular contact with nonmarket birds. A higher percentage of market operators in the South region did not know if workers had contact with nonmarket birds than market operators in the North region (17.6 percent and 3.2 percent, respectively).

a. Percentage of markets where any workers or market owner(s) had regular contact with birds other than market birds, by region:

Percent Markets						
Region						
	North		South		All	
Regular Contact With Nonmarket Birds	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Yes	6.7	(0.2)	2.7	(--)	5.2	(0.1)
Don't know	3.2	(0.2)	17.6	(--)	8.5	(0.1)
No	90.1	(0.3)	79.7	(--)	86.3	(0.2)
Total	100.0		100.0		100.0	

### 3. Resident flock or avian mascot

In the South region, 16.0 percent of markets reported a resident flock or avian mascot, compared to only 1.9 percent of markets in the North region.

a. Percentage of markets that reported a resident flock or avian mascot, by region:

Percent Markets					
Region					
North*		South		All	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
1.9	(0.1)	16.0	(--)	7.1	(0.3)

\*Since resident flocks and avian mascots are prohibited in New York and New Jersey, the reported percentage of markets in the North region with a resident flock or avian mascot is likely a minimum estimation.

### 4. Use of market vehicles to deliver live or dressed birds

Only one in four of all markets (26.0 percent) used their vehicles to deliver live or dressed birds. In the South region, 12.2 percent of markets delivered live birds and 13.5 percent delivered dressed birds. In the North region, 5.3 percent of markets delivered live birds and 27.4 percent delivered dressed birds.

a. Percentage of markets that used their vehicles to deliver live and/or dressed birds, by region:

Percent Markets						
Region						
	North*		South		All	
Used Vehicles to:	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Deliver live birds	5.3	(2.5)	12.2	(--)	7.8	(1.6)
Deliver dressed birds	27.4	(0.4)	13.5	(--)	22.3	(0.2)
Deliver either live or dressed birds	28.6	(0.8)	21.6	(--)	26.0	(0.5)

\*Since it is illegal in New York and New Jersey to remove live birds from live-poultry markets, the reported percentage of markets in the North region that made live-bird deliveries is likely a minimum estimation.

Approximately three out of four markets that delivered either live or dressed birds (77.1 percent) disinfected vehicles between deliveries.

b. For markets that delivered either live or dressed birds, percentage of markets that disinfected vehicles between deliveries:

Percent Markets	Standard Error
77.1	(0.6)

**5. Slaughter of birds onsite**

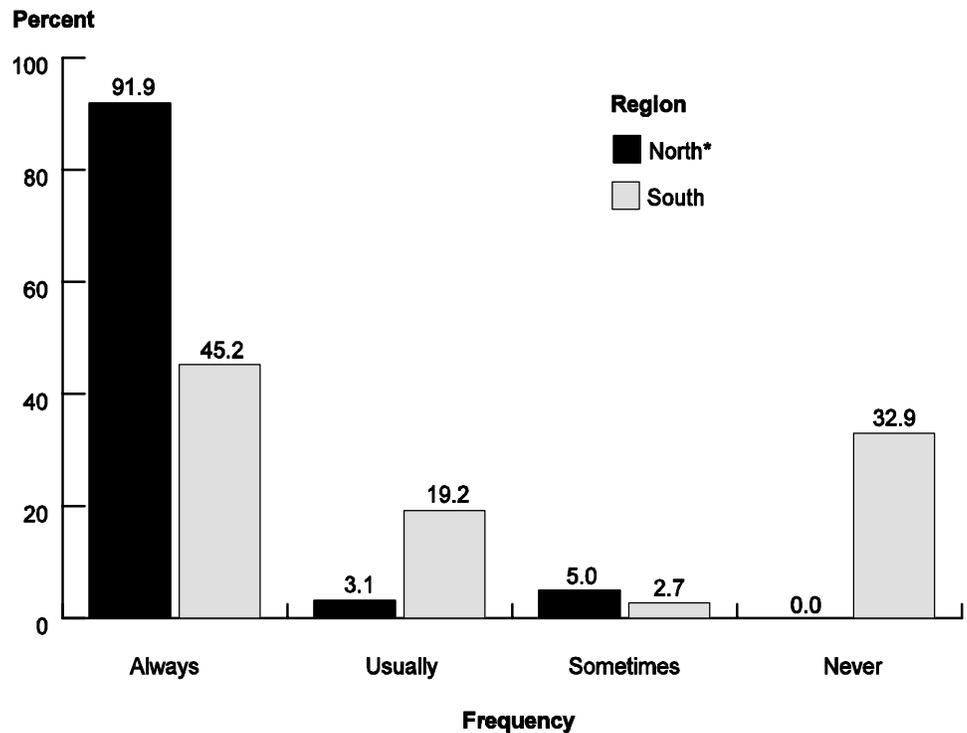
Most markets in the North region (91.9 percent) always slaughtered birds onsite, compared to less than half of markets in the South region (45.2 percent). One-third of markets in the South region (32.9 percent) never slaughtered birds onsite.

a. Percentage of markets by frequency birds were slaughtered onsite and by region:

Frequency	Percent Markets					
	Region					
	North*		South		All	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Always	91.9	(4.0)	45.2	(--)	74.6	(2.5)
Usually	3.1	(0.7)	19.2	(--)	9.0	(0.6)
Sometimes	5.0	(4.0)	2.7	(--)	4.2	(2.5)
Never	0.0	(--)	32.9	(--)	12.2	(0.6)
Total	100.0		100.0		100.0	

\*Since it is illegal in New York and New Jersey to remove live birds from live-poultry markets, the reported percentage of markets in the North region that always slaughtered birds onsite is likely overestimated.

### Percentage of Markets by Frequency Birds were Slaughtered Onsite and by Region



\*Since it is illegal in New York and New Jersey to remove live birds from live-poultry markets, the reported percentage of markets in the North Region that always slaughtered birds onsite is likely overestimated.

For markets that slaughtered birds onsite, 57.3 percent slaughtered more than 1,000 birds per week. Only 0.5 percent slaughtered fewer than 100 birds per week.

b. For markets that slaughtered birds onsite, percentage of markets by number of birds slaughtered per week:

Birds Slaughtered (Per Week)	Percent Markets	Standard Error
1 to 99	0.5	(0.0)
100 to 499	23.9	(0.1)
500 to 999	18.3	(0.2)
1,000 or more	57.3	(0.2)
Total	100.0	

**E. Management of Sick and Dead Birds**

**1. Handling of sick birds**

The majority of markets in North region (94.0 percent) immediately euthanized sick birds, while 3.2 percent separated sick birds from healthy birds. In the South region, 66.7 percent of markets immediately euthanized sick birds, while 24.0 percent separated sick birds from healthy birds. A small percentage of all markets (1.7 percent) gave sick birds no special handling.

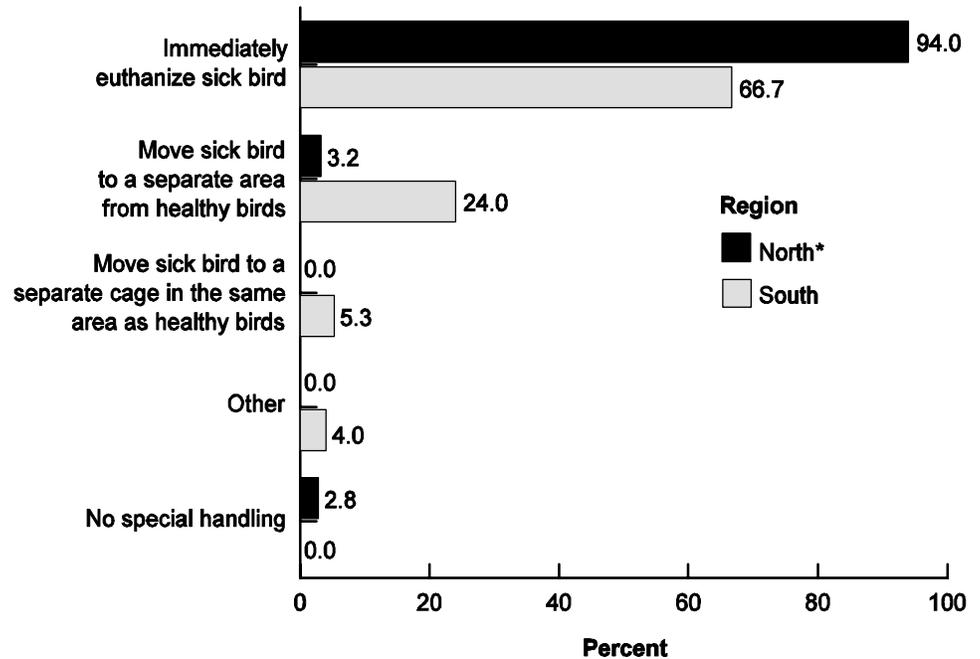
a. Percentage of markets by sick-bird handling practices and by region:

Practice	Percent Markets					
	Region					
	North*		South		All	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Immediately euthanize sick bird	94.0	(0.7)	66.7	(--)	83.9	(0.4)
Move sick bird to a separate area from healthy birds	3.2	(0.2)	24.0	(--)	10.9	(0.1)
Move sick bird to a separate cage in the same area as healthy birds	0.0	(--)	5.3	(--)	2.0	(0.0)
Other	0.0	(--)	4.0	(--)	1.5	(0.0)
No special handling	2.8	(0.7)	0.0	(--)	1.7	(0.4)
<b>Total</b>	<b>100.0</b>		<b>100.0</b>		<b>100.0</b>	

\*In New Jersey, sick or injured birds must be treated or removed within 24 hours or humanely euthanized.

**Percentage of Markets by Sick-Bird Handling Practices and by Region**

**Practice**



\*In New Jersey, sick or injured birds must be treated or removed within 24 hours or humanely euthanized

**2. Use of a veterinarian**

No markets in the North region used the services of a veterinarian to care for birds in the previous 12 months, and only 6.7 percent of markets in the South region used the services of a veterinarian.

a. Percentage of markets that used the services of a veterinarian to care for birds in the previous 12 months, by region:

Percent Markets					
Region					
North		South		All	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
0.0	(--)	6.7	(--)	2.5	(0.0)

b. Percentage of markets that used the services of a veterinarian to care for birds in the previous 12 months, by number of birds sold per week:

<b>Percent Markets</b>			
<b>Number of Birds Sold (Per Week)</b>			
<b>Fewer Than 500</b>		<b>500 or More</b>	
<b>Pct.</b>	<b>Std. Error</b>	<b>Pct.</b>	<b>Std. Error</b>
5.3	(0.0)	1.4	(0.0)

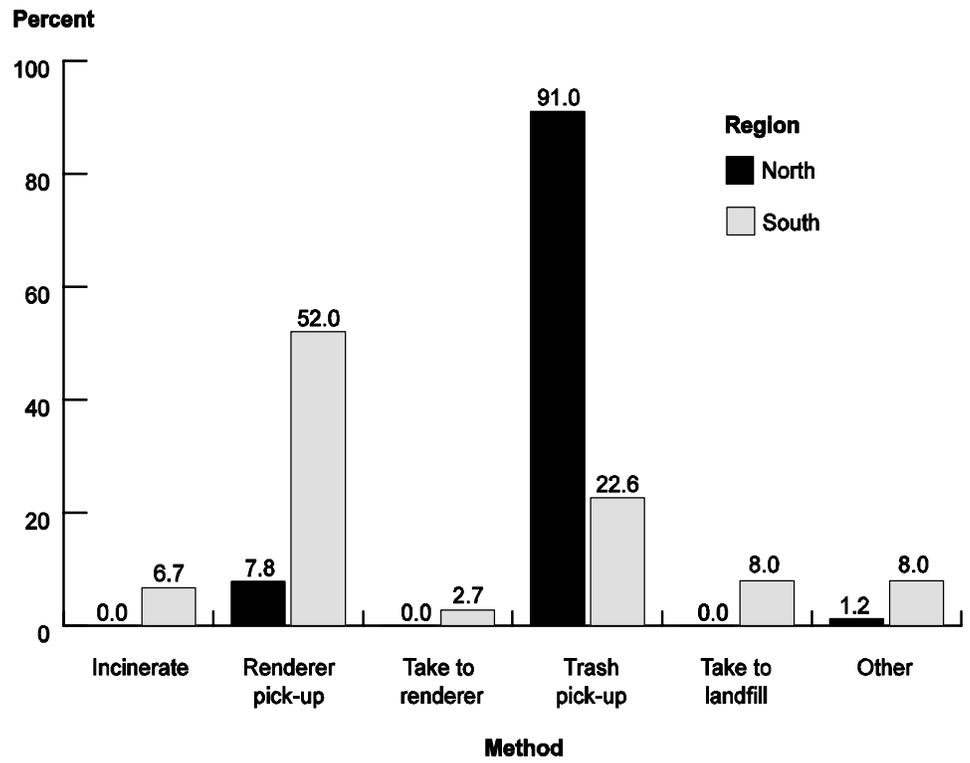
**3. Disposal of dead birds and offal**

Most markets in the North region (91.0 percent) used trash pick-up to dispose of bird carcasses and offal, compared to 22.6 percent of markets in the South region. About half of markets in the South region (52.0 percent) used renderer pick-up, while only 7.8 percent of markets in the North region did so. Common “other” disposal methods were burial and return to farm or vendor.

a. Percentage of markets by method used to dispose of bird carcasses and offal, and by region:

<b>Method</b>	<b>Percent Markets</b>					
	<b>Region</b>					
	<b>North</b>		<b>South</b>		<b>All</b>	
	<b>Pct.</b>	<b>Std. Error</b>	<b>Pct.</b>	<b>Std. Error</b>	<b>Pct.</b>	<b>Std. Error</b>
Incinerate	0.0	(--)	6.7	(--)	2.5	(0.0)
Renderer pick-up	7.8	(0.1)	52.0	(--)	24.4	(0.1)
Take to renderer	0.0	(--)	2.7	(--)	1.0	(0.0)
Trash pick-up	91.0	(0.7)	22.6	(--)	65.3	(0.4)
Take to landfill	0.0	(--)	8.0	(--)	3.0	(0.0)
Other	1.2	(0.7)	8.0	(--)	3.8	(0.4)
Total	100.0		100.0		100.0	

**Percentage of Markets by Method Used to Dispose of Bird Carcasses and Offal, and by Region**



For markets that sold 500 or more birds per week, 74.6 percent used trash pick-up and 22.6 percent used renderer pick-up to dispose of dead birds and offal. Among markets that sold fewer than 500 birds per week, 42.2 percent used trash pick-up, and 29.1 percent used renderer pick-up.

b. Percentage of markets by method used to dispose of carcasses and offal, and by number of birds sold per week:

Method	Percent Markets			
	Number of Birds Sold (Per Week)			
	Fewer Than 500		500 or More	
	Pct.	Std. Error	Pct.	Std. Error
Incinerate	7.0	(0.0)	0.7	(0.0)
Renderer picks up	29.1	(0.1)	22.6	(0.1)
Take to renderer	0.0	(--)	1.4	(--)
Trash pick up	42.2	(1.5)	74.6	(0.1)
Take to landfill	8.7	(0.0)	0.7	(0.0)
Other	13.0	(1.5)	0.0	(--)
Total	100.0		100.0	

**F. Information  
Delivery Preferences**

**1. Delivery method**

Overall, most market operators (81.3 percent) preferred that information from State or Federal agencies regarding changes in laws and/or requirements be received by letter.

a. Percentage of markets by preference of information delivery from State or Federal agencies regarding changes in laws and/or requirements, and by region:

<b>Percent Markets</b>						
<b>Region</b>						
	<b>North</b>		<b>South</b>		<b>All</b>	
<b>Delivery Preference</b>	<b>Pct.</b>	<b>Std. Error</b>	<b>Pct.</b>	<b>Std. Error</b>	<b>Pct.</b>	<b>Std. Error</b>
In person	17.2	(0.7)	14.7	(--)	16.2	(0.5)
Phone	5.8	(0.2)	5.3	(--)	5.7	(0.1)
Letter	79.8	(0.3)	84.0	(--)	81.3	(0.2)
E-mail	1.9	(0.0)	8.0	(--)	4.1	(0.0)
Other	0		0		0	

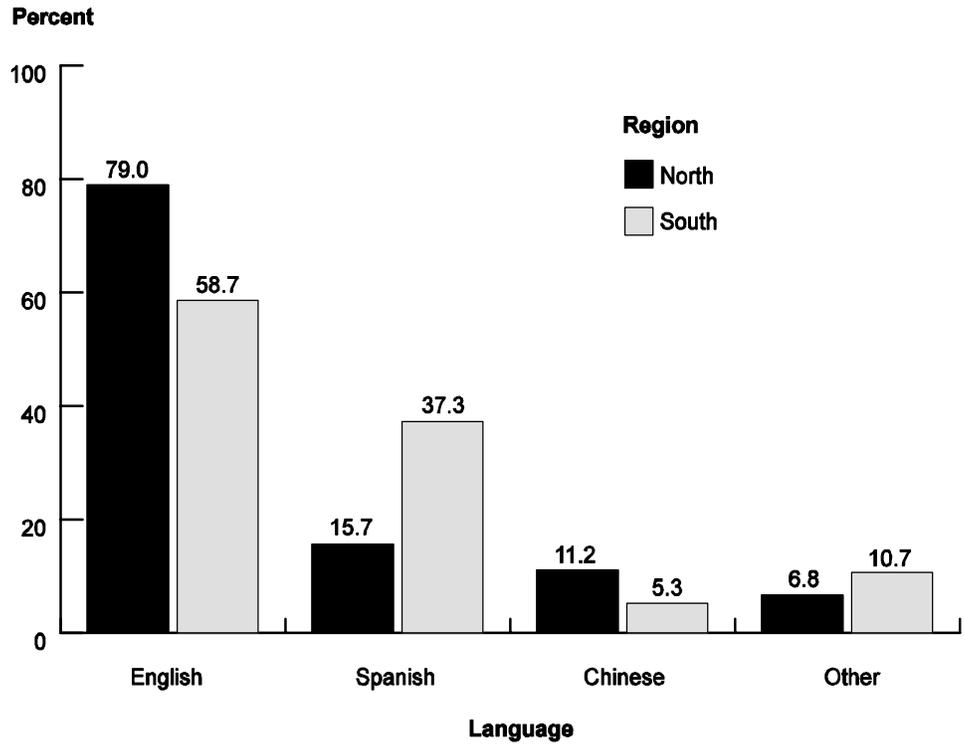
## 2. Preferred language

Most market operators preferred to receive information from State or Federal agencies regarding changes in laws and/or requirements in English, though just over a third of operators in the South region (37.3 percent) preferred Spanish. "Other" languages included Arabic, Korean, and Vietnamese.

a. Percentage of markets by language preferred when receiving information from State or Federal agencies regarding changes in laws and/or requirements, and by region:

<b>Percent Markets</b>						
<b>Region</b>						
	<b>North</b>		<b>South</b>		<b>All</b>	
<b>Preferred Language</b>	<b>Pct.</b>	<b>Std. Error</b>	<b>Pct.</b>	<b>Std. Error</b>	<b>Pct.</b>	<b>Std. Error</b>
English	79.0	(0.3)	58.7	(--)	71.4	(0.2)
Spanish	15.7	(0.2)	37.3	(--)	23.7	(0.1)
Chinese	11.2	(0.3)	5.3	(--)	9.0	(0.2)
Other	6.8	(0.7)	10.7	(--)	8.2	(0.5)

**Percentage of Markets by Language Preferred when Receiving Information from State and Federal Agencies Regarding Changes in Laws and/or Requirements, and by Region**



**3. Willingness to attend meeting**

Most market operators (78.9 percent) would be willing to attend an informational meeting about AI surveillance.

a. Percentage of market operators willing to attend an informational meeting about AI surveillance in live-poultry markets, by region:

**Percent Market Owners**

Region					
North		South		All	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
72.7	(0.8)	89.3	(--)	78.9	(0.5)

#### 4. Distance to meeting

In the North region, 63.9 percent of market operators would drive 50 miles or more to attend a meeting about AI surveillance in live-poultry markets, compared to 30.3 percent of market operators in the South region. About half of market operators in the South region were willing to drive 20 to 49 miles.

a. For market operators willing to attend a meeting about AI surveillance in live-poultry markets, percentage of market operators by distance operators were willing to drive to attend the meeting and by region:

	Percent Markets					
	Region					
	North		South		All	
Distance (Miles)	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Less than 5	5.6	(0.0)	0.0	(--)	3.1	(0.0)
5 to 19	6.3	(0.2)	22.7	(--)	13.5	(0.1)
20 to 49	24.2	(0.5)	47.0	(--)	34.2	(0.3)
50 or more	63.9	(0.5)	30.3	(--)	49.2	(0.3)
Total	100.0		100.0		100.0	

### 5. Hours willing to spend at meeting

Two-thirds of market operators in the North region (67.2 percent) were willing to spend 2 to 3 hours at a meeting about AI surveillance in live-poultry markets, while half of market operators in the South region (49.3 percent) were willing to spend 1 hour.

a. For market operators willing to attend a meeting, percentage of markets by hours willing to attend a meeting, and by region:

Hours	Percent Markets					
	Region					
	North		South		All	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
1	10.6	(0.3)	49.3	(--)	27.7	(0.2)
2 to 3	67.2	(0.6)	32.8	(--)	52.0	(0.4)
4 to 5	13.1	(0.4)	10.4	(--)	11.9	(0.2)
6 or more	9.1	(0.2)	7.5	(--)	8.4	(0.1)
Total	100.0		100.0		100.0	

## Section II: AI in Live-Poultry Markets

### A. Market Testing

Live-poultry markets are tested for AI via State or Federal programs. Data in this section are based upon those testing programs. Only results for AI H5 or H7 are reported.

**NOTE: No standard errors or confidence intervals were generated for the South region because all markets in the region were selected for the survey and there was a 100-percent response rate.**

#### 1. Number of testing occasions

Testing for AI was performed more frequently in the North region where—between March 2004 and March 2005—98.4 percent of markets were tested at least once and 86.4 percent of markets were tested four or more times. In the South region, 73.1 percent of markets were tested at least once and 18.0 percent were tested four or more times.

a. Percentage of markets by number of testing occasions for AI between March 2004 and March 2005, and by region:

Number of Testing Occasions	Percent Markets					
	Region					
	North		South		All	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
0	1.6	(0.1)	26.9	(--)	11.1	(0.1)
1	2.6	(0.1)	14.1	(--)	7.0	(0.1)
2 - 3	9.4	(0.1)	41.0	(--)	21.3	(0.1)
4 - 5	22.2	(0.2)	2.6	(--)	14.8	(0.1)
6 or more	64.2	(0.3)	15.4	(--)	45.8	(0.2)
Total	100.0		100.0		100.0	

**2. Test results**

For markets that tested for AI at least once, markets in the North region tested positive for H5 or H7 during 14.6 percent of testing visits (separate occasions). No markets in the South region tested positive for H5 or H7 at any time during the year. Because a higher level of testing occurred in the North region compared to the South region, infection, if it existed, was more likely to be found in the North region. The level of testing in the South region ensures that the prevalence is less than 1.5 percent of testing occasions with 95-percent confidence.

a. Percentage of testing occasions where markets tested positive for AI H5/H7\*:

<b>Percent Tests</b>					
<b>Region</b>					
<b>North</b>		<b>South</b>		<b>All</b>	
<b>Percent</b>	<b>Std. Error</b>	<b>Percent</b>	<b>Std. Error</b>	<b>Percent</b>	<b>Std. Error</b>
14.6	(0.1)	0.0	(--)	11.9	(0.1)

\*(Number of occasions market tested positive for AI H5 H7 x 100) divided by (number of testing occasions)

Testing and test results from the 12-month period were analyzed for each market. Based upon this information, each market was assigned to one of six categories shown in the table below. No positive markets were identified by a single testing occasion in either the North or South regions. Overall, 7.0 percent of markets had a single negative test, about half of markets (52.6 percent) had two or more tests with all negative results, and 29.3 percent of markets had at least one positive test result during the year.

b. Percentage of markets by AI H5/H7 test results between March 2004 and March 2005, and by region:

Results	Percent Markets					
	Region					
	North		South		All	
	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
No tests	1.6	(0.1)	26.9	(--)	11.1	(0.1)
1 test: negative	2.6	(0.1)	14.1	(--)	7.0	(0.1)
1 test: positive	0.0	(--)	0.0	(--)	0.0	(--)
2 or more tests: all negative*	48.7	(0.4)	59.0	(--)	52.6	(0.2)
2 or more tests: 1 positive	21.7	(0.3)	0.0	(--)	13.5	(0.2)
2 or more tests: 2 or more positive**	25.4	(0.3)	0.0	(--)	15.8	(0.2)
Total	100.0		100.0		100.0	

\*Selected as control markets for further analysis of risk factors

\*\*Selected as case markets for further analysis of risk factors

Large markets were more likely to test positive for AI H5/H7 than small markets. This result is likely related to regional market size differences, since markets in the North region tend to be larger.

c. Percentage of markets by AI H5/H7 test results between March 2004 and March 2005, and by number of birds sold per week:

<b>Percent Markets</b>				
<b>Number of Birds Sold Per Week</b>				
	<b>Fewer Than 500</b>		<b>500 or More</b>	
<b>Results</b>	<b>Percent</b>	<b>Std. Error</b>	<b>Percent</b>	<b>Std. Error</b>
No tests	8.7	(0.0)	12.5	(0.1)
1 test: negative	10.4	(0.0)	5.8	(0.1)
1 test: positive	0.0	(--)	0.0	(--)
2 or more tests: all negative*	75.0	(0.2)	43.4	(0.3)
2 or more tests: 1 positive	0.0	(0.0)	19.4	(0.3)
2 or more tests: 2 or more positive**	5.9	(0.2)	18.9	(0.3)
<b>Total</b>	<b>100.0</b>		<b>100.0</b>	

\*selected as control markets for further analysis of risk factors

\*\*selected as case markets for further analysis of risk factors

## B. Risk-Factor Analysis

### 1. Case and control markets

In order to evaluate management practices related to the persistence of AI H5/H7 in markets, a subset of markets was selected to be included in the analysis. Because no AI H5/H7-positive markets were identified in the South region, risk factor analysis was limited to the North region. Case markets were defined as all markets that had two or more positive test results for AI H5/H7 (on separate occasions) between March 2004 and March 2005. Control markets were defined as all markets that had at least two testing occasions for AI between March 2004 and March 2005, and all tests were negative for AI H5/H7. The remaining tables refer only to these two market groups.

Case markets were tested more frequently than control markets. This may be because positive test results trigger additional testing. Average number of testing occasions for cases and controls: cases 9.0; controls 6.2; all 7.2.

## 2. Characteristics for evaluation

The risk-factor analysis follows an analytic process of comparing markets in the (case) group with markets in the (control) group. Comparison characteristics of the markets were selected from all items asked on the questionnaire (descriptive results were reported in Section I). The following 11 characteristics were included for evaluation:

1. Types of birds and other animals present at the market in the previous 30 days,
2. Number of days open per week (7 versus 1 to 6),
3. 1 or more days per week empty of birds,
4. Number of birds sold per week (500 or more versus fewer than 500),
5. New arrivals added to cages with birds,
6. Frequency loose wild birds or rodents observed,
7. Number of bird sources,
8. Disposal method for dead birds and offal,
9. Dirty crate storage,
10. Indoor housing, and
11. Number of times market cleaned and disinfected in the previous 30 days (0, 1 to 2, 3 or more).

Each characteristic contributed to one or more variables for analysis. Each variable was modeled individually by logistic regression. Variables with an odds ratio of 2.5 or greater, and for which there was a sample size of 5 or greater for each level of the variable, were selected for backward elimination logistic regression modeling. The following variables met the selection criteria:

- Number of birds sold per week
- Open 7 days per week
- Number of times market cleaned and disinfected
- Trash disposal of dead birds/offal
- Presence of rabbits.

None of the markets without ducks or guinea fowl were positive for AI H5/H7. Because odds ratios and p-values could not be generated for variables with no case markets for one level, presence of ducks and guinea fowl and their relation to AI could not be evaluated. However, these variables, along with number of times the market was tested, were included as covariates in the model to account for the potential confounding effect they may have on the other variables.

### 3. Analysis summary of results

Over one-third of case markets (38.6 percent) had not cleaned or disinfected in the previous 30 days compared to 8.1 percent for control markets. The resulting odds ratio was calculated to be 3.3.

a. Percentage of case markets and percentage of control markets with the following characteristics, and results of backward elimination logistic regression: (For subset of markets: case = two or more positive tests; control = all negative tests with minimum of two tests.)

<b>Characteristic</b>	<b>Percent Case Markets</b>	<b>Percent Control Markets</b>	<b>Odds Ratio (Model)</b>	<b>95% CI</b>
Number of times completely cleaned and disinfected (previous 30 days) <sup>++</sup>				
0	38.6	8.1	3.3	2.8 – 3.9
1 to 2	42.1	47.0	1.2	1.1 – 1.4
3 or more	19.3	44.9	1	
Ducks present in previous 30 days <sup>+</sup>	100.0	83.4	*	
Guinea fowl present in previous 30 days <sup>+</sup>	100.0	87.1	*	
Rabbits present in previous 30 days <sup>+</sup>	93.4	72.4	3.2	2.6 – 3.9
Open 7 days per week <sup>+</sup>	78.0	56.8	2.1	1.8 – 2.6
500 or more birds sold per week <sup>+</sup>	89.0	75.9	**	
Dead bird/offal disposal in trash <sup>+</sup>	96.4	83.1	2.4	1.8 – 3.4
More than 1 bird source <sup>+++</sup>	87.7	71.5	+++	

\*Odds ratios were not generated where no positive markets were identified for one level of the variable.

\*\*This variable was not significant in the model.

<sup>+</sup>Reference level = absence of the factor.

<sup>++</sup>Clean and disinfect floors, wall, cages, and ceiling at one time.

<sup>+++</sup>Information on subset of data; too few observations to include in the model.

#### 4. Discussion

AI H5/H7 was found only in the North region. This finding may be due to a climate in the North region more conducive to the AI virus, the continuous introduction from infected supplier flocks, or other practices such as indoor housing, where the virus may achieve higher concentrations.

Following backward elimination logistic regression, four variables in the model remained significant risk factors:

- Trash disposal of dead birds and offal
- Number of times cleaning and disinfecting was performed
- Open 7 days per week
- Presence of rabbits

Dead birds and offal in the trash may be a source of contamination to birds in the market and their environment. Compared to markets that cleaned and disinfected 3 or more times during the previous 30 days, markets that did not perform a complete cleaning and disinfection during the previous 30 days were 3.3 times more likely to be positive for AI H5/H7. Markets that cleaned and disinfected 1 to 2 times during the previous 30 days were 1.2 times more likely to be positive for AI H5/H7.

**NOTE: Many of the practices evaluated relate to the 30 days prior to the survey, whereas test results span a full year. Practices as well as the AI status of the market may have changed during that time.**

Case markets were 2.1 times more likely to be open 7 days per week compared to control markets, which is similar to findings from a previous live-poultry market study. This factor may also be related to ability to thoroughly clean and disinfect the market due to market traffic and the continual presence of birds.

Presence of rabbits was statistically associated with presence of AI H5/H7. Markets with rabbits were six times more likely to have multiple sources of birds compared to markets without rabbits, which may explain in part why markets with rabbits were more likely to be cases. Data regarding number of bird sources were available on just a subset of markets and therefore could not be included in the model. However, univariately, case markets were 4.2 times more likely to have multiple bird sources compared to control markets.

a. Percentage of markets with multiple bird sources by presence of rabbits during the previous 30 days:

Rabbits Present	Rabbits Not Present	OR	95% CI
80.6	69.9	6.1	1.4 – 25.7

**5. Conclusions**

In 2001, a one-time sampling of markets in New York and New Jersey found 59.6 percent of markets positive for AI H7. In this study, AI H5/H7 was found on 14.6 percent of testing occasions in the North region, indicating a reduction in prevalence of AI H7 in the North region. AI prevalence in the South region was estimated to be less than 1.5 percent of test occasions.

Cleaning/disinfecting is an important strategy to reduce disease transmission in markets. Three risk factors identified in this study (number of times cleaning and disinfecting occurred; disposal of dead birds and offal in the trash; and being open 7 days per week) could all relate to hygiene and ability to thoroughly clean and disinfect the market.

Presence of rabbits was associated with AI H5/H7 risk but may be a proxy for other factors such as multiple sources of birds. The role of multiple suppliers warrants further investigation.

Although this study focused on the market, it is only one component in the live-poultry market system. The role that suppliers and dealers play in the perpetuation of the AI virus in the live-poultry market system needs to be addressed.

## Section III: Methodology

### A. Needs Assessment

NAHMS develops study objectives by exploring existing literature and contacting industry members and other stakeholders about their informational needs and priorities during a needs assessment phase. For Poultry '04, the following activities were conducted:

- A focus group consisting of industry, State, Federal, and university representatives met at the World Poultry Exposition in Atlanta, Georgia, in January 2002.
- A needs assessment questionnaire was distributed to poultry veterinarians via the presidents of the egg layer, broiler, and turkey veterinary groups. This questionnaire was also distributed to State and Federal veterinarians and laboratory and research personnel.

### B. Sampling and Estimation

#### 1. Market selection

All known live-poultry markets in seven areas containing known live-poultry markets were selected (California, Florida, New England, New Jersey, New York, Pennsylvania, and Texas).

#### 2. Population inferences

Inferences cover the population of known live-poultry markets in the seven areas. All respondent data were statistically weighted for nonresponse to reflect the population from which they were selected. The initial weight was equal to the number of markets selected (all known markets) within each area divided by the number of respondent markets in that area. This weight was used to generate estimates for the in-person interview portion of the survey. In New York, some of the questions were removed from the interview questionnaire, and market operators were asked to complete these questions via a mail-in survey. As a result, for New York respondents, the weight was adjusted by the number of respondents to the initial interview divided by the number of respondents to the mail-in portion, within three size strata. The adjustment in all other States was equal to 1. This second weight was used to generate estimates for the portion of the questionnaire that was a mail survey in New York, but part of the initial personal interview in other States.

## C. Data Collection

In-person interviews were conducted by State and Federal veterinarians and animal health technicians between Jan. 1, 2005, and June 30, 2005, in all States but New Jersey. In New Jersey, Federal personnel visited markets during June 2005 to explain the study, and a questionnaire was left with the market operator for completion. A stamped, addressed envelope was provided, and questionnaires were mailed directly to NAHMS staff in Fort Collins, CO. In addition, in New York some of the questions were removed from the interview questionnaire and market operators were asked to complete these questions as a mail-in survey. The different methods used to collect data in each State may have influenced participation as well as responses to questions. While the potential bias this may have caused cannot be measured, it is reasonable to assume that questions regarding activities that are illegal in certain States would likely be underestimated. Information on number of times tested and number of times positive for AI H5/H7 between March 2004 and March 2005 was provided by State animal health officials—except for New Jersey, where the information was market-reported.

## D. Data Analysis

### 1. Validation and estimation

Data were entered into a SAS data set. Validation checks were performed to identify numeric extremes, improper categorical responses, skip patterns not followed, and relational checks. Weighted point estimates were generated using SUDAAN software, which accounts for sampling methodology.

### 2. Risk-factor analysis

The purpose of the risk-factor analysis was to identify characteristics associated with markets that persistently tested positive for AI H5/H7 compared to markets that persistently tested negative. A subset of markets was used for this analysis. Case markets were defined as markets that had two or more positive test results between March 2004 and March 2005. Control markets were defined as markets that had at least two testing occasions for AI between March 2004 and March 2005 and all tests were negative for AI H5/H7. Because no AI H5/H7 positive markets were identified in the South region, risk-factor analysis was limited to the North region. Odds ratios were obtained by modeling each variable using logistic regression. Variables with an odds ratio of 2.5 or greater, and for which there was a sample size of 5 or greater for each level of the variable, were selected for backward elimination logistic regression modeling.

### 3. Response rate

A total of 215 markets were selected, of which 11 did not qualify for the survey (did not sell live poultry). Of the remaining 204 eligible markets, 183 (89.7 percent) participated in the study. A total of 108 of 129 eligible markets in the North region participated (83.7 percent) and all 75 markets in the South region participated. Of the 84 markets in New York that participated in the personal interview, 26 completed the mail-in portion of the study (31.0 percent).

Region	State	Selected	Eligible	Respondents	Response Rate (Percent)
North	NJ	33	33	14	42.4
	NY	87	85	84	98.8
	Other*	11	11	10	90.9
	Total	131	129	108	83.7
South	CA	44	37	37	100.0
	FL	31	29	29	100.0
	TX	9	9	9	100.0
	Total	84	75	75	100.0
	Total (both regions)	215	204	183	89.7

\*Includes markets in New England and Pennsylvania

## Appendix I: Sample Profile

### A. Responding Sites

#### 1. Number of respondents by region

Number of Respondents		
Region		
North	South	Total
108	75	183

#### 2. Number of respondents by number of birds sold per week

Number of Respondents		
Number of Birds Sold (Per Week)		
Fewer than 500	500 or more	Total
52	131	183

## Appendix II: Poultry '04 Study Objectives and Related Outputs

Objectives: Provide a basic understanding of bird health, management, and movement practices of live-poultry markets, gamefowl, and backyard flocks.

- Part I: Reference of Health and Management of Backyard/Small Production Flocks in the United States, 2004, August 2005
- Part II: Reference of Health and Management of Gamefowl Breeder Flocks in the United States, 2004, August 2005
- **Part III: Reference of Management Practices in Live-Poultry Markets in the United States, 2004, April 2006**
- Part IV: Reference of Health and Management of Backyard/Small Production Flocks and Gamefowl Breeder Flocks in the United States, 2004, October 2005
- Highlights: Health and Management of Backyard/Small Production Flocks in the United States, 2004, Info Sheet, August 2005
- Highlights: Health and Management of Gamefowl Breeder Flocks in the United States, 2004, August 2005
- Highlights: Management Practices in Live-Poultry Markets in the United States, 2004, spring 2006

