



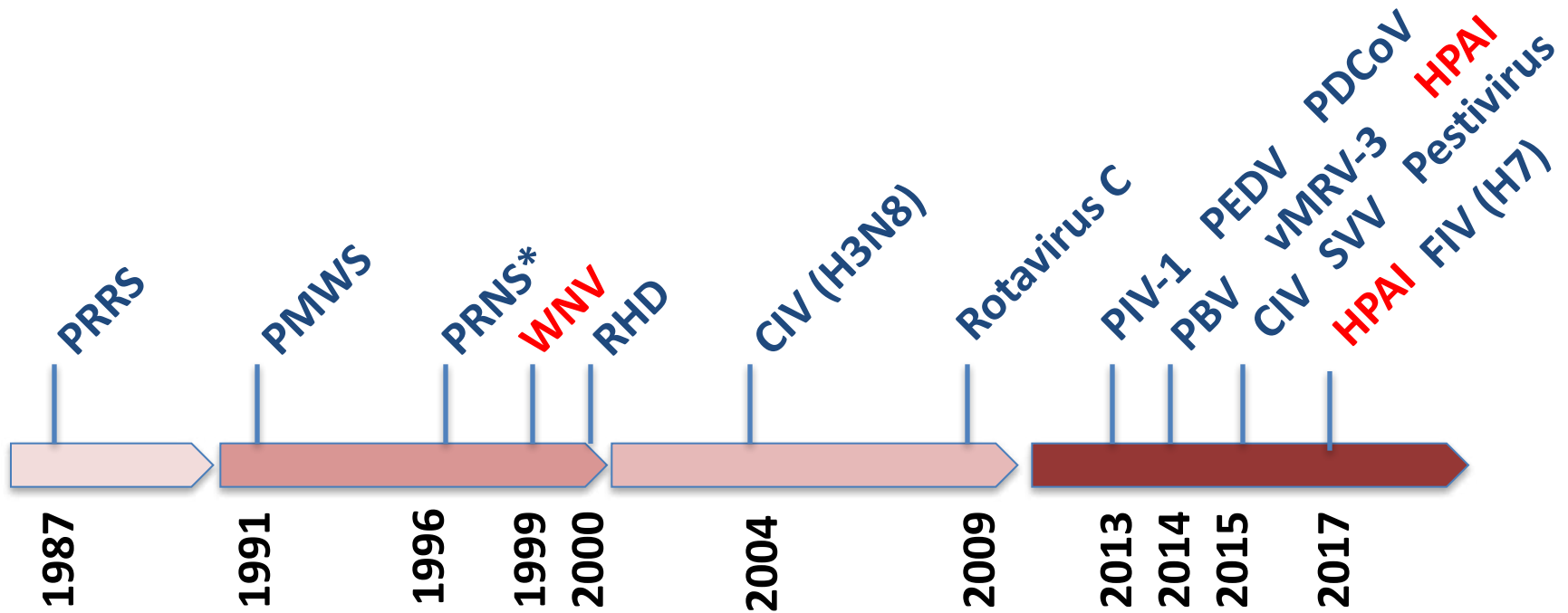
# ***Role of terrestrial wild birds and rodents in spreading AIV to commercial layer operations***

K.J. Yoon, J. Adelman, Y. Sato, P.G. Gauger,  
J.Q. Zhang, G. Li, J. Blanchong

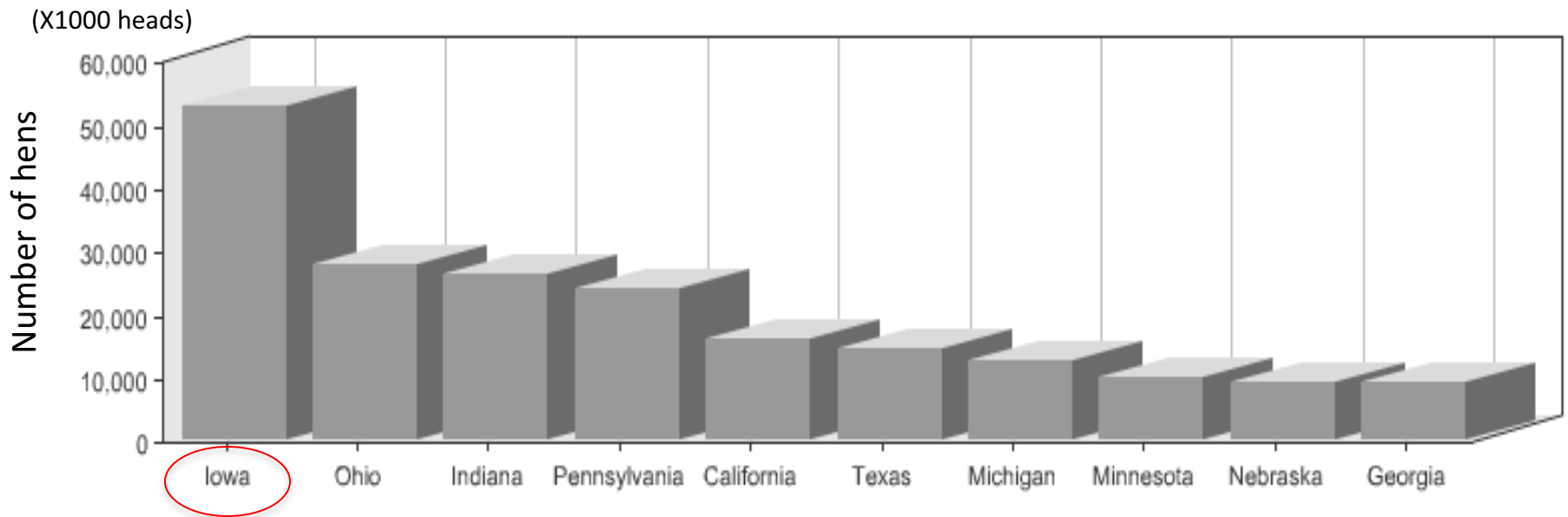
VDPAM, College of Veterinary Medicine  
NREM, College of Agriculture



# Recent animal EID in the US



# Iowa - #1 egg hen state in the US



(Source: American Egg Board, 2013)

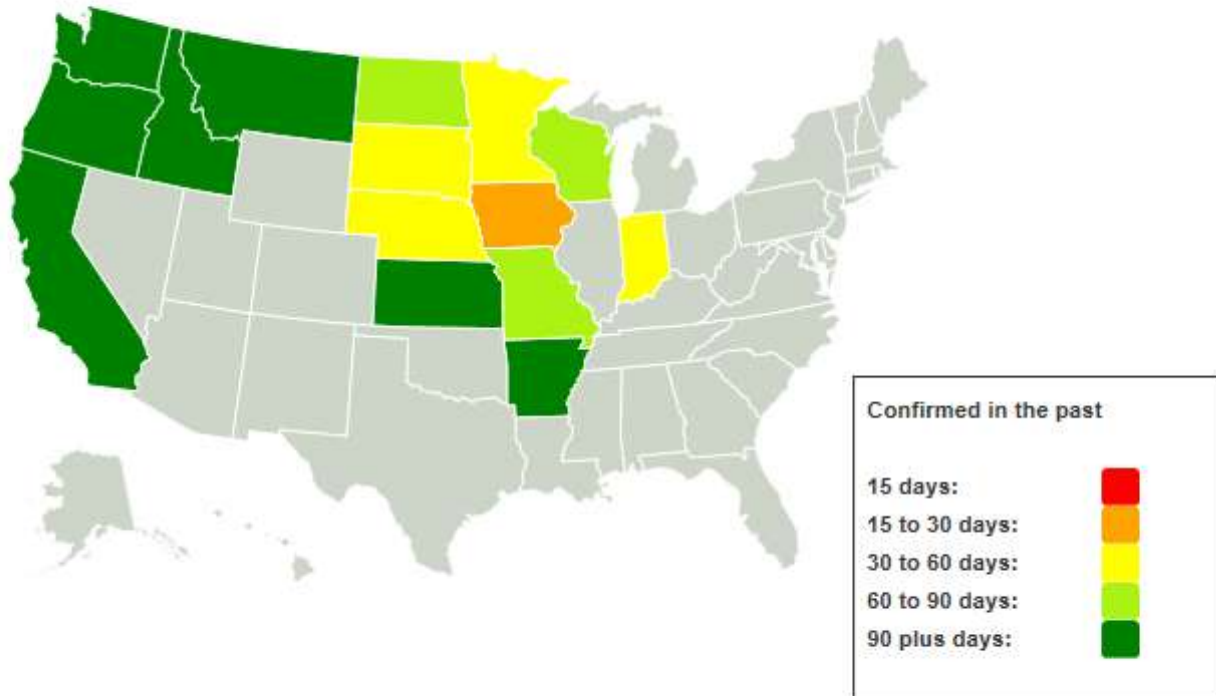
BUSINESS DAY

# Egg Farms Hit Hard as Bird Flu Affects Millions of Hens

By STEPHANIE STROM MAY 14, 2015



**Update on Avian Influenza Findings**  
**Poultry Findings Confirmed by USDA's National Veterinary Services Laboratories**



**223**

Detections Reported

**48,091,293**

Birds Affected

**12/19/14**

First Detection Reported

**6/17/15**

Last Detection Reported

(7/5/15)



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Research Service**

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# **Update on the Highly-Pathogenic Avian Influenza Outbreak of 2014-2015**

**Joel L. Greene**

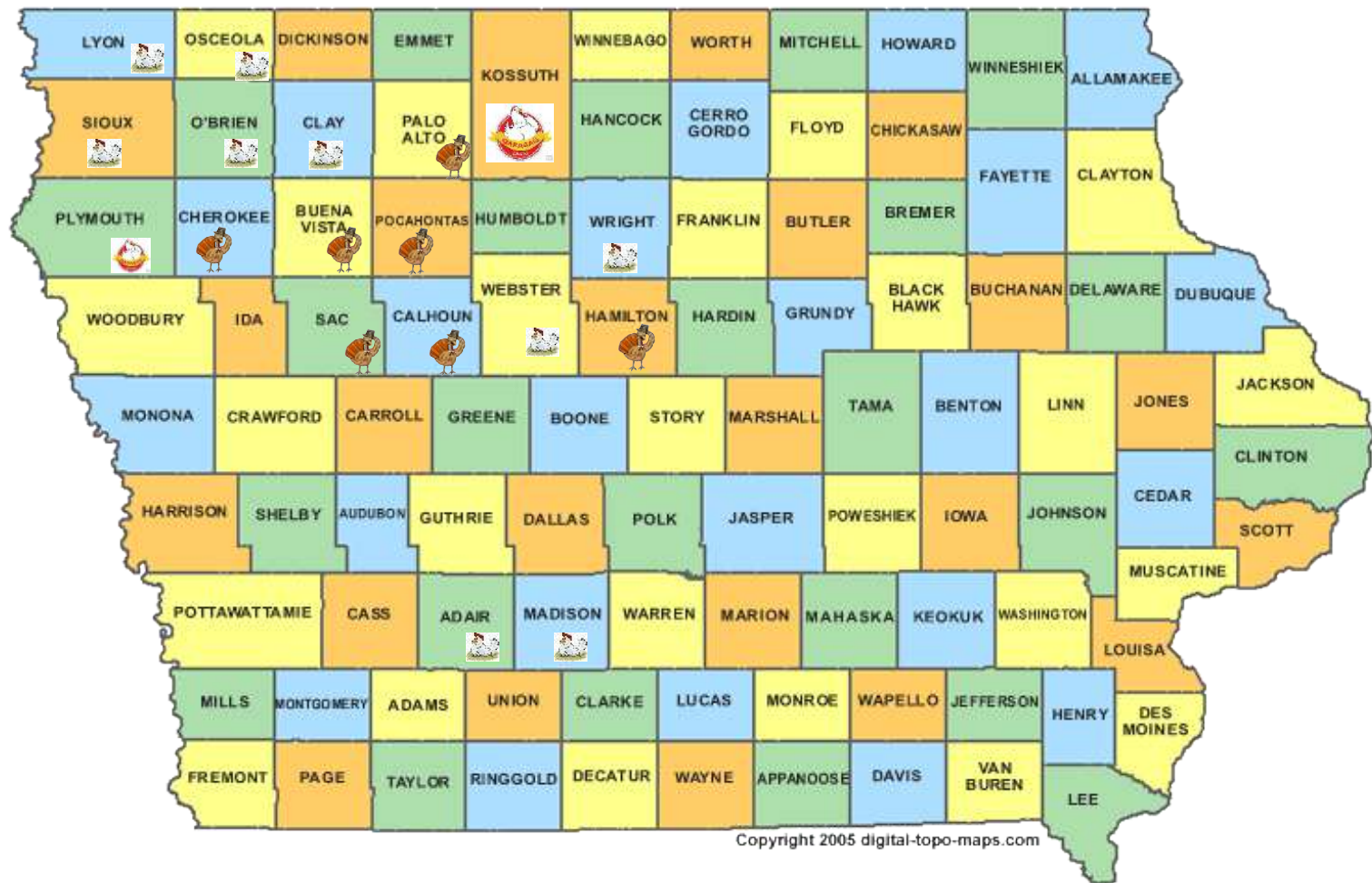
Analyst in Agricultural Policy

July 20, 2015

“The value of turkey and laying hen losses is estimated at nearly \$1.6 billion. Economy-wide losses are estimated at \$3.3 billion.”

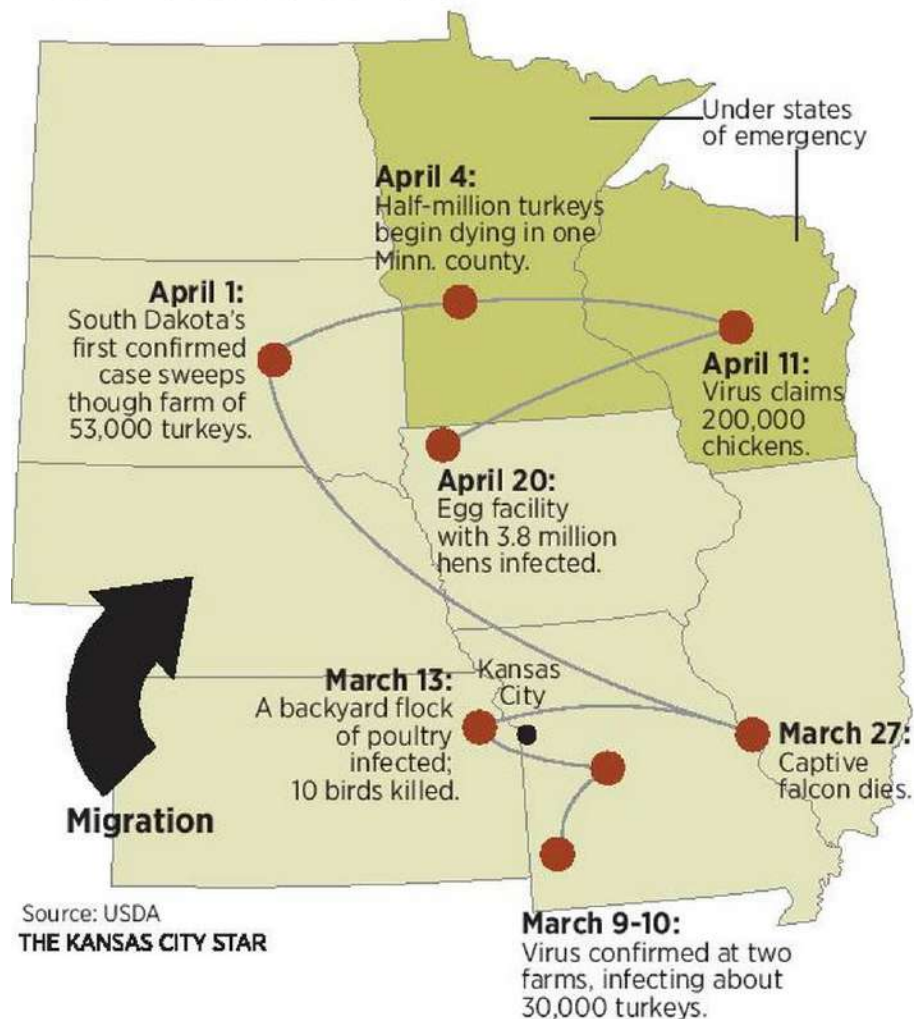
# HPAI outbreaks in Iowa

## (April-June, 2015)

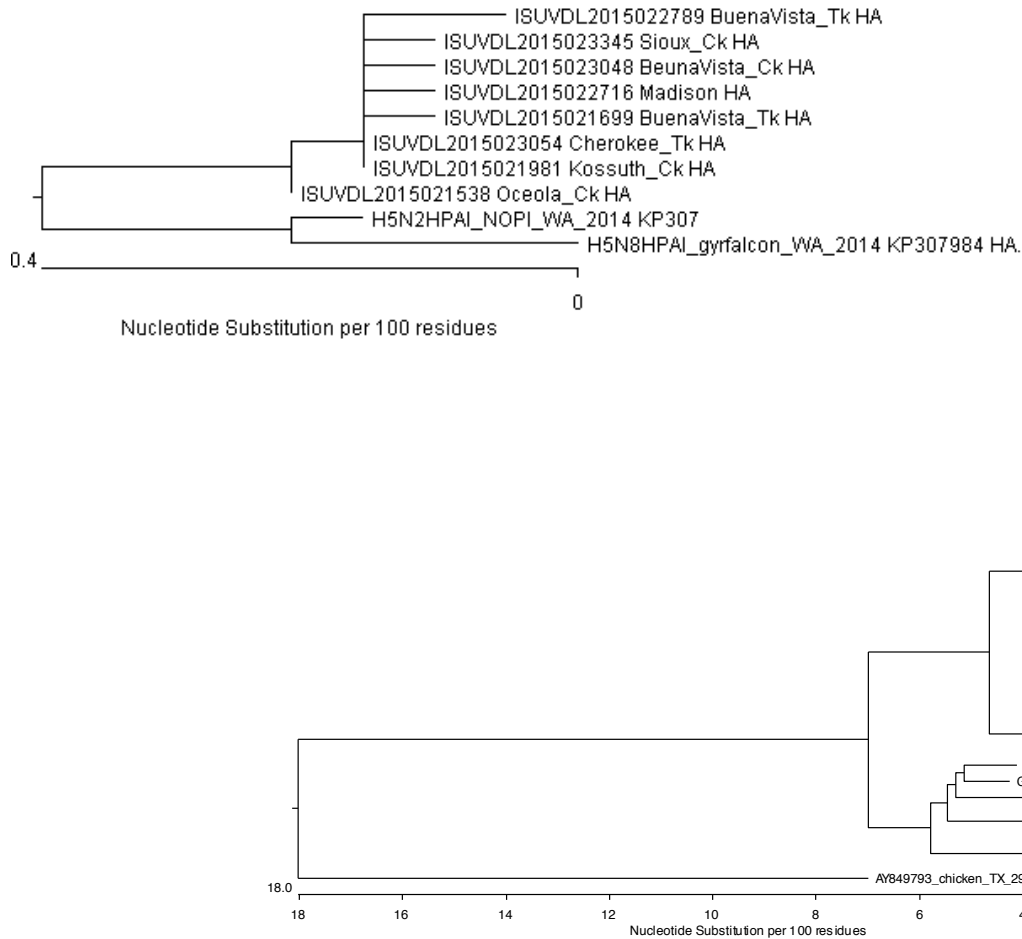


# FLYING FLU

In recent months migratory waterfowl are believed to have spread the avian influenza virus H5N2, killing or prompting euthanasia of more than 7 million birds, mostly commercial poultry. Here's a sample of Midwest incidents confirmed by the USDA's national animal lab:



# Phylogenetic analysis of H5N2 HPAI viruses from Iowa poultry



- ISUVDL2015022624 Osceola Ck HA
- ISUVDL2015022624b Osceola Ck HA
- ISUVDL2015021699 BuenaVista\_Tk HA
- ISUVDL2015022376b Sioux Ck HA
- ISUVDL2015023687 Sioux Ck HA
- ISUVDL2015022393 Pocahontas Tk HA
- ISUVDL2015023345 Sioux Ck HA
- ISUVDL2015021233 Osceola Ck HA
- ISUVDL2015022789 BuenaVista\_Tk HA
- ISUVDL2015023054 Cherokee\_Tk HA
- ISUVDL2015021981 Kossuth\_Ck HA
- ISUVDL2015023688 Sioux Ck HA
- ISUVDL2015023684 Wright Ck HA
- ISUVDL2015023048 BeunaVista\_Ck HA
- ISUVDL2015023312 Osceola Backyard HA
- ISUVDL2015023247 Dickinson Ck HA
- ISUVDL2015022384 Dickinson Ck HA
- ISUVDL2015023693 Cherokee Tk HA
- ISUVDL2015022047 BuenaVista Ck HA
- ISUVDL2015022391 Clay Ck HA
- ISUVDL2015021533 OBrien Ck HA
- ISUVDL2015023277 BuenaVista Tk HA
- ISUVDL2015023277-2b BuenaVista Tk HA
- ISUVDL2015023307 Sioux Backyard HA
- ISUVDL2015023959 Cherokee Tk HA
- ISUVDL2015022716 Madison Ck HA
- ISUVDL2015022716-1 Madison Ck HA
- ISUVDL2015023331 Osceola Ck HA
- KR492974.3\_Ck\_IA\_20150420 HA
- ISUVDL2015023292 BuenaVista Tk HA
- ISUVDL2015023436 Sioux Ck HA
- ISUVDL2015023295 BuenaVista Tk HA
- ISUVDL2015021506 OBrien Ck HA
- ISUVDL2015022376 Sioux Ck HA
- ISUVDL2015023692 BuenaVista Tk HA
- ISUVDL2015023963 BuenaVista Ck HA
- ISUVDL2015022723 Sac Tk HA
- ISUVDL2015022723b Sac Tk HA
- ISUVDL2015021538 Osceola\_Ck HA
- KR234022\_turkey/AR/2015(H5N2)
- KR233982\_turkey/MN/2015(H5N2)
- KR234038\_turkey/MN/2015(H5N2)
- ISUVDL2015021979 BeunaVista\_Tk HA
- KP739381\_chicken/WA/2014(H5N2)
- KP739389\_domestic\_duck/WA/2014(H5N2)
- KP739397\_turkey/WA/2014(H5N2)
- KR233990\_chicken/WA/2015(H5N2)
- KR234014\_turkey/MO/2015(H5N2)
- KR233998\_chicken/OR/2015(H5N2)
- KR150909\_pheasant/WA/2015(H5N2)
- KP795729\_chicken/BC/2014(H5N2)
- KP795737\_chicken/BC/2014(H5N2)
- KR234030\_chicken/KS/2015(H5N2)
- KR234006\_turkey/MN/2015(H5N2)
- KP307957\_turkey/BC/2014(H5N2)
- H5N2HPAI\_NOPI\_WA\_2014 KP307
- KR150901\_turkey/CA/2015(H5N8)
- KP739421\_AGW teal/WA/2014 (H5N1)
- H5N8HPAI\_gyrfalcon\_WA\_2014 KP307984 HA
- KR233690\_chicken/Netherlands/2014(H5N8)
- KR233682\_EAW/Netherlands/2014(H5N8)
- KR233674\_EAW/Netherlands/2014(H5N8)
- KR232364\_EAW/Netherlands/2015(H5N8)
- KJ509132\_mallard/Korea/2014(H5N8)
- AB932556\_chicken/kumamoto/2014(H5N8)
- KJ509116\_chicken/Korea/2014(H5N8)
- KJ509036\_baikal teal/Korea/2014(H5N8)
- KJ413834\_breeder\_duck/Korea/2014(H5N8)
- KJ508961\_baikal teal/Korea/2014(H5N8)
- KJ476657\_mallard/Shanghai/2013(H5N8)
- JQ973694\_duck/Jiangsu/2010 (H5N8)
- CY099966\_chicken/Metnam/2008(H5N1)
- GU050325\_avian/Hong Kong/2007(H5N1)
- CY098723\_Hunan/1/2009(H5N1)
- CY098853\_water/Hunan/7/2009(H5N1)
- KF182741\_duck/Metnam/2012(H5N1)
- KC631946\_chicken/China/2010(H5N1)
- KC631945\_chicken/Shandong/2010(H5N1)
- AY849793\_chicken\_TX\_298313\_04(H5N2) HA

H5N2 AIV in Iowa



United States  
Department of  
Agriculture

Animal and Plant  
Health Inspection  
Service

Veterinary Services

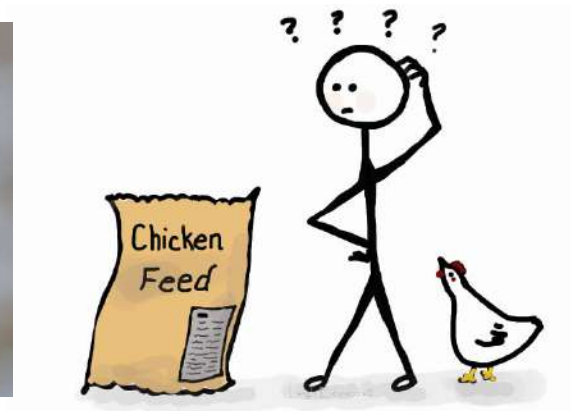
“...there is not substantial or significant enough evidence to point to a specific pathway or pathways for the current spread of the virus.”

“Wild birds were observed inside the barns on 35 percent of the farms.”

**Epidemiologic and Other Analyses of  
HPAI-Affected Poultry Flocks:  
September 9, 2015 Report**

# Can other carriers be involved?

- Wildlife?
- Feeds?



# AIV in wild birds



JOURNAL OF VIROLOGY, Dec. 2005, p. 15460–15466  
0022-538X/05/\$08.00+0 doi:10.1128/JVI.79.24.15460-15466.2005  
Copyright © 2005, American Society for Microbiology. All Rights Reserved.

Vol. 79, No. 24

## New Genotype of Avian Influenza H5N1 Viruses Isolated from Tree Sparrows in China

Z. Kou,<sup>1</sup> F. M. Lei,<sup>2\*</sup> J. Yu,<sup>3</sup> Z. J. Fan,<sup>1</sup> Z. H. Yin,<sup>2</sup> C. X. Jia,<sup>2</sup> K. J. Xiong,<sup>1</sup> Y. H. Sun,<sup>2</sup>  
X. W. Zhang,<sup>3</sup> X. M. Wu,<sup>4</sup> X. B. Gao,<sup>4</sup> and T. X. Li<sup>1\*</sup>

*State Key Laboratory of Virology, Wuhan Institute of Virology, Chinese Academy of Sciences, Wuhan, 430071 China<sup>1</sup>;  
Institute of Zoology, Chinese Academy of Sciences, Beijing, 100080 China<sup>2</sup>; Beijing Genomics Institute,  
Chinese Academy of Sciences, Beijing, 101300 China<sup>3</sup>; and  
Shaanxi Institute of Zoology, Xi'an, 710032 China<sup>4</sup>*

Received 28 June 2005/Accepted 27 September 2005

DISPATCHES

## Novel Avian Influenza A(H7N9) Virus in Tree Sparrow, Shanghai, China, 2013

Baihui Zhao,<sup>1</sup> Xi Zhang,<sup>1</sup> Wenfei Zhu,<sup>1</sup>  
Zheng Teng, Xuelian Yu, Ye Gao, Di Wu,  
Enle Pei, Zhengan Yuan, Lei Yang, Dayan Wang,  
Yuelong Shu, and Fan Wu

In spring 2013, influenza A(H7N9) virus was isolated from an apparently healthy tree sparrow in Chongming Dongping National Forest Park, Shanghai City, China. The entire gene constellation of the virus is similar to that of isolates from humans, highlighting the need to monitor influenza A(H7N9) viruses in different species.

## Avian influenza A virus subtype H5N2 in a red-lored Amazon parrot

Michelle G. Hawkins, VMD, DABVP; Beate M. Crossley, DVM, PhD, MPVM; Anna Osofsky DVM, DABVP;  
Richard J. Webby, PhD; Chang-Won Lee, DVM, PhD; David L. Suarez, DVM, PhD, DACVM;  
Sharon K. Hietala, PhD

SMALL ANIMALS/  
AVIAN



# Objective

- To determine whether small terrestrial wild birds (e.g., sparrows, starlings, finches), rodents, and/or insects can transmit AIV, including H5N2 HPAIV, between traditional wildlife reservoirs (i.e., waterfowl/shorebirds) and commercial layer operations, or among such farms.



(source: USDA)



# Study Plan

- Targeted surveillance for AIV infection in and on potential vectors (terrestrial birds, rodents) at locations likely to contribute to links between waterfowl and commercial layer operations within a proximity to wetlands






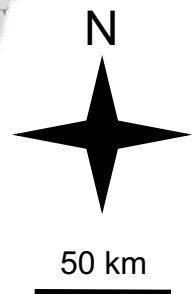
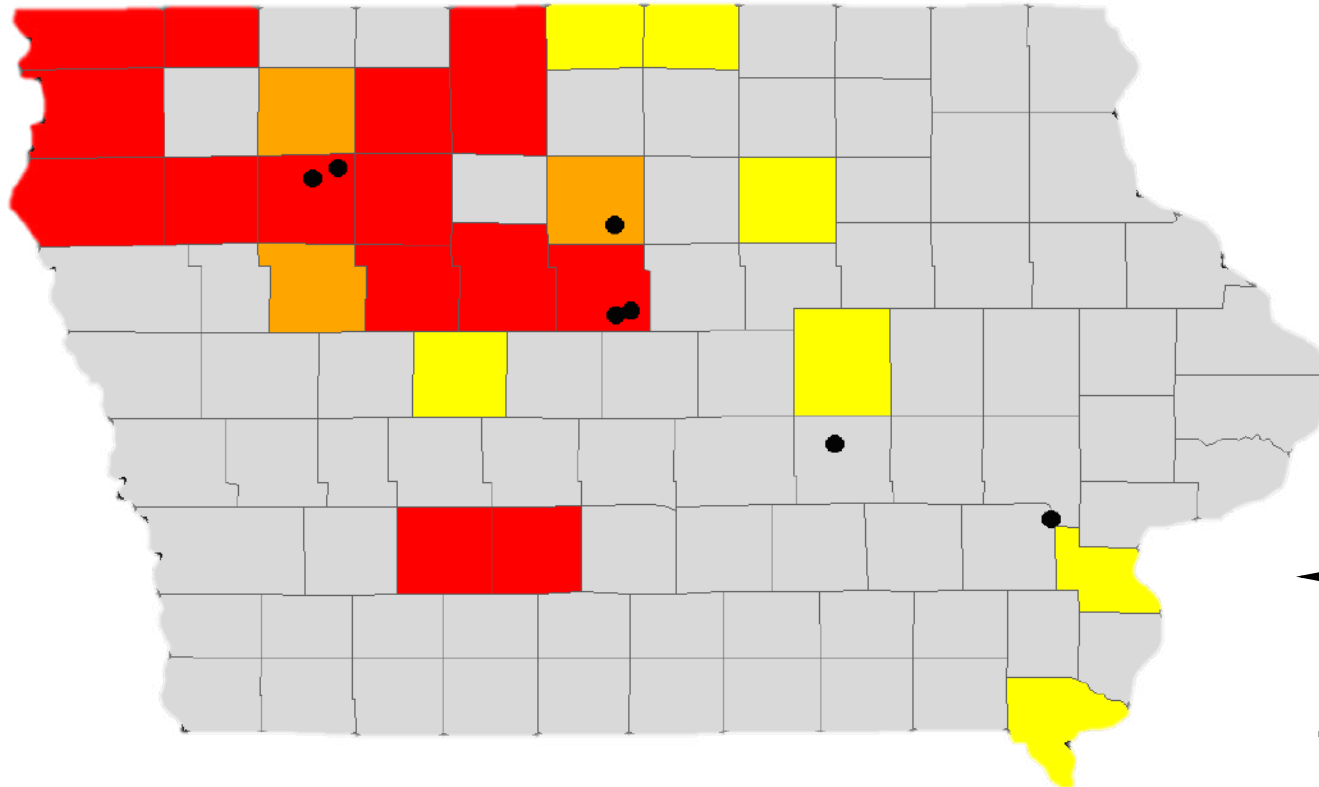
# Field sampling, Fall 2015-Spring 2016





# Field sampling map

-  High-path AIV in domestic poultry during 2015 outbreak
-  Low-path AIV in waterfowl in surveys conducted 2006-2011
-  Both of the above



# Animal Catchment



# Animal Catch & Sampling

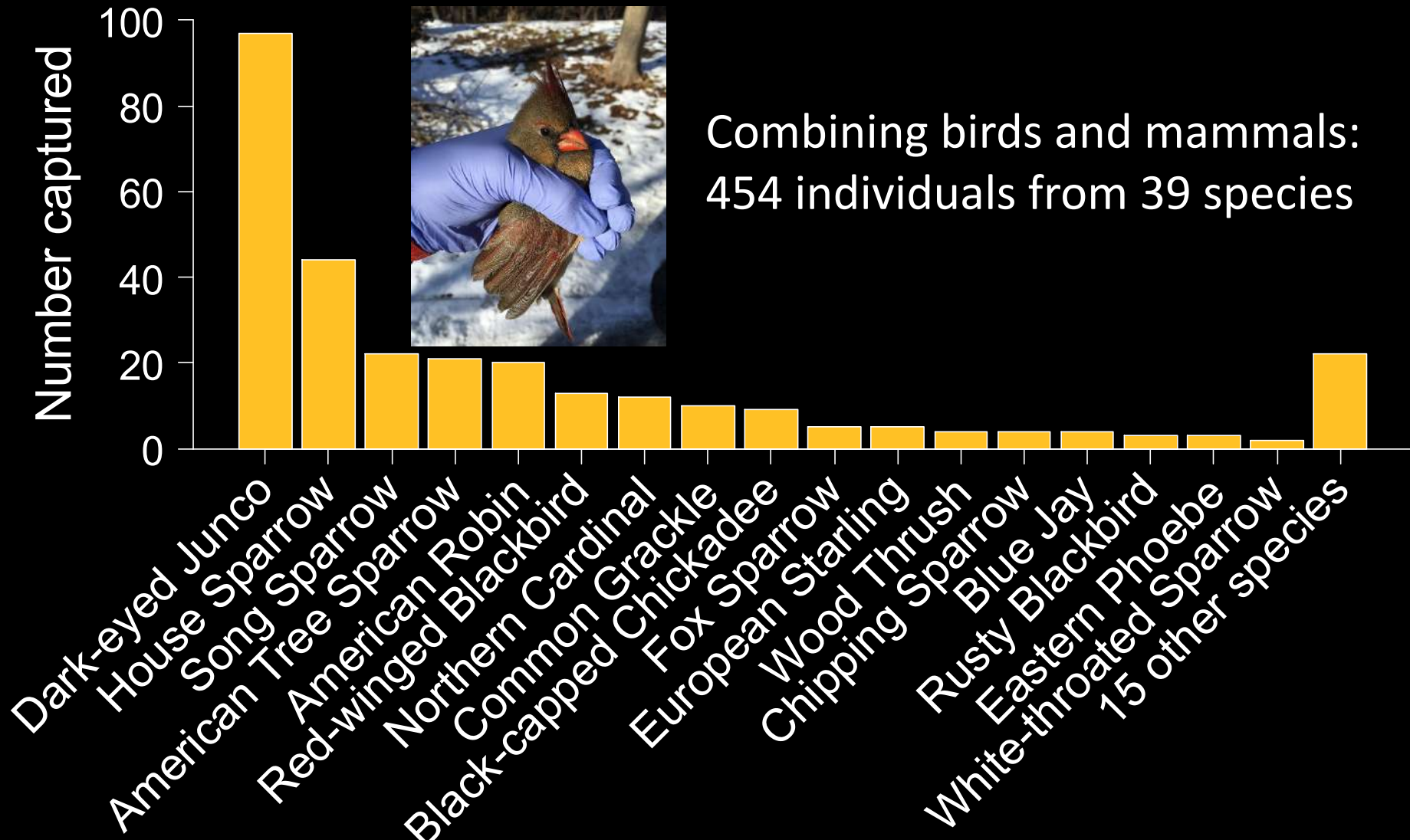


# Field sampling

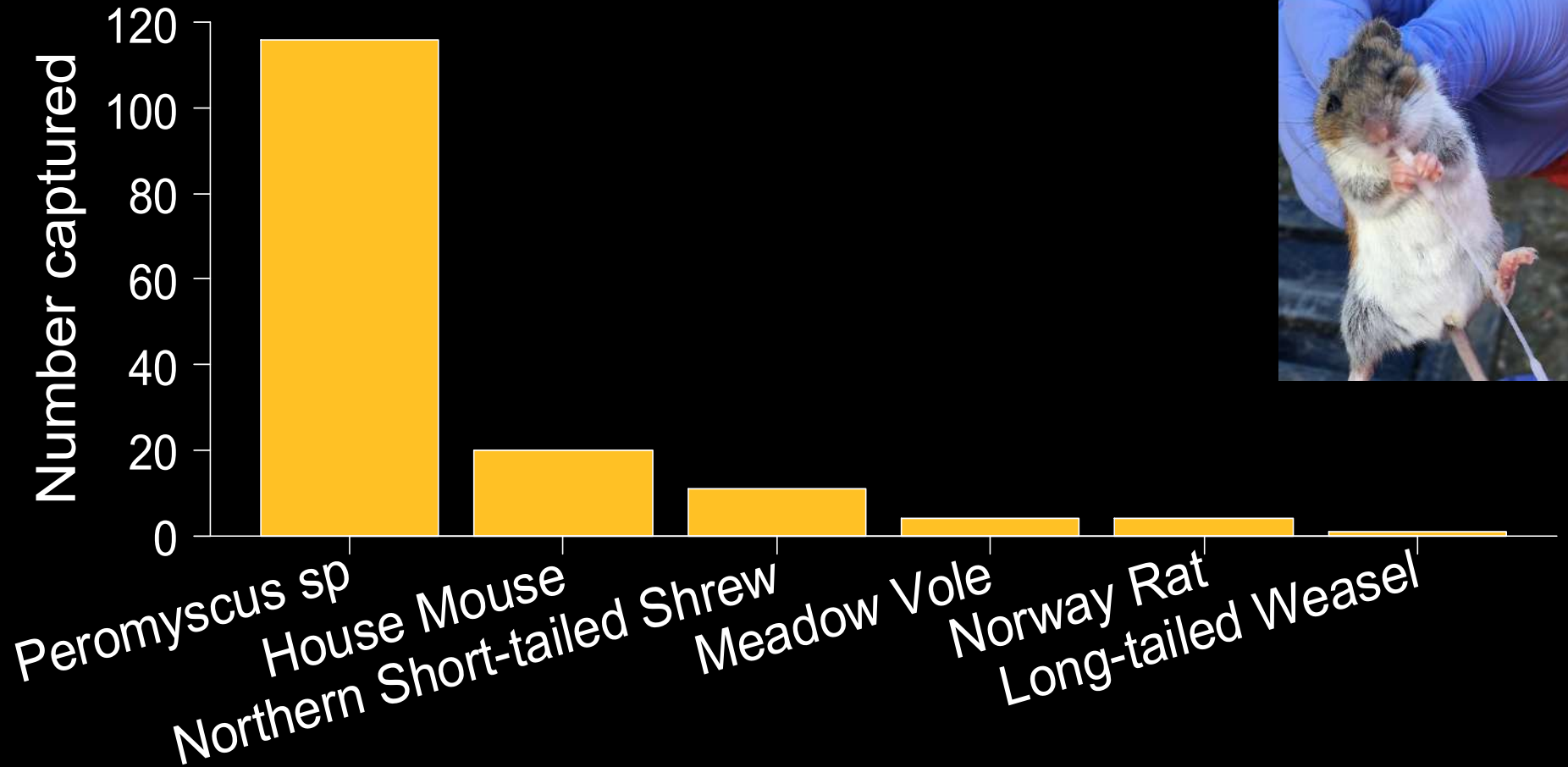
- Swabs
  - Pooled internal swabs:  
Oropharyngeal &  
anal/cloacal
  - Pooled external swabs:  
Feet, fur/feathers
  - Into BHI media, on ice  
until frozen at  $-20^{\circ}\text{C}$
- Blood samples, on ice  
until centrifuged and  
frozen at  $-20^{\circ}\text{C}$



# What did we catch?

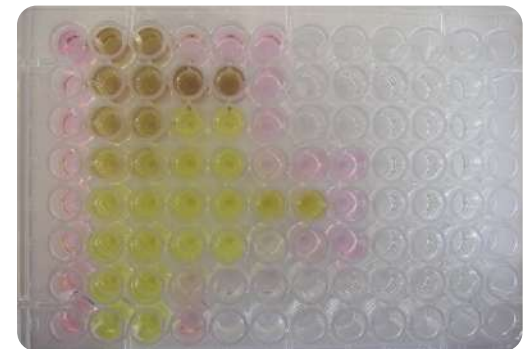


# What did we catch?

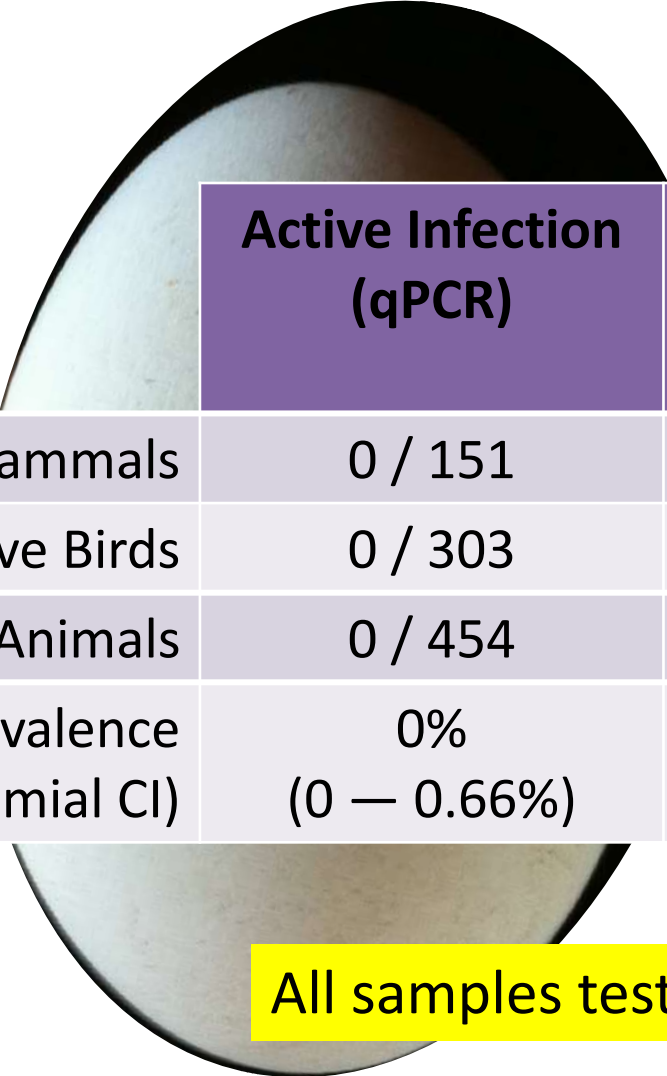


# Laboratory testing

- RT-qPCR for influenza A virus
  - VetMAX™ Gold AIV Detection Kit (Thermo-Fisher)
  - NP gene & M gene
- Virus isolation using embryonated eggs
- Multi-species ELISA for antibodies against influenza A
  - AI MultiS-Screen Ab (IDEXX)



# Results



	Active Infection (qPCR)	Prior Exposure (Antibodies)
# of Positive Mammals	0 / 151	0 / 115
# of Positive Birds	0 / 303	0 / 289
Total Positive Animals	0 / 454	0 / 404
Estimated Prevalence (95% Binomial CI)	0% (0 — 0.66%)	0% (0 — 0.74%)

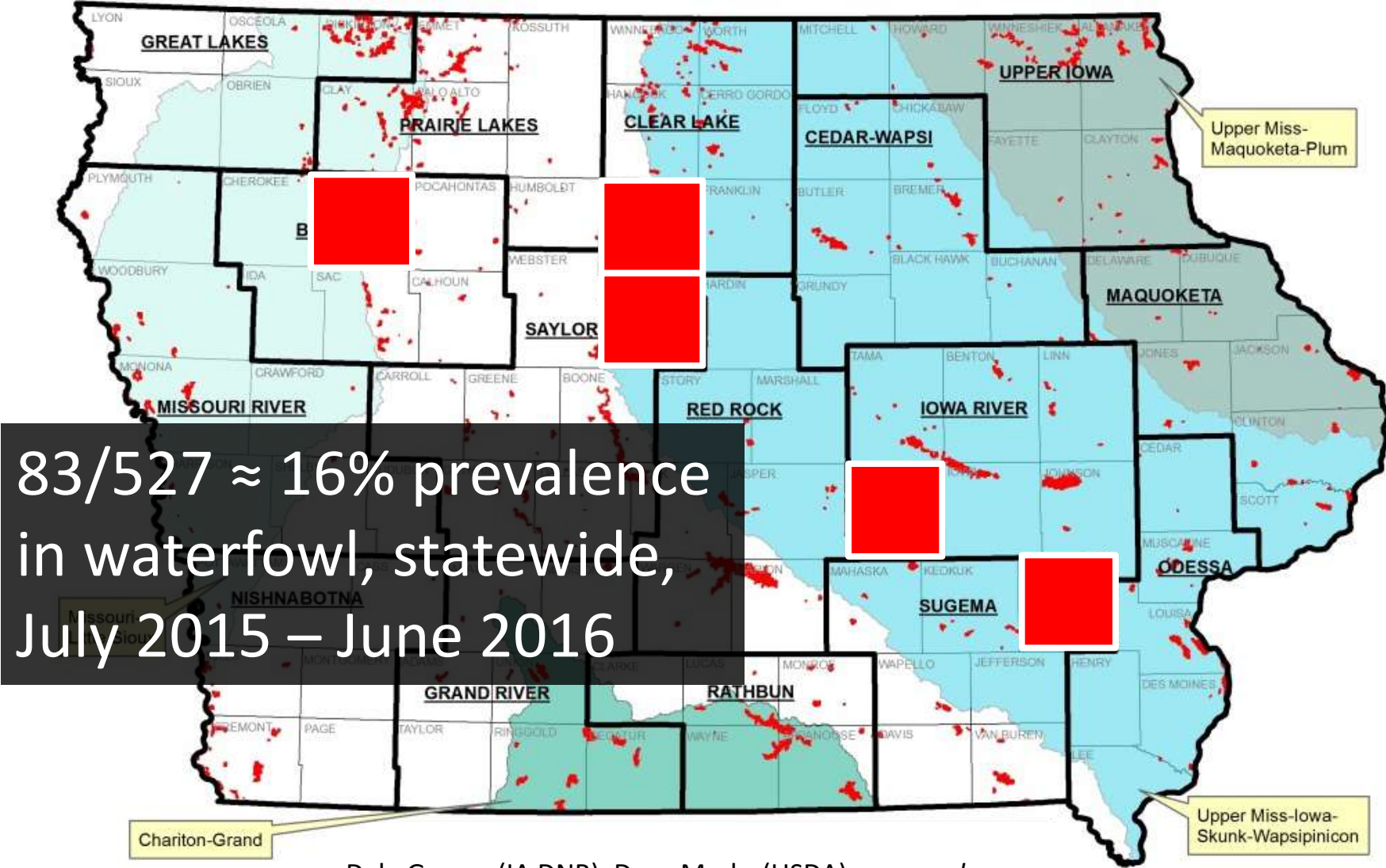
All samples tested negative by VI

# Results - Bayesian remix

Williams, C.J. and C.M. Moffit. 2015.  
Ecological Informatics 5: 273-280.

	Active Infection (qPCR)	Prior Exposure (Antibodies)
Num. Positive Mammals	0 / 151	0 / 115
Num. Positive Birds	0 / 303	0 / 289
Total Positive Animals	0 / 454	0 / 404
Estimated Prevalence (95% Binomial CI)	0% (0 — 0.66%)	0% (0 — 0.74%)
Estimated Prevalence (95% Bayesian CI)		

# Avian influenza was present at the time



Dale Garner (IA DNR), Dave Marks (USDA), *personal comm.*

# What does this mean?





# Industry implications

- Wildlife is a risk to manage concerning AI

OPEN ACCESS Freely available online



## Low-Pathogenic Avian Influenza Viruses in Wild House Mice

Susan A. Shriner\*, Kaci K. VanDalen, Nicole L. Mooers, Jeremy W. Ellis, Heather J. Sullivan, J. Jeffrey Root, Angela M. Pelzel, Alan B. Franklin

National Wildlife Research Center, United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service, Fort Collins, Colorado, United States of America

SCIENTIFIC REPORTS

OPEN When fur and feather occur together: interclass transmission of avian influenza A virus from mammals to birds through common resources

Received: 16 May 2015  
Accepted: 21 August 2015  
Published: 24 September 2015

J. Jeffrey Root, Susan A. Shriner, Jeremy W. Ellis, Kaci K. VanDalen, Heather J. Sullivan & Alan B. Franklin

DISPATCHES

**Novel Avian Influenza A(H7N9) Virus in Tree Sparrow, Shanghai, China, 2013**

Columbus, Ohio • May 20, 2016 • 71° Overcast

Search

**The Columbus Dispatch**

Hot Links:

**Biologist: Rabbits, skunks can pass bird-flu virus to ducks**

By David Pitt  
The Associated Press • Wednesday May 18, 2016 7:03 AM

HEALTH HEADLINES

- Scientists figure out how Zika destroys healthy brain growth
- Columbus expands program promoting proper use of car seats
- Groundwork set in Franklin County infant-mortality fight

DES MOINES, Iowa — A government wildlife researcher has found that rabbits and skunks can become infected with the bird flu virus and shed it enough to infect ducks — offering scientists one more clue about how bird flu may move in the environment and spread between farms, the U.S. Department of Agriculture said.



# Industry implications (cont'd)

- But wildlife would be a low risk.

Minnesota to expand wild bird flu testing; only 1 infected bird found

MPR News Staff · Jun 18, 2015

Health

~3300 samples tested





# Industry implications (cont'd)



United States  
Department of  
Agriculture



**Table 15. Results of multivariable logistic regression of farm level analysis.**

FACTOR	Percent case farms	Percent control farms	Adjusted Odds Ratio	P-value
In an existing control zone	50	10	28.8	.002
Garbage trucks near barns	61	23	14.0	<.001
Rendering trucks near barns	29	3	21.4	<.001
Visitors change clothes	77	93	0.10	.01
Company service person visit in past 14 days	50	19	4.3	<.001

# Acknowledgements

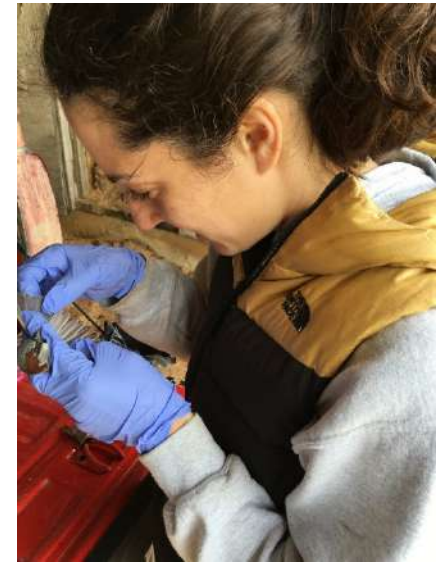
Derek Houston, PhD



Shahan Azeem, DVM, MS



Hannah M. Carroll



Coady Lundy



Baoqing Guo, DVM, PhD

Dale Garner, Iowa DNR  
Dave Marks, USDA

# Thank you!



- Funding:



- Iowa poultry partners
- Independent Landowners



# Questions?

