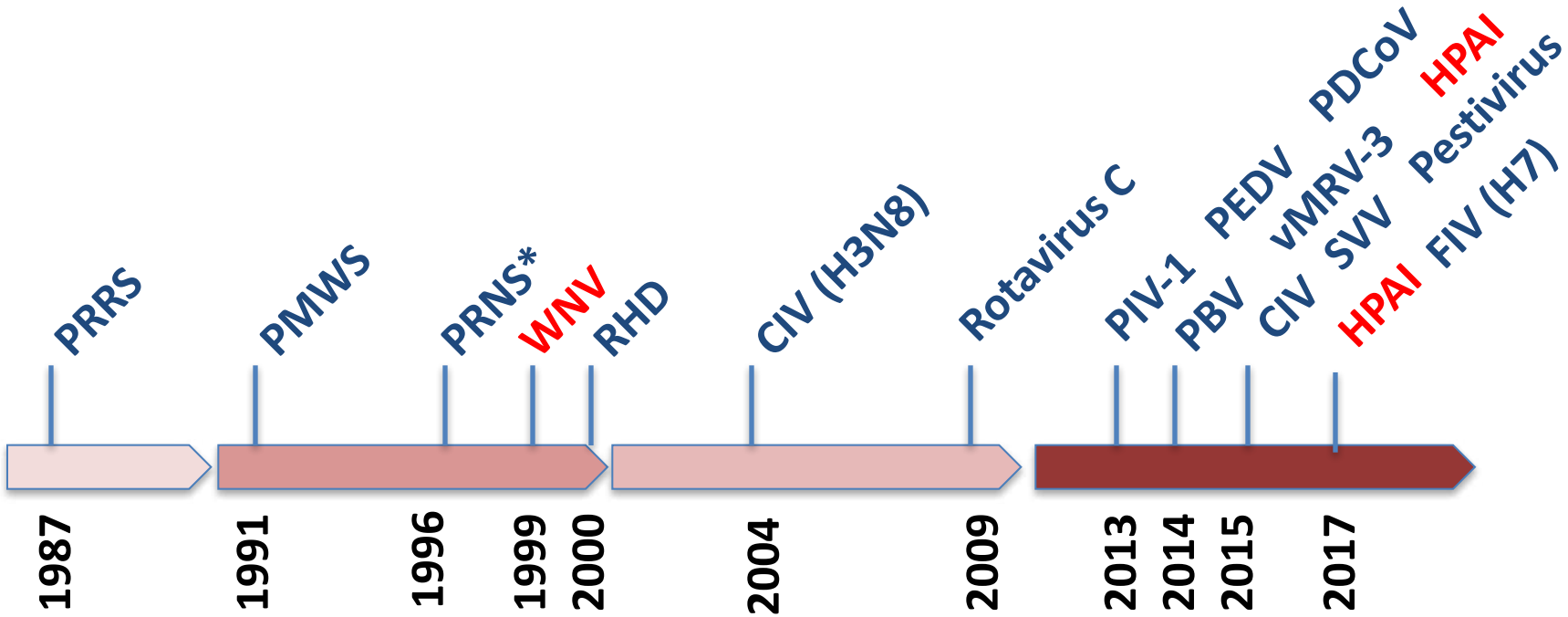
Role of terrestrial wild birds and rodents in spreading AIV to commercial layer operations

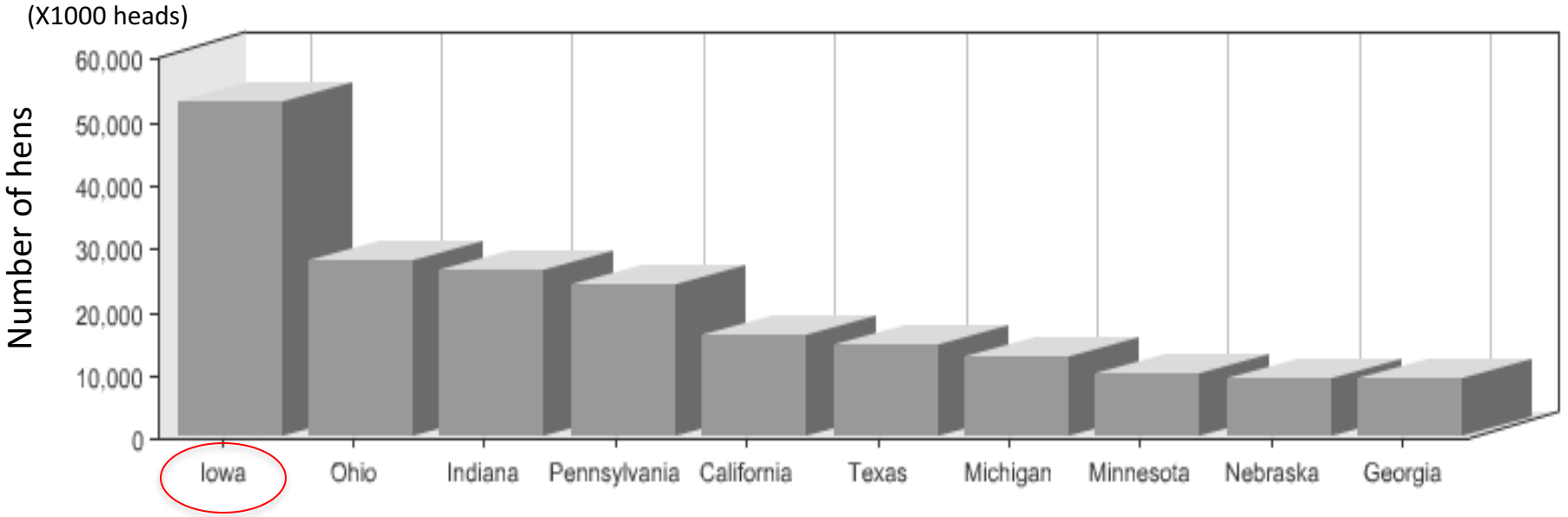
K.J. Yoon, J. Adelman, Y. Sato, P.G. Gauger,
J.Q. Zhang, G. Li, J. Blanchong

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)

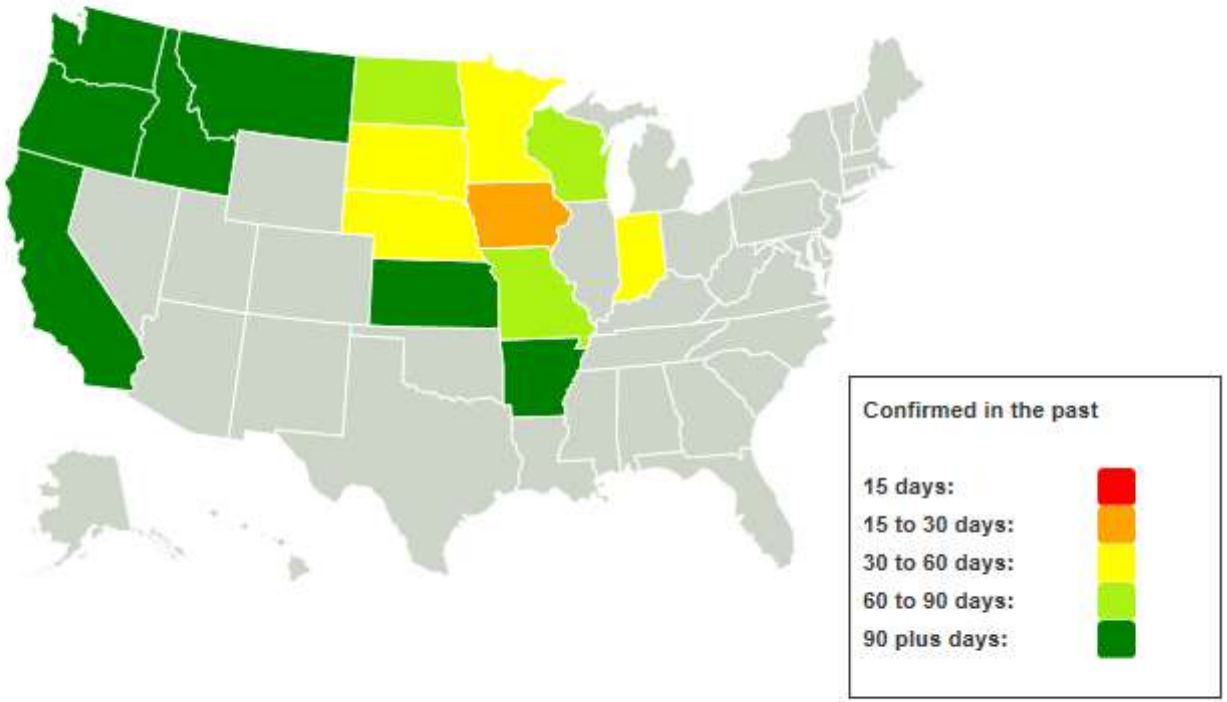
The New York Times

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)

Congressional Research Service
Informing the legislative debate since 1914

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

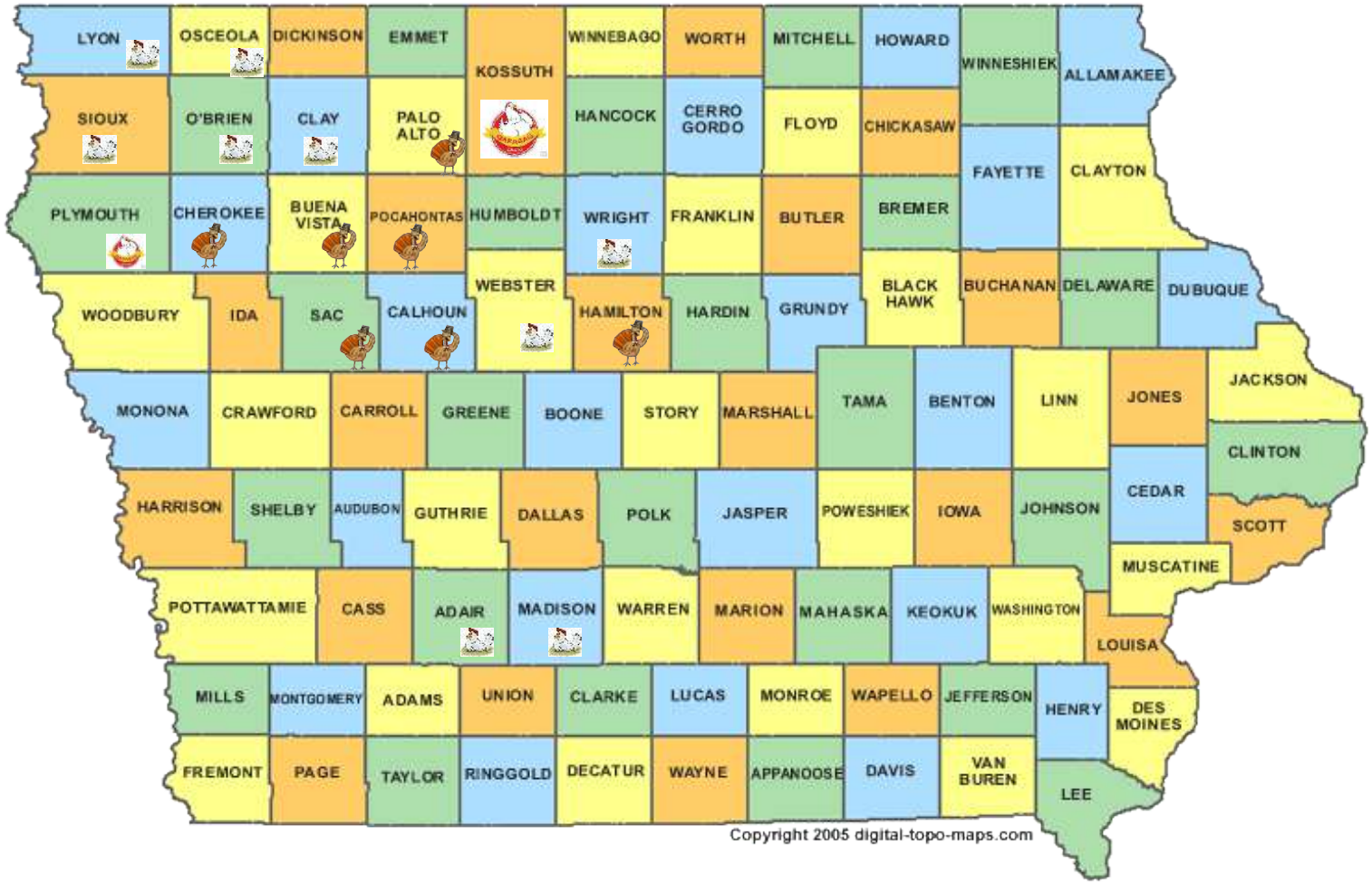
Joel L. Greene
Analyst in Agricultural Policy

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."

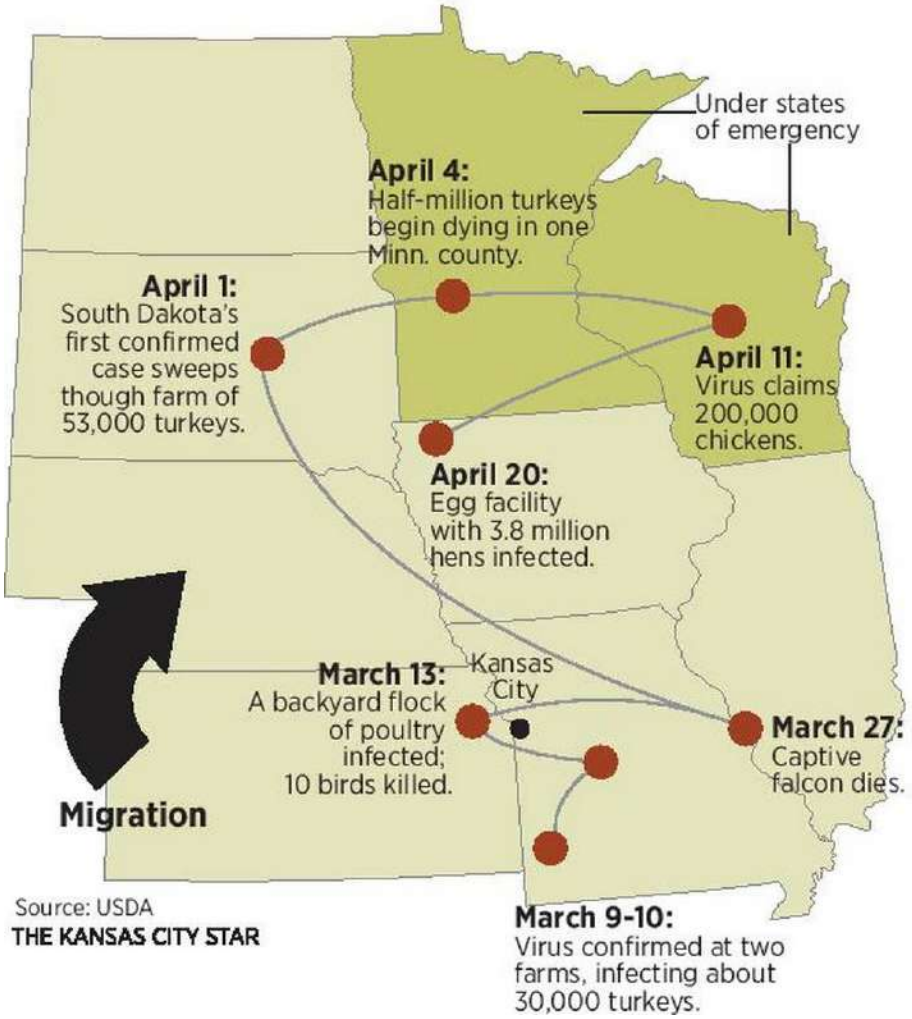
HPAI outbreaks in Iowa

(April-June, 2015)



FLYING FLU

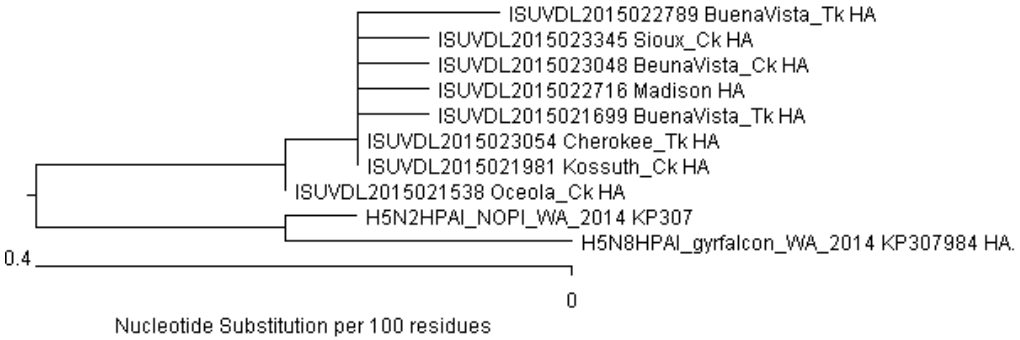
In recent months migratory waterfowl are believed to have spread the avian influenza virus H5N2, killing or prompting euthanasia of more than 7 million birds, mostly commercial poultry. Here's a sample of Midwest incidents confirmed by the USDA's national animal lab:

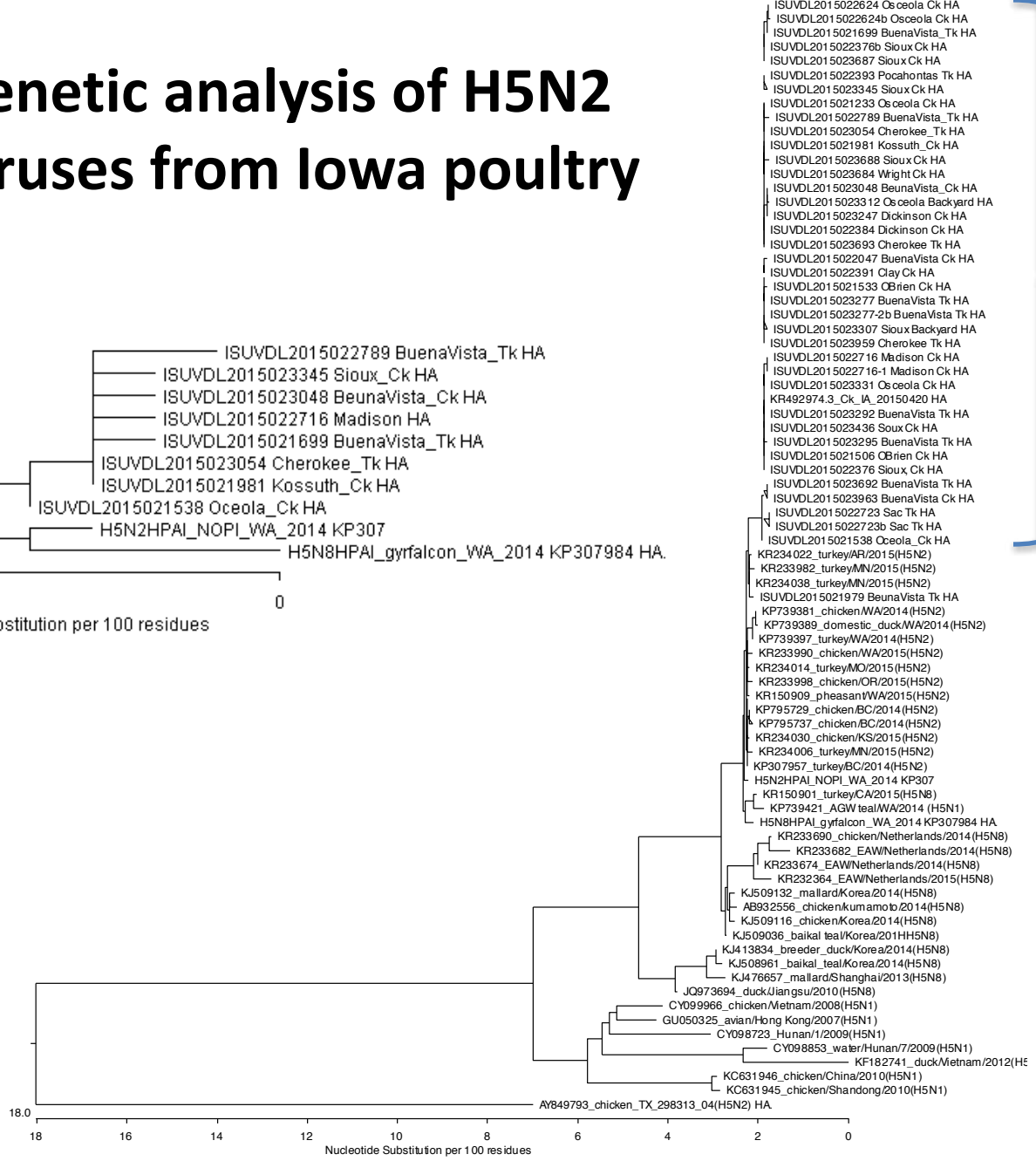


Source: USDA

THE KANSAS CITY STAR

Phylogenetic analysis of H5N2 HPAI viruses from Iowa poultry





H5N2 AIV in Iowa

USDA

United States Department of Agriculture

Animal and Plant Health Inspection Service

Veterinary Services

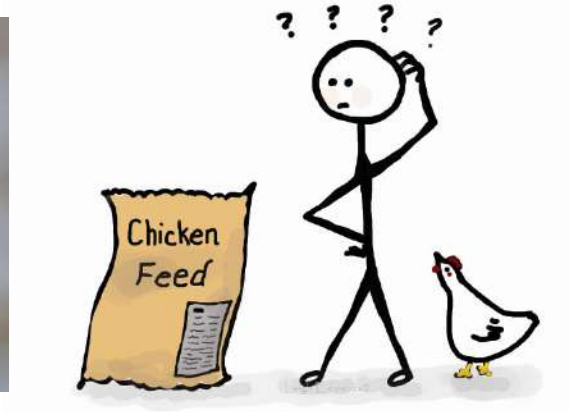
"…there is not substantial or significant enough evidence to point to a specific pathway or pathways for the current spread of the virus."

"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 Vol. 79, No. 24
0022-538X/05/$08.00+0 doi:10.1128/JVI.79.24.15460–15466.2005

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

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

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

Received 28 June 2005/Accepted 27 September 2005

SMALL ANIMALS/ AVIAN

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

DISPATCHES

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

Baihui Zhao,[1] Xi Zhang,[1] Wenfei Zhu,[1] 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.

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

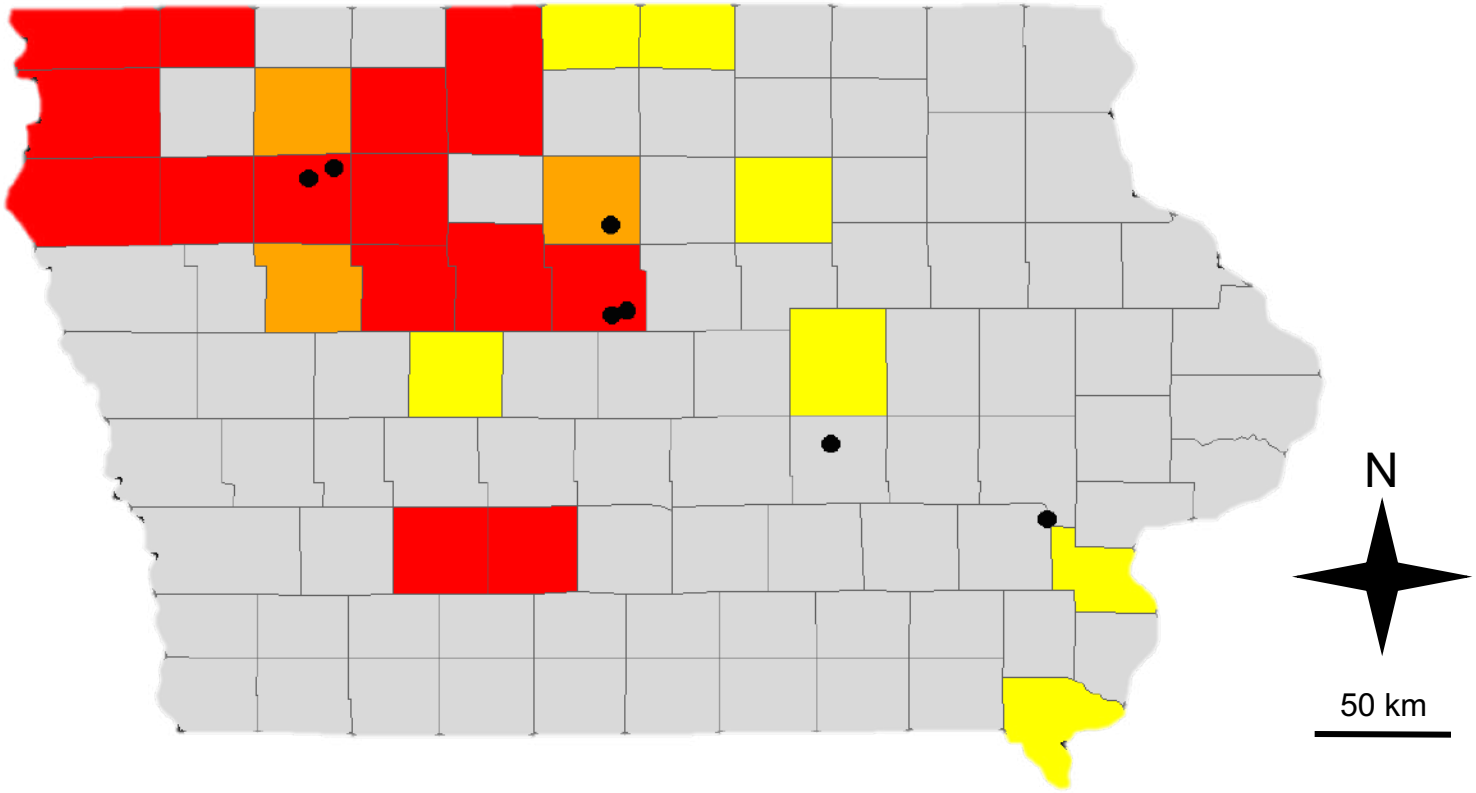


Field sampling map

High-path AIV in domestic poultry during 2015 outbreak

Low-path AIV in waterfowl in surveys conducted 2006-2011

Both of the above



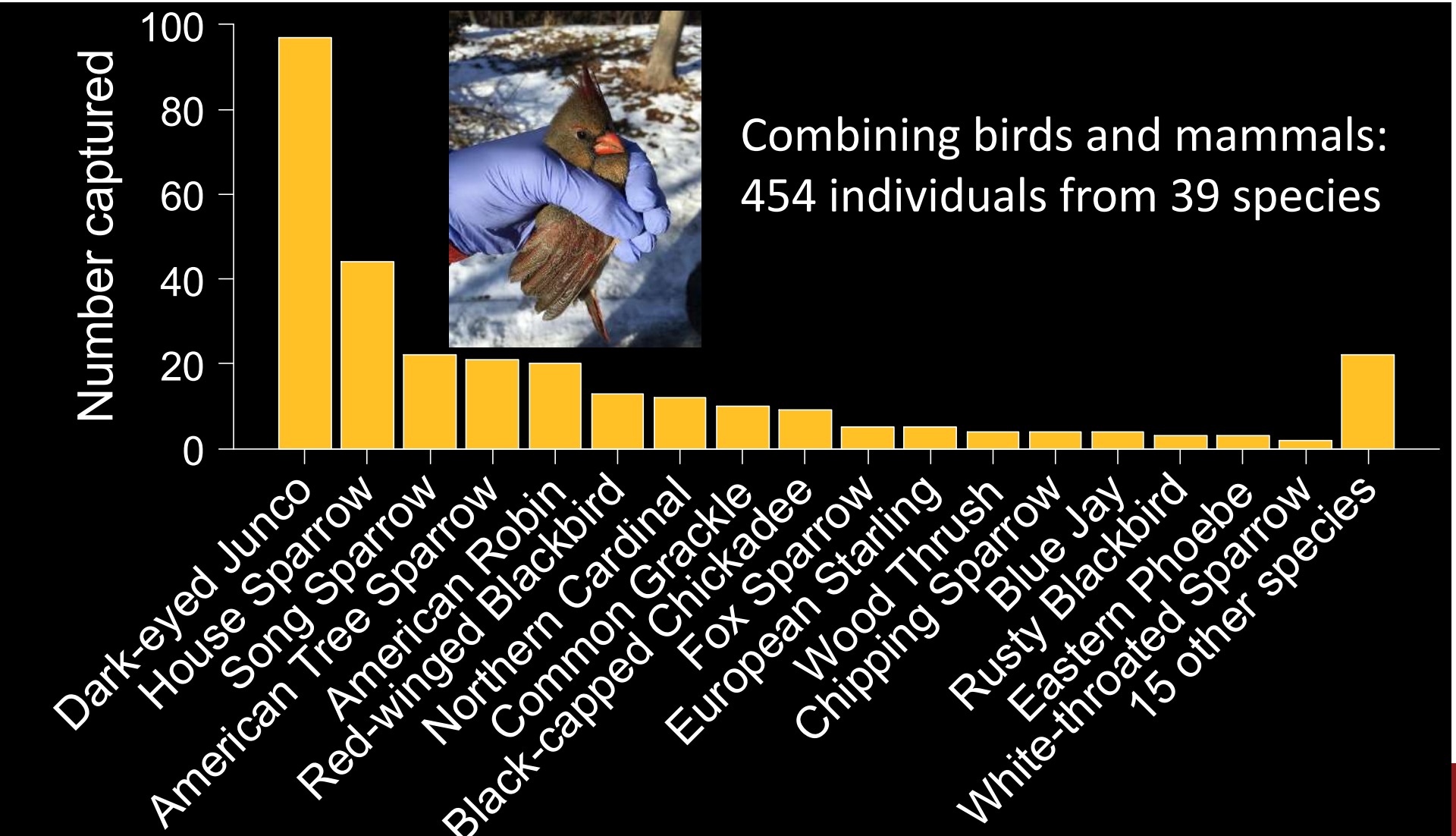
Animal Catchment

Animal Catch & Sampling

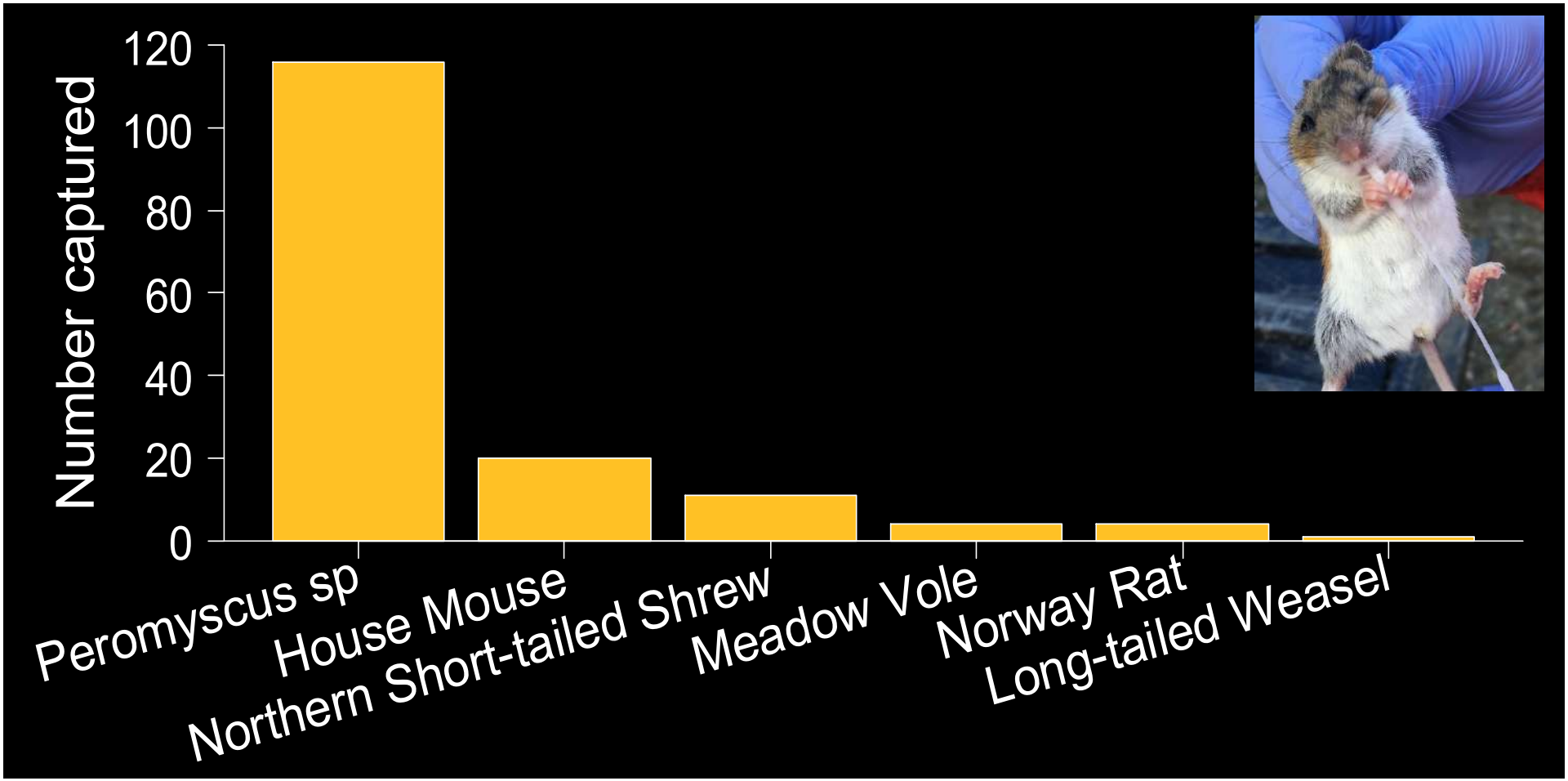
Field sampling

- Swabs
  - Pooled internal swabs: Oropharyngeal & anal/cloacal
  - Pooled external swabs: Feet, fur/feathers
  - Into BHI media, on ice until frozen at -20˚C
- Blood samples, on ice until centrifuged and frozen at -20˚C

What did we catch?

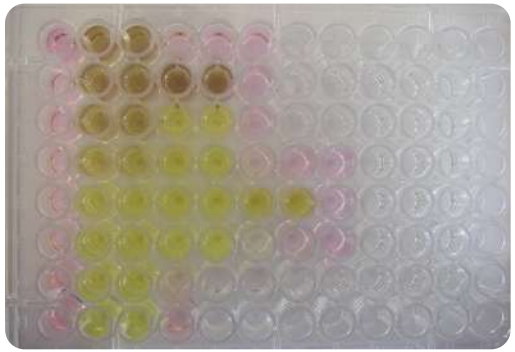


What did we catch?

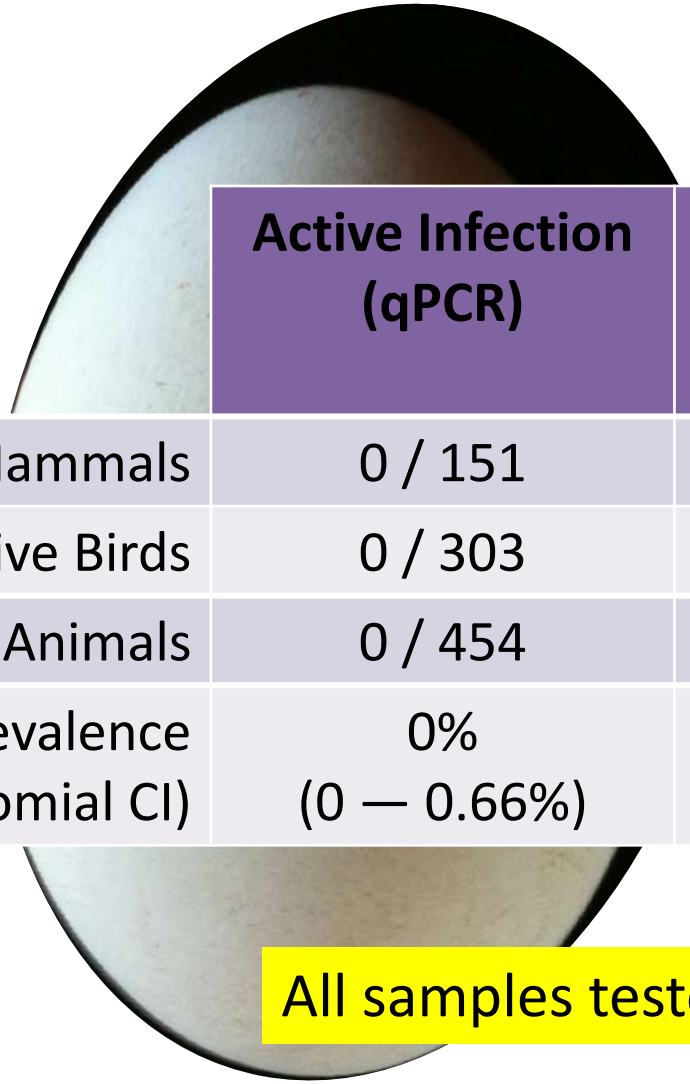


Laboratory testing

- 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%)

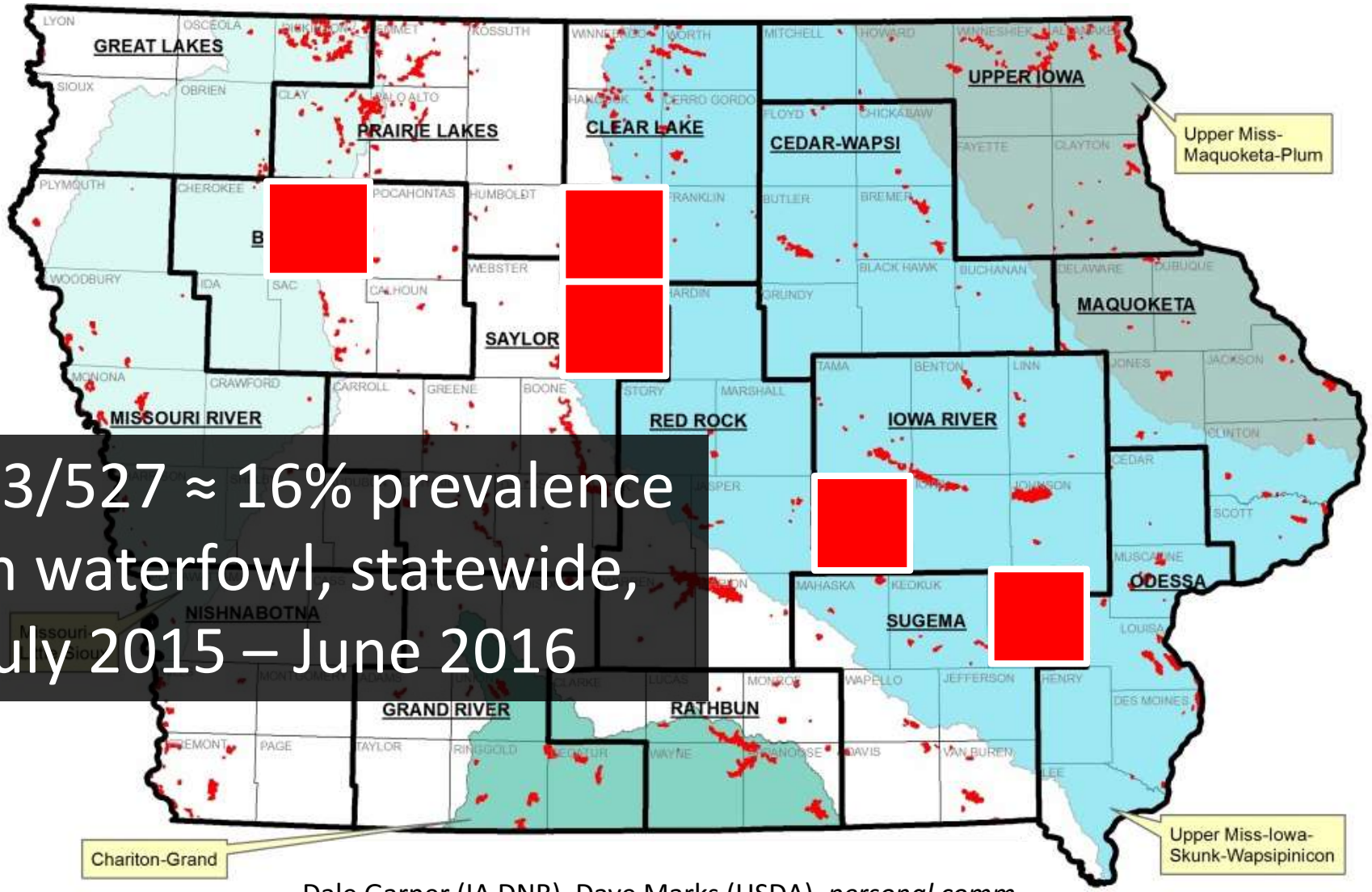
All samples tested negative by VI

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



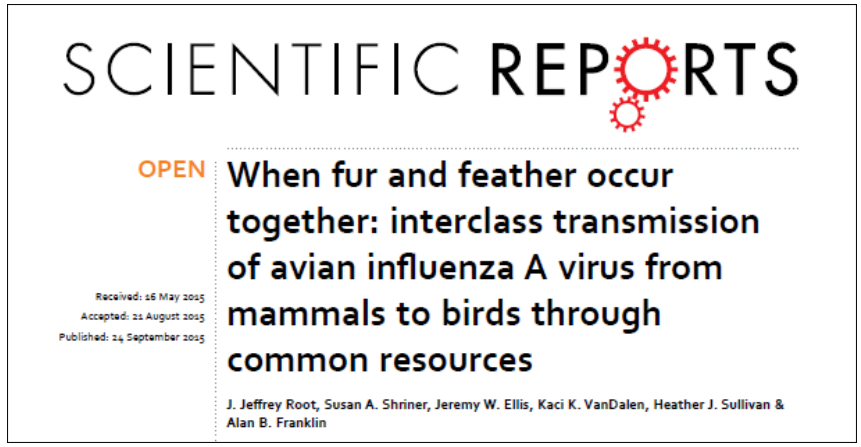
83/527 ≈ 16% prevalence in waterfowl, statewide, July 2015 – June 2016

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

What does this mean?

Industry implications

- Wildlife is a risk to manage concerning AI

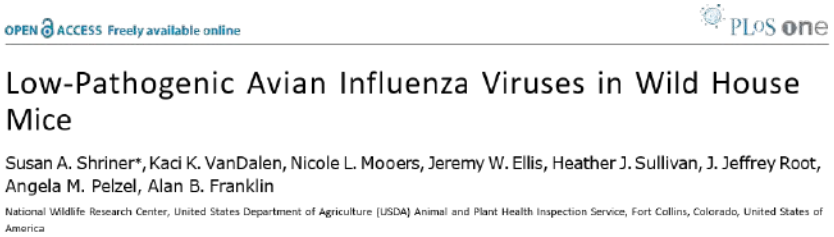

SCIENTIFIC REPORTS

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

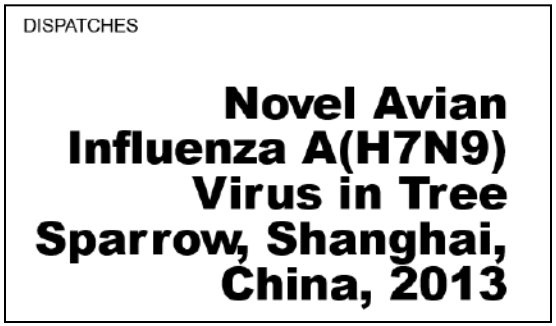

OPEN ACCESS Freely available online

PLoS one

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


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

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

By David Pitt

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

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)

USDA
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

Coady Lundy

Shahan Azeem, DVM, MS

Baoqing Guo, DVM, PhD

Hannah M. Carroll

Dale Garner, Iowa DNR
Dave Marks, USDA

Thank you!

- Funding:

Egg Industry Center
EGG INDUSTRY CENTER
ADVANCING A THRIVING INDUSTRY

- Iowa poultry partners
- Independent Landowners

Questions?