AVIAN INFLUENZA SURVEILLANCE IN WILD BIRDS

Tom Gidlewski, VMD, MS
Program Manager
National Wildlife Disease Program
National Wildlife Research Center
USDA, APHIS, WS

History of the National Wildlife Disease Program

• West Nile Disease Outbreak in 1999
  – Wake up call
  – Surveillance, communication, detection and reporting failed
  – Need for One Health
• 9/11 2001 and Homeland Security
• NAHLN laboratory system initiated in 2002
• Need to coordinate, standardize, and foster collaboration between state, federal and tribal Ag, wildlife agencies and public health agencies as well as diagnostic laboratories and universities
• WS uniquely situated to fill this niche

History of the National Wildlife Disease Program

• 2003 program established
• 2004 initial group of 23 WDB
  – Establish and implement program
  – Liaison
    • State, federal, tribal, Ag and wildlife
    • meeting goals
  – Emergency responders
    • Local, national and international
    • Opportunistic sampling
    • Highly and specifically trained
  – Maintain medical, respiratory fit, and other clearance
• 2004 Declaration by the OIE, WOAH, WHO “Wildlife Disease Surveillance….is the overarching, key element in transboundary animal disease preparedness”

History of the National Wildlife Disease Program

• Avian influenza
  – Spring 2006 in response to concern over Eurasian H5N1 and potential translocation to the US by wild waterfowl
  – Huge surveillance effort, no evidence discovered
  – 21 additional wildlife disease biologists hired
  – Disease program lead the effort
  – December, 2014 High Pathogenic AI discovered in wild waterfowl
    • Epidemic in poultry unfolds
History of the National Wildlife Disease Program

- Feral Swine Diseases
  - Feral swine are very destructive and control efforts are a large part of operational activities in many states
  - Nationally recognized and funded with the development of the Feral Swine Damage Management Program
  - Initiated by Classical Swine Fever surveillance request by VS in 2006
  - Expanded into major feral swine surveillance

2015-16 Interagency Surveillance Plan for Highly Pathogenic Avian Influenza in Wild Birds in the United States

Spread of H5N8

Introduction of EA H5 into North America
Situation Overview

- Since the current HPAI outbreak started in December 2014, 21 States have had HPAI detections in commercial premises, backyard flocks, captive wild birds and/or wild birds (AR, CA, IA, ID, IN, KS, KY, MI, MN, MO, MT, NE, ND, NM, NV, OR, SD, UT, WA, WI, WY).

- There have been 232 premises positive for HPAI (211 commercial, 21 backyard). This includes 7 dangerous contact premises. Commercial premises with HPAI have been found in nine States: MN-109, IA-71, SD-10, WI-9, NE-5, CA-2, MO-2, ND-2, and AR-1.

- Approximately 49.6 million commercial birds were affected and have been depopulated:
  - Turkeys: approximately 7.5 million
  - Chickens: approximately 42.1 million
  - These depopulation losses represent:
    - 3.16% of U.S. annual turkey production (7.46% of average U.S. turkey inventory)
    - 10.01% of U.S. average layer inventory
    - 6.33% of U.S. average pullet inventory
    - Less than 0.01% of U.S. broiler inventory
Situation Overview

- On July 7, 2015, the Secretary transferred approximately $305 million in Commodity Credit Corporation (CCC) funds to APHIS for HPAI activities. This is in addition to emergency funding in the amount of $393 million previously made available to respond to HPAI. Approximately $800,000,000 has been paid out for response activities indemnity.
**Central and Mississippi Flyway**

- Apparently healthy wild bird surveillance
  - October – February: ≈ 400 in each flyway
  - March
    - IA/MO
    - ~ 300 Hunter Harvest Snow Geese (3 positive)
- Environmental fecal samples
  - March-Present
    - MN
    - ~ 300 (all negative)
    - IN
    - ~ 200 environmental (all negative)

---

**Central and Mississippi Flyway**

- Wild bird Morbidity/Mortality
  - WY – 1 Canada Goose
  - MO – 3 Snow Geese
  - KS – 1 Canada Goose
  - NM – 1 Cinnamon Teal
  - KY – 1 Snow Goose, 1 Ring-necked Duck
  - WI – 1 Snowy Owl
  - MN – 1 Cooper’s Hawk
  - MI – 12 Canada Geese

---

**HPAI Positive Counties**
Avian Influenza

- Need to know if HPAIs are present or are not present in an area
- Need sufficient sampling to detect virus
- Need statistically significant surveillance despite the lack of resources to sample every species in every location

Avian influenza

- To get a sample size that will meet these goals we need:
  - A population size
  - An estimated prevalence
    - Prior survey data
    - 95% confidence interval of detection at 1%
  - Diagnostic sensitivity (86.3%)
  - Prior effort: sample sizes set by assuming
    - A population of more than 10,000 birds per state
    - All bird species had same AI prevalence and prevalence was the same throughout the state/country

Avian influenza

- Prevalence based on AI data collected during 2006-2011
  - Dabbling ducks
  - Assuming current HPAIs act like LPAIs in dabbling ducks
  - Also used information from Pacific Flyway sampling earlier this year
- Population estimates of dabbling ducks at the watershed scale
  - Banding data
  - Annual estimated dabbler population
  - Breeding bird survey data
- Watershed selection partially based on lessons learned during the last AI wild bird sampling effort
  - Influenza clusters
  - High intra- and inter-flyway mixing of dabbling ducks
  - Temperature constraints and virus survival

Plans for HPAI Surveillance

- Identify distribution across U.S.
- Detect early spread into new flyways/regions
- Provide flexible surveillance framework that can monitor wild waterfowl populations for
  - re-assortments of influenzas
  - introductions of new viruses
  - prevalence of important influenzas once detected in an area of concern
Plans for HPAI Surveillance

- Based on:
  - What we know of wild duck movements
  - Priority watersheds
  - What we learned from previous AI surveillance

Plans for HPAI Surveillance

- Sampling
  - Passive (morbidity/mortality)
    - Year round
    - Especially raptors
  - Active (apparently healthy birds)
    - In post nesting season (summer)
    - Fall/Winter Migration Season
  - Environmental Fecal
    - Targeted year round

Summer (May-Aug)

Fall (Aug-Dec)
Highly Pathogenic Avian Influenza and Raptors

• General assumptions:
  • Highly susceptible to viral infection
  • Raptors infected with HPAI die quickly with little to no chance of recovery
  • Based on limited surveillance and little research

• What is the effect of HPAI viruses on raptor populations in the United States?
• What role do raptors play in the epidemiology of HPAI viruses?

• Objectives
  – Determine antibody prevalence of HPAI viruses in raptors
  – Examine susceptibility of raptors to HPAI viruses
Highly Pathogenic Avian Influenza and Raptors

• Sampling procedures
  – Blood and swab collection
  • USDA APHIS WS Airport Wildlife Hazards Program
  • Raptor rehabilitation facilities
  • Non-government raptor organizations

Methods

• Sampled wildlife at 10 facilities in NW Iowa
  – 5 influenza A negative farms
  – 5 outbreak farms
  – Matched infected and negative farms
    • 2 small, one med, 2 large
• Sampled mammals and birds
  – Mammals: Tomahawk and Sherman traps
  – Birds: Mist nets, funnel traps, air guns
• Samples
  – Oral, cloacal, nasal, and external swabs
  – Lung tissues
  – Blood
• Laboratory Testing
  – RT-qPCR at NWRC – test for virus
  – ELISA screening (birds), hemagglutinin inhibition – test for antibodies

Limitations

• Work in progress
  – Place to start
  – Modify as knowledge changes
• Ground truth
  – Various reasons why sampling objectives cannot be met, change sampling plan
• Targeted surveillance
  – HPAI detections trigger local surveillance interest
• Weather and logistics

Interface Disease

• Largest outbreak ever encountered
• Lethal in raptors and owls
• ? Wild gallinaceous birds, mammals
• Virus constantly changing affecting susceptibility
• True One Health issue
• Wildlife vs domestic animal diseases
  – Blurred
    • CWD, TB, Brucellosis, EHD, Pneumonia complex BHS
Surveillance Summary

- Since 1 July 2015:
  - 17,898 / 41,000 wild dabbling ducks sampled (15% matrix)
    - Atlantic Flyway: 4,661
    - Mississippi Flyway: 6,077
    - Central Flyway: 3,302
    - Pacific Flyway: 3,836
    - American Oceania: 22
  - Only 1 positive (15% matrix +)
    - Mallard
      - Apparently healthy, Great Salt Lake, UT

Global trends in infectious diseases at the wildlife–livestock interface

Weiss K, Wetzelhoeterk, Daniel Bolin, Almas, and Sridhara M. May*†‡.

Surveillance Summary

Wildlife
- Dabbling Ducks are primary reservoir
  - Exhibit little to no signs
- Unidentified number of raptors affected
- Canada Geese
  - Clinical disease
  - May be a good sentinel

Current Status
- Wildlife
  - Other wildlife
    - First identified case in passerines in MN
      - PCR positive, no virus isolated
    - No virus isolated from peridomestic species in IA
      - Including: Passerines and Small mammals
      - Exposure (antibody positive): 5 passerines
        » One PCR positive

Clinical disease
- Mallard
  - Apparently healthy, Great Salt Lake, UT

The role and significance of wildlife–livestock interfaces in disease dynamics has largely been neglected despite recent interest in avian, as well as domestic, emergence of zoonotic diseases in humans. Several review articles have been published in recent years highlighting the need to identify and quantify wildlife–livestock interfaces. However, the specific role of wildlife is not always clear. In this review, we summarize recent studies on wildlife–livestock interfaces and discuss potential implications for public health and disease control.
<table>
<thead>
<tr>
<th>Group</th>
<th>Species</th>
<th>Total # of Families</th>
<th>States</th>
<th>Subtypes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterfowl</td>
<td>American Green-winged Teal</td>
<td>4</td>
<td>OR, CA, WA</td>
<td>EA/H5N2, EA/H5, EA/H5N1, EA/AM H5N2</td>
</tr>
<tr>
<td></td>
<td>American Wigeon</td>
<td>36</td>
<td>OR, CA, UT, WA</td>
<td>EA/H5N8, EA/AM H5N1, EA H5</td>
</tr>
<tr>
<td></td>
<td>Cinnamon Teal</td>
<td>1</td>
<td>NM</td>
<td>EA H5</td>
</tr>
<tr>
<td></td>
<td>Gadwall</td>
<td>1</td>
<td>CA</td>
<td>EA H5N8</td>
</tr>
<tr>
<td></td>
<td>Mallard</td>
<td>18</td>
<td>UT, NV, ID, WA, CA, OR</td>
<td>EA/AM H5N2, EA H5N8, EA H5</td>
</tr>
<tr>
<td></td>
<td>Northern Pintail</td>
<td>6</td>
<td>CA, OR, WA</td>
<td>EA/AM H5N2, EA/H5N1, EA H5N2</td>
</tr>
<tr>
<td></td>
<td>Northern Shoveler</td>
<td>3</td>
<td>OR, CA, UT, WA</td>
<td>EA/AM H5N2</td>
</tr>
<tr>
<td></td>
<td>Wood Duck</td>
<td>3</td>
<td>OR</td>
<td>EA/AM H5N2</td>
</tr>
<tr>
<td></td>
<td>Ring-necked Duck</td>
<td>1</td>
<td>KY</td>
<td>EA/AM H5N2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>73</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Passerine</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>European Starling</td>
<td>1</td>
<td>IA</td>
<td>EA H5</td>
<td></td>
</tr>
<tr>
<td>Black-capped Chickadee</td>
<td>1</td>
<td>MN</td>
<td>EA H5</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Goose</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada Goose</td>
<td>15</td>
<td>MI, WY, KS, OR, WA</td>
<td>EA/AM H5N2, EA/H5N8, EA H5</td>
<td></td>
</tr>
<tr>
<td>Lesser Snow Goose</td>
<td>4</td>
<td>MO, KY</td>
<td>EA/AM H5N2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Raptor</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bald Eagle</td>
<td>1</td>
<td>ID</td>
<td>EA H5N8</td>
<td></td>
</tr>
<tr>
<td>Cooper's Hawk</td>
<td>2</td>
<td>SD, WA</td>
<td>EA/AM H5N2</td>
<td></td>
</tr>
<tr>
<td>Peregrine Falcon</td>
<td>1</td>
<td>WY</td>
<td>EA/AM H5N2</td>
<td></td>
</tr>
<tr>
<td>Red-tailed Hawk</td>
<td>2</td>
<td>WA</td>
<td>EA/AM H5N2</td>
<td></td>
</tr>
<tr>
<td>Snowy Owl</td>
<td>1</td>
<td>WI</td>
<td>EA/AM H5N2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Grand Total | 101 |
Minimizing the Potential for Avian Influenza Transmission between Wildlife and Poultry

Managing Risks

- Shooting wild birds is not recommended
  - Doesn’t prevent use and contamination
  - Can provide false sense of security
  - Focuses time and resources on the wrong risk.
  - Requires State and Federal Permits

- More effective techniques
  - Remove vegetation from banks of man-made water structures
  - Fence to separate people and equipment from water and natural vegetation
  - Use deterrent devices

Wildlife Testing

- Report sick or dead wild birds found on or near the farm
- Consider submitting sick wild birds and removed rodents for testing

Other Resources

USDA Biosecurity for the Birds
http://healthybirds.aphis.usda.gov

CDC H5 Viruses
http://www.cdc.gov/flu/avianflu/h5/index.htm#_blank

Wildlife Health
http://www.nwhc.usgs.gov/