# Knowledge, attitudes, and practices among Florida bird rehabilitators regarding Highly Pathogenic Avian Influenza (HPAI) H5N1

Zach Mills, DVM, MBA, GCPH

Integrated Learning Experience – Applied Practical Experience

Site: Florida Wildlife Commission | Preceptor: Dr. Mark Cunningham

Kansas State University

2023

# Outline

Background

History

Transmission

Significance

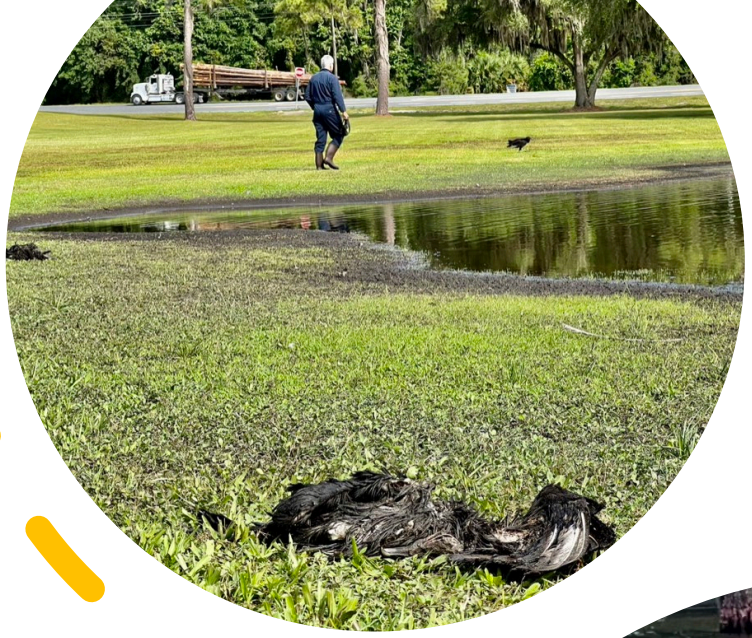
Applied Practical Experience

Action Plan

# Background

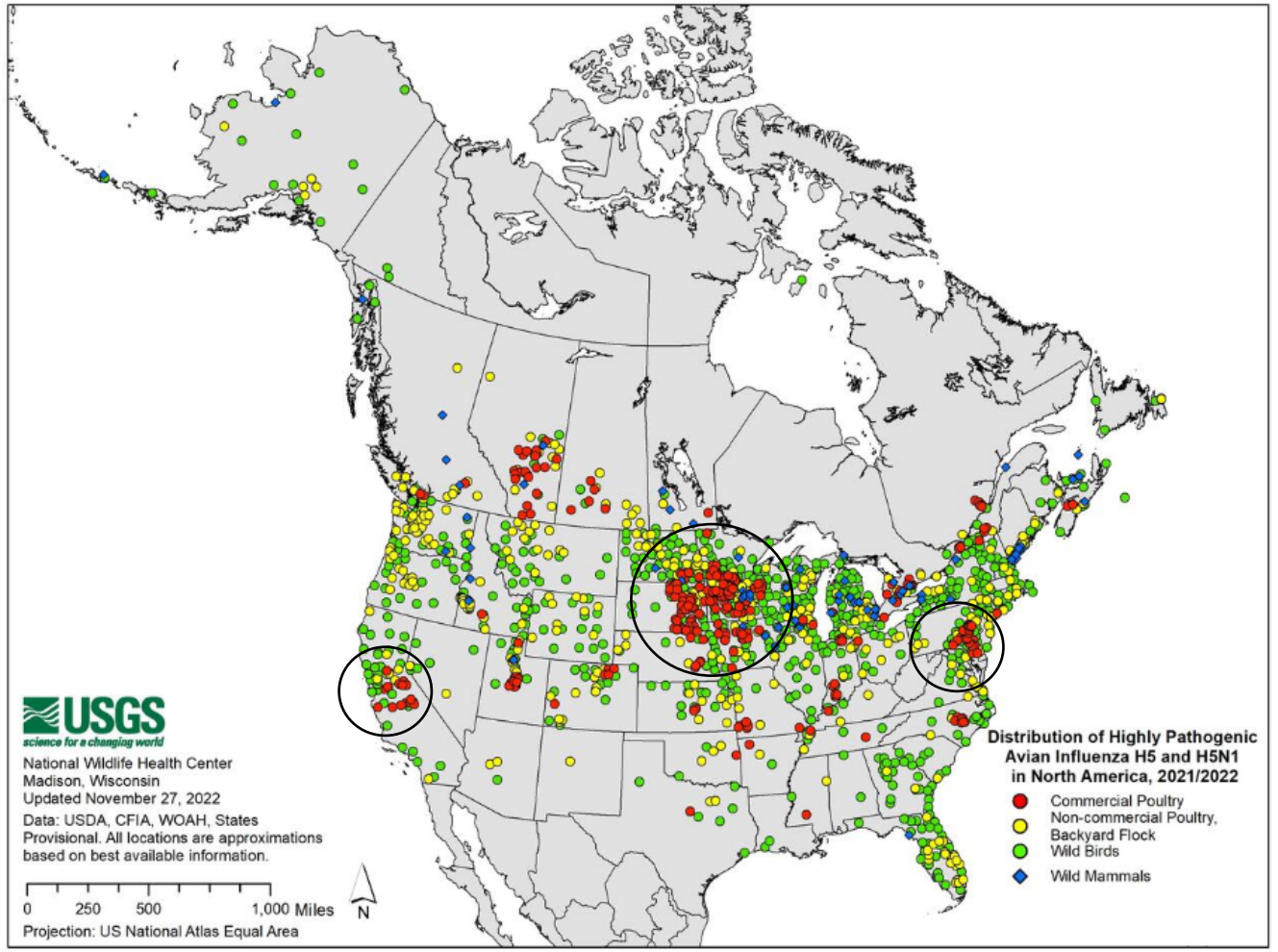
- Avian Influenza Virus
- Type: Alpha Influenza (Influenza Type A)
- *Orthomyxoviridae*
- Low Pathogenic & Highly Pathogenic Avian Influenza (HPAI)
- Surface glycoproteins
  - Hemagglutinin (HA) and neuraminidase (NA)
- Reservoir
  - Ducks, geese, and shorebirds
  - Affects over 100 species of domestic and wild birds globally
- Terminology: “Bird Flu”

# History of Bird Flu



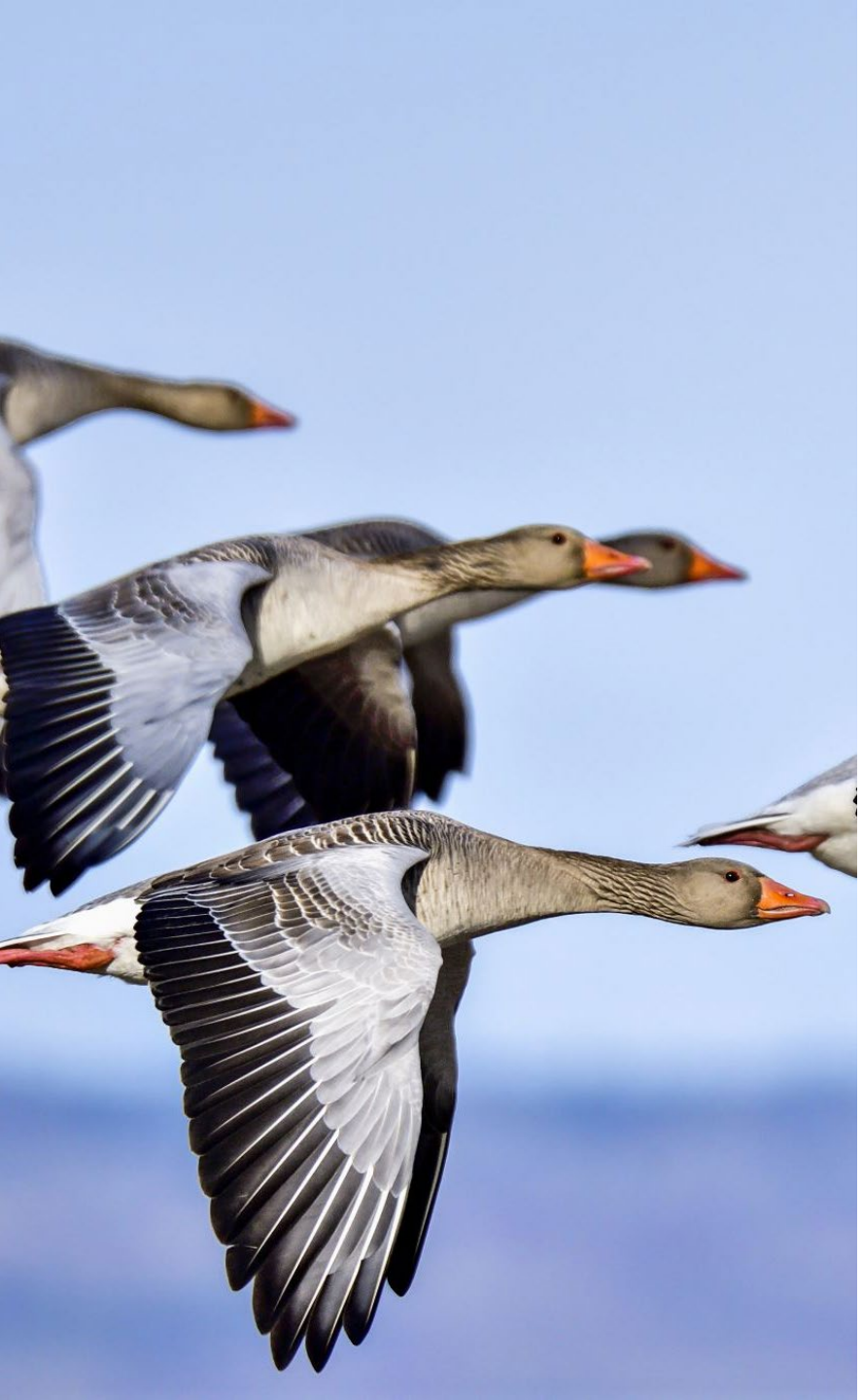
- Highly contagious disease of birds, characterized by a **case-fatality rate of >75% and often 90-100% in non-waterfowl birds**
- First **identified in birds in 1996 in China**
- HPAI A(H5N1) **first isolated in the United States in waterfowl (ducks) in 2015**
- The current outbreak:
  - started at the end 2020 to present
  - **~60M birds** in the United States euthanized
  - **~50M birds** in Europe euthanized

# Distribution of Highly Pathogenic Avian Influenza H5 and H5N1 in North America, 2021/2022



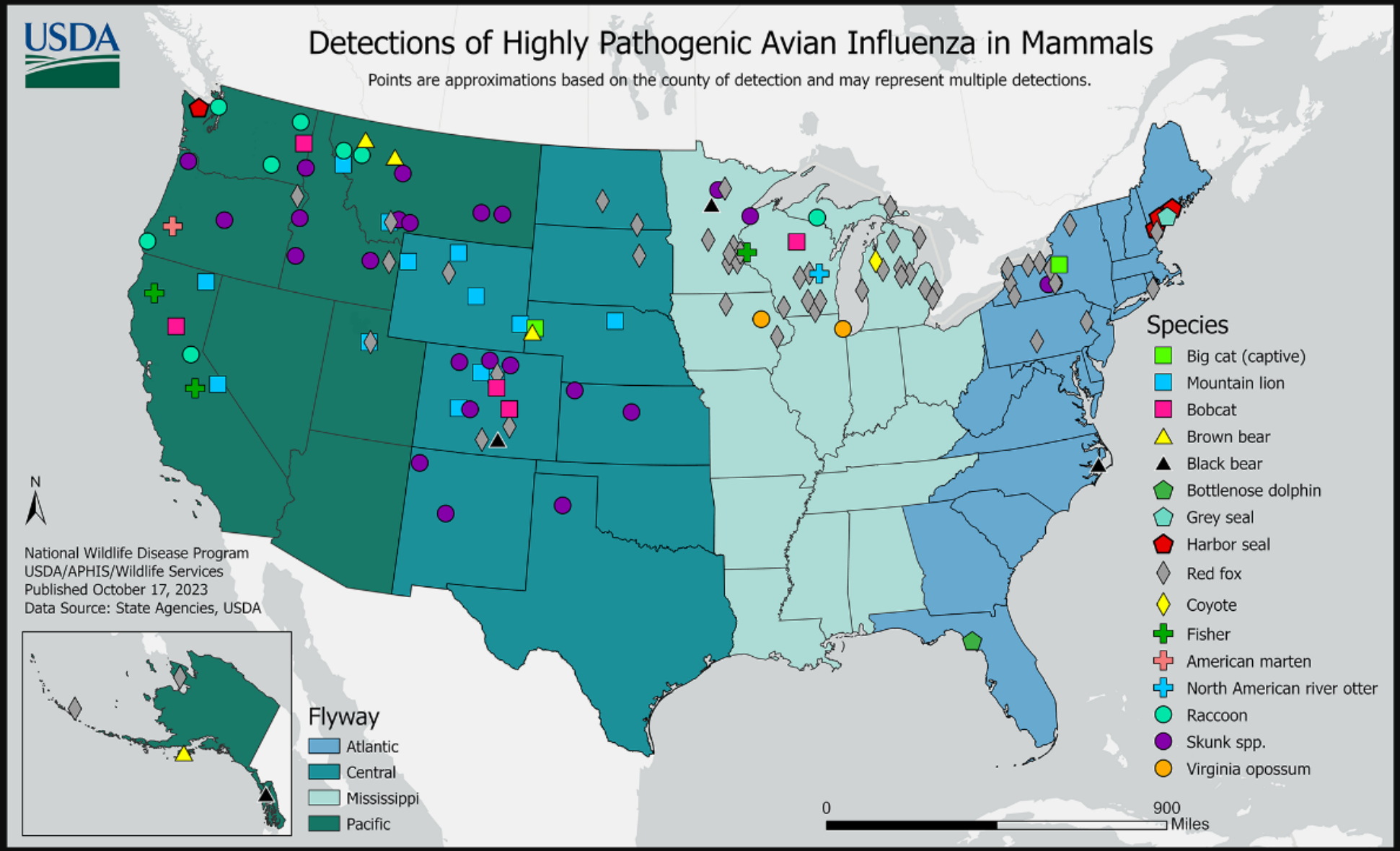

https://www.usgs.gov/centers/nwhc/science/distribution-highly-pathogenic-avian-influenza-north-america-20212022

Concentrations of U.S. Commercial Poultry Operations

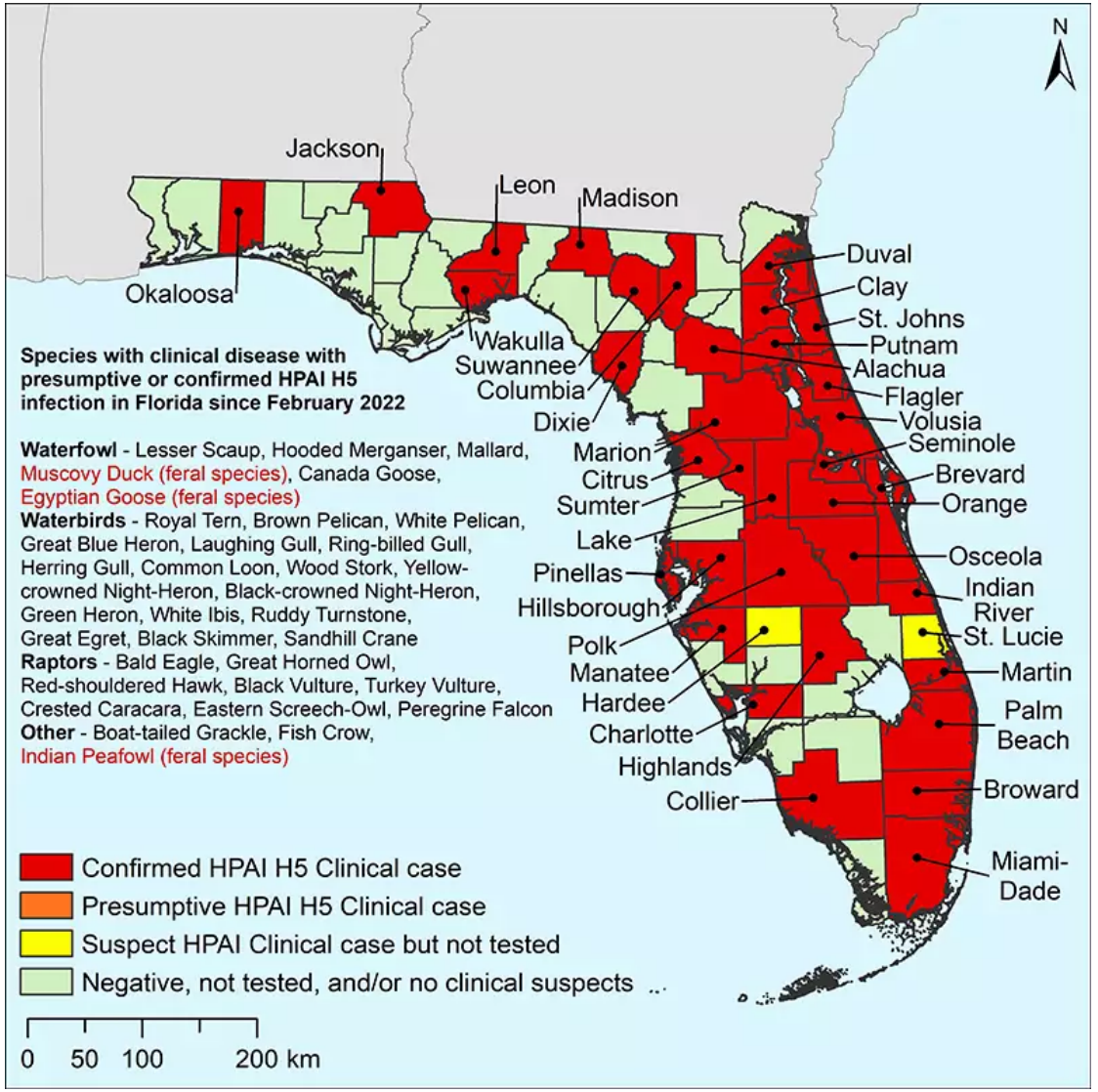


# Transmission

- Influenza virus is shed in excretions (feces, saliva, and mucus)
- Virus can remain viable for a year or longer in the environment
- Birds can be infected:
  - Directly from other birds
  - Indirectly from the environment (water, soil, and dead animals)


USDA
Detections of Highly Pathogenic Avian Influenza in Mammals
Points are approximations based on the county of detection and may represent multiple detections.
N
National Wildlife Disease Program
USDA/APHIS/Wildlife Services
Published October 17, 2023
Data Source: State Agencies, USDA
Flyway
Atlantic
Central
Mississippi
Pacific
Species
Big cat (captive)
Mountain lion
Bobcat
Brown bear
Black bear
Bottlenose dolphin
Grey seal
Harbor seal
Red fox
Coyote
Fisher
American marten
North American river otter
Raccoon
Skunk spp.
Virginia opossum
0
900
Miles

Veterinarians collecting dead black vultures in Hamilton County, Florida in May 2022




https://myfwc.com/research/wildlife/health/avian/influenza/




Article | Published: 18 October 2023

# The episodic resurgence of highly pathogenic avian influenza H5 virus

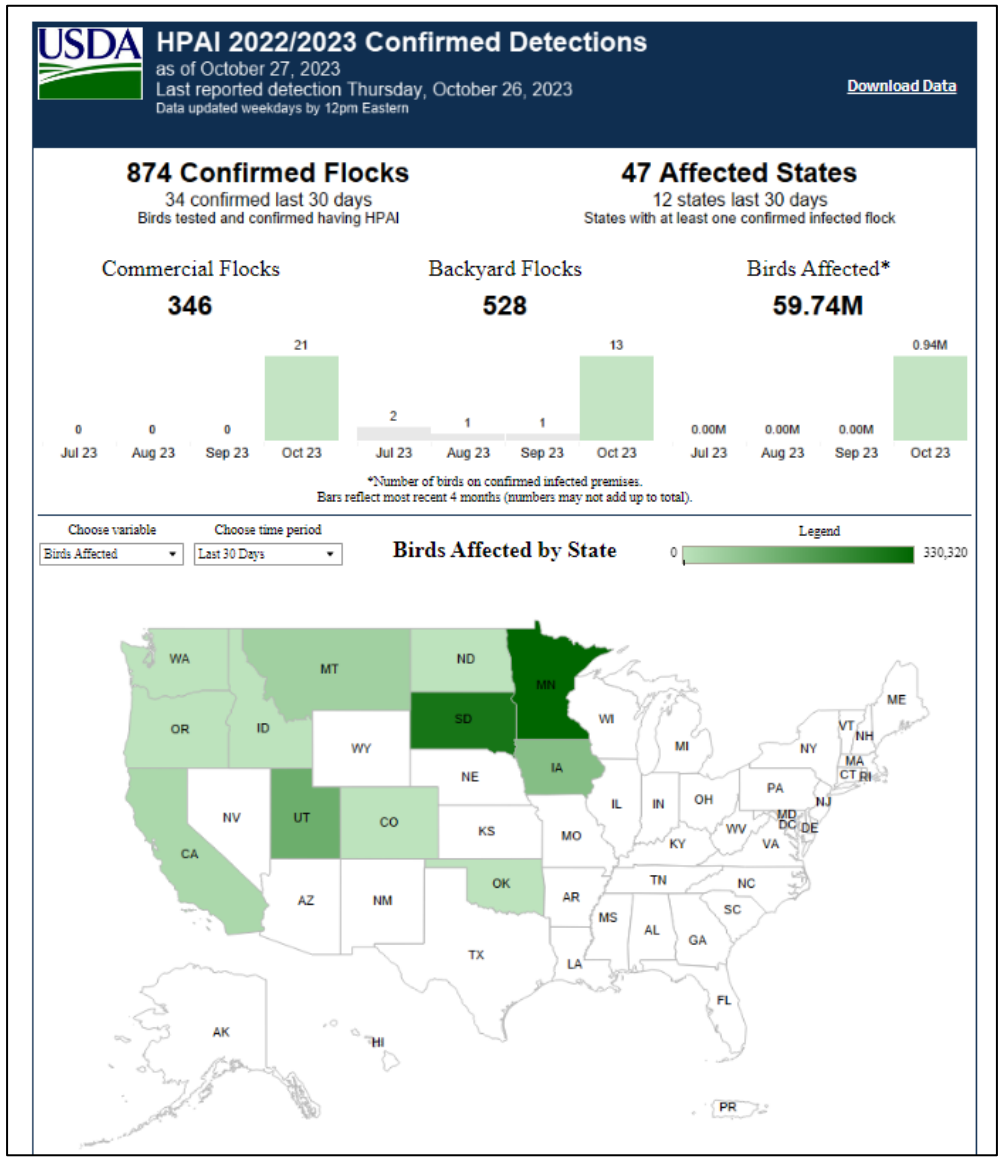
Ruopeng Xie, Kimberly M. Edwards, Michelle Wille, Xiaoman Wei, Sook-San Wong, Mark Zanin, Rabeh El-Shesheny, Mariette Ducatez, Leo L. M. Poon, Ghazi Kayali, Richard J. Webby & Vijaykrishna Dhanasekaran

*Nature* (2023) | Cite this article



## Abstract

Highly pathogenic avian influenza (HPAI) H5N1 activity has intensified globally since 2021, increasingly causing mass mortality in wild birds and poultry and incidental infections in mammals[1,2,3]. However, the ecological and virological properties that underscore future mitigation strategies still remain unclear. Using epidemiological, spatial and genomic approaches, we demonstrate changes in the origins of resurgent HPAI H5 and reveal significant shifts in virus ecology and evolution. Outbreak data show key resurgent events in 2016–2017 and 2020–2021, contributing to the emergence and panzootic spread of H5N1 in 2021–2022. Genomic analysis reveals that the 2016–2017 epizootics originated in Asia, where HPAI H5 reservoirs are endemic. In 2020–2021, 2.3.4.4b H5N8 viruses emerged in African poultry, featuring mutations altering *HA* structure and receptor binding. In 2021–2022, a new H5N1 virus evolved through reassortment in wild birds in Europe, undergoing further reassortment with low-pathogenic avian influenza in wild and domestic birds during global dissemination. These results highlight a shift in the HPAI H5 epicentre beyond Asia and indicate that increasing persistence of HPAI H5 in wild birds is facilitating geographic and host range expansion, accelerating dispersion velocity and increasing reassortment potential. As earlier outbreaks of H5N1 and H5N8 were caused by more stable genomic constellations, these recent changes reflect adaptation across the domestic-bird–wild-bird interface. Elimination strategies in domestic birds therefore remain a high priority to limit future epizootics.




https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/avian/avian-influenza/hpai-2022/2022-hpai-commercial-backyard-flocks

# Public Health Impact

*"HPAI A(H5N1) virus infections have been reported in more than 890 people with approximately 50% case fatality proportion since 1997, including 20 cases and 7 deaths in Hong Kong during 1997-2003, and more than 870 cases reported in 22 countries since November 2003."*

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

## H5N1 Update: Two Human H5N1 Cases in Cambodia

Español | Other Languages Print

**February 25, 2023** — Two human infections with avian influenza A H5N1 (H5N1 bird flu) virus have been reported by Cambodia. These cases are thought to be a result of exposure to infected birds/poultry. An investigation to try to confirm the source of the infections and detect any potential additional cases is ongoing. Based on preliminary genetic sequencing

## WHO: Recent severe H5N1 avian flu cases in China, Vietnam linked to current clade

*News brief | December 28, 2022*
*Lisa Schnirring*
*Topics: Avian Influenza (Bird Flu)*

World Health Organization

Health Topics | Countries | Newsroom | Emergencies

Home / Disease Outbreak News / Item / Human infection caused by avian influenza A(H5) - Ecuador

## Human infection caused by avian influenza A(H5) - Ecuador

18 January 2023

**Situation at a glance**

On 9 January 2023, WHO was notified of a human infection caused by an avian influenza A(H5) virus. The case, a nine-year-old girl, living in a rural area in the province of Bolívar, Ecuador, was in contact with backyard poultry, which was acquired a week before the onset of her symptoms. She is currently hospitalized, in isolation, and is being treated with antivirals.

# Significance

Science

## ‘Incredibly concerning’: Bird flu outbreak at Spanish mink farm triggers pandemic fears

Spread among captive mink could give the H5N1 strain opportunities to evolve and adapt to mammals

24 JAN. 2023 · 5:00 P.M. · BY KAI KUPFERSCHMIDT

Rapid communication

Open Access

Highly pathogenic avian influenza A(H5N1) virus infection in farmed minks, Spain, October 2022

Like 0

Check for updates

Download

Montserrat Agüero[1,*], Isabella Monne[2,*], Azucena Sánchez[1], Bianca Zecchin[2], Alice Fusaro[2], María José Ruano[1], Manuel del Valle Arrojo[3], Ricardo Fernández-Antonio[4], Antonio Manuel Souto[5], Pedro Tordable[5], Julio Cañás[5], Francesco Bonfante[2], Edoardo Giussani[2], Calogero Terregino[2], Jesús Javier Orejas[6]

- “…it is necessary to **strengthen the culture of biosafety** and biosecurity in this farming system and promote the implementation of ad hoc **surveillance** programs for influenza A viruses and other zoonotic pathogens at a global level.”

# Significance

Biological Sciences - Article

## Transmission of lethal H5N1 clade 2.3.4.4b avian influenza in ferrets

Darwyn Kobasa, Bryce Warner, Tamiru Alkie, Robert Vendramelli, and 10 more

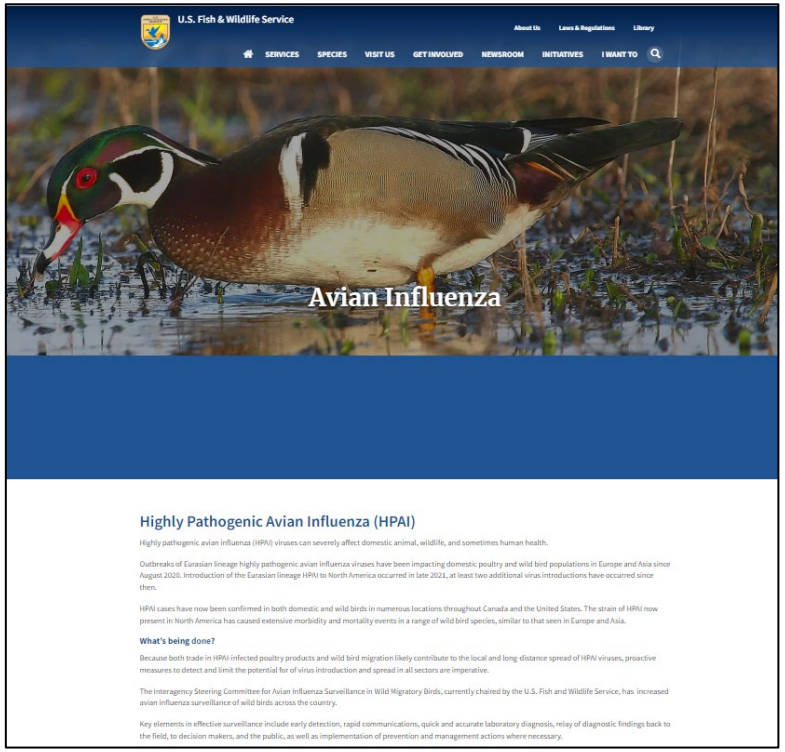
This is a preprint; it has not been peer reviewed by a journal.

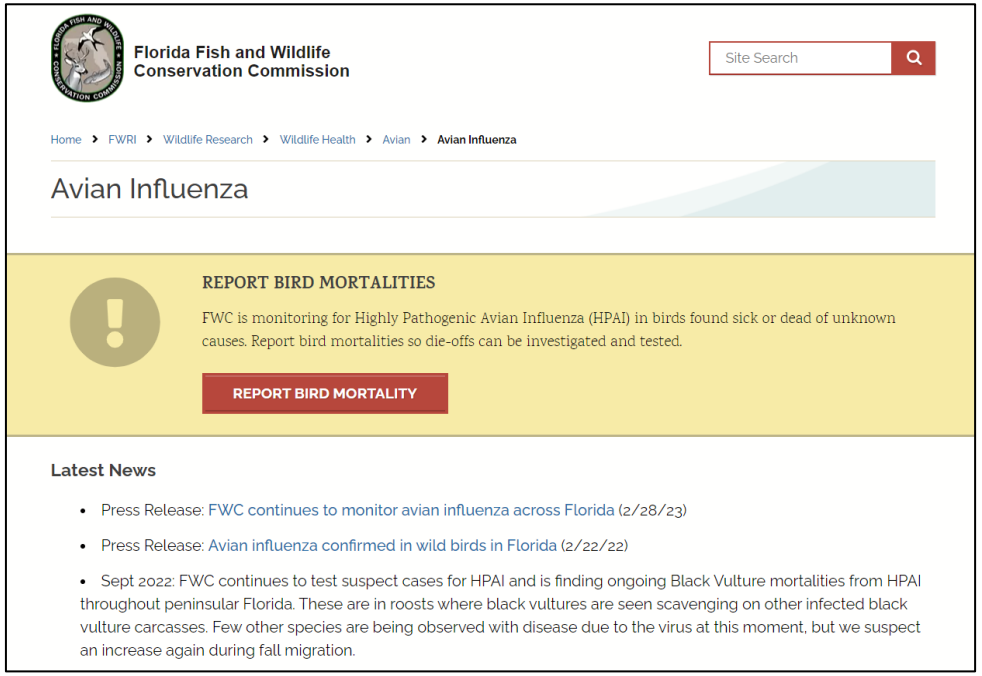
https://doi.org/10.21203/rs.3.rs-2842567/v1


"One isolate, A/Red Tailed Hawk/ON/FAV-0473-4/2022, efficiently transmitted by direct contact between ferrets, resulting in lethal outcomes."

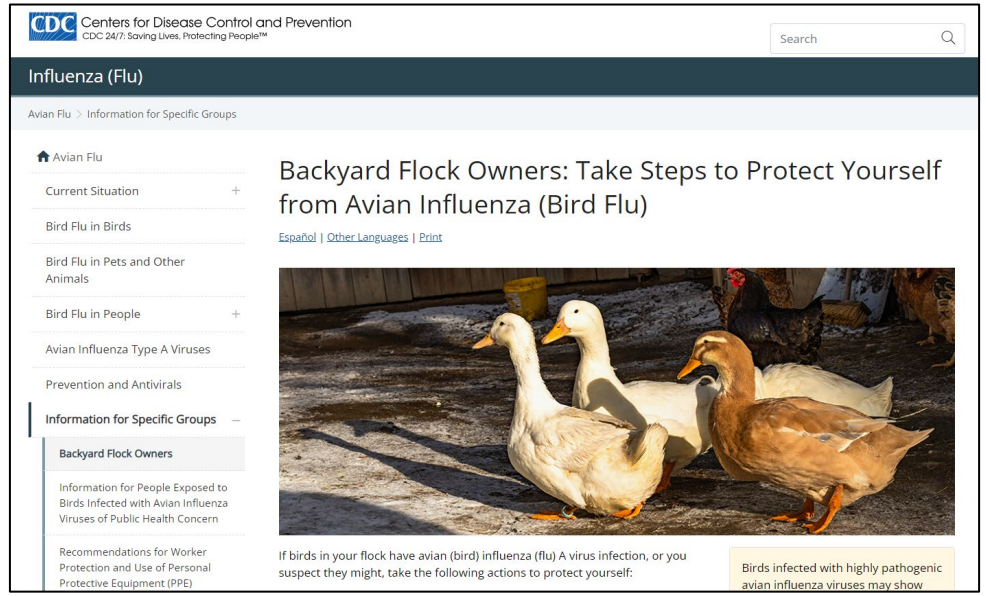
"Ongoing surveillance of circulating HPAI A(H5N1) viruses across species, including humans, should be a top priority so as to promptly identify viruses that may have pandemic or outbreak potential in mammals."

# Needs Identification Process







# Applied Practical Experience (APE)

- Florida Fish and Wildlife Conservation Commission, aka Florida Wildlife Commission (FWC)
- Bird Collection
- Sample Handling
- Carcass Disposal
- Coordination of Training
- Survey Tool Development
- Communication Plans


# Bird collection and sampling

# Survey Development and Distribution

**Public Records Request :: W179245-071223**

**Attachments:**
Rehab_List_7-21-23_Redacted.xlsx

--- Please respond above this line ---

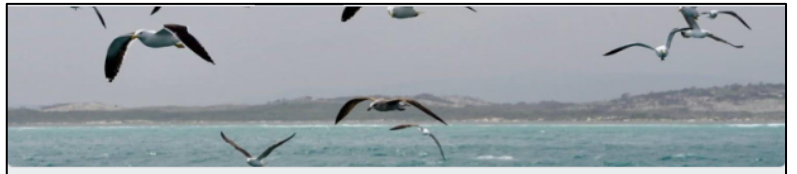
07/31/2023

Masters in Public Health Student and Lead Researcher Zach Mills
1005 Oak Lane
Roswell GA 30075

**Agency Tracker# W179245-071223**

Dear Zach Mills:

Enclosed please find the duplicated records you requested.



## Florida Bird Rehabber Survey (Summer 2023)

Dear Florida Bird Rehabilitators,

We hope this message finds you well. As you may recall, in January 2022, Highly Pathogenic Avian Influenza (HPAI) H5N1 was first identified in Florida, raising concerns about the impact of this disease on wild bird populations and the need for effective management strategies. As dedicated professionals in the field of bird rehabilitation, your role in mitigating the spread of avian influenza and ensuring the welfare of birds is crucial.

To this end, we are conducting a survey of rehabilitation facilities across the state of Florida to assess the knowledge, experiences, and strategies employed by bird rehabbers before, during, and after the identification of HPAI H5N1. By participating in this survey, you will contribute to a comprehensive understanding of the impact of avian influenza and help us identify areas where support, guidance, and resources may be needed.

Your participation in this survey is greatly appreciated and completely voluntary. The survey consists of a series of multiple-choice questions, scaled responses, and some short answer questions that cover various aspects of avian influenza management in bird rehabilitation centers.

The goal of asking for your participating in this study is to help provide support, guidance, and resources to rehabilitation facilities and people in the event of future highly pathogenic avian influenza outbreaks or other potential outbreaks of infectious diseases that can have an impact on human, bird, and animal health.

**NOTE**: In some instances, there were multiple email address for a single facility. Please provide only one response per rehabilitation facility. If your email is associated with multiple facilities/organizations, you might be asked to provide a response for each facility/organization.

**Due Date**: In order for us to be able to analyze the responses, we kindly ask that you complete the survey as soon as possible.

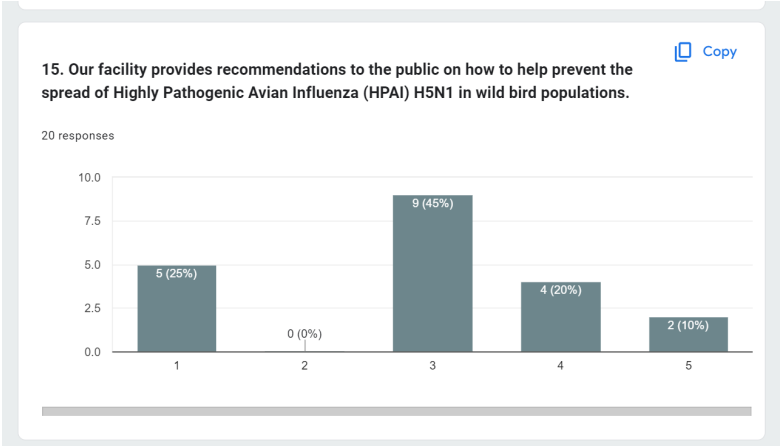
Thank you so much for your time, your dedication to the well-being of birds, and your commitment to avian health.

Sincerely,

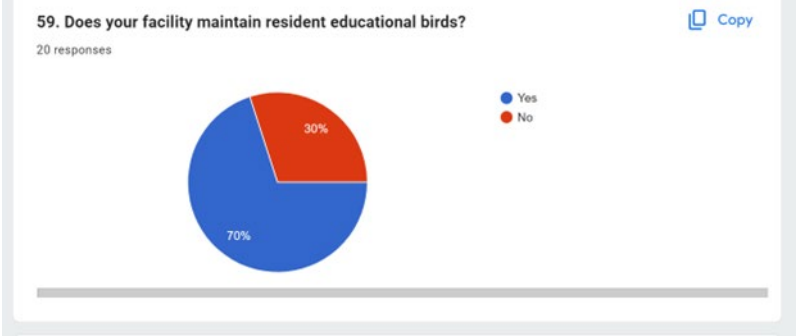
Zach Mills, DVM, MBA, GCPH, Kansas State University Public Health Program

Mark Cunningham, DVM, MS, DACVPM, Florida Commission of Wildlife

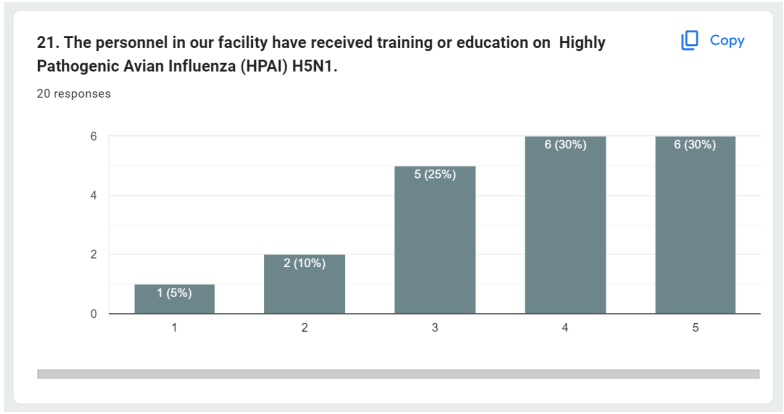
# Select Survey Results



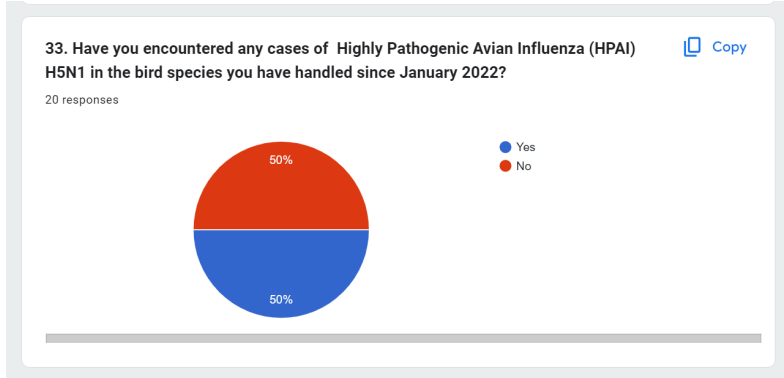

**Opportunity: only 10% "strongly agree" that they educate the public; 25% do no education**


**70% maintain resident educational birds**




**30% of respondents "strongly agreed" that they received adequate training on HPAI H5N1**

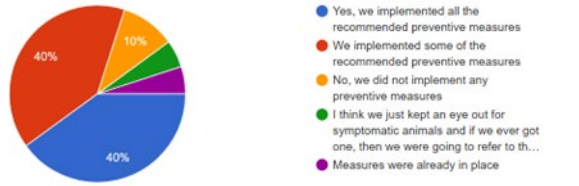




****50% had cases of HPAI H5N1****

29. Did your wildlife rehabilitation center implement any preventive measures in response to the Highly Pathogenic Avian Influenza (HPAI) H5N1 recommendations from the Florida Wildlife Commission issued in January 2022?

Copy

20 responses




**Opportunity: only 40% implemented the recommended preventive measures**

40. Did you electively euthanize any birds because of Highly Pathogenic Avian Influenza (HPAI) H5N1?

Copy

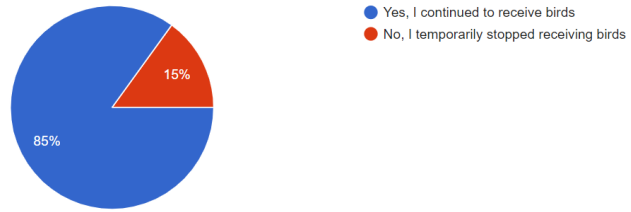
20 responses


**65% of respondents euthanized suspected HPAI H5N1**

42. After January 2022, did you continue to receive birds at your rehabilitation center?

Copy

20 responses

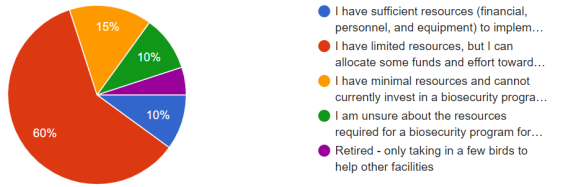



**85% continued to receive birds after HPAI H5N1 found in FL**

64. Which of the following best describes your resources to manage a biosecurity program for Highly Pathogenic Avian Influenza (HPAI) H5N1?

Copy

20 responses




**Only 10% have adequate resources**

47. After January 2022, did you start testing birds for Highly Pathogenic Avian Influenza (HPAI) H5N1?

Copy

20 responses


**40% did NOT test for HPAI H5N1 after it was found in FL**

# Applied Practical Experience Products Guidance for Avian Rehabilitators

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**Recommendations to Reduce the risk of Highly Pathogenic Avian Influenza HPAI H5N1 Transmission in Wildlife Rehabilitation Centers**

**October 20, 2023**

Florida Fish and Wildlife Conservation Commission / Fish and Wildlife Health

In January 2022 Highly Pathogenic Avian Influenza (HPAI) virus (H5N1 Eurasian strain) was detected in hunter-harvested blue-winged teal in Palm Beach County. Although there have been only rare human infections in the in the US, this strain of HPAI can infect at-risk people, birds, and other mammals; personnel involved with wildlife rehabilitation are at increased risk.
All wildlife rehabilitators should be aware of these facts and take proper safety precautions.

- Some avian species, e.g., waterfowl, may be infected with HPAI without showing clinical signs.
- Domestic birds and wild birds, including waterfowl, other aquatic birds, raptors, and scavengers (gulls, ravens, crows) are at higher risk for infection.
- Any bird should be considered susceptible, especially in a rehabilitation setting where there is close contact among birds.
- Clinical signs in infected birds can range from asymptomatic, to gastrointestinal, to respiratory, to neurologic disease, and death. The clinical signs are not specific and could be due to other causes (HPAI cannot be diagnosed based on clinical signs alone).
- The virus is highly transmissible to poultry and domestic chickens, ducks, turkeys, etc., and any direct or indirect exposure of infected wildlife to poultry must be avoided.
- The avian influenza virus is shed through all excretions (oronasal and fecal).
- Although there is low risk for human infection with the current HPAI H5N1 strain, wildlife rehabilitators, especially those who frequently work with wild birds and waterfowl, are at increased risk for exposure.

Avian influenza is a reportable disease and by law must be reported to the Florida Department of Agriculture and Consumer Services (FDACS, (850) 410-0900 (during office hours) or 1-800-342- 5869 (after hours) or email RAD@FDACS.gov) or USDA-Veterinary Services if suspected.

Isolate/quarantine any birds on intake suspected of having an infectious disease.

- Protect yourself and your staff with the appropriate use of personal protective equipment (PPE), including at least dedicated outerwear (washable or disposable), disposable gloves, N95 masks, and eye protection.
- Consider immediate euthanasia of waterfowl, raptors, or scavengers with unexplained neurologic, gastrointestinal, or respiratory symptoms.
- While wearing appropriate PPE, collect oropharyngeal and cloacal swabs from suspected bird. Cloacal samples may be combined for each bird in a labeled BHI broth with antibiotics vial and submitted to an approved laboratory for Avian Influenza testing.
- Carcasses from euthanasia and/or natural mortality should be double-bagged, the outside of the outer bag must be disinfected, and the carcasses must be stored in a refrigerator or freezer labeled "Not for Food Use."
    - Contact FWC or FDACS for necropsy/disposal information. **FWC is coordinating the necropsy and testing of suspect waterfowl and aquatic birds, raptors, and scavengers (call 866-293-9282)**
- Test any birds and ensure negative results *before* transferring them to your facility.
- House education birds, and other non-releasable birds, in a separate facility away from other birds if possible. Have separate and dedicated staff care for resident birds, and not handle any potentially infected birds.



If you choose to hospitalize and treat suspect birds pending results of HPAI H5N1 test results, the recommendations below may help reduce risk. It must be stressed that infection control with HPAI H5N1 in hospital or rehabilitation settings is profoundly difficult and likely beyond the capacity of most wildlife rehabilitation hospitals:

- Always don and doff dedicated PPE (disposable gloves, booties, and N95 mask or equivalent; eye protection; dedicated washable or disposable Tyvek outerwear) https://www.cdc.gov/flu/avianflu/h5/worker-protection-ppe.htm
- Refer the CDC Workplace safety guidelines for Protecting Poultry Workers https://www.cdc.gov/niosh/docs/2008-128/pdfs/2008-128.pdf
- Identify and designate a quarantine in a room away from other birds and mammals. This room would preferably be in a separate building or location with a separate entrance.
- Provide adequate air exchange and air filtration.
- Use a footbath with disinfectant (quaternary ammonia compounds, virucide, or 10% bleach solutions) at the room entrance/exit.
- Wash cages thoroughly with soap and water to remove any organic debris, allow 20 seconds of soap contact time with the cage surface before rinsing and disinfecting.
- Disinfect cages with a 10% bleach solution or hospital grade virucide for disinfection. Allow adequate contact time of at least 30 seconds.
- Contaminated cage liners/supplies/materials should be double bagged for disposal.
- Please refer to the USDA poultry biosecurity recommendations for more details https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/animal-disease-information/avian/defend-the-flock-program/dtf-biosecurity
- Do not transport affected birds from one facility to another unless the birds have been confirmed HPAI test negative.
- Have designated personnel care for quarantined birds. If this is not possible then care for quarantined birds last.
- Staff caring for affected birds should not handle, or have contact with, domestic poultry at the rehab facility, home, or elsewhere.
- Wash hands well with soap and water after handling affected birds, contaminated surfaces, or contaminated materials. Do not eat, drink, or smoke while treating affected birds or cleaning/disinfecting cages.
- Consider vaccination for seasonal influenza and current bivalent COVID-19 to reduce the risk of co-infection.
- If you develop flu-like symptoms, seek prompt medical care, and let your provider know you have regular contact with wildlife including wild birds.
- Please report any bird die-offs or unusual mortality events within your facility by entering the information into the bird mortality database https://app.myfwc.com/FWRI/AvianMortality/

**If HPAI is detected in a bird at your facility:**

- Immediately notify FWC (FDACS and USDA should also be made aware).
- Do not take in or release any birds or mammals.
- Euthanize the HPAI-positive bird, double-bag (disinfect the outside of the bag) and save frozen.
- FDACS and/or FWC may conduct a foreign animal disease investigation, and it is possible that any exposed birds would be euthanized.
- Facility must be thoroughly cleaned and disinfected.

Questions or concerns? Please contact Becky Hardman rebecca.hardman@myfwc.com or Mark Cunningham at mark.cunningham@myfwc.com or 352-494-4229. For more information see our website at https://myfwc.com/research/wildlife/health/avian/influenza/

# Applied Practical Experience Products Guidance for Florida Wildlife Commission

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**Recommendations for the Florida Wildlife Commission to Better Communicate the risk of Infectious Diseases with Wildlife Rehabilitation Centers**

**October 12, 2023**

Florida Fish and Wildlife Conservation Commission / Fish and Wildlife Health

**Background**:
In January 2022 Highly Pathogenic Avian Influenza (HPAI) virus (H5N1 Eurasian strain) was detected in hunter-harvested blue-winged teal in Palm Beach County. Although there have been only rare human infections in the in the US, this strain of HPAI can infect at-risk people, birds, and other mammals; personnel involved with wildlife rehabilitation are at increased risk. All wildlife rehabilitators should be aware of these facts and take proper safety precautions.

While this situation involved Highly Pathogenic Avian Influenza (HPAI), any number of zoonotic infectious disease agents could be responsible for the next outbreak of importance for the state of Florida and avian rehabilitators. It is important to understand how well the avian rehabilitators in Florida understand infectious diseases, and it is also important to provide training, information, and education in ways that optimize the transfer and update of information.

Following the 2022-2023 HPAI H5N1 outbreak in Florida, a survey was conducted of avian rehabilitation organizations to help characterize their knowledge of HPAI, how they reacted to the disease before, during, and after the outbreak, and how they would prefer to receive information on the disease.

**Overarching findings**:
- Among the avian rehabilitators who responded, there is a wide range of understanding about infectious disease and responses to outbreaks.
- With HPAI H5N1, euthanasia was a key to controlling the spread of disease.
- There was little change in the use of PPE among respondents from before the event, during the event, and after the event.
- Avian rehabilitators are looking for a variety of opportunities to receive training on infectious diseases.
- Avian rehabilitators felt that they had limited resources with which to respond to the outbreak of HPAI H5N1

**Key HPAI H5N1 learnings**:
- 85% of respondents continued to receive birds after the HPAI H5N1 outbreak was identified
- 50% of respondents reported encountering rehabilitated birds with suspected HPAI H5N1
- 20% of respondents reported taking no measures to reduce the spread of HPAI H5N1
- 75% of respondents relied on clinical signs for diagnosis of HPAI H5N1
- Despite HPAI being a reportable disease and by law must be reported to the Florida Department of Agriculture and Consumer Services, only 65% of respondents reported having a protocol in place to report the disease.
- 85% of respondents reported monitoring government/health agency sites to get updates on HPAI.
- The most common steps identified by respondents to prepare for future HPAI outbreaks are:
  - Training staff on HPAI (85%)
  - Acquire the necessary personnel protective equipment (PPE) (75%)
  - Establishing partnerships with avian health professionals or local authorities (75%)
- 55% of respondents reported implementing strict quarantine for all new arrivals.
- No (0%) respondents indicated any bird-to-bird transmission of HPAI H5N1
- Diagnostic testing of birds remained low during the active outbreak with only 60% testing
- 30% of respondents "strongly agreed" that personnel received training or education on HPAI.



**Recommendations for future infectious disease outbreaks:**
- Resource allocation is key. Only 10% of respondents indicated that they had sufficient resources to manage a biosecurity program.
- Educational birds are a big part of the rehabilitator program (70% maintain resident birds)
  - Staff training on biosecurity is vital, as 40% of respondents do not have dedicated staff to handle potentially sick birds separately form educational birds.
- 1in 5 facilities keep poultry on their premises, so education on biosecurity, PPE use, and disease containment training is critical.
- Many facilities rely on clinical signs for diagnosis. Training on the need for proper diagnostic testing is important to understand the scope of disease.
- Euthanasia of affected birds remains an important way to reduce the spread of disease and human exposure to infectious disease agents.
- The most requested method to receive information on disease outbreaks is from regional or national avian rehabilitator associations, followed by online updates from government organizations such as USDA and CDC.

Questions or concerns? Please contact Mark Cunningham at mark.cunningham@myfwc.com or 352-494-4229.

For more information see our website: https://myfwc.com/research/wildlife/health/avian/influenza/

# Conclusions, Take-aways, and Next Steps

- Florida has been successful preventing epizootics of HPAI H5N1
  - To date there have been no human cases of HPAI H5N1 deaths
  - No commercial poultry operations been impacted by HPAI H5N1
- Recommendations must be:
  - Designed to be easily implemented
  - Costs and personnel will be rate limited factors
  - Include comprehensive communications and execution plans where the target groups receive their information
- Influenza is a virus that can rapidly evolve, and even though the current HPAI H5N1 variant does not affect people in large numbers, it is potentially just one mutation away from a potential pandemic.

# MPH Foundational Competencies

| Number and Competency | | Description |
|---|---|---|
| 4 | Interpret results of data analysis for public health research, policy, or practice | Development, distribution, and evaluation of survey tool to characterize preparedness of avian rehabilitators in Florida to help update and optimize Florida Wildlife Commission education practices. |
| 13 | Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes | Working with the Florida Commission of Wildlife (FWC) was able to utilize the Freedom of Information Act to comprehensive and up-to-date lists of registered rehabilitators in Florida. Cross-referenced this list with the list curated by Dr. Cunningham and active avian rehabbers to target the most likely impacted group for exposure to potential zoonotic wildlife disease. |
| 16 | Apply principles of leadership, governance, and management, which include creating a vision, empowering others, fostering collaboration, and guiding decision making | Led the creation of a vision for improved management of information distribution in collaboration with the Florida Commission of Wildlife for Florida avian rehabilitators. Aligned capabilities of the FWC with the preferred methods of communication of the rehab group to create novel guidelines for communications. |
| 19 | Communicate audience-appropriate public health content, both in writing and through oral presentation | Developed written guidelines for the FWC to improve communications on management of zoonotic infectious diseases for avian rehabilitators, and prepared presentation for virtual information sharing to the leading avian rehabilitation constituency in Florida. |
| 21 | Interprofessional and/or Intersectional Practice - Integrate perspectives from other sectors and/or professionals to promote and advance population health. | Worked with Florida Wildlife Commission professionals and veterinarians, members of the USDA, veterinary pathologists from the Disney Animal Kingdom, and soldiers of the US Army Reserve (USAR) to train on, and collect samples from, affected birds in north central Florida. |

# MPH Emphasis Area Competencies

| MPH Emphasis Area: Infectious Diseases & Zoonoses | | |
|---|---|---|
| **Number and Competency** | | **Description** |
| 1 | Pathogens/pathogenic mechanisms | Evaluated Avian Influenza HPAI H5N1 and transmission between birds, to mammals, and to humans. |
| 2 | Host response to pathogens/immunology | Described species immune response regarding species-dependency, waterfowl prevalence, domestic bird susceptibility, and transmission from birds to humans and mammals to humans. |
| 3 | Environmental/ecological influences | Examined the influence of migratory flyways, proximity to water sources, proximity to other avians species, avian-human interface; discussed potential seasonality and maintenance in the waterfowl populations. |
| 4 | Disease surveillance | Analyzed HPAI H5N1 surveillance efforts in the US by different federal and state agencies, what the FWC is doing, and identified potential gaps in surveillance that can be improved. |
| 5 | Disease vectors | Avian Influenza, while not a vector-borne disease, is maintained in the bird-specific populations of waterfowl, while then infecting other birds, mammals, and humans. |

# Discussion

# References


1. Centers for Disease Control and Prevention. (2015, January 28). *Highly Pathogenic Avian Influenza A(H5N1) in Birds and Other Animals*. https://www.cdc.gov/flu/avianflu/h5n1-animals.htm

2. Centers for Disease Control and Prevention. (2023, April 26). *Bird Flu: Current Situation*. https://www.cdc.gov/flu/avianflu/avian-flu-summary.htm

3. Xie, R., Edwards, K.M., Wille, M. et al. The episodic resurgence of highly pathogenic avian influenza H5 virus. Nature (2023). https://doi.org/10.1038/s41586-023-06631-2

4. United States Department of Agriculture, APHIS. (2023, October 17). *Detections of Highly Pathogenic Avian Influenza in Mammals*. https://www.aphis.usda.gov/animal_health/animal_diseases/avian/images/hpai-mammals-map.png

5. United States Geologic Survey. (2022, November 28). *Distribution of Highly Pathogenic Avian Influenza H5 and H5N1 in North America, 2021/2022.* https://www.usgs.gov/media/images/distribution-highly-pathogenic-avian-influenza-h5-and-h5n1-north-america-20212022

6. Leguia, M. (2023, March 3). *Highly pathogenic avian influenza A (H5N1) in marine mammals and seabirds in Peru*. bioRxiv. https://www.biorxiv.org/content/10.1101/2023.03.03.531008v1

7. World Health Organization. (2023, April 24). *Global Influenza Programme.* https://www.who.int/teams/global-influenza-programme/avian-influenza

8. Centers for Disease Control and Prevention. (2023, April 28). *Past H5N1 Human Infections by Country*. https://www.cdc.gov/flu/avianflu/chart-epi-curve-ah5n1.html

9. World Health Organization. (2023, January 18). *Human infection caused by avian influenza A(H5) – Ecuador***.** https://www.who.int/emergencies/disease-outbreak-news/item/2023-DON434

10. Schnirring, L. (2022, December 28). *WHO: Recent severe H5N1 avian flu cases in China, Vietnam linked to current clade*. https://www.cidrap.umn.edu/avian-influenza-bird-flu/who-recent-severe-h5n1-avian-flu-cases-china-vietnam-linked-current-clade

11. Kupferschmidt, K. (2023, January 24). *'Incredibly concerning': Bird flu outbreak at Spanish mink farm triggers pandemic fear*. Science**.** https://www.science.org/content/article/incredibly-concerning-bird-flu-outbreak-spanish-mink-farm-triggers-pandemic-fears

12. Agüero Montserrat, Monne Isabella, Sánchez Azucena, Zecchin Bianca, Fusaro Alice, Ruano María José, del Valle Arrojo Manuel, Fernández-Antonio Ricardo, Souto Antonio Manuel, Tordable Pedro, Cañás Julio, Bonfante Francesco, Giussani Edoardo, Terregino Calogero, Orejas Jesús Javier. Highly pathogenic avian influenza A(H5N1) virus infection in farmed minks, Spain, October 2022. Euro Surveill. 2023;28(3):pii=2300001. https://doi.org/10.2807/1560-7917.ES.2023.28.3.2300001https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2023.28.3.2300001

13. Darwyn Kobasa, Bryce Warner, Tamiru Alkie et al. Transmission of lethal H5N1 clade 2.3.4.4b avian influenza in ferrets, 21 April 2023, PREPRINT (Version 1) available at Research Square [https://doi.org/10.21203/rs.3.rs-2842567/v1]

14. US Department of Labor, Occupational Safety and Health Association. *Avian Influenza*. Retrieved 2023, April 30. https://www.osha.gov/avian-flu/control-prevention

15. US Environmental Protection Agency. (2022, June 5). *Carcass Management During Avian Influenza Outbreaks*. https://www.epa.gov/homeland-security-waste/carcass-management-during-avian-influenza-outbreaks

16. Centers for Disease Control and Prevention. (2022, May 4). *Bird Flu in People*. https://www.cdc.gov/flu/avianflu/avian-in-humans.htm

17. Centers for Disease Control and Prevention. (2022, October 31). *Prevention and Antivirals*. https://www.cdc.gov/flu/avianflu/prevention.htm