

One Health Update

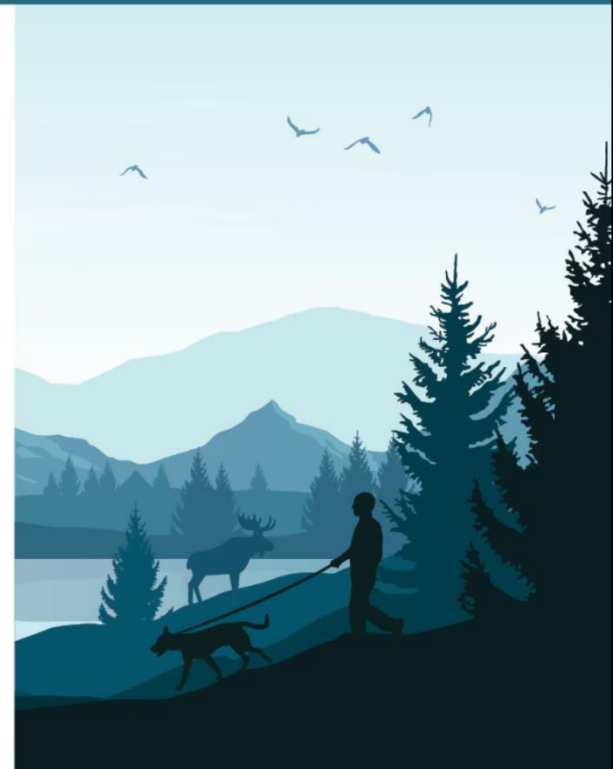
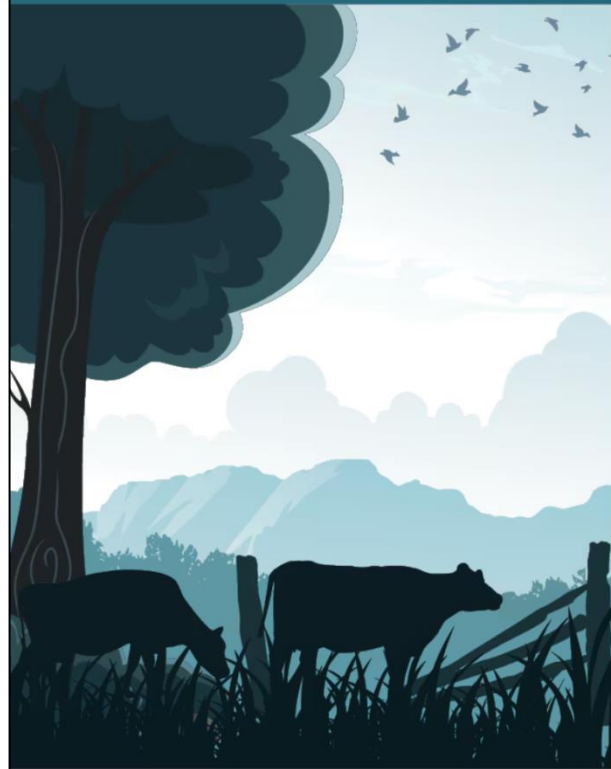
Highly Pathogenic Avian Influenza

May 9, 2024

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ONE HEALTH

When we protect **one**,
we help protect **all**.



CONNECTING HUMAN, ANIMAL, AND ENVIRONMENTAL HEALTH

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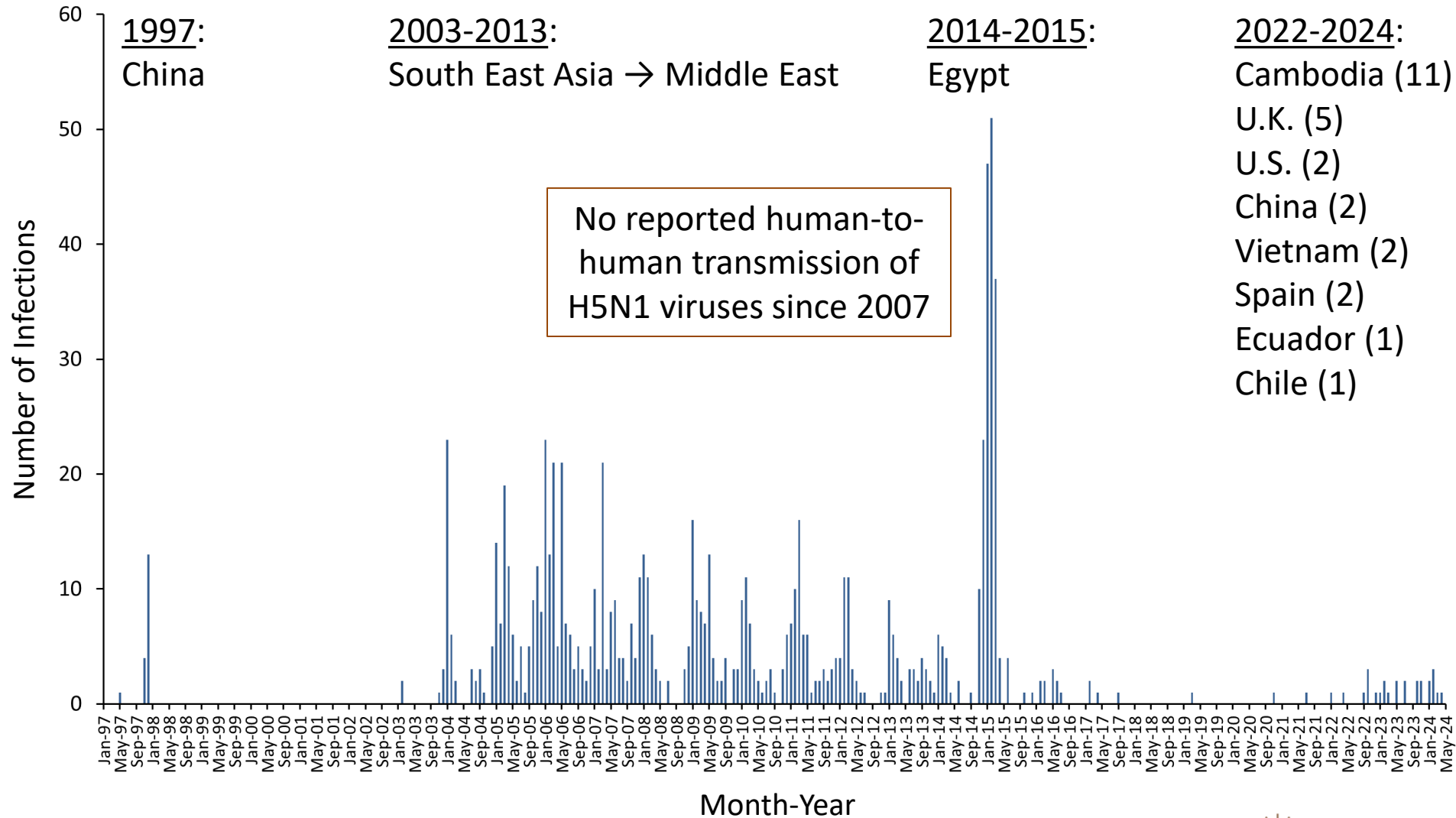
Avian Influenza Terminology

- Avian influenza A viruses are classified into two general categories:
 - Low pathogenic avian influenza (LPAI): cause no signs of disease, or only mild disease in poultry
 - Highly pathogenic avian influenza (HPAI): cause severe disease and high mortality in infected birds
- LPAI and HPAI do NOT refer to, or correlate with, severity of illness in people

H5N1 Overview

- HPAI A(H5N1) first emerged in China in 1997, and has continued to evolve into different genetic groups called “clades” through reassortment
- Eurasian lineage H5 clade 2.3.4.4b is currently circulating
- Initially introduced into the Americas in December 2021 via the Atlantic Flyway resulting in spillover from wild birds into commercial and backyard poultry and mammals
- Very small number of human infections with H5N1 have occurred since 2021
- No evidence of human-to-human transmission

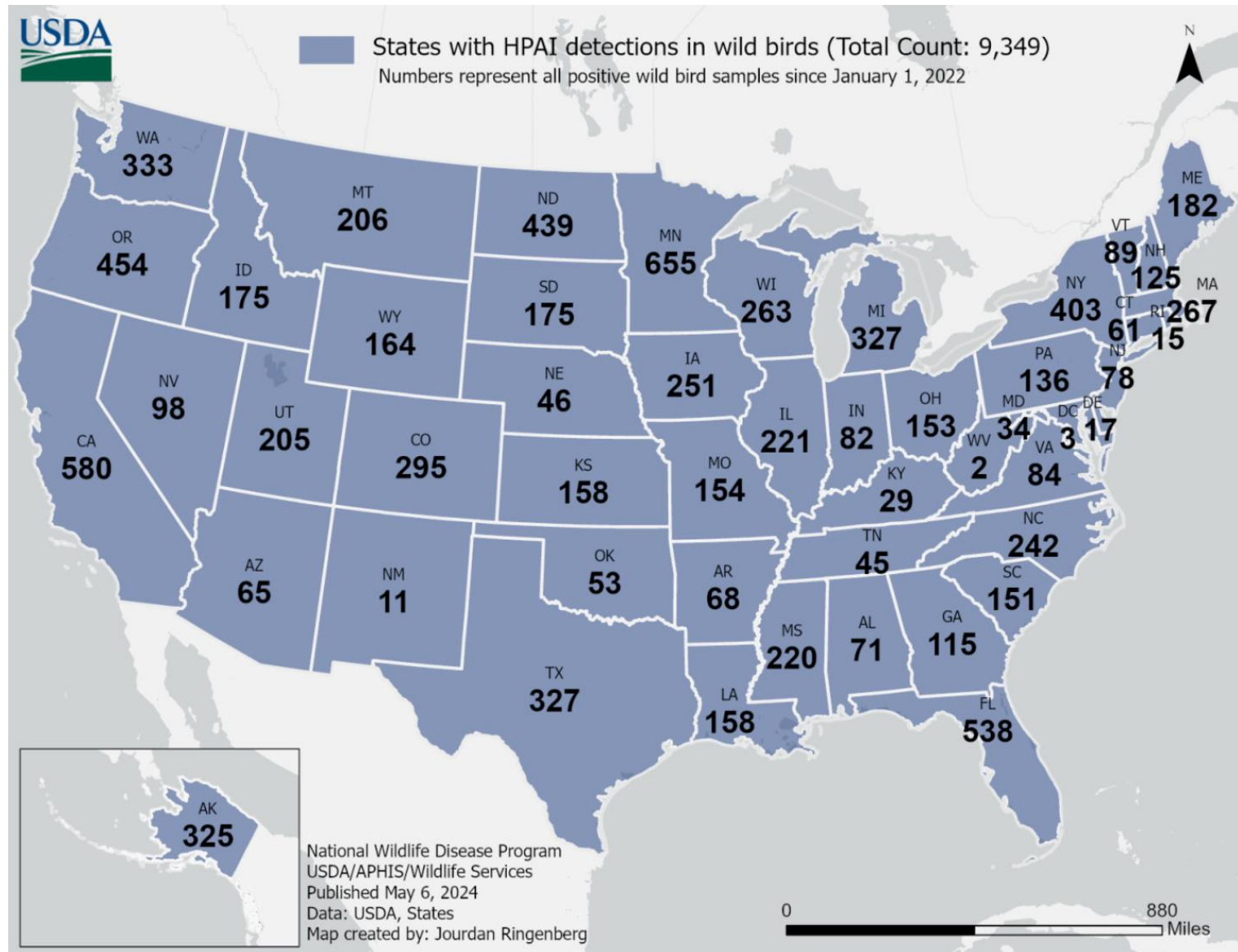
Global Human H5N1 Infections/Detections, 1997-2024



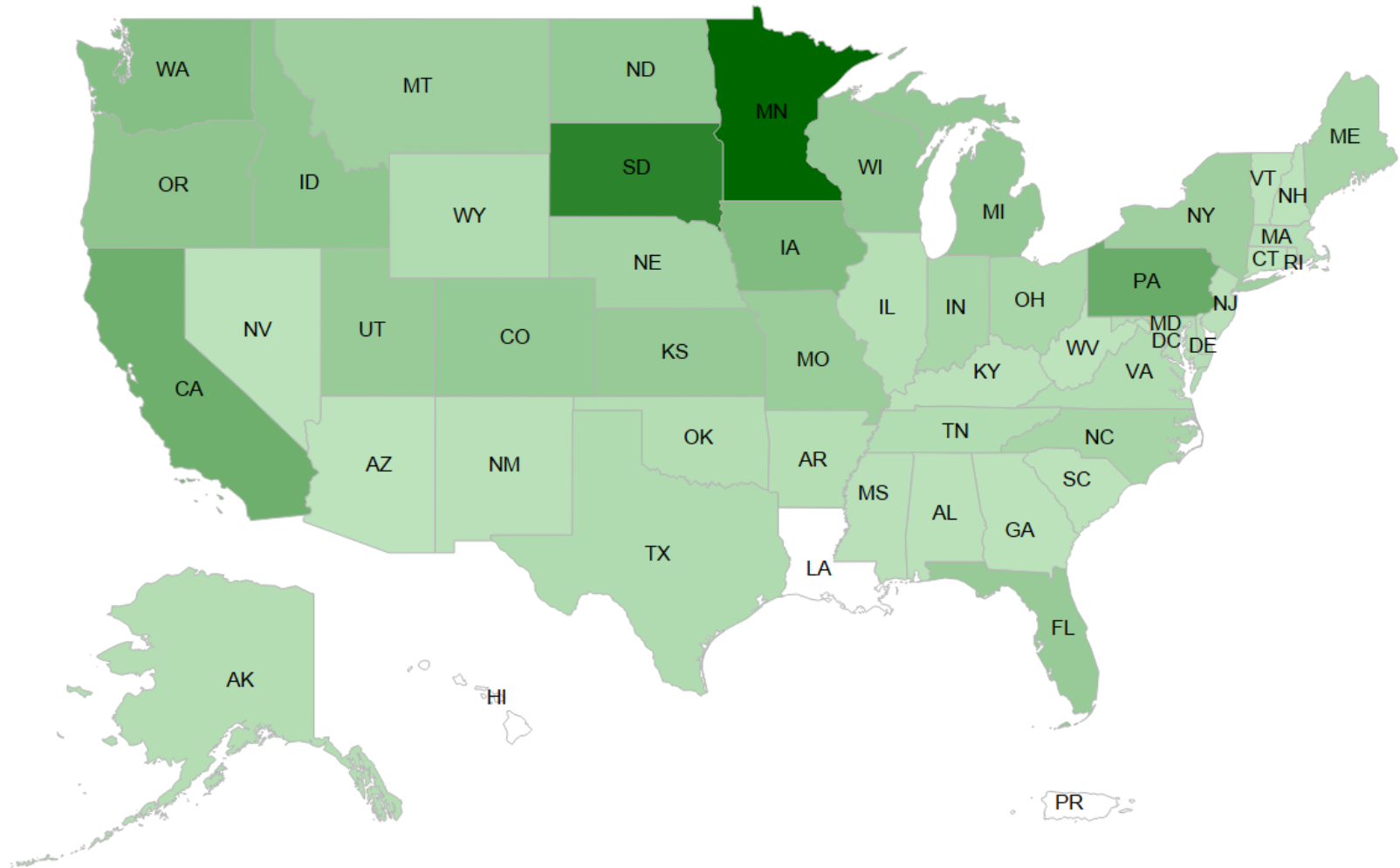


<https://www.fws.gov/media/migratory-bird-flyways-north-america>

Wild Bird Detections in the U.S. (2022-2024)

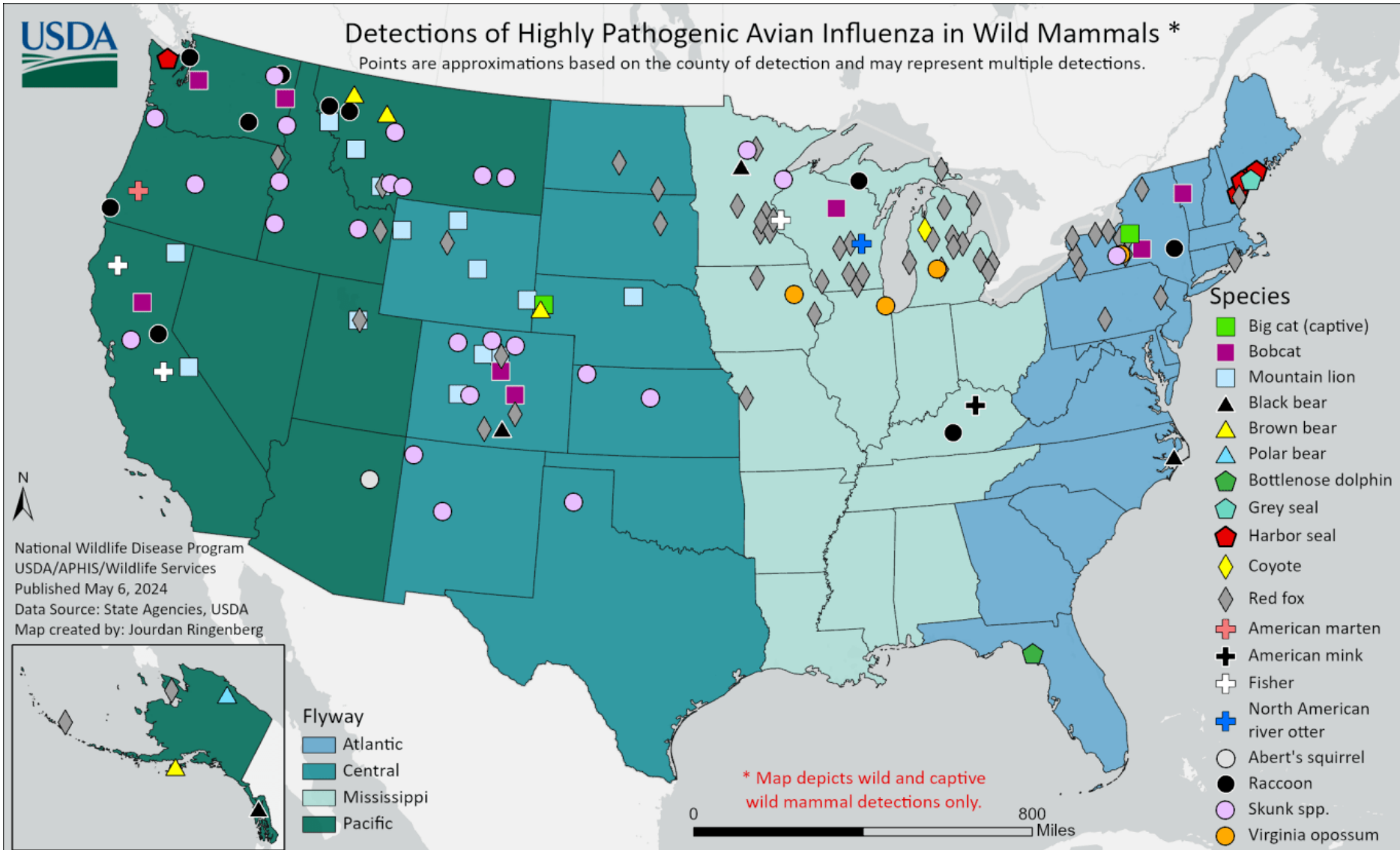


Commercial and Backyard Poultry Flock Detections in the U.S. (2022-2024)

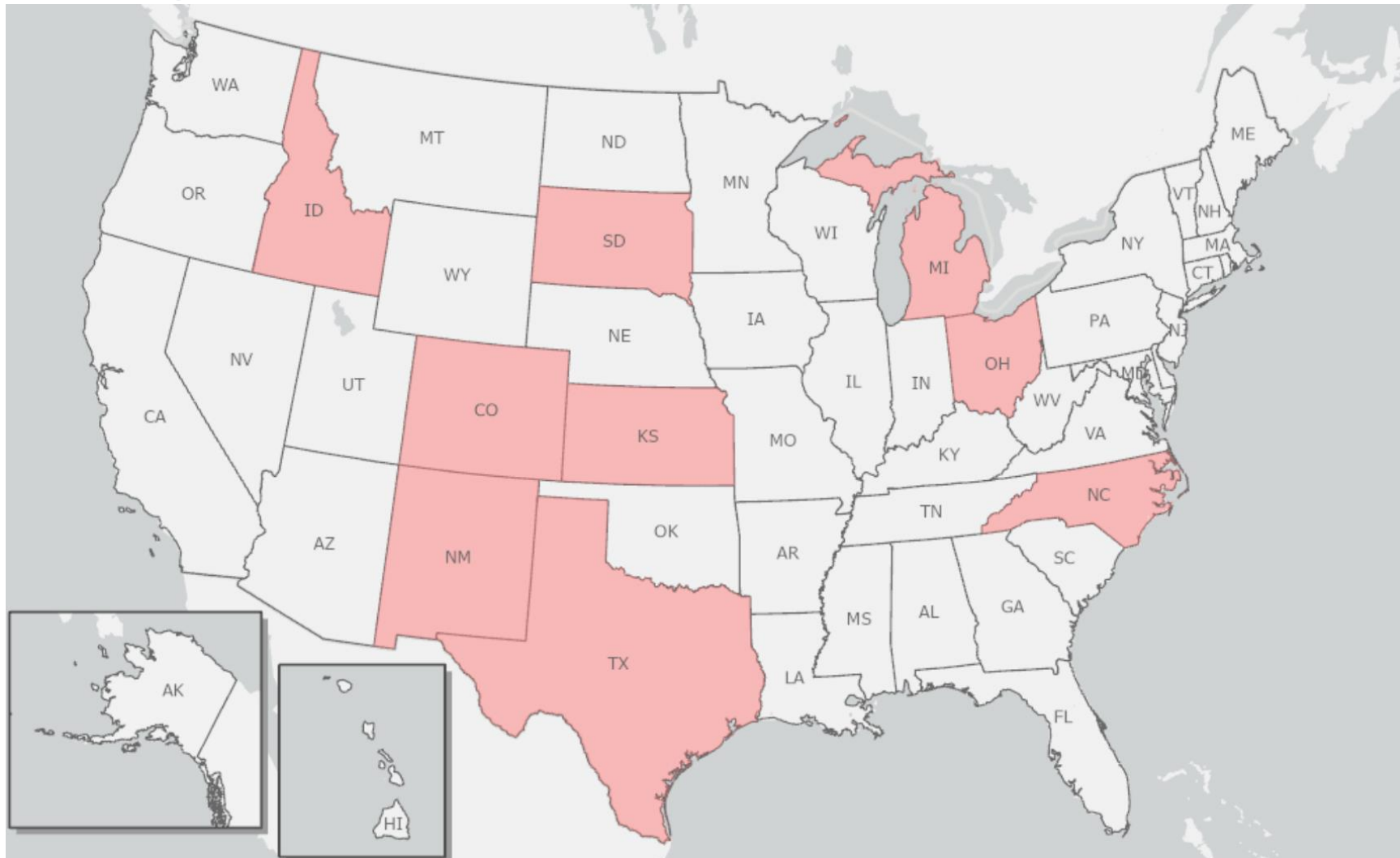


<https://www.aphis.usda.gov/livestock-poultry-disease/avian/avian-influenza/hpai-detections/commercial-backyard-flocks>

Detection in Wild Mammals (2022-2024)



Detection in Domestic Livestock (Dairy Milking Cattle), 2024



Mammal-to-Mammal Transmission Events

- June-July 2022: Seals in U.S. (Maine)
- October 2022: Mink in Spain
- Jan-Feb 2023: Sea lions in Peru
- Mar-Present 2024: Dairy Cattle in U.S. (multiple states)

<https://www.ecdc.europa.eu/en/publications-data/avian-influenza-overview-december-2022-march-2023>

https://wwwnc.cdc.gov/eid/article/29/4/22-1538_article

<https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2023.28.3.2300001>

H5N1 Spread in Dairy Cattle

Posted May 01, 2024.

bioRxiv
THE PREPRINT SERVER FOR BIOLOGY

Emergence and interstate spread of highly pathogenic avian influenza A(H5N1) in dairy cattle

- March 25, 2024: H5N1, clade 2.3.4.4b was confirmed by the USDA in dairy cattle in Texas
- Whole genome sequencing suggests there was a single introduction event from wild birds into cattle, and then cattle-to-cattle spread
- Direct movement of cattle between states allowed the virus to spread from state-to-state
- Genetic analysis suggests that the virus was likely circulating in cattle for ~4 months prior to confirmation by the USDA
- Subsequent transmission identified from cattle into poultry and wild birds, domestic cats, and a single human infection
- A cow may shed virus for 2-3 weeks after infection
- Virus predominantly found in mammary tissue and milk of dairy cattle

Avoid Raw Milk Consumption

- Highest levels of H5N1 virus from infected dairy cattle have been found in raw milk and mammary glands
- Milk from affected cows is diverted before going into the commercial supply, and pasteurization should kill influenza viruses
 - FDA tested 297 retail dairy products (pasteurized milk, cottage cheese, sour cream) and 20% of samples tested positive by PCR for H5N1 virus
 - No live virus detected on egg inoculation tests indicating that pasteurization is effective at killing the virus
- Consumption of raw milk may be able to transmit H5N1 to humans (no data), but is able to transmit diseases like *Listeria*, *E. coli*, *Salmonella*, *Campylobacter*, *Cryptosporidium*, etc.
- Public health continues to recommend that people should not drink raw milk because of multiple potential infectious diseases



**H5N1 IN DAIRY
CATTLE
PROVIDER UPDATE
05.09.2024**

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DAIRY QUIZ

- 2017 study by the Innovation Center for US Dairy
 - Online
 - “nationally representative”
- Not intended to mock rather to document how much education the dairy industry (and others in agriculture) still need to do regarding animal agriculture and the source of food
- Where does chocolate milk come from?
 - **48%** did not know

- Perhaps circulating in west Texas prior to first confirmation in early February
- 9 states, 36 affected herds, most recent on 4.25.2024
- 74 licensed dairies in NH, >26k licensed dairies in US, ~0.28%
- ~10k dairy cattle in NH, ~9.4M dairy cattle in US, ~0.11%



LAY OF THE LAND

H5N1 IN CATTLE ... WHERE DID IT COME FROM?

- Global outbreak of H5N1 in wild & domestic birds, as well as some wild & domestic mammals, has been ongoing since 2022
- Highly pathogenic avian influenza (HPAI) response in US to domestic poultry findings since 2022
- Based on preliminary genetic analysis, the cattle index case is thought to be a single spillover from wild birds in late 2023 in west Texas.
 - *Emergence and interstate spread of highly pathogenic avian influenza A(H5N1) in dairy cattle | bioRxiv*
- Subsequent spread appears to be mechanical from cow-to-cow on farms and spread between States by cow movement.



AN ANIMAL HEALTH ISSUE

- Based on the current science, the Federal Order, effective 4.29.2024, applies only to lactating dairy cattle. [Federal Order Requiring Testing for and Reporting of Highly Pathogenic Avian Influenza \(HPAI\) in Livestock \(usda.gov\)](#)
- Dr. Todd Davis, CDC, on a May 6, 2024, WHO webinar stated that CDC position is that risk to public health is “quite low” and that this is still “primarily a bird virus”.
- *[CDC confirmed one human HPAI A\(H5N1\) infection that had exposure to dairy cattle in Texas which were presumed to be infected with the virus. While thought to be rare, this exposure to HPAI A\(H5N1\) bird flu virus is the first instance of likely mammal to human transmission.](#)* [Current H5N1 Bird Flu Situation in Dairy Cows | Avian Influenza \(Flu\) \(cdc.gov\)](#)
- Up-to-date information is available at [Highly Pathogenic Avian Influenza \(HPAI\) Detections in Livestock | Animal and Plant Health Inspection Service](#)

FEDERAL ORDER

EFFECTIVE 4.29.2024

- [Federal Order Requiring Testing for and Reporting of Highly Pathogenic Avian Influenza \(HPAI\) in Livestock \(usda.gov\)](#)
 - **Lactating dairy cattle, only.**
 - **Interstate movement testing and documentation.**
 - **Mandatory reporting and testing of clinical suspects.**
- **This is a Federal Order so there is not much latitude for state flexibility – who can collect samples, disposition of non-negative herds (with USDA), documentation for slaughter movements, milk disposal**
- **The 1.5 page Order has generated almost 20 pages of clarification, FAQs, lab guidance...in the first week+**

Clinical presentation as initially described in USDA documents...

Decreased herd level milk production; acute sudden drop in production with some severely impacted cows experiencing thicker, concentrated, colostrum-like milk; decrease in feed consumption with a simultaneous drop in rumen motility; abnormal tacky or loose feces, lethargy, dehydration, and fever. Initial cases indicated older cows in mid-lactation may be more likely to be severely impacted than younger cows and fresh cows or heifers. Additional data indicates younger cattle have been affected; more data and reporting from impacted producers will help to clarify the range of animals affected.



CLINICAL PRESENTATION IN DAIRY COWS



CURRENT DESCRIPTION OF CLINICAL PICTURE IN ORDER GUIDANCE

Briefly, dairy cattle may experience a sudden drop in feed intake; a marked drop in herd level milk production with some more severely affected cows having thickened milk or may have essentially no milk; subsequent acute drop in milk production; and respiratory signs including clear nasal discharge.

LENGTH OF ILLNESS

- Field reports from veterinarians indicate within 10-14 days the cows return to normal production.
- Recovery with supportive care, no other interventions.



- Not well established yet. Monitoring in affected herds ongoing.
- Some evidence of shedding prior to clinical signs.
- Federal Order requires 30 days of no interstate movement then a negative retest. Just coming up to that timeline in many of the affected herds.



HOW LONG DO COWS SHED VIRUS

WHERE/H OW TO TEST?

CLINICAL OR PRE- MOVEMENT T

- Per the Order, an accredited veterinarian or a state licensed veterinarian can collect samples or it can be done *“under the supervision of a licensed or accredited veterinarian or as determined by the respective State Animal Health Official.”*
- The Order and Guidance are silent on the definition of “supervision”, so veterinarians should look to the New Hampshire Veterinary Practice Act for the definitions of supervision in New Hampshire, [Vet 100-700 \(state.nh.us\)](http://vet100-700.state.nh.us).
- Testing is limited to National Animal Health Lab Network (NAHLN), no other labs should be conducting testing for this disease.
- Supplies can be obtained from a NAHLN lab or NHVDL.
- Testing is only validated for individual samples at the moment.



CVI OR OSS?

- As of late on April 29, 2024, cull **lactating dairy cattle** leaving New Hampshire and moving **directly to a federally inspected slaughter plant** can travel on either an interstate certificate of veterinary inspection (iCVI) or on an owner shipper statement (OSS).
- *Should you wish to use an OSS, please contact the department for an electronic copy of the approved document.*
- ****Shipping lactating dairy cattle to an auction in another state requires a CVI, official identification, a premises ID, and a negative milk test from a NAHLN lab collected within 7 days prior to movement.**

*****This is an area of active discussion, with several formal requests submitted to USDA. The logistics of the***

OTHER MOVEMENTS ...

01

Exhibitions.

- Guidance under discussion, in New England and nationally.

02

Private sales.

- CVI, official ID, premises ID, negative milk test.

03

Exemptions from testing are rare.



PERSONAL PROTECTIVE EQUIPMENT (PPE)

- CDC recommendations
- Gloves, eye protection, respiratory protection. More?
- Do workers want it?

FOOD SAFETY Q'S

- <https://www.aphis.usda.gov/livestock-poultry-disease/avian/avian-influenza/hpai-detections/livestock/h5n1-beef-safety-studies>

USDA's Food Safety and Inspection Service (FSIS) is announcing results from its testing of retail ground beef. FSIS collected 30 samples of ground beef from retail outlets in the states with dairy cattle herds that had tested positive for the H5N1 influenza virus at the time of sample collection. The samples were sent to APHIS' National Veterinary Services Laboratories (NVSL) for PCR testing. On May 1, NVSL reported that all samples tested negative for H5N1. These results reaffirm that the meat supply is safe.

- <https://www.fda.gov/food/alerts-advisories-safety-information/updates-highly-pathogenic-avian-influenza-hpai>

...preliminary results of egg inoculation tests on quantitative polymerase chain reaction (qPCR)-positive retail milk samples show that pasteurization is effective in inactivating HPAI. This additional testing did not detect any live, infectious virus. These results reaffirm our assessment that the commercial milk supply is safe.

WHAT HAPPENS IF ... ?

- Order prohibits interstate movement of lactating herd for minimum of 30 days post-test then until a negative test in herd.
- State investigation & quarantine authorities.
 - RSA 436:31-39
- Human exposures?
- Milk questions?
Brand protection?



QUESTIONS
?

Spread of H5N1 from Dairy Cattle to Domestic Cats

EMERGING INFECTIOUS DISEASES®

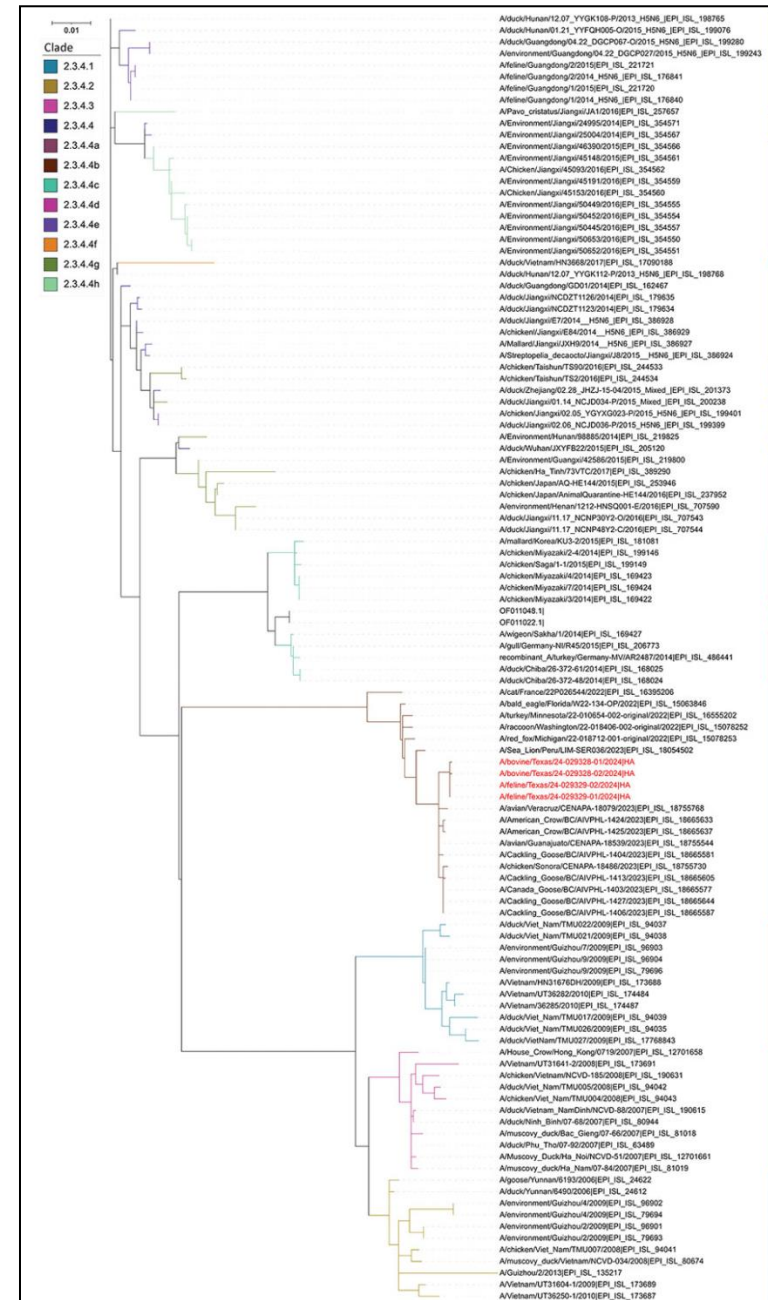
Volume 30, Number 7—July 2024

Highly Pathogenic Avian Influenza A(H5N1)
Clade 2.3.4.4b Virus Infection in Domestic
Dairy Cattle and Cats, United States, 2024

- ~24 domestic cats on a Texas dairy farm were fed milk from sick cattle
- Clinical symptoms in cattle developed March 16th
- Cats became sick on March 17th
 - Symptoms included depressed mental state, stiff body movements, ataxia, blindness, circling, copious oculonasal discharge, absence of menace reflexes and pupillary light responses with a weak blink response
- ~50% of cats at the dairy farm became ill and died in a cluster between March 19-20
- Iowa State University Veterinary Diagnostic Laboratory (ISUVDL) tested specimens from affected cattle in Texas and Kansas and 2 deceased cats from Texas

Cross-Species Mammal-to-Mammal Transmission

- Genetic analysis of hemagglutinin sequences from milk samples and cat tissue showed high genetic relatedness (99.9%+ nucleotide identities)
- Suggests transmission from cattle to cats
- Milk and mammary gland homogenates in cattle consistently showed higher viral loads (based on PCR Ct values)
- Brain and lung samples from 2 deceased cats showed high viral loads (based on PCR Ct values)



Simplified Table of PCR Cycle Threshold (Ct) Values for H5 Clade 2.3.4.4 Testing on Various Specimens

(Note: Lower Ct values indicate higher viral loads)

Animal	State	Milk	Mammary Gland	Brain	Lung	Spleen	Lymph Node	Ocular Fluid	Rumen Contents
Cow	Texas	--	17.8	--	--	--	--	--	--
Cow	Texas	--	--	--	34.8	--	--	--	--
Cow	Texas	14.7	--	--	--	--	--	--	--
Cow	Texas	15.1	--	--	--	--	--	--	--
Cow	Kansas	17.1	--	--	--	--	--	30.9	32.2
Cow	Kansas	--	--	--	--	--	--	--	--
Cow	Kansas	20.0	--	--	≥40	--	33.9	--	31.1
Cow	Kansas	--	--	--	37.3	33.9	--	--	--
Cat	Texas	--	--	11.9	18.0	--	--	--	--
Cat	Texas	--	--	15.2	24.8	--	--	--	--

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Cow	Texas	--	17.8	--	--	--	--	--	--
Cow	Texas	--	--	--	34.8	--	--	--	--
Cow	Texas	14.7	--	--	--	--	--	--	--
Cow	Texas	15.1	--	--	--	--	--	--	--
Cow	Kansas	17.1	--	--	--	--	--	30.9	32.2
Cow	Kansas	--	--	--	--	--	--	--	--
Cow	Kansas	20.0	--	--	≥40	--	33.9	--	31.1
Cow	Kansas	--	--	--	37.3	33.9	--	--	--
Cat	Texas	--	--	11.9	18.0	--	--	--	--
Cat	Texas	--	--	15.2	24.8	--	--	--	--

Highly Pathogenic Avian Influenza A(H5N1) Virus Infection in a Dairy Farm Worker



Figure 1. Conjunctivitis with Subconjunctival Hemorrhage in Both Eyes.

- An adult dairy farm worker presented with redness and discomfort in the right eye in late March, 2024
 - Subconjunctival hemorrhage and serous drainage noted (no visual impairment)
 - Afebrile, normal vital signs and oxygenation
 - No respiratory signs or symptoms
- Reported direct contact and close exposure to dairy cows (including sick cows)
- PCR positive for Influenza A(H5) on testing of conjunctival swab (Ct 18) and nasopharyngeal swab (Ct 33)
 - Successful live-virus isolation from both specimens
 - Virus was closely related to H5N1 virus detected in dairy cattle

Highly Pathogenic Avian Influenza A(H5N1) Virus Infection in a Dairy Farm Worker



Figure 1. Conjunctivitis with Subconjunctival Hemorrhage in Both Eyes.

- Home isolation and treatment with oral oseltamivir x 5 days
- Household contacts provided with oseltamivir post-exposure prophylaxis (PEP)
- Viral sequences “maintained primarily avian genetic characteristics and lacked changes in the hemagglutinin gene that would affect receptor-binding specificity... and transmission risk to humans.”
- No genetic markers found associated with reduced susceptibility to influenza antiviral drugs

CDC Technical Update: Analysis of Genetic Sequences of H5N1 from Texas (Apr 2024)

- Both cattle and human H5N1 sequencing shows “primarily avian genetic characteristics”
 - The hemagglutinin gene lacks mutations that would increase adaptation to mammalian receptors
- No evidence of onwards spread among people
- No markers associated with antiviral resistance were identified
- Virus is closely related to two existing candidate vaccine viruses (CVVs) available to vaccine manufacturers (if needed)
- General human health risk remains “low”
- Risk may be higher for farm workers exposed to the virus

Public Health Monitoring for Persons Exposed to H5N1

- Public health monitoring for 10 days after a person is exposed
- Contact NH DPHS if symptoms develop after exposure to coordinate testing with a local healthcare facility

February 2022 - Present

CDC and state and local health departments monitor people exposed to infected birds, poultry or other animals for 10 days after exposure. Between February 2022 and now, there have been

- At least 9,000 people monitored and
- At least 200 people tested for novel influenza A

Current HPAI in Cattle Outbreak (2024)

CDC and state and local health departments monitor people exposed to infected cattle for 10 days after exposure. Between March 2024 and now, there have been

- At least 220 people monitored
- At least 30 persons tested for novel influenza A

If You Suspect H5N1 Infection in a Patient

Consider HPAI (H5N1) virus infection in persons showing compatible signs or symptoms (e.g., fever, respiratory illness, conjunctivitis, etc.) AND who have a relevant exposure history.

- Isolate the patient:
 - Airborne infection isolation room (AIIR), if available
 - Standard, Contact, and Airborne Precautions, PLUS eye protection
- Notify NH DPHS immediately
- Collect recommended respiratory specimens, including either:
 - NP swab **PLUS** a nasal swab combined with an OP swab
 - Conjunctival swab (if person has conjunctivitis) **PLUS** a NP swab
- Initiate empiric antiviral treatment as soon as possible (oseltamivir) – do not delay treatment while awaiting laboratory results
- Notify patient to isolate at home away from others in their household until it is known if patient has H5N1 infection

H5 Influenza Virus Detected in Wastewater

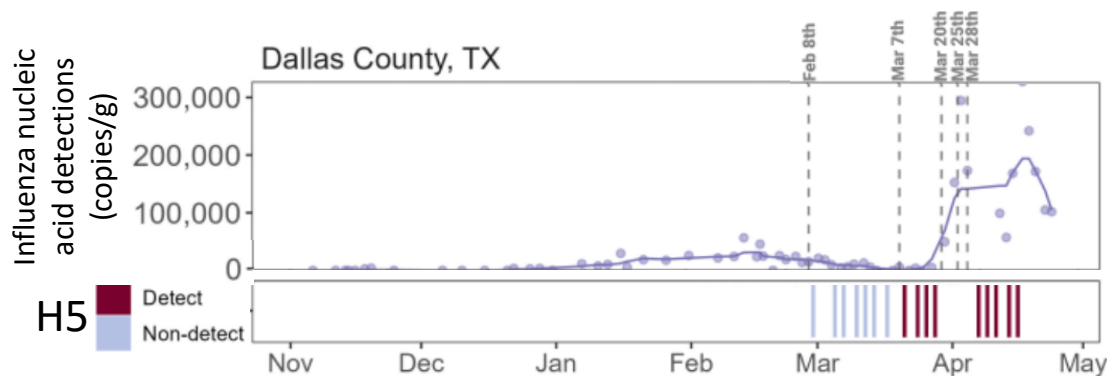
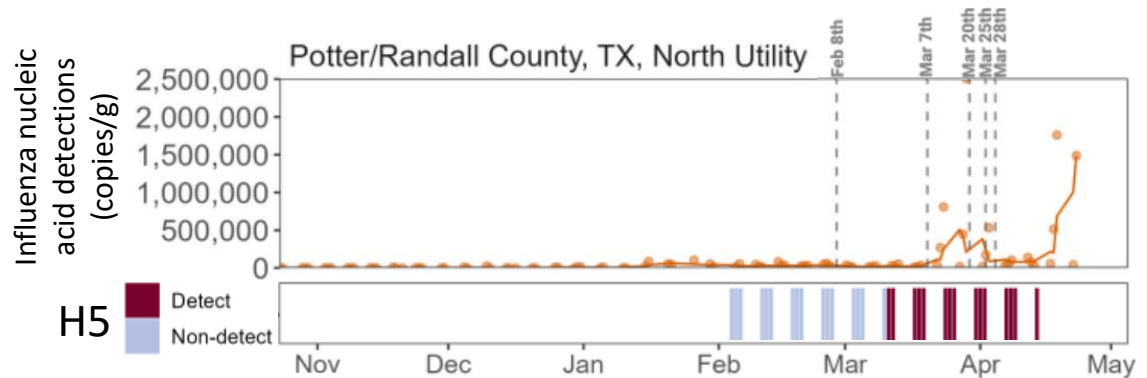
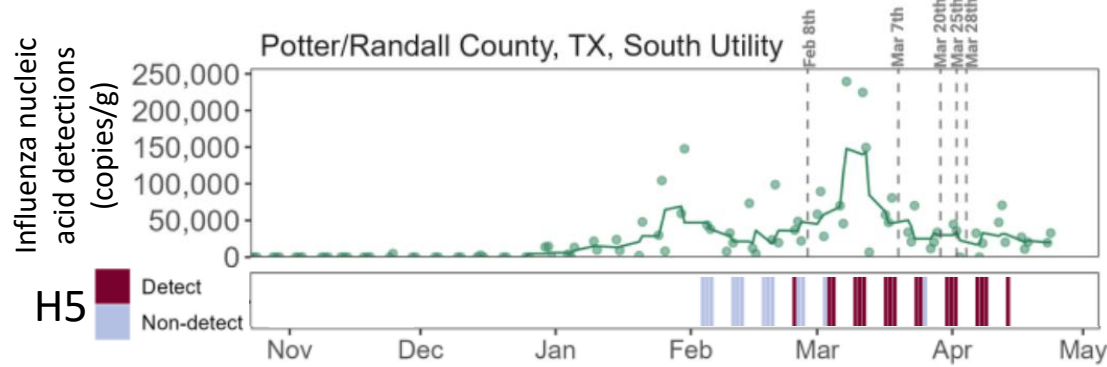
Posted April 29, 2024.

medRxiv
THE PREPRINT SERVER FOR HEALTH SCIENCES

Detection of hemagglutinin H5 influenza A virus sequence in municipal wastewater solids at wastewater treatment plants with increases in influenza A in spring, 2024

- Wastewater samples tested for influenza A virus – increases in influenza A detections AFTER the seasonal peak, which coincided with identification of H5N1 circulating in dairy cattle
- Developed an influenza H5-specific probe for testing wastewater
- Prior to early-mid March, the H5 virus marker was non-detect in wastewater, but H5 detections subsequently increased when general influenza A virus detections also increased in wastewater
- Wastewater detections were not associated with increases in human influenza activity and occurred in areas receiving effluent from industries handling animal bioproducts, including dairies and beef processing plants
- Hypothesis: dairy processing discharge into the wastewater system was driving detections of H5 virus in wastewater

Influenza and H5-Specific Detections in Wastewater



National Wastewater Surveillance System (NWSS) Evaluating Influenza A Virus Testing

Monitoring for Influenza in Wastewater

- Wastewater surveillance can complement other existing influenza virus surveillance systems to monitor influenza trends.
- Currently, [CDC's National Wastewater Surveillance System \(NWSS\)](https://www.cdc.gov/flu/avianflu/h5-monitoring.html#waste) has over 600 sites reporting influenza A virus data to CDC. Data are reported by a variety of NWSS partners. Public health jurisdictions have access to and can monitor NWSS influenza A virus data. Current wastewater testing detects but does not distinguish influenza A(H5N1) virus from other influenza A virus subtypes.
- CDC is monitoring wastewater data for any evidence of unusual levels of influenza and is working to develop and validate an influenza wastewater metric that will be publicly shared soon on CDC's website.
- This metric will compare the current influenza A virus levels for a specific sewer system to influenza A virus levels from the 2023-24 respiratory virus season.
- Data will be displayed for individual sewer systems rather than aggregating at the state or regional level to show increases that are limited to a single sewer system, which may be more relevant in the current situation.
- For sites with unusual influenza A virus activity detected in wastewater data, we will notify relevant partners and continue to actively investigate. Part of this work might include collaboration with partners to better understand factors contributing to these increases such as animal sources located in individual sewer systems (e.g., waste from a milk processing plant).

Q&A

Monthly Webinar Information

- Our monthly healthcare provider webinar continues to occur on the 2nd Thursday of every month from 12:00 – 1:00 pm
- Webinar link and call-in information HAS CHANGED to Microsoft Teams:
 - [Join the meeting in Microsoft Teams](#)
 - Meeting ID: 278 434 186 837
 - Passcode: Bvfiah

 - Call-in phone number: 603-931-4944
 - Call-in passcode: 902 201 066#

Webinar Slides Are Posted to our Healthcare Provider Resources Website

<https://www.dhhs.nh.gov/programs-services/disease-prevention/infectious-disease-control/bidc-resources-healthcare-providers>