

Avian Influenza – A primer

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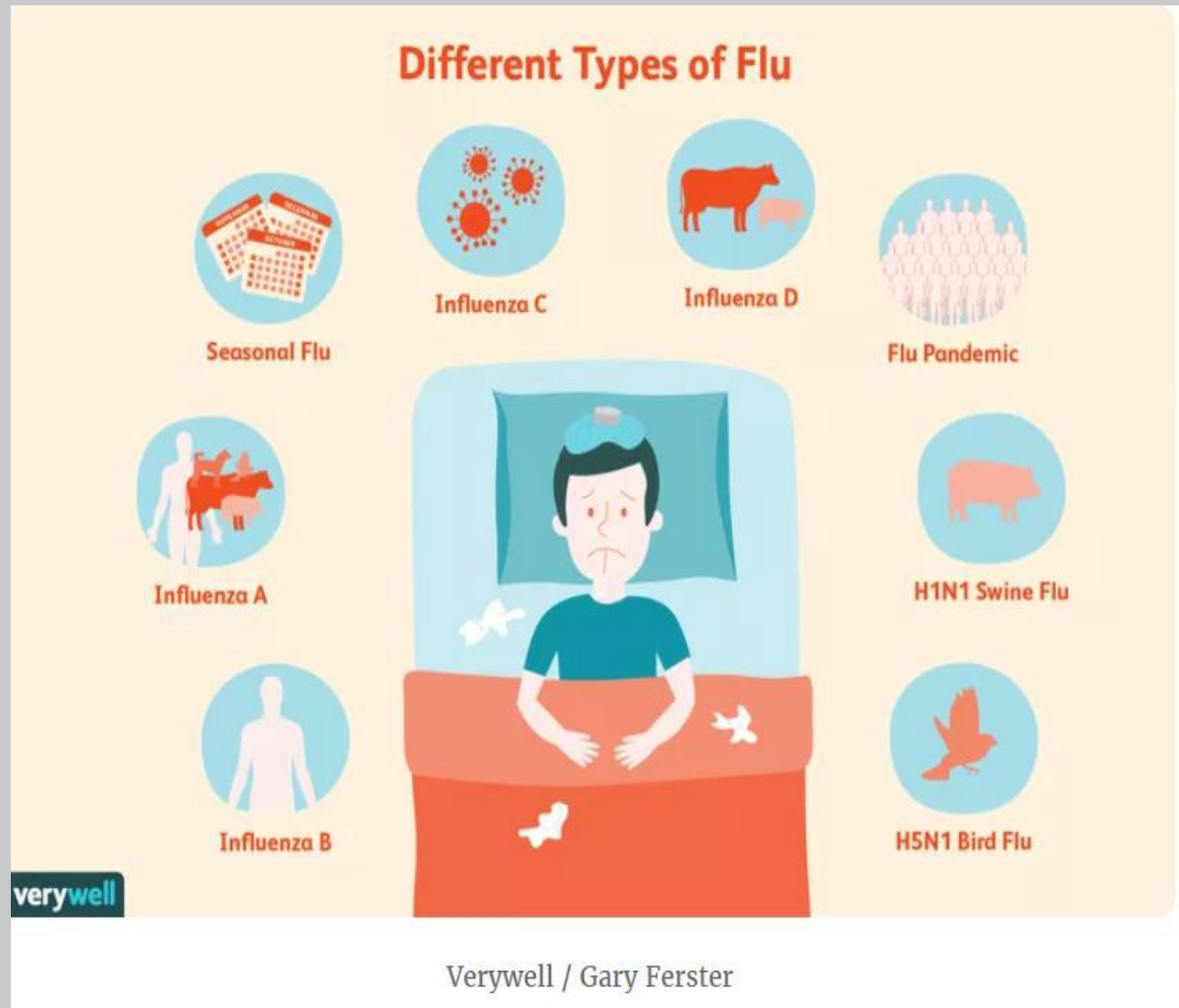
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Photo credit: Audubon Society

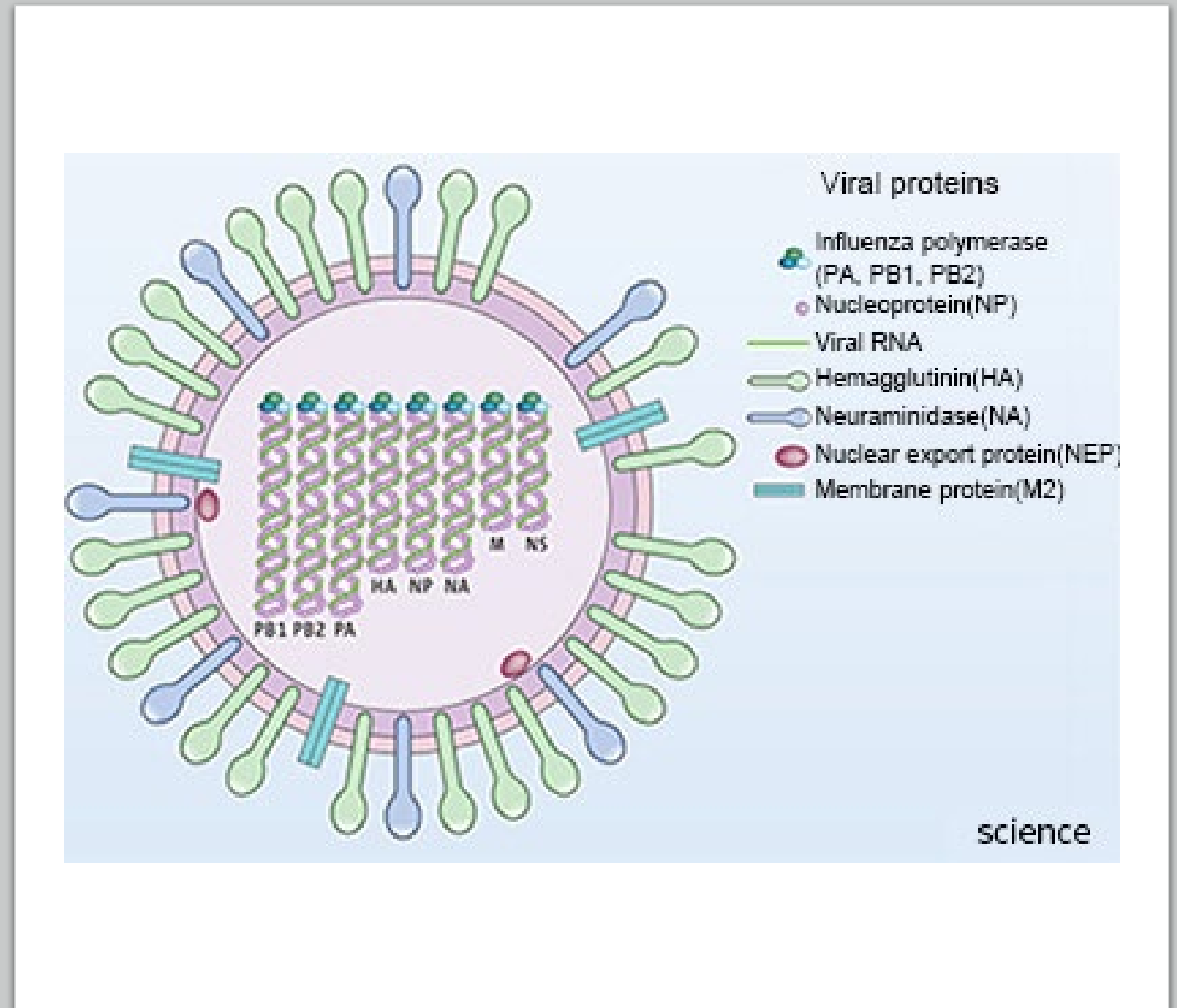
Influenza – 4 types

- Influenza A – Humans and birds (+ others!)
 - Seasonal flu (e.g., H1N1)
- Influenza B – Humans
 - Seasonal flu
- Influenza C – Humans
 - Mild infections
- Influenza D- Pigs and Cows
 - No human cases (yet)



Influenza A – the basics

- Influenza A is most significant of the 4 to humans (b/c can cause major illness in humans!)
- Strains named for their specific proteins
 - H = Hemagglutinin (18 types)
 - N = Neuraminidase (11 types)
- Different strains can infect different taxa differently.



More about Influenza A

- In birds, only 16HA and 9NA → Avian Influenza Virus A
- H17N10 and H18N11 – in bats!
- Many (!!) different H and N combinations possible.
- **All known subtypes of Influenza A can infect birds (except the 2 bat varieties).**
- Currently only 2 subtypes circulating in people (H1N1 and H3N2).
 - This changes!
- Can circulate in at least 7 different animal groups (humans, wild water birds, poultry, swine, horses, dogs, cats, bats).
- Can infect many other animal species, just not known to circulate.
- Type A is generally responsible for the human flu epidemics.
- Concern is based on rapid reassortment (evolution) of the flu virus.
- But, what does this mean?

Zoonotic risks and Avian Flu

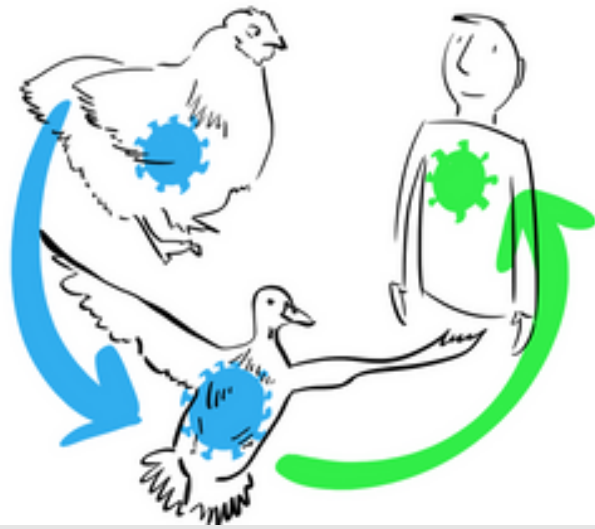











Image credit: World Health Organization

- There are genetic and antigenic differences between the influenza A virus subtypes that typically infect only birds and those that can infect birds and people
- H5, H6, H7, H9 and H10 – AIV that are known to cause human infections
- But, 1918 Pandemic – H1N1 from avian origin!!
- **Phew... it's complicated.**



Virus	H5N1	H7N9	H9N2
Host & sialic acid			
 α -2,3-Gal	Mild Moderate	Mild	Mild
 α -2,3-Gal	Severe	Mild	Mild Moderate
 α -2,3-Gal α -2,6-Gal	Moderate	Mild	Mild
 α -2,6-Gal	Severe	Moderate Severe	Mild Moderate
 α -2,6-Gal	Severe	Severe	Mild Moderate

Horman et al., 2018.

A large flock of white geese is gathered in a field of dry, brown grass. One goose is captured in mid-flight in the upper center of the frame, its wings fully extended. The sky is a clear, bright blue. The geese in the foreground are mostly white with some darker feathers on their wings. The background shows a dense group of geese stretching across the field.

AIV – more basics

- Waterfowl are considered natural reservoir of AIV
- AIV rarely causes issues for wild birds
 - HPAI can be deadly
- Recombination of AIV with Human IV-A is of concern
 - 1918 Spanish Flu was an AIV (H1N1)

Image credit: Amy Lutz

So, what's LPAI vs HPAI?

- Pathogenicity is defined by the impact on domestic poultry
- Low pathogenicity avian influenza –
 - Doesn't really cause disease in domestic birds
- HPAI – can kill >75% of infected domestic birds
- Only H5 and H7 are considered HPAI.
 - But, not all H5 or all H7 ARE actually HPAI.
 - Remember, flu viruses readily reassort/evolve, so a low-path H5 may easily become a high-path H5. (Hence the concern.)
- Though human infections w/ HPAI are rare, when they do occur, >50% mortality rate.



How does AIV spread?



Image credit: wattagnet.com

- Infected birds shed virus in saliva, nasal secretions, and feces.
- Virus can survive in environment for variable length of time.
- Susceptible birds become infected when they have contact with the virus
 - Eyes
 - Nose / inhaled
 - Mouth / eaten

Exposure and Persistence of AIV

- Avian influenza is mostly spread between birds through fecal material
- Infected fecal material can contaminate wetlands and roost sites if used by large numbers of birds
- Avian influenza can remain viable for several weeks (or longer)
- AIV are easily killed by heat, drying, and disinfectants. But NOT freezing.

Image credit: Ducks Unlimited





What are the symptoms of LPAI?

- In wild birds, typically none.
- In domestics, mild respiratory signs.

Image credit: Ryan Schain / Macaulay Library

What about HPAI?



Image credit: CDC

- Bluish skin
- Nasal or eye discharge (may be blood tinged)
- Tilting head
- Lack of coordination
- Depressed mentation
- Ruffled feathers
- Sudden death

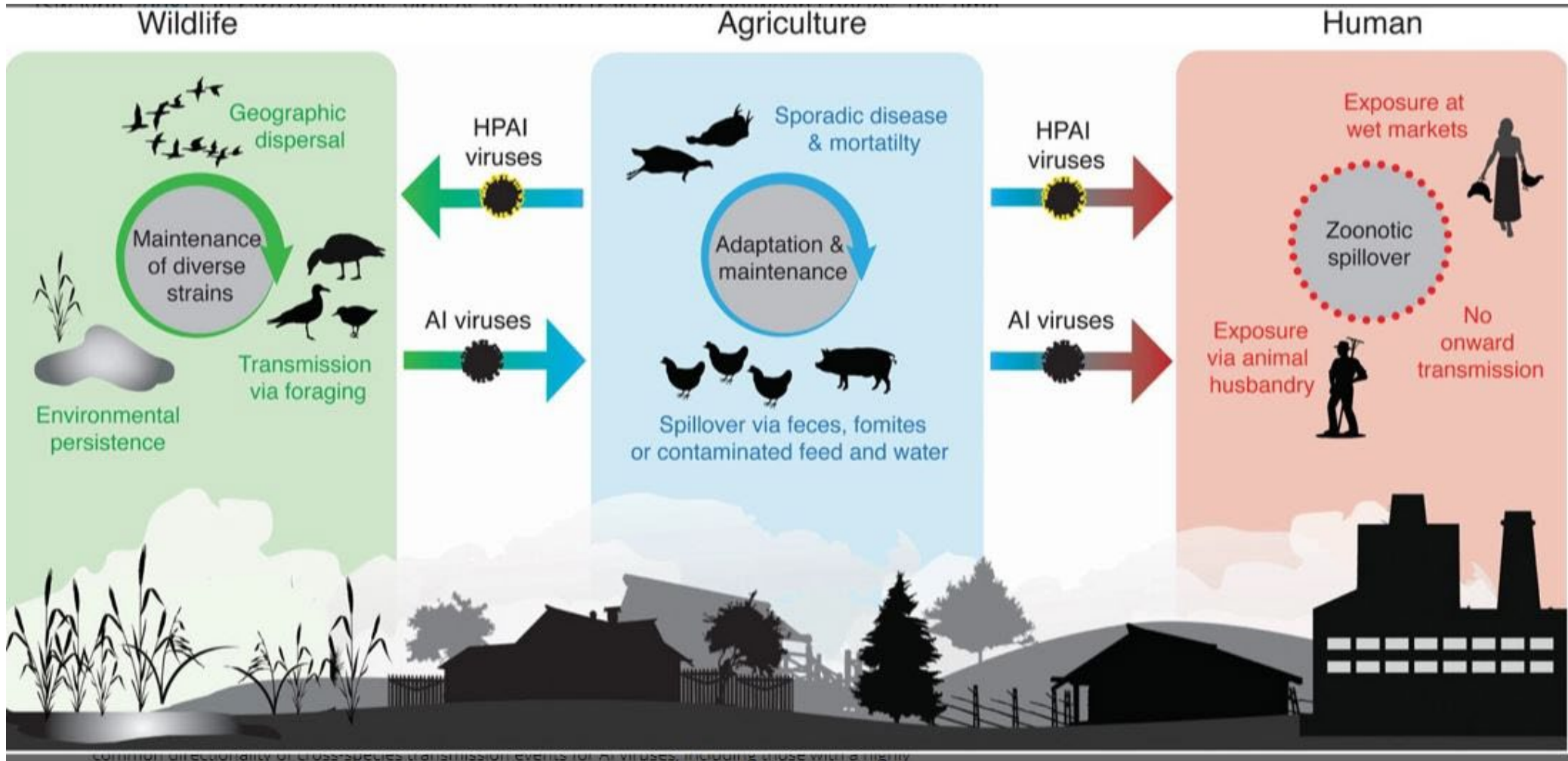
Historically (before 2002), HPAI infections were only associated with domestic birds!

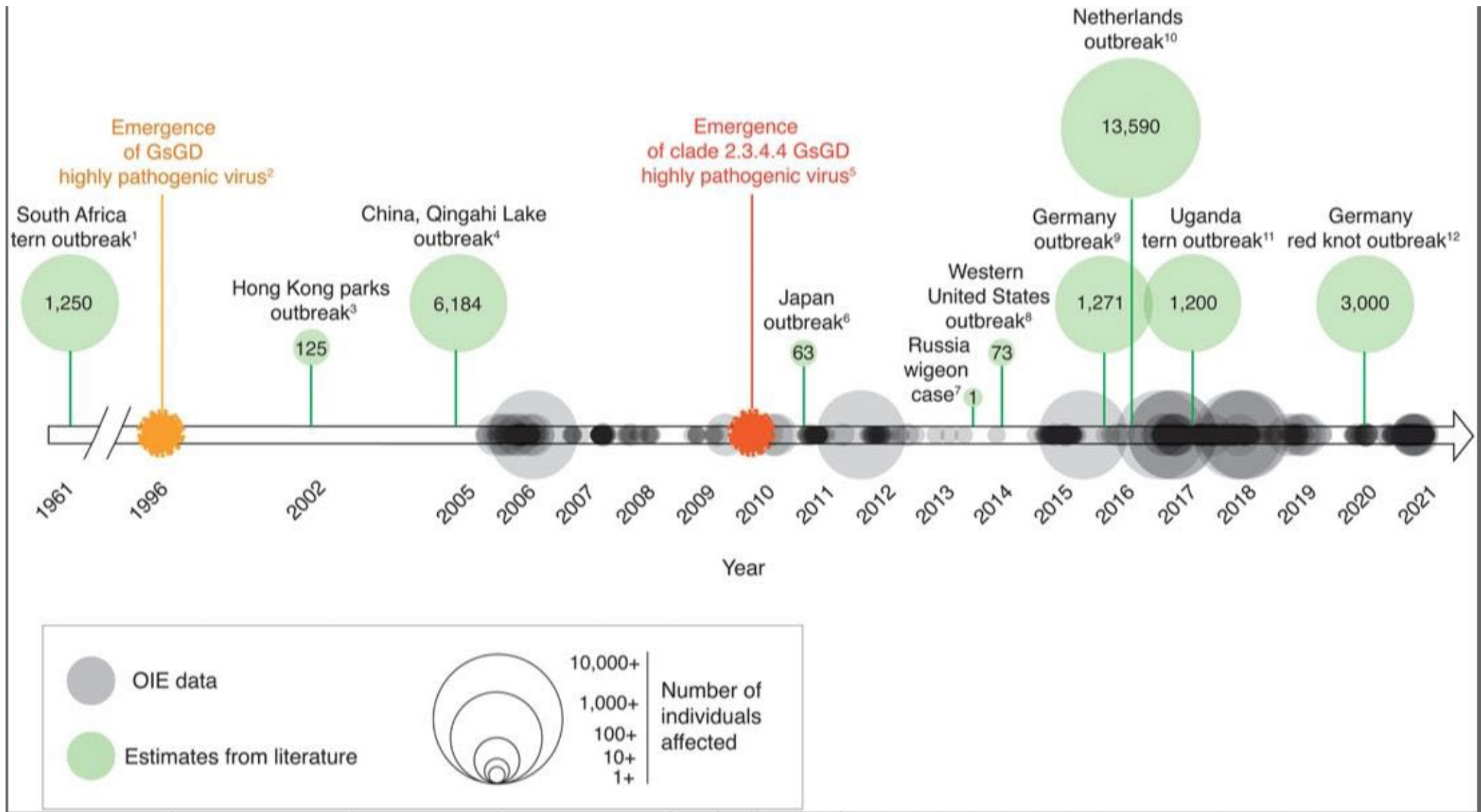
One exception: terns in South Africa in 1961, but very little is known about this event.



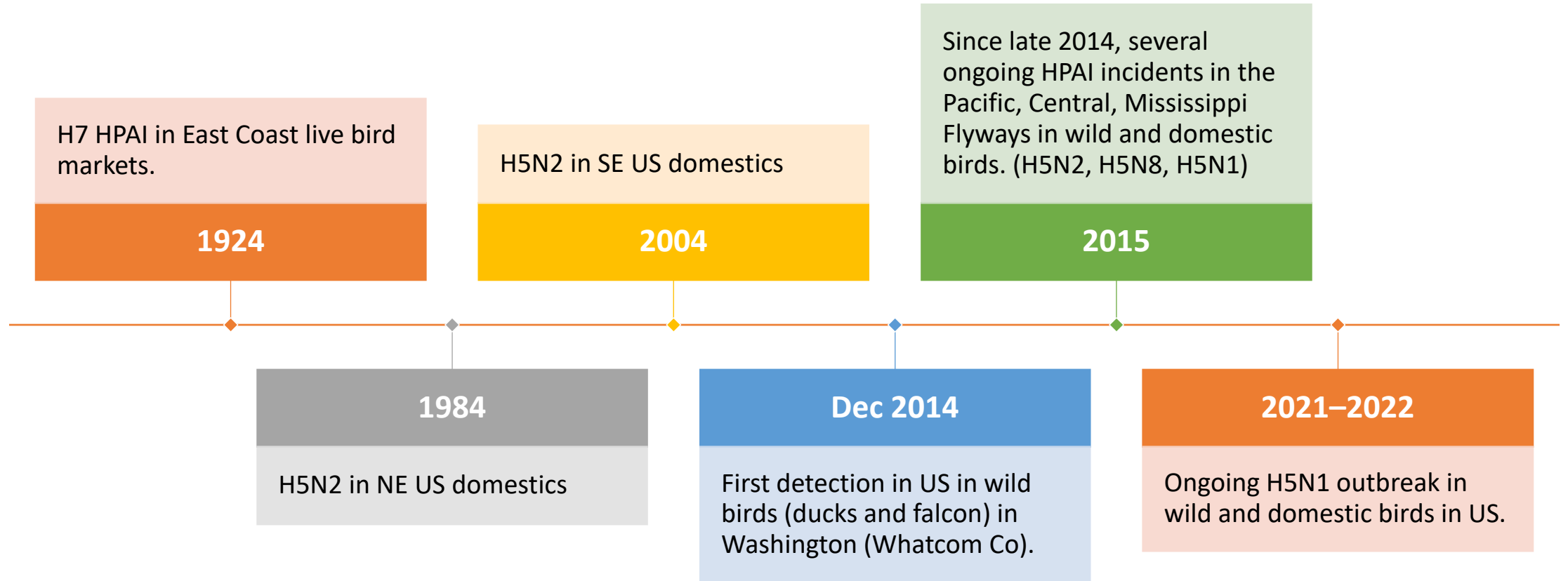
Image credit: Science News

Is HPAI (H5N1) an emerging disease threat for wild birds?





History of HPAI in the US



2014/15 HPAI Outbreak in US

>50 million domestic
birds dead (most culled)

Only 99 wild birds (total!)

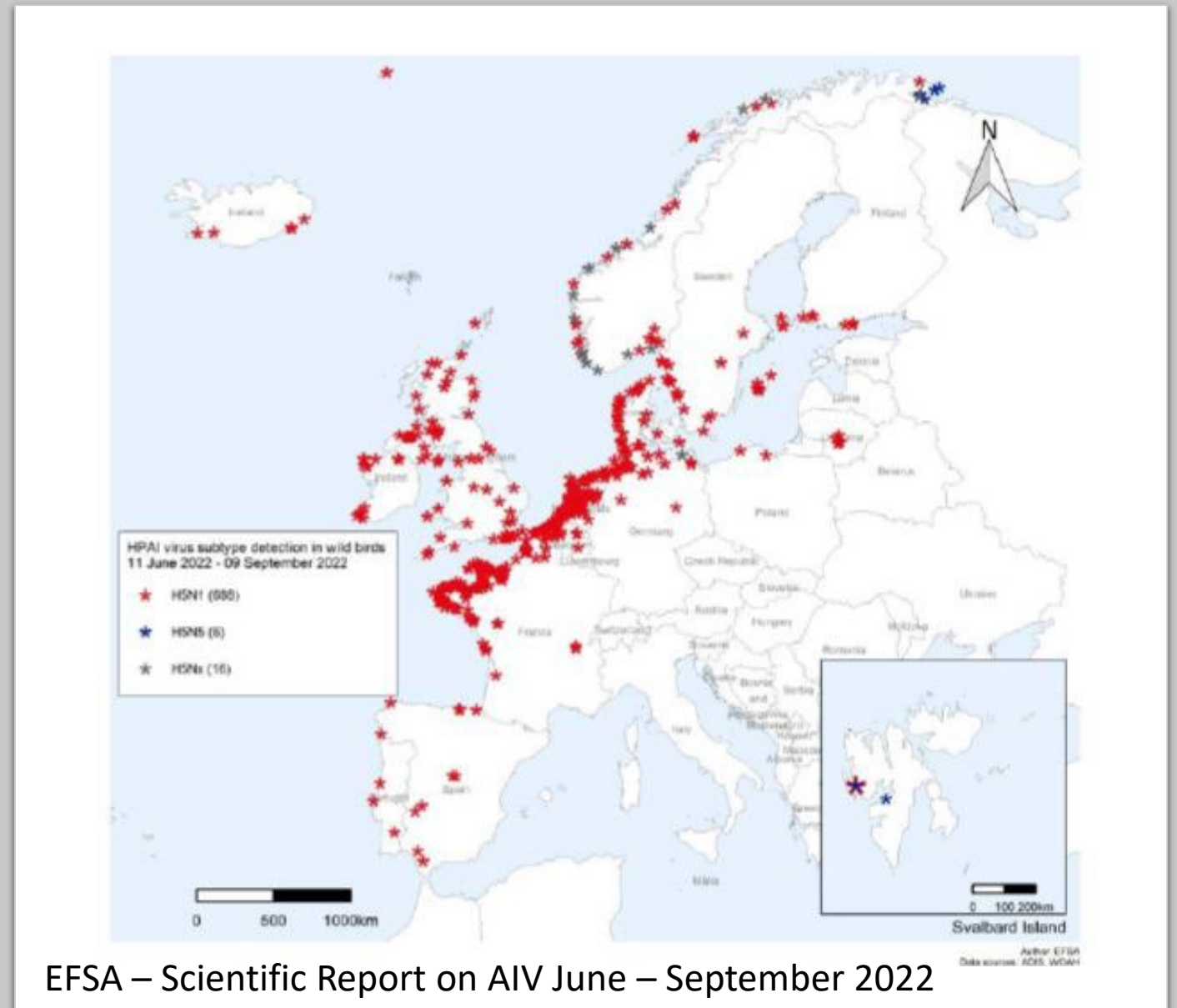
Cost >\$1.6 billion

By June 2015 virus had
vanished

(EA) H5N1

2.3.4.4b

- 2021-2022 HPAI epidemic is largest ever in Europe
- 2,467 outbreaks (poultry)
- 48 million birds culled
- 3573 HPAI events in wild birds
- HUGE geographic extent – Svalbard Islands to South Portugal
 - 37 European countries!
 - Africa
 - Middle East
 - Asia



EFSA – Scientific Report on AIV June – September 2022



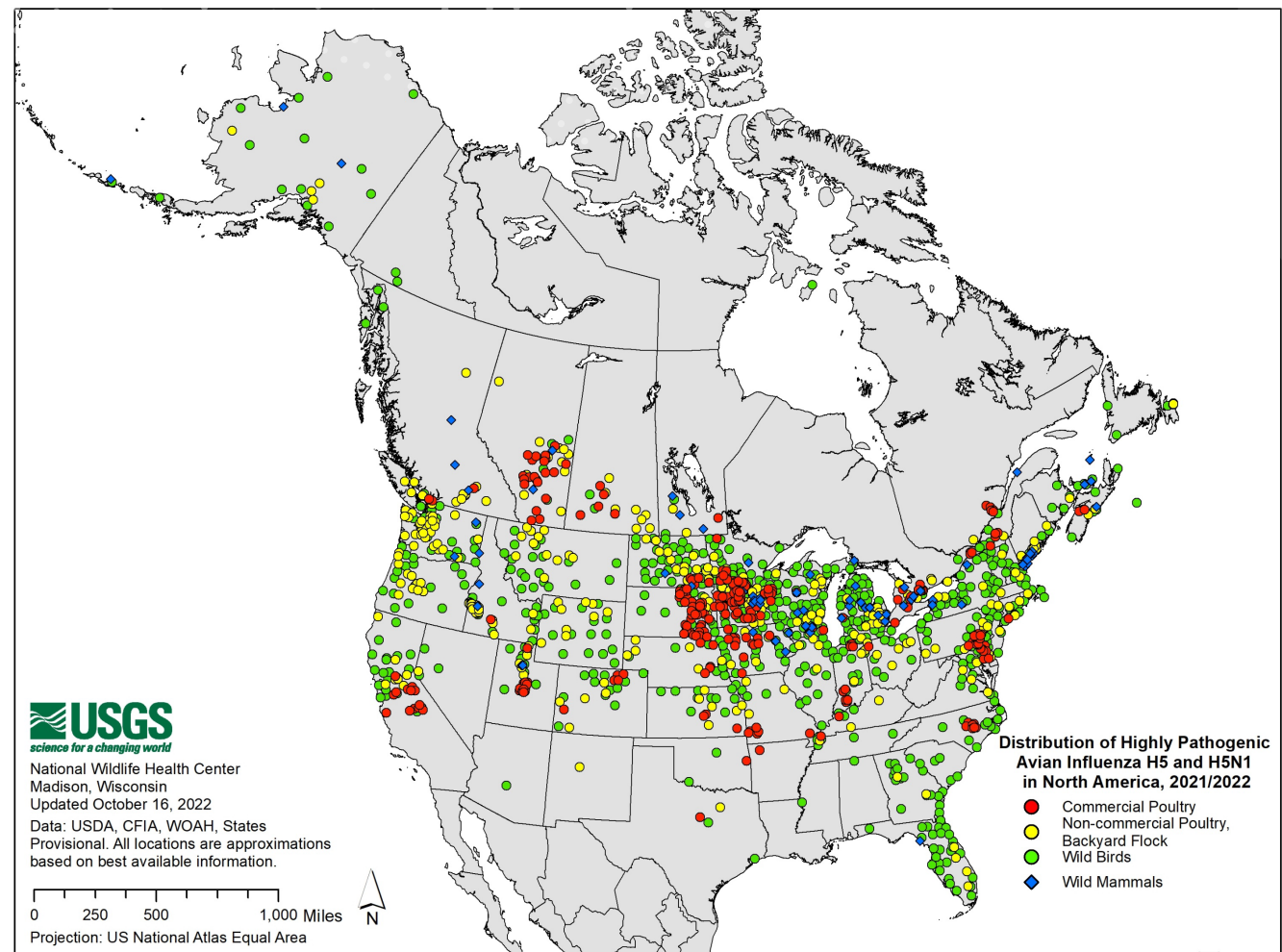
(EA) H5N1 in the US

- Jan 2022 – South Carolina wild duck
- Is thought waterbirds brought virus to US from Canada
- Found in >3400 (and counting) wild birds so far. And also:
 - Harbor seals
 - Raccoons
 - Fox
 - Striped skunk



More on (EA)H5N1 in US

- >50million birds
- 46 states
- Economic impact??



H5N1 (EA 2.3.4.4b) in Washington

- 1 March 2022 – 1st case in WA
- Greater white fronted goose
- Walla Walla Co

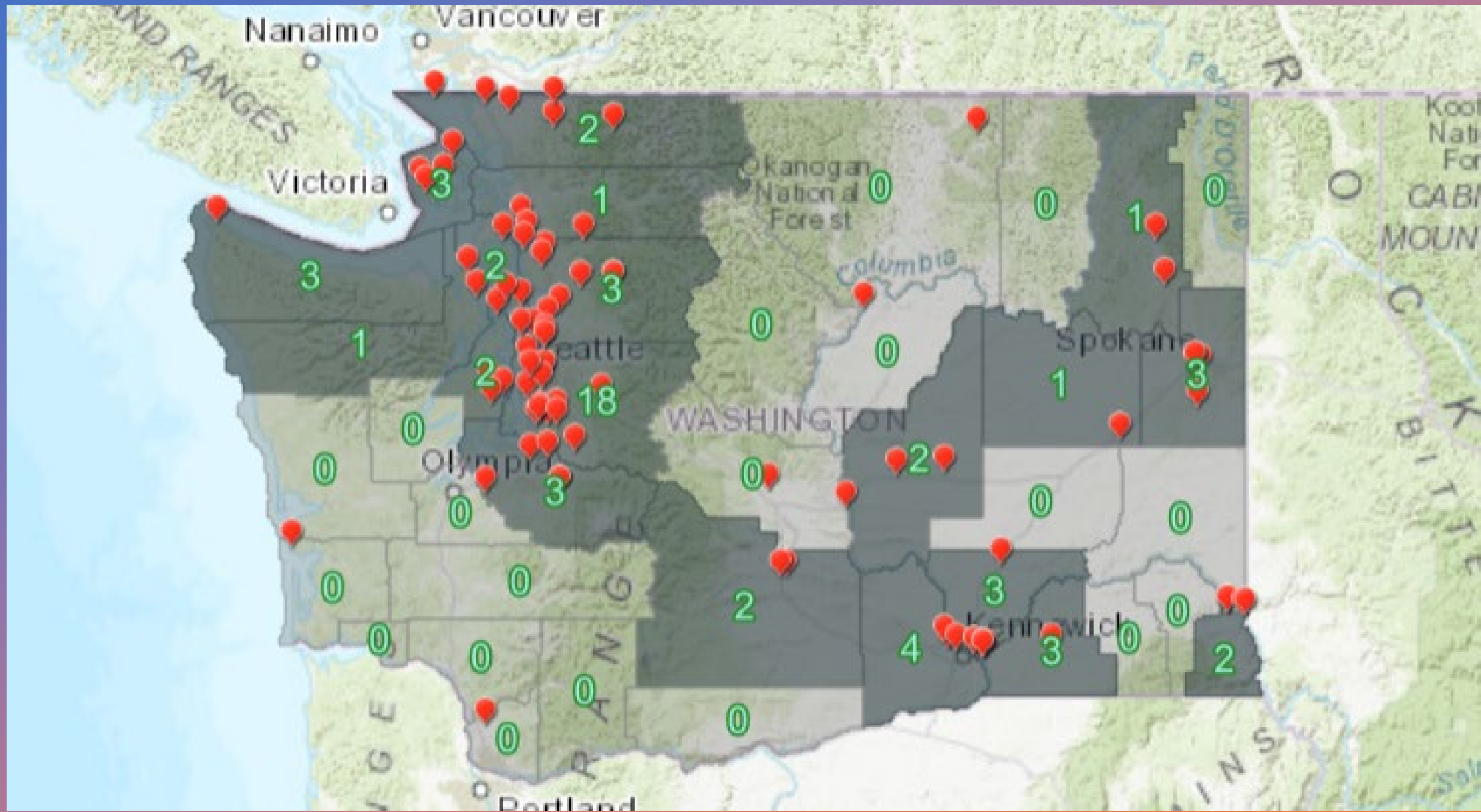


Image credit: Audubon Society

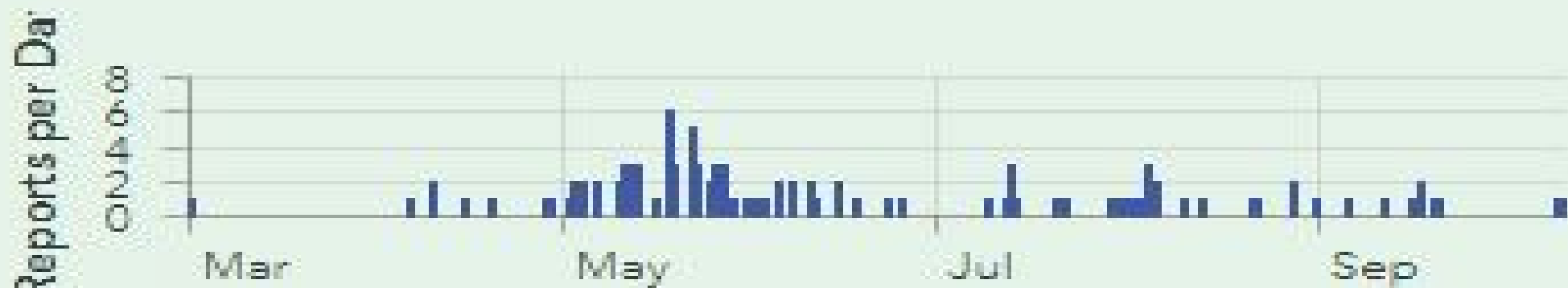
Since then....

- Monitoring reports sick/dead wild birds
- Submit suspect cases for testing
- Working closely with wildlife rehabilitators





Reports Submitted per Day



Total Positive Cases

62

96 Cases Tested (in WA)

Positive for PCR AIV, H5,
or N1H5 2.3.4.4.

WADDL PCR AIV Results



AIV




HPAI Positives Wild Species in Washington

Raccoon	Greater white fronted goose	Snow goose	Bald Eagle	Sandhill crane	Trumpeter Swan
Red-Tailed hawk	Peregrine Falcon	Canada Goose	Raven	Crow	Mallard
Great Horned Owl	American Coot	Bufflehead	Gull	Caspian Tern	White Pelican
		Turkey Vulture	Great blue heron		

Ongoing mortality events...

- Several in WA
- Geese (Snow, Canadian) and Swans
- So far, western WA
- Also in OR (>1000 birds)
- We are investigating ...



A bald eagle is perched on a dark, textured branch. The eagle's head is turned to the right, showing its white feathers, yellow beak, and yellow eye. Its dark brown wings and back are visible. The background is a solid, deep blue color. The text is overlaid in the center of the image.

This strain of HPAI (EA H5N1)
is more deadly to wild birds

Photo credit: Mike Segar

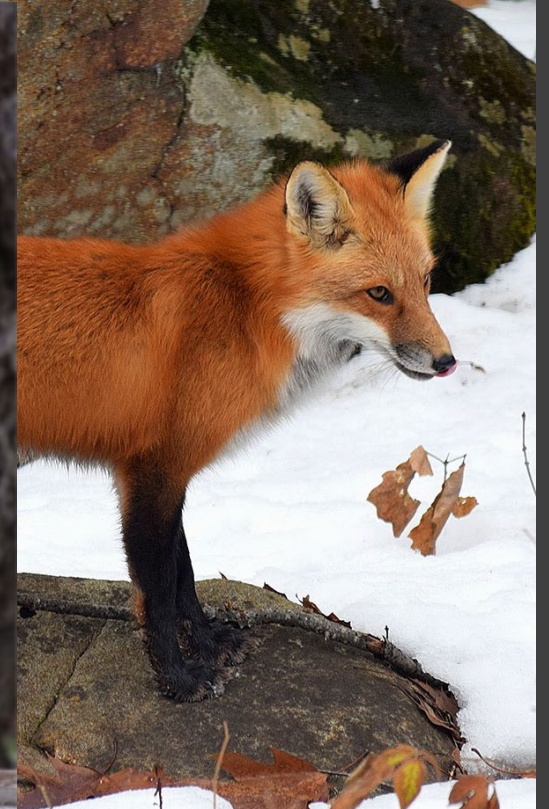
H5N1 in mammals



Image credit: NVDW

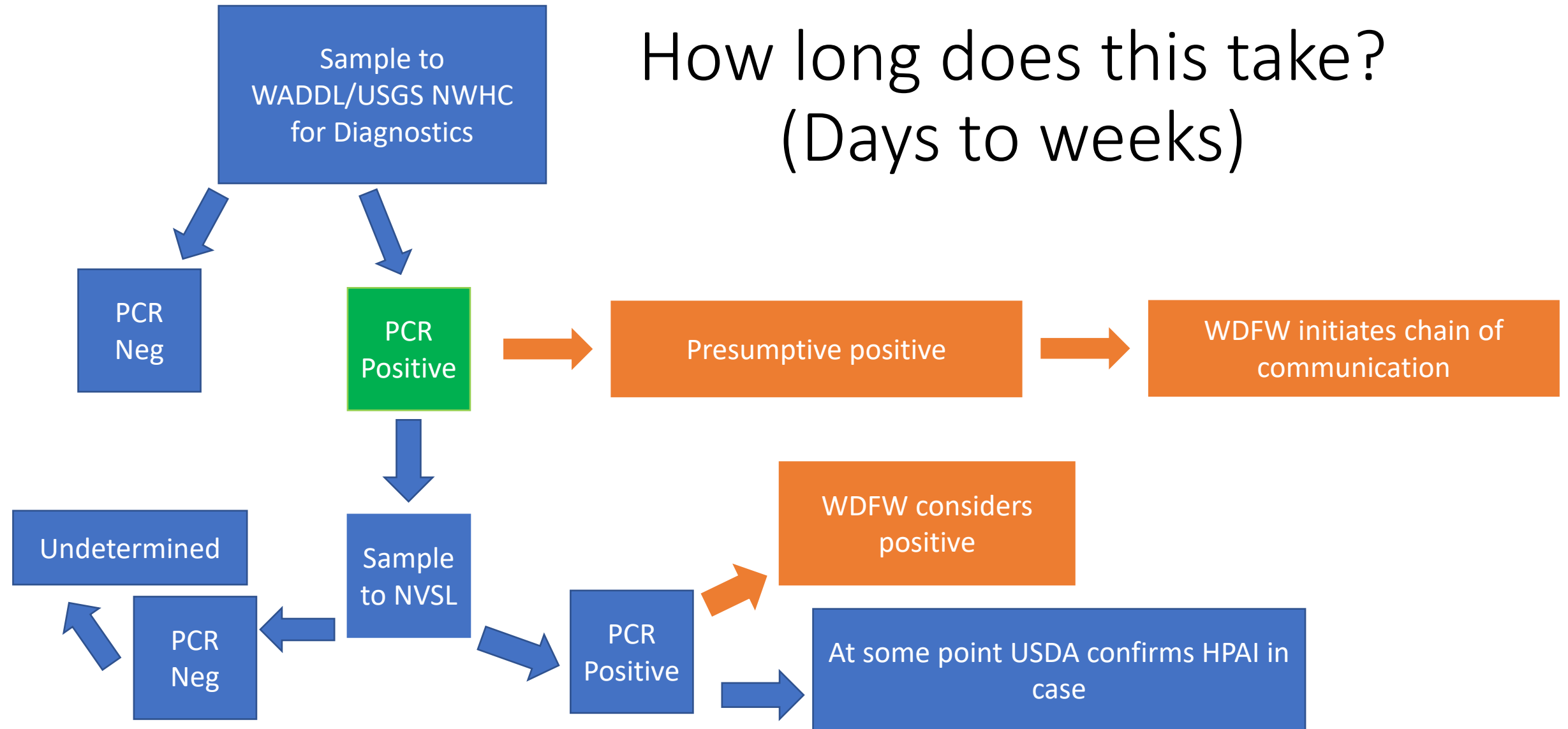


Image credit: Dreamstime



So, what is “confirmed” ??

How long does this take?
(Days to weeks)



What to do with sick/dead wild bird reports?

- Prioritize raptors, scavengers, waterfowl, and SGCN
- Priority areas - new counties, species, or other unusual aspects
- Samples to collect? → Swab and dispose carcass or full necropsy?
- Importance of human health concerns and chain of communication with Dept of Health



How can you keep your birds safe?

- Biosecurity!
- Don't let them eat waterfowl or domestic birds
- Wash hands after handling live birds (including domestics)
- Clean boots
- Prevent contact w/ domestic birds and free-ranging wild birds



Image credit: Brian and Linda Kellogg



What about vaccination?

- None available in US (yet)
 - Due to export/import issues
 - Vaccinated birds cannot be distinguished from infected birds
- But, USDA is investigating and funding research
 - Vaccine that could be distinguished from wild type HPAI
- Some European nations are also investigating
- Research has shown vaccine can protect falcons
 - Lierz et al., 2007

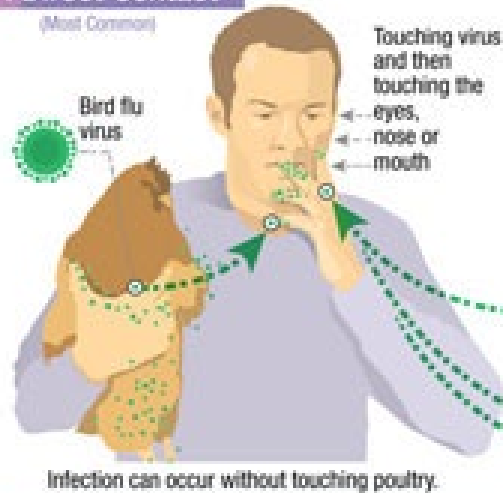
Image credit: FeatheredPhotography

How Infected Backyard Poultry Could Spread Bird Flu to People

Human Infections with Bird Flu Viruses Rare But Possible

1 Direct Contact

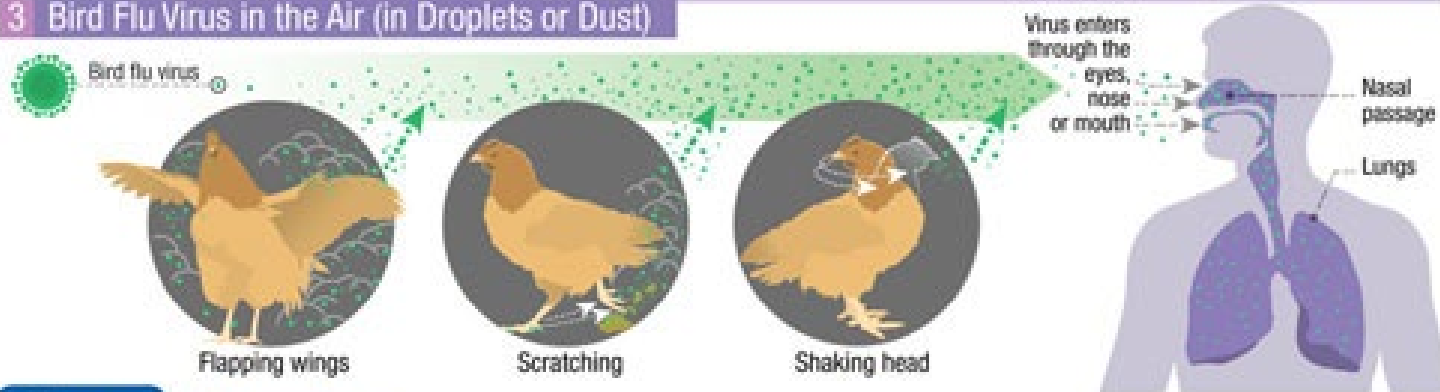
(Most Common)



2 Contaminated Surfaces



3 Bird Flu Virus in the Air (in Droplets or Dust)



U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

www.cdc.gov/flu/avianflu/avian-in-humans.htm

2009-10

Questions?

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Image Credit: American Oceans

