Current knowledge for optimising HPAI surveillance and scientific update from OFFLU

Prof Ian Brown
Chair of OFFLU steering committee

Standing Group of Experts on High Pathogenicity Avian Influenza in Europe under the GF-TADs umbrella Second Meeting (SGE HPAI-2), Samarkand (Uzbekistan) 30/9/24

Joint WOAH-FAO network of scientific expertise on animal influenzas OFFLU

Reference laboratories
Influenza Experts

OFFLU Technical working groups:
Avian Influenza
Wildlife group
Human animal interface
Poultry vaccination
Applied epidemiology
Socioeconomics
Equine Influenza
Swine Influenza

Network promoting the sharing of information (and sequence data)

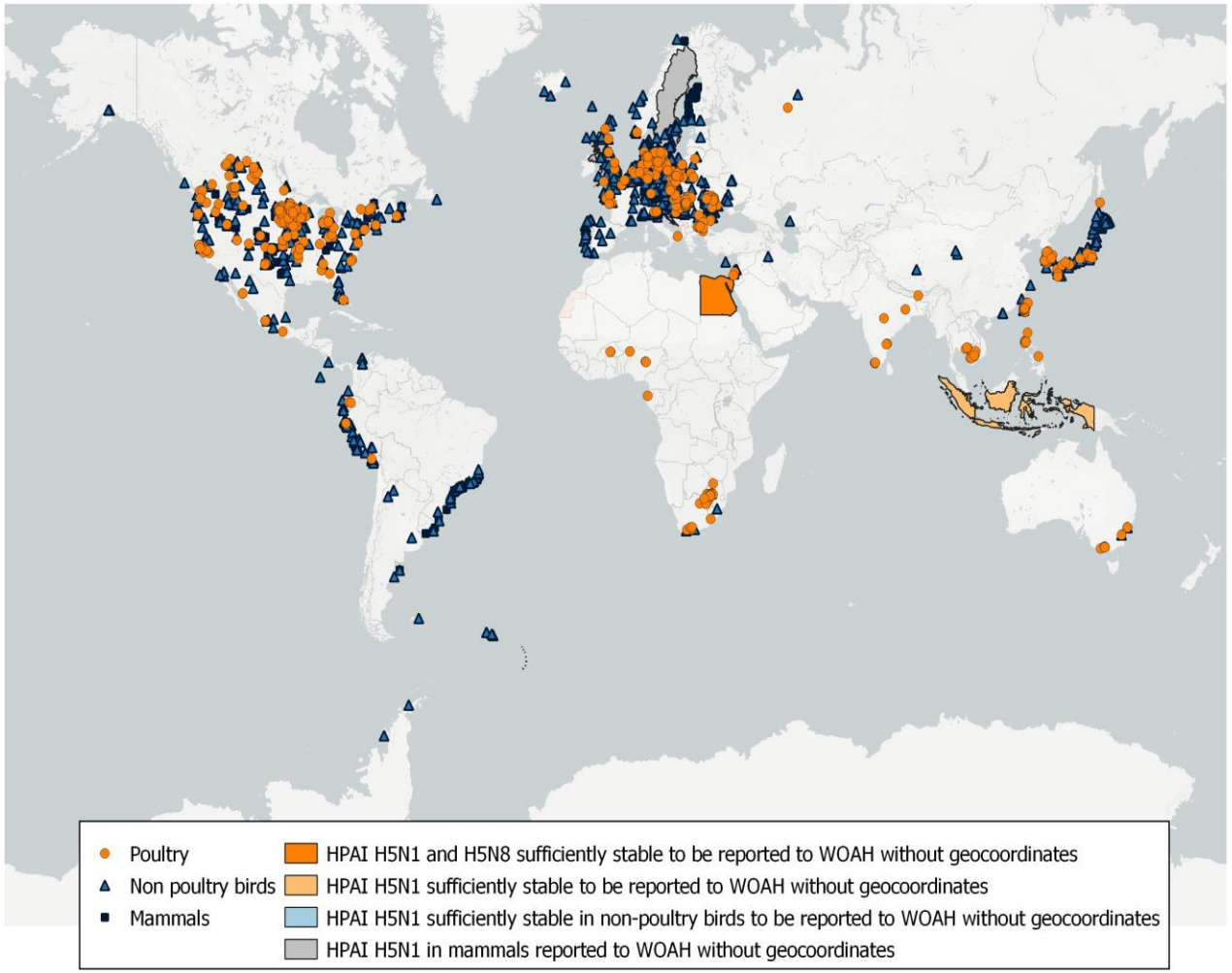
OFFLU GLOBAL TECHNICAL MEETING HAPPENED IN JULY 2024 to revise ToR of groups and future plan of action

OFFLU's core aims

- To share and offer technical advice, training and veterinary expertise to international organisations and Member Countries to assist in the prevention, diagnosis, surveillance, and control of animal influenza.
- To exchange scientific data and biological materials (including virus strains) within the network, analyse such data, and share information with the wider scientific community.
- To collaborate with the WHO on issues relating to the animal-human interface, including pandemic preparedness for early preparation of human vaccines.
- To highlight influenza surveillance and research needs, promote their development and coordination.

STAR-IDAZ
International Research Consortium on Animal Health

Global avian influenza situation since 1 October 2023 until 16 August 2024

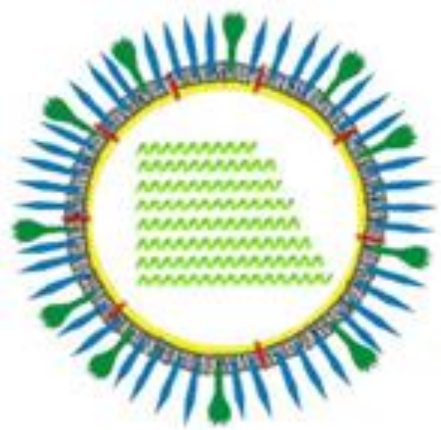


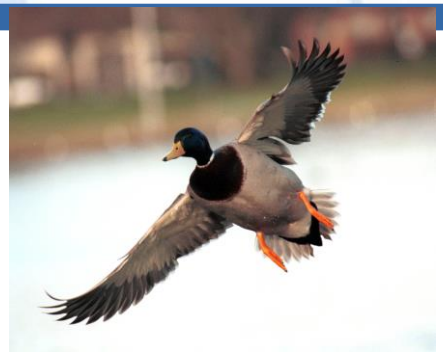
	Mammals	Non_poultry_birds	Poultry
Africa		**4**	**34**
H5N1			6
H7N6		1	21
Untyped or partially typed		3	7
Americas	**240**	**330**	**306**
H5 (N untyped)	1	105	2
H5N1	237	220	304
H5N2		1	
H5N5	2	4	
Asia		**187**	**123**
H5 (N untyped)		2	
H5N1		141	96
H5N5		31	
H5N6		13	27
Europe	**50**	**720**	**266**
H5 (N untyped)		8	19
H5N1	48	686	246
H5N5	2	25	
H5N8		1	
H7N5			1
Oceania		**4**	**12**
H7N3			7
H7N8		4	4
H7N9			1
Antarctica		**2**	
H5 (N untyped)		1	
H5N1		1	

Production systems matter

Thanks to Dr Lina Awada and Dr Gounalan Pavade

The virus driving the impact!

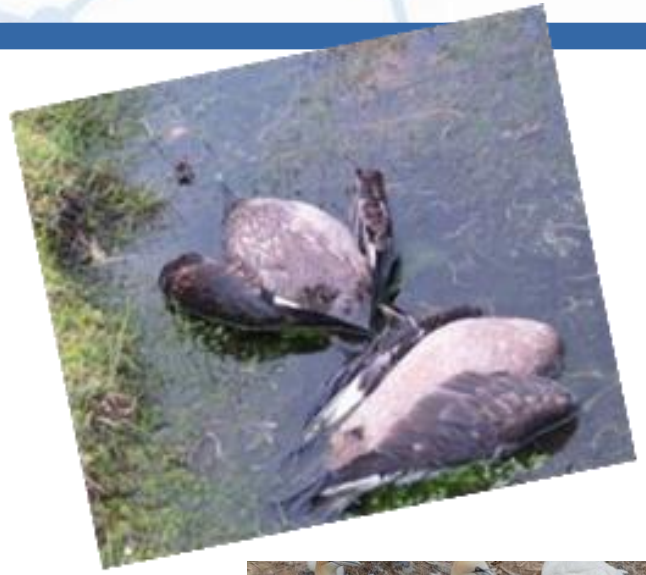




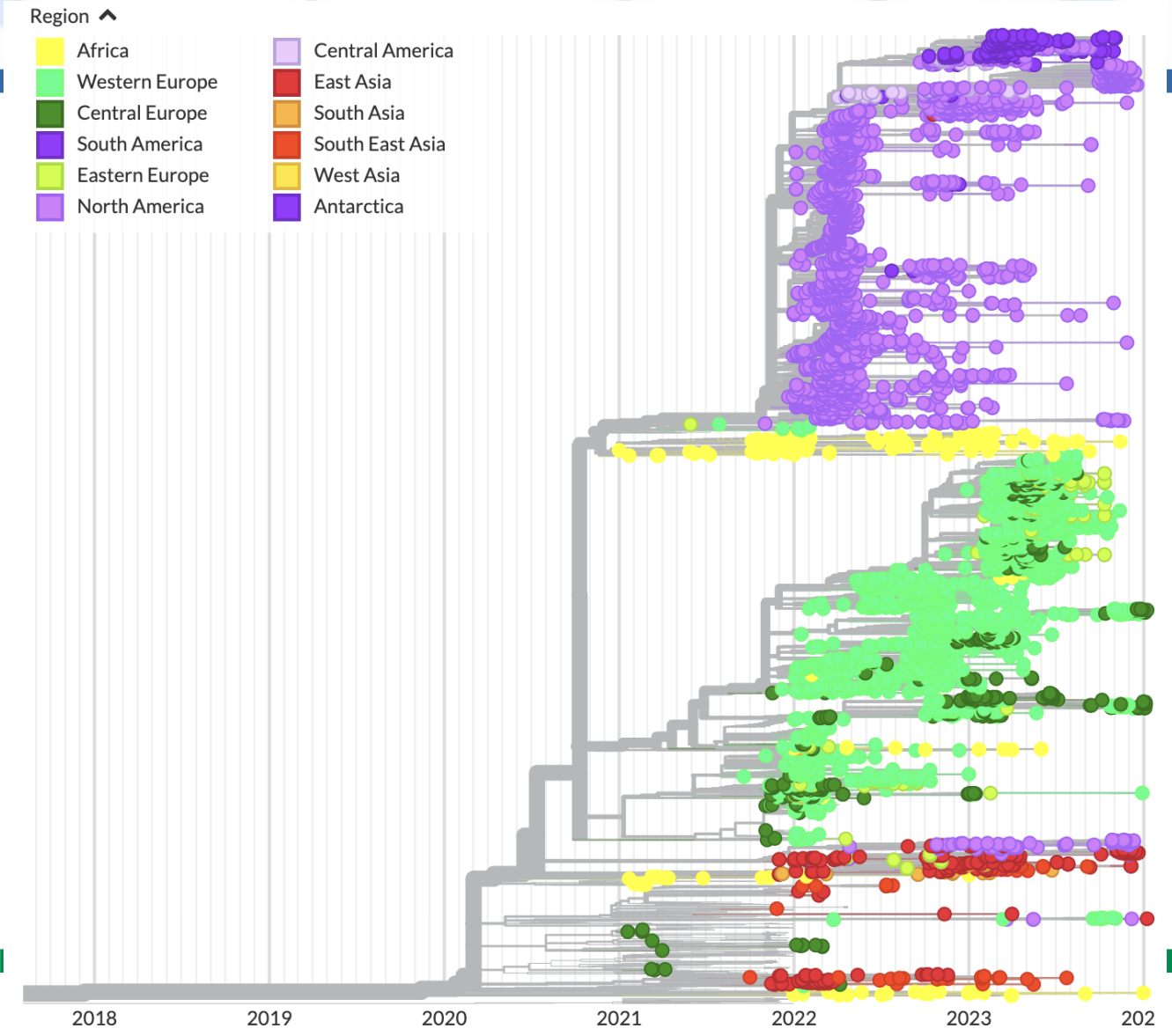
The 2021-24 H5N1 HPAI clade 2.3.4.4b group of viruses is the most infectious and dangerous of ‘strains’ to date

Multiple evolved traits

Impacts on biodiversity



Genetic analysis of Gs/Gd A(H5) sequences



Monitoring viral spread: Collaboration with multi-national laboratories and institutions

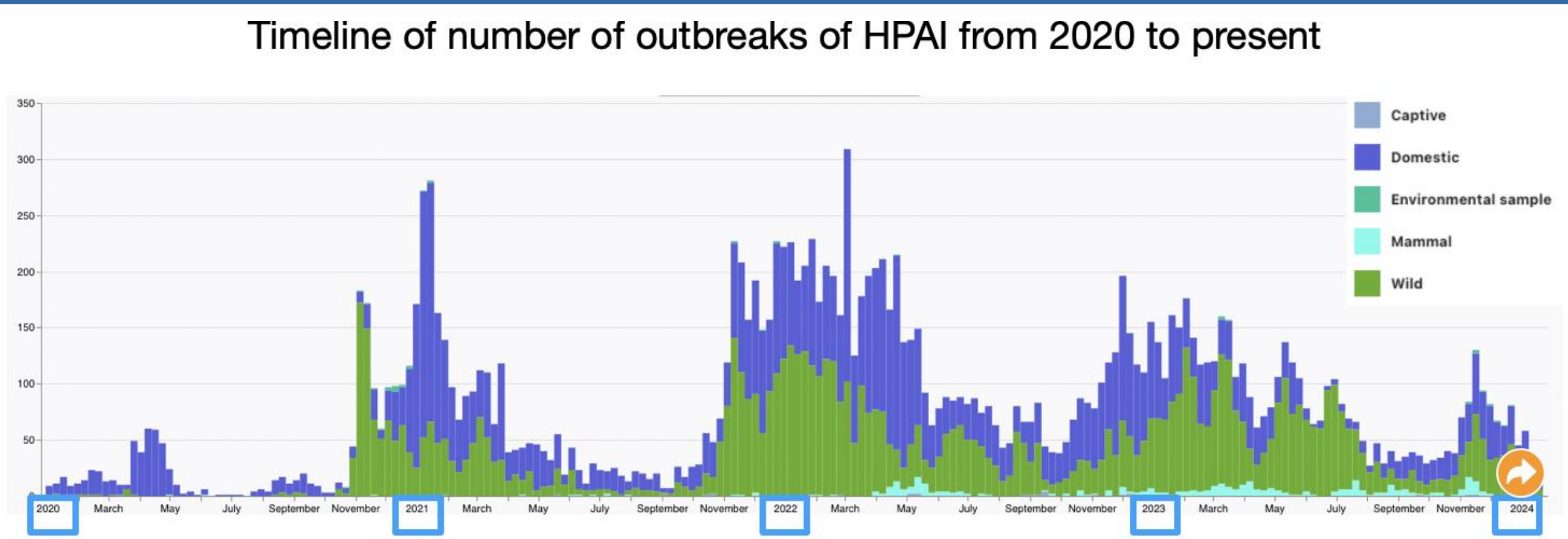
Introductions into continents through long range migratory birds

Maintenance and secondary spread of the virus in poultry populations and resident wild birds

Occasional spillover into mammals

Occasional spillover into humans

H5 detections, wild birds: Expanded host range



Wild bird species affected

Wild bird orders affected by Gs/Gd H5Nx HPAI		
	Since 2021	
Accipitriformes (n=51)	Galliformes (n=19)	Psittaciformes (n=25)
Anseriformes (n=94)	Gaviiformes (n=3)	Rheiformes (n=1)
Caprimulgiformes (n=1)	Gruiformes (n=16)	Sphenisciformes (n=4)
Casuariiformes (n=1)	Passeriformes (n=49)	Strigiformes (n=18)
Cathartiformes (n=2)	Pelecaniformes (n=31)	Struthioniformes (n=1)
Charadriiformes (n=111)	Phoenicopteriformes (n=4)	Suliformes (n=25)
Ciconiiformes (n=6)	Piciformes (n=3)	Trogoniformes (n=1)
Columbiformes (n=7)	Podicipediformes (n=8)	
Falconiformes (n=13)	Procellariiformes (n=14)	

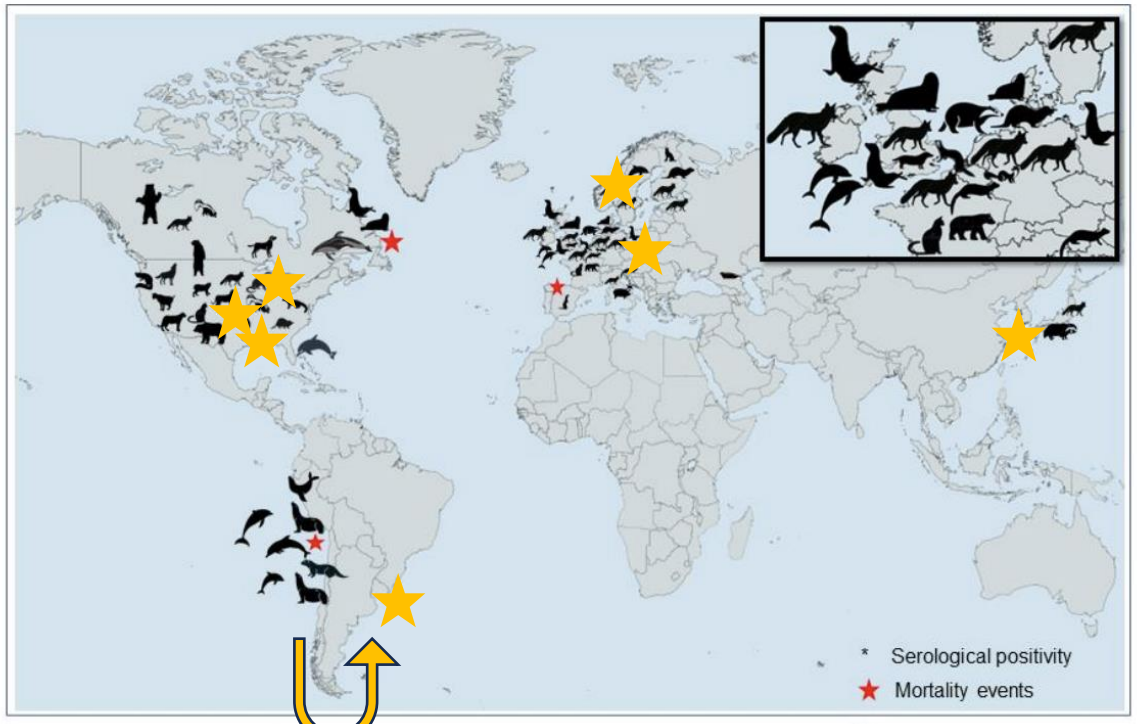
Wild bird species affected by Gs/Gd H5Nx HPAI		
	Since 2021	
Anseriformes (n=40)	Galliformes (n=8)	Phoenicopteriformes (n=2)
Amazonetta brasiliensis (Brazilian Teal)*	Alectoris rufa (Red legged partridge)	Phoenicopterus chilensis (Chilean flamingo)*
Anas cyanoptera (Cinnamon Teal)	Bonasa umbellus (Ruffed grouse)	Phoenicopterus ruber (American Flamingo)*
Anas discors (Blue-winged Teal)	Callipepla californica (California Quail)	Gruiformes (n=7)
Anas flavirostris (Andean Teal)	Centrocercus urophasianus (Greater sage-grouse)	Anthropoides virgo (Demoiselle Crane)
Anas formosa (Baikal Teal)*	Coturnix coturnix (Common Quail)*	Balearica regulorum (Crowned crane)
Anas fulvigula (Mottled Duck)	Cracidae (incognita)*	Fulica americana (American coot)
Anas rhynchotis (Australasian Shoveler)	Lagopus lagopus (Willow Grouse)	Fulica armillata (Red-gartered Coot)
Anas rubripes (American Black Duck)	Perdix perdix (Grey Partridge)*	Grus canadensis (Sandhill Crane)
Anser cygnoides (Swan Goose)*	Charadriiformes (n=78)	Grus leucogeranus (Siberian crane)*
Anser rossii (Ross's Goose)	Alca torda (Razorbill)	Rallus aquaticus (Water Rail)
Aythya affinis (Lesser Scaup)	Alle alle (Little auk)	Psittaciformes (n=10)
Aythya americana (Redhead Duck)	Arenaria interpres (Ruddy Turnstone)	Amazona farinosa (Southern mealy amazon)*
Aythya baeri (Baer's pochard)*	Arenaria melanocephala (Black turnstone)	Amazona ochrocephala (Yellow-crowned Parrot)*
Aythya valisineria (Canvasback)	Calidris alba (Sanderling)	Amazona oratrix (Yellow-headed amazon)*
Branta ruficollis (Red breasted goose)	Calidris alpina (Dunlin)	Ara militaris (Military macaw)*
Branta sandvicensis (Nene)*	Calidris fuscicollis (White-rumped Sandpiper)	Brotogeris versicolurus (White-winged Parakeet)*
Bucephala albeola (Bufflehead)	Calidris maritima (Purple sandpiper)	Cyanoliseus patagonus (Burrowing Parrot)
Bucephala islandica (Barrow's goldeneye)*	Calidris pusilla (Semipalmated sandpiper)	Enicognathus ferrugineus (Austral Parakeet)
Chloephaga melanoptera (Andean Goose)	Cepphus grylle (Black Guillemot)	Enicognathus leptorhynchus (Slender-billed Parakeet)
Chloephaga picta (Upland Goose)	Charadrius hiaticula (Common ringed plover)	Loriculus spp. (Hanging Parrot)*
Cygnus bewickii (Tundra swan)	Charadrius mongolus (Lesser Sand Plover)	Pycnonotus zeylanicus (Straw-headed bulbul)*
Cygnus buccinators (Trumpeter Swan)	Charadrius nivosus (Snowy plover)	Falconiformes (n=8)
Cygnus melancoryphus (black-necked swan)	Chlidonias hybrida (Whiskered Tern)	Caracara cheriway (Northern Crested Caracara)
Dendrocygna bicolor (Fulvous whistling Duck)	Chroicocephalus maculipennis (Brown-hooded gull)	Caracara plancus (Southern Caracara)
Dendrocygna viduata (White-faced Whistling-Duck)	Chroicocephalus ridibundus (Black-headed Gull)	Falco biarmicus (Lanner Falcon)
Lophodytes cucullatus (Hooded Merganser)	Fratercula arctica (Atlantic Puffin)	Falco columbarius (Merlin)
Mareca falcata (Falcated Duck)	Gallinago gallinago (Common Snipe)	Falco mexicanus (Prairie falcon)
Marmaronetta angustirostris (Marbled Teal)	Gallinago stenura (Pin-tailed Snipe)	Falco sparverius (American Kestrel)
Melanitta fusca (Velvet Scoter)	Gelochelidon nilotica (Common Gull-billed Tern)	Falco vespertinus (Red-footed Falcon)
Melanitta nigra (Common Scoter)	Haematopus ater (Blackish Oystercatcher)	Milvago chimango (Chimango Caracara)
Melanitta perspicillata (Surf Scoter)	Haematopus ostralegus (Eurasian oystercatcher)	Accipitriformes (n=30)
Mergellus albellus (Smew)*	Haematopus palliatus (American oystercatcher)	Accipiter brachyurus (New Britain Sparrowhawk)
Mergus serrator (Red-breasted merganser)	Hydroprogne caspia (Caspian Tern)	Accipiter gularis (Japanese Sparrowhawk)
Mergus squamatus (Scaly-sided merganser)*	Ichthyaetus melanocephalus (Mediterranean Gull)	Accipiter striatus (Sharp-shinned Hawk)
Oxyura jamaicensis (Ruddy Duck)	Larosterna inca (Inca tern)	Aquila audax (Wedge-tailed Eagle)
Spatula cyanoptera (Cinnamon Teal)	Larus atricilla (Laughing Gull)	Aquila chrysaetos (Golden Eagle)
Spatula puna (Puna Teal)*	Larus audouinii (Audouin's Gull)	Aquila fasciata (Bonelli's eagle)
Spatula querquedula (Garganey)	Larus belcheri (Belcher's Gull)	Aquila rapax (Tawny Eagle)*
Tachyeres pteneres (Magellanic Steamerduck)	Larus brachyrhynchus (Short-billed Gull)	Buteo lagopus (Rough-legged Hawk)
Tadorna ferruginea (Ruddy Shelduck)	Larus brunicephalus (Brown-headed Gull)	Buteo lineatus (Red-shouldered Hawk)
Gaviiformes (n=3)	Larus cachinnans (Caspian Gull)	Buteo magnirostris (Roadside Hawk)
Gavia immer (Common Loon)	Larus californicus (California Gull)	Buteo platypterus (Broad-winged Hawk)
Gavia pacifica (Pacific Loon)	Larus crassirostris (Black-tailed Gull)	Buteo polyosoma (Red-backed Hawk)*
Gavia stellata (Red-throated Loon)	Larus delawarensis (Ring-billed Gull)	Buteo regalis (Ferruginous Hawk)
Sphenisciformes (n=3)	Larus dominicanus (Kelp Gull)	Buteo swainsoni (Swainson's Hawk)
Eudyptes chrysocome (Southern Rockhopper Penguin)	Larus genei (Slender-billed Gull)	Buteogallus urubitinga (Great Black Hawk)
Spheniscus humboldti (Humboldt Penguin)	Larus glaucescens (Glaucous-winged Gull)	Cathartes aura (Turkey Vulture)
Spheniscus magellanicus (Magellanic Penguin)	Larus glaucoides (Iceland Gull)	Circus assimilis (Spotted Harrier)
Ciconiiformes (n=3)	Larus hyperboreus (Glaucous Gull)	Circus cyaneus (Hen Harrier)
Ciconia boyciana (Oriental Stork)	Larus michahellis (Yellow-legged Gull)	Circus pygargus (Montagu's Harrier)
Ciconia nigra (Black Stork)	Larus novaehollandiae (Silver Gull)	Coragyps atratus (Black Vulture)
Mycteria americana (American Wood Stork)	Larus occidentalis (Western Gull)	Geranoaetus melanoleucus (Black-chested buzzard-eagle)
Procellariiformes (n=13)	Larus philadelphia (Bonaparte's Gull)	Gypaetus barbatus (Bearded vulture)
Ardenna gravis (Great Shearwater)	Larus pipixcan (Franklin's Gull)	Gyps africanus (White-backed vulture)*
Ardenna grisea (Sooty Shearwater)	Larus schistisagus (Slaty-backed Gull)	Haliaeetus pelagicus (Steller's Sea Eagle)
Ardenna tenuirostris (Short-tailed Shearwater)	Larus scopulinus (Silver Gull)	Haliaeetus vocifer (African Fish Eagle)
Fulmarus glacialis (Northern Fulmar)	Larus smithsonianus (Arctic Herring Gull)	Milvus migrans (Black Kite)
Fulmarus glacialoides (Southern Fulmar)	Larus thayeri (Thayer's gull)	Milvus milvus (Red Kite)
Macronectes giganteus (Southern Giant Petrel)	Leucophaeus modestus (Grey gull)	Pandion haliaetus (Osprey)
Macronectes halli (Northern Giant Petrel)	Numenius phaeopus (Whimbrel)	Parabuteo unicinctus (Harris's Hawk)
Pachyptila desolata (Antarctic Prion)	Phalaropus lobatus (Red-necked phalarope)	Sagittarius serpentarius (Secretary Bird)
Phoebastria irrorata (Waved Albatross)	Pluvialis dominica (American Golden Plover)	Strigiformes (n=6)
Procellaria aequinoctialis (White-chinned Petrel)	Pluvialis squatarola (Grey Plover/Black-bellied Plover)	Aegolius acadicus (Northern Saw-whet Owl)
Pterodroma macroptera (Great-winged Petrel)	Rissa tridactyla (Black-legged Kittiwake)	Megascops asio (Eastern Screech Owl)
Puffinus puffinus (Manx Shearwater)	Rynchops niger (Black skimmer)	Megascops choliba (Tropical Screech-owl)
Thalassarche melanophris (Black-browed Albatross)	Scolopax rusticola (Eurasian Woodcock)	Megascops kennicottii (Western Screech-Owl)
Suliformes (n=18)	Stercorarius antarcticus (Brown skua)	Strix nebulosa (Great grey owl)
Fregata magnificens (Magnificent Frigatebird)	Stercorarius chilensis (Chilean Skua)	Strix varia (Barred owl)
Fregata minor (Great Frigatebird)	Stercorarius parasiticus (Arctic Skua)	Caprimulgiformes (n=1)
Leucocarbo atriceps (Imperial Shag)	Stercorarius skua (Great Skua)	Caprimulgus fossii (Mozambique Nightjar)
Morus capensis (Cape Gannet)	Sterna dougallii (Roseate Tern)	Columbiformes (n=2)
Nannopterum brasilianum (Neotropic Cormorant)	Sterna forsteri (Forster's Tern)	Columbina inca (Inca Dove)
Phalacrocorax auritus (Double-crested Cormorant)	Sterna hirundinacea (South American Tern)	Streptopelia turtur (European Turtle-dove)
Phalacrocorax bougainvillii (Guanay Cormorant)	Sterna paradisaea (Arctic Tern)	Piciformes (n=3)
Phalacrocorax brasilianus (Neotropical Cormorant)	Sternula albifrons (Little Tern)	Dendrocopos major (Great spotted woodpecker)
Phalacrocorax gaimardi (Red-legged Cormorant)	Thalasseus acuflavidus (Cabot's Tern)	Pteroglossus castanotis (Chestnut-eared aracari)*
Phalacrocorax lucidus (White-breasted Cormorant)	Thalasseus elegans (Elegant Tern)	Ramphastos cuvieri (white-throated toucan)*
Phalacrocorax magellanicus (Rock Shag)	Thalasseus maximus (Royal Tern)	Trogoniformes (n=1)
Phalacrocorax neglectus (Bank Cormorant)	Tringa flavipes (Lesser Yellowlegs)	Harpactes erythrocephalus (Red-headed Trogon)
Phalacrocorax punctatus (Spotted Shag	Tringa melanoleuca (Greater Yellowlegs)	Passeriformes (n=22)
Sula leucogaster (Brown Booby)	Tringa semipalmata (Willet)	Agelaius phoeniceus (Red-winged Blackbird)
Sula nebouxii (Blue-footed Booby)	Tringa totanus (Common Redshank)	Carduelis carduelis (European goldfinch)
Sula sula (Red-footed Booby)	Uria aalge (Common Murre)	Carduelis chloris (European Greenfinch)
Sula variegata (Peruvian Booby)	Uria lomvia (Thick-billed Murre)	Corvus brachyrhynchos (American Crow)
Urile penicillatus (Brandt's Cormorant)	Vanellus chilensis (Southern Lapwing)	Corvus caurinus (Northwestern Crow)
Pelecaniformes (n=13)	Vanellus vanellus (Northern Lapwing)	Corvus corone (Carrion Crow)
Ajaia ajaja (Roseate Spoonbill)	Xema sabini (Sabine's Gull)	Corvus monedula (Western Jackdaw)
Ardea herodias (Great Blue Heron)	Podicipediformes (n=8)	Corvus ossifragus (Fish Crow)
Bostrychia hagedash (Hadada Ibis)	Aechmophorus occidentalis (Western Grebe)	Cyanocitta cristata (Blue Jay)
Egretta caerulea (Little Blue Heron)	Podiceps auritus (Horned Grebe)	Cyanocorax chrysops (Plush-crested Jay)
Egretta intermedia (Intermediate Egret)	Podiceps grisegena (Red-necked Grebe)	Garrulus glandarius (Eurasian Jay)
Egretta thula (Snowy Egret)	Podiceps major (Great Grebe)	Junco hyemalis (Dark-eyed Junco)
Eudocimus ruber (Scarlet Ibis)*	Podilymbus podiceps (Pied-billed Grebe)	Passer montanus (Eurasian Tree Sparrow)
Geronticus eremita (Northern Bald Ibis)	Spilornis cheela (Crested Serpent Eagle)	Phylloscopus trochilus (Willow warbler)
Pelecanus erythrorhynchos (American White Pelican)	Spizaetus nipalensis (Mountain hawk-eagle)	Pica hudsonia (Black-billed Magpie)
Pelecanus occidentalis (Brown Pelican)	Vultur gryphus (Andean condor)*	Pygochelidon cyanoleuca (Blue-and-white Swallow)
Pelecanus rufescens (Pink-backed Pelican)	Cathartiformes (n=2)	Pyrrhula pyrrhula (Eurasian Bullfinch)
Pelecanus thagus (Peruvian Pelican)	Gymnogyps californianus (California Condor)	Quiscalus mexicanus (Great-tailed grackle)
Plegadis chihi (White-faced Ibis)*	Sarcoramphus papa (King Vulture)	Quiscalus quiscula (Common Grackle)
		Tachycineta bicolor (Tree Swallow)
		Turdus iliacus (Redwing)
		Turdus migratorius (American Robin)

>300

https://www.fao.org/animal-health/situation-updates/global-aiv-with-zoonotic-potential/bird-species-affected-by-h5nx-hpai/en

Mammalian species affected by A(H5)

Avian influenza overview March - April 2023



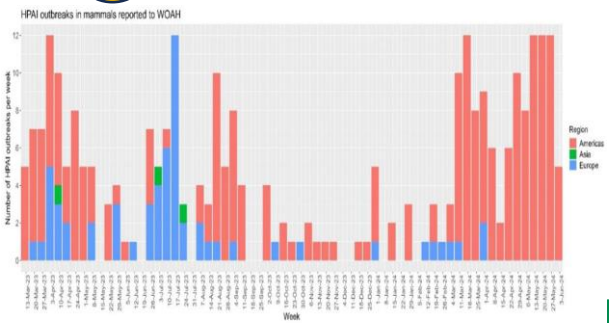
American black bear (Ursus americanus)
American mink (Neogale vison)
American pine marten (Martes americana)
Amur leopard (Panthera pardus orientalis)
Amur tiger (Panthera tigris)
Asiatic black bear (Ursus thibetanus)
Bobcat (Lynx rufus)
Beech marten (Martes foina)
Bottlenose dolphin (Tursiops truncatus)
Brown bear (Ursus arctos)
Burmeister's porpoise (Phocoena spinipinnis)
Caspian seal (Pusa caspica)
Cat (Felis catus)
Chilean dolphin (Cephalorhynchus eutropia)
Common dolphin (Delphinus delphi)
Coyote (Canis latrans)
Dog (Canis familiaris)
Eurasian badger (Meles meles)
Eurasian lynx (Lynx lynx)
Eurasian otter (Lutra lutra)
European polecat (Mustela putorius)
Ferret (Mustela furo)
Fisher cat (Pekania pennanti)
Grey seal (Halichoerus grypus)
Harbour seal (Phoca vitulina)
Japanese raccoon dog (Nyctereutes viverrinus)
Kodiak grizzly bear (Ursus arctos horribilis)
Marine otter (Lontra felina)
Mountain lion (Puma concolor)
North American river otter (Lontra canadensis)
Porpoise (Phocoena phocoena)
Raccoon (Procyon lotor)
Red fox (Vulpes vulpes)
Skunk (Mephitis mephitis)
South America fur seal (Arctophoca australis)
South American bush dogs (Speothos venaticus)
South American sea lion (Otaria flavescens)
Virginia opossum (Didelphis virginiana)
White-sided dolphin (Lagenorhynchus acutus)
Pig (Sus scrofa)

- High viral load in environment
- Expect some spillover into mammals

<-- Plus: **Humans** Arctic Fox, Cats, Dog, Caracal, Dolphin spp. Otter spp. Coati, Polar bear, Seal spp. Sea lion Sp, Elephant seal, Goats, **Cows,** Alpacas

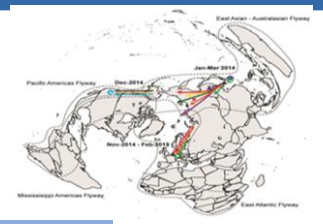
★ Additional mortality events since April 2023

Spread since 2023

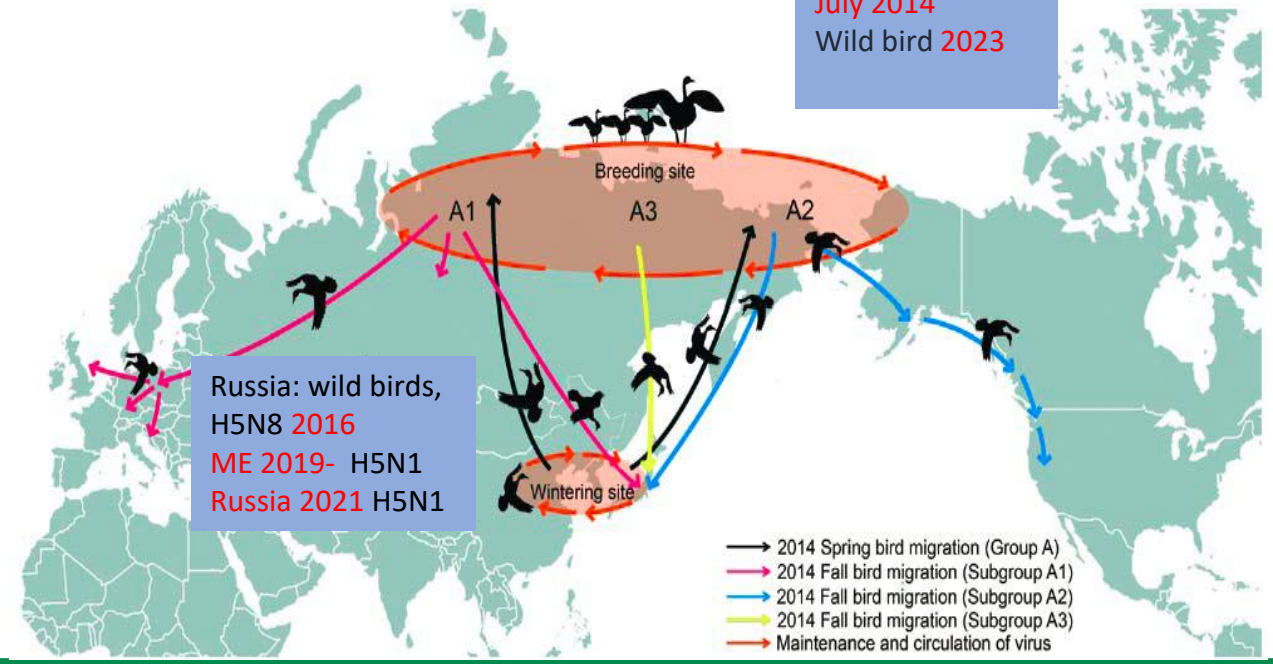


https://www.ecdc.europa.eu/sites/default/files/documents/Avian-influenza-overview-March-April-2023_0.pdf

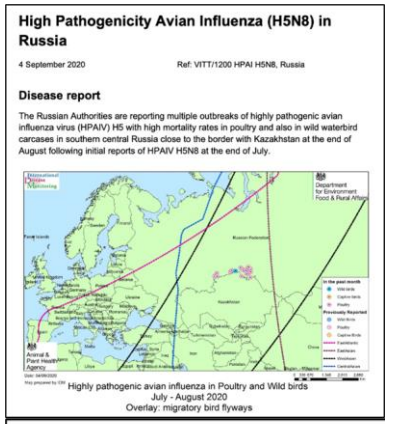
Signposting events? Diversification & spread of H5 HPAIV 2014-2024 via wild birds (including expanded host range)



E. Siberia: wild bird H5N8 , July 2014
Wild bird 2023



Russia: wild birds, H5N8 2016
ME 2019- H5N1
Russia 2021 H5N1



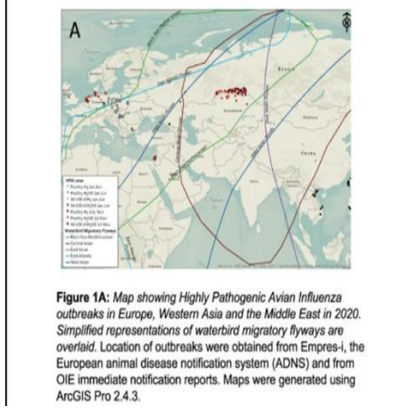
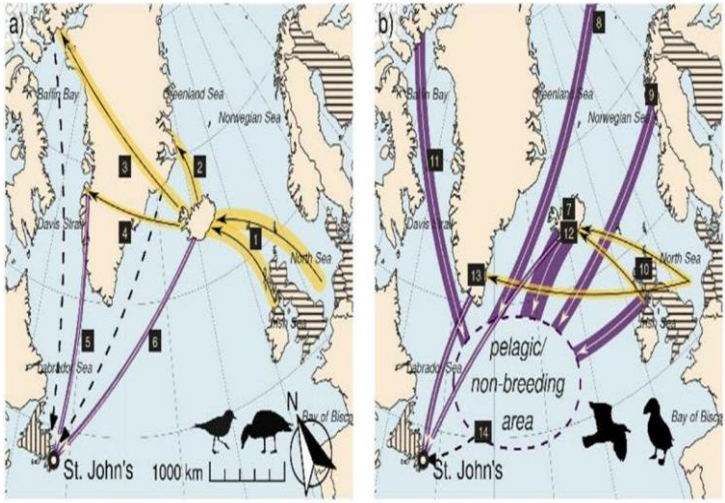
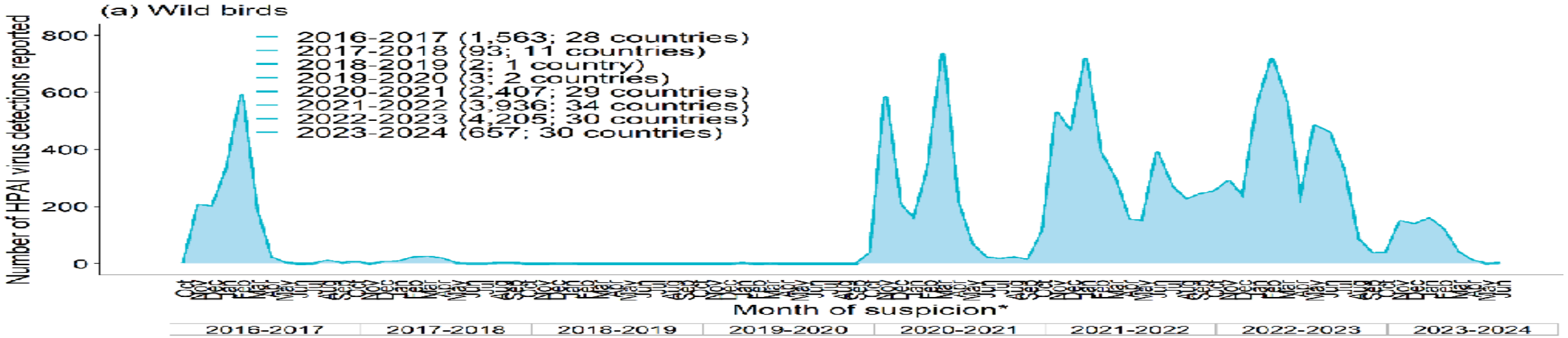


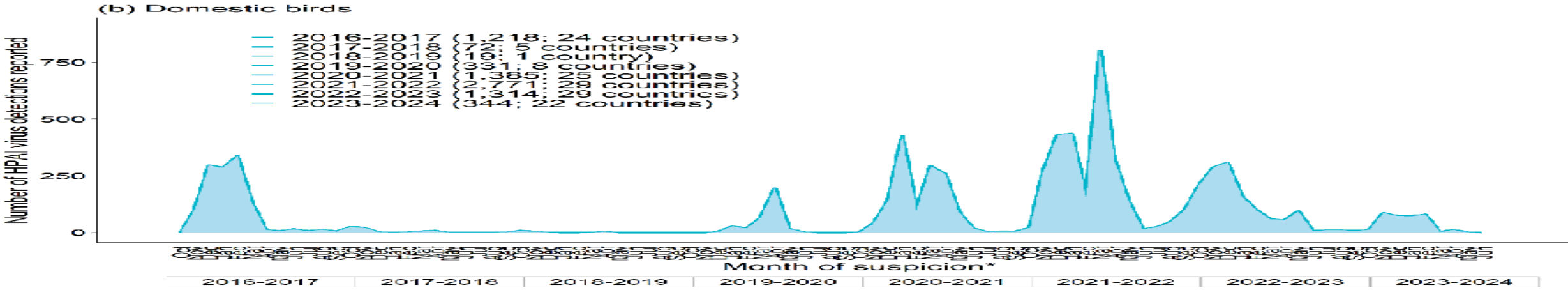
Figure 1A: *Map showing Highly Pathogenic Avian Influenza outbreaks in Europe, Western Asia and the Middle East in 2020. Simplified representations of waterbird migratory flyways are overlaid.* Location of outbreaks were obtained from Empres-i, the European animal disease notification system (ADNS) and from OIE immediate notification reports. Maps were generated using ArcGIS Pro 2.4.3.

Putative transmission pathways between Europe and Newfoundland via migratory waterfowls/shorebirds



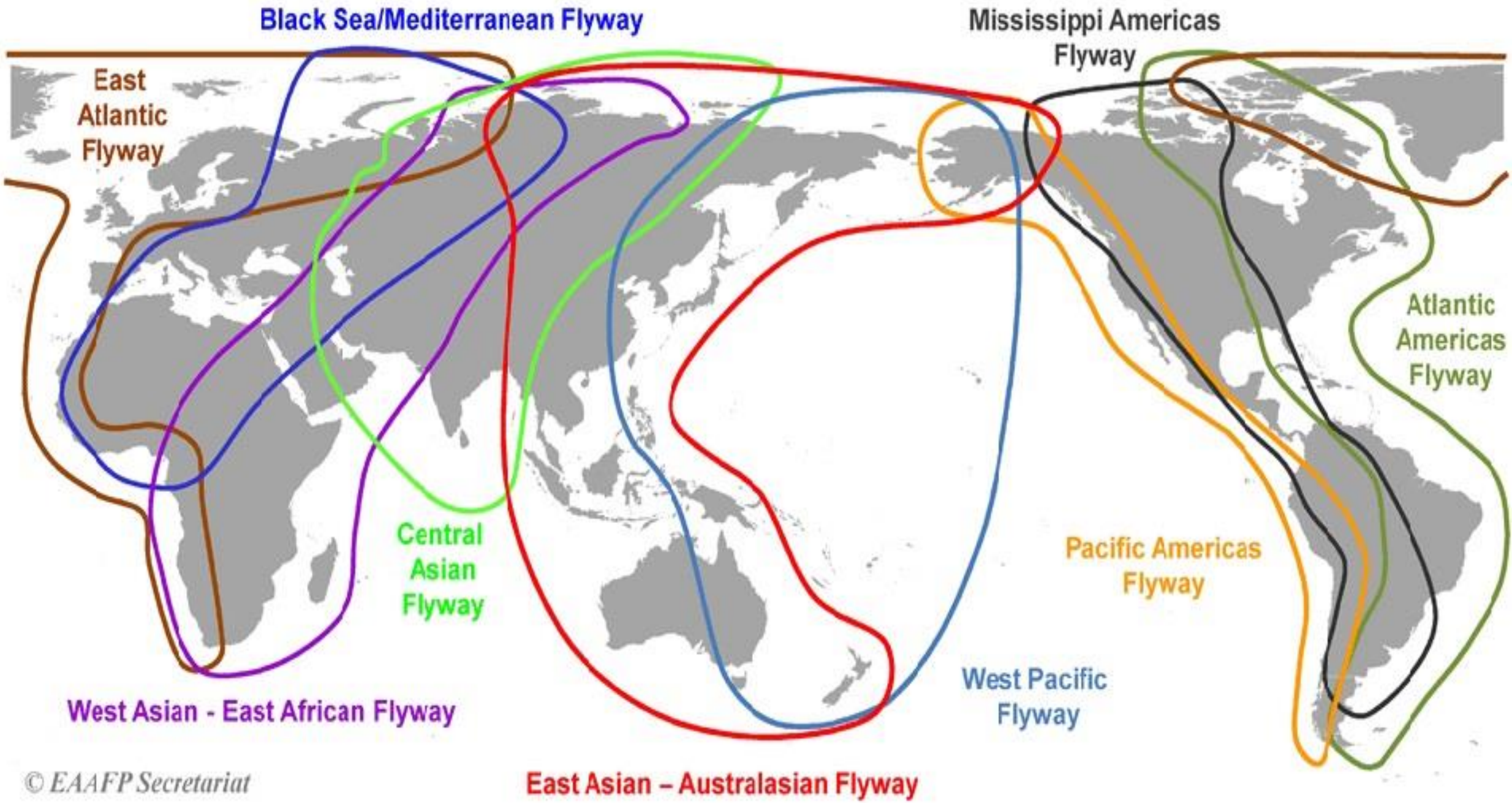
Direct correlation between infection in wild birds and poultry; highly relevant for new and emerging strains



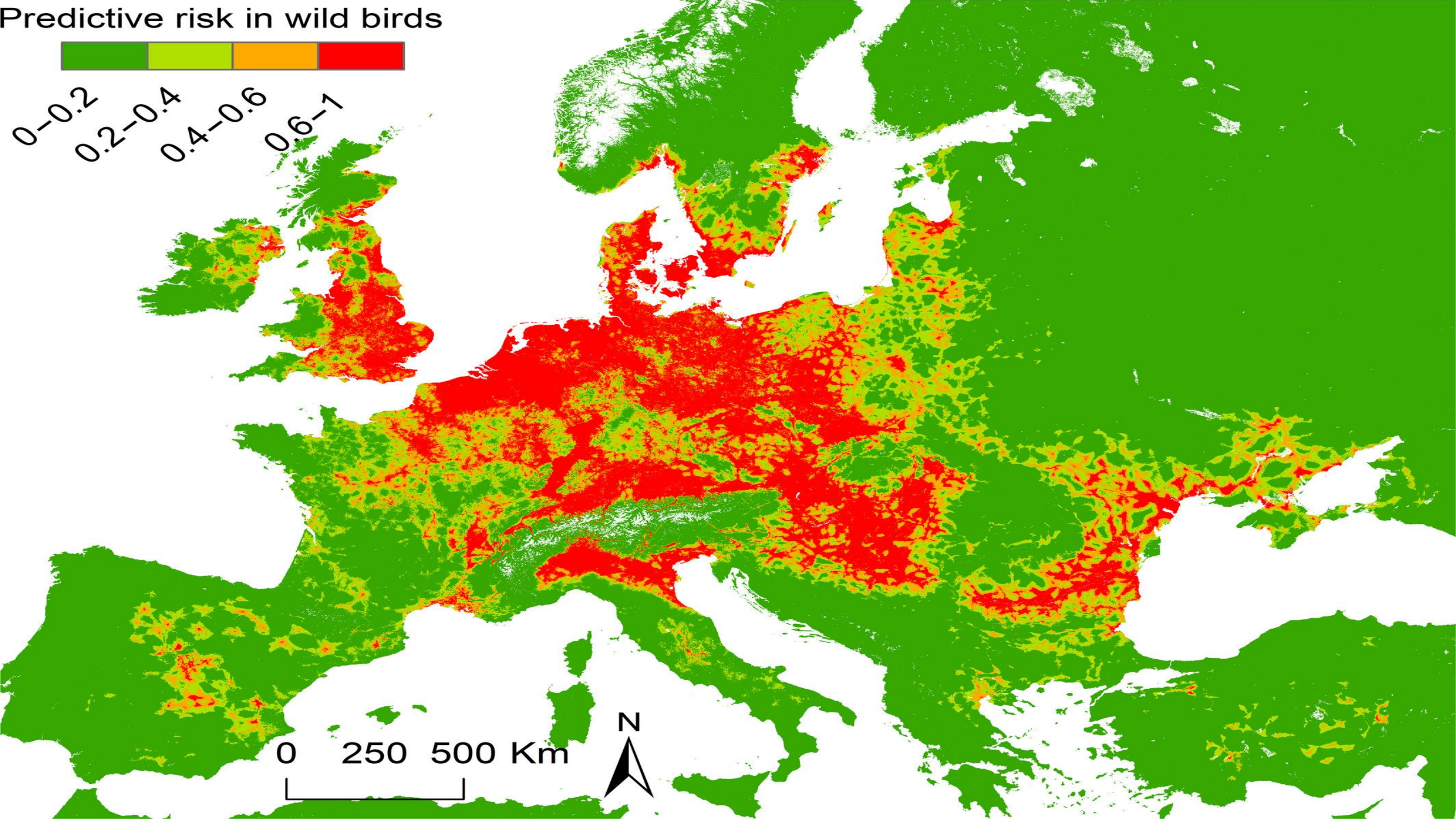


Reflections on 15 years of wild bird surveillance
What have we learnt???

- Migratory waterfowl can carry viruses over long distances
- Virus evolves in poultry and wild birds
- Interface between poultry and wild birds key for long term evolution
- Independent maintenance of HPAI occurs in wild birds but each strain has a finite life
- Factors influencing duration of maintenance (and therefore risk for poultry):
  - Flyway mixing
  - Population susceptibility sometimes linked to age
  - Prior immunity ie previously circulating H5 strains/clades
- Wild bird surveillance invaluable for defining risk levels to poultry and interventions



https://www.eaaflyway.net/about-us/the-flyway/


Predictive risk in wild birds
0–0.2
0.2–0.4
0.4–0.6
0.6–1
0 250 500 Km
N

How can we apply 20 years knowledge to effective cost efficient HPAI surveillance?

- Passive surveillance in poultry for early detection
  - New approaches?
- Targeted wild bird surveillance to identify
  - New incursions of previous strains
  - New strains that carry multiple genetic changes/changed risk for poultry infection?
- Hot spots in your country/region for virus emergence/spillover?
- What are key host populations distinguishing between
  - Migratory
  - Resident (spill over)
  - Major reservoir species

Challenges

- Poultry and risk-based host interface active surveillance needs substantive resource (dwindling appetite?)
- Drivers to undertake surveillance are country- and regionally defined. (Food security, data sharing, transparency, proportionate response to detection)
- Production system structure underpinning pathogen (e.g. influenza) dynamics and transmission poorly defined
- Implementation of a mixture of surveillance methods (active and passive) and longitudinal are required at key interfaces to determine longer term impacts/effects (nodes for risk mitigation)
- Changing economical situations, climates, habitat changes and behaviour changes may change interactions between humans, wild birds, wild animals and domestic animals. These could change and create new potential interfaces and change AIV dynamics.

- **Requires cross sector collaboration**

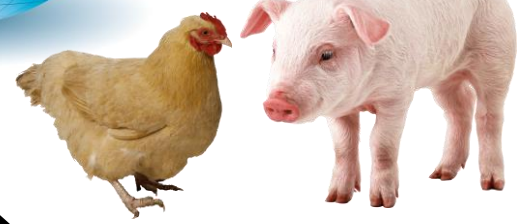
Opportunities

- Network of surveillance sites covering different regions/ecosystems.
- Risk assessments should include the identification of multi- host livestock systems, populations exposed to wild birds, potential exposure pathways, ecological factors and habitats
- Safe and sustainable food systems lead to greater food security and improved animal and human health
- Resource allocation should be risk-based and focus on hosts with opportunities for exposure and deeper investigation in populations with higher contact structure.
- **Collaboration between stakeholders and sectors**
- Contact OFFLU (secretariat@offlu.org) if you require specialist advice in setting up wildlife surveillance programmes

One Health and Pre-Pandemic Preparedness: Putting Zoonotic Influenza into Context - The OFFLU Network's Contributions to the WHO's Vaccine Composition Meetings for Influenza

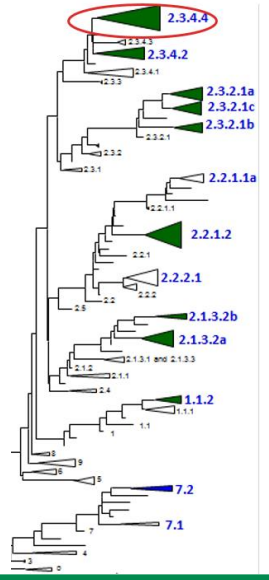
Methodology and standardisation of approach

Global Samples



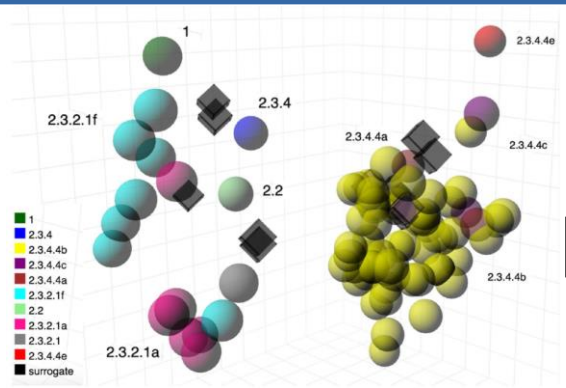
Step 1:

Epidemiological and genetic analysis



Step 2:

Evaluate antigenic changes of significance to candidate vaccine viruses (CVV)



Step 3:

- OFFLU data package presented
- Discussed in the context of zoonotic human influenza cases
- WHO VCM zoonotic report
- Updates to CVVs

OFFLU SWINE INFLUENZA REPORT
JANUARY 2023 TO JUNE 2023

SCOPE
In this document we present a summary of H1 and H3 swine influenza A virus evolution.

OFFLU contribution to the February 2024 VCM

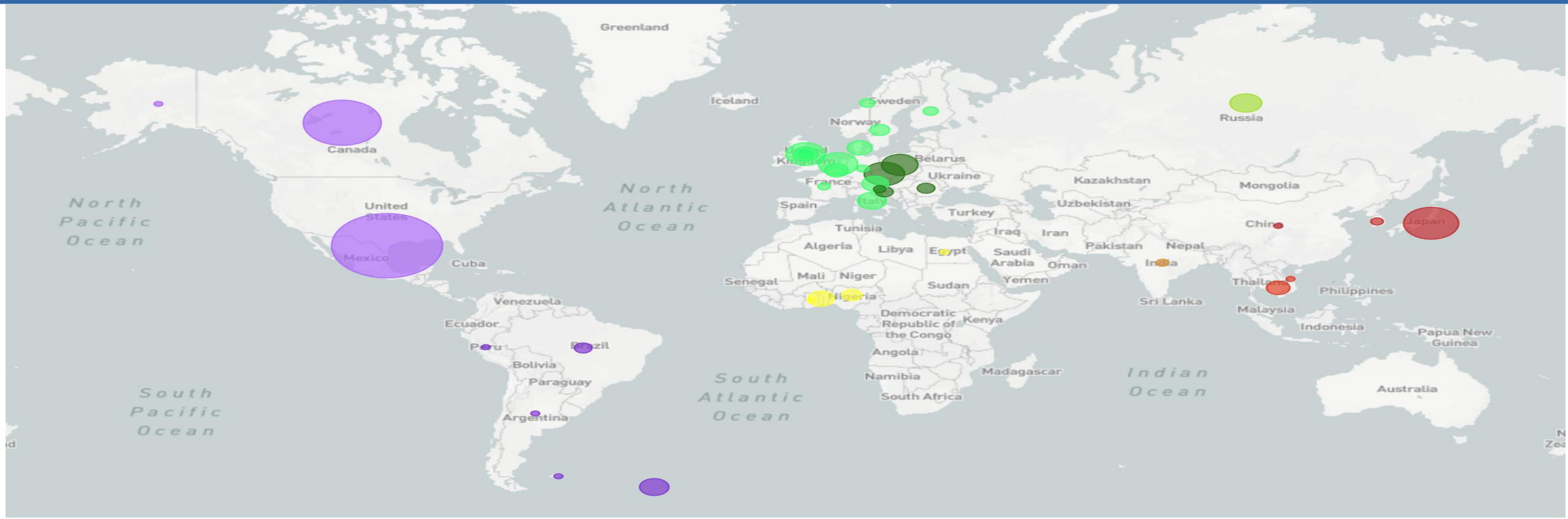


Figure 4: A map showing countries where H5 sequences collected within the reporting period were retrieved from GISAID, or countries which submitted sequences to OFFLU.

Control: Vaccination in poultry against A(H5)

- Preventative/emergency/routine & stamping out

+ Maintain food security & livelihoods
+ Reduce zoonotic spillover
+ Reduce spillback into wild birds

- Surveillance for freedom from infection

- Species considerations
- Vaccination strategies
- Types of vaccines
- Vaccine delivery
- **Vaccine match --> OFFLU AIM**

Policy brief

December 202

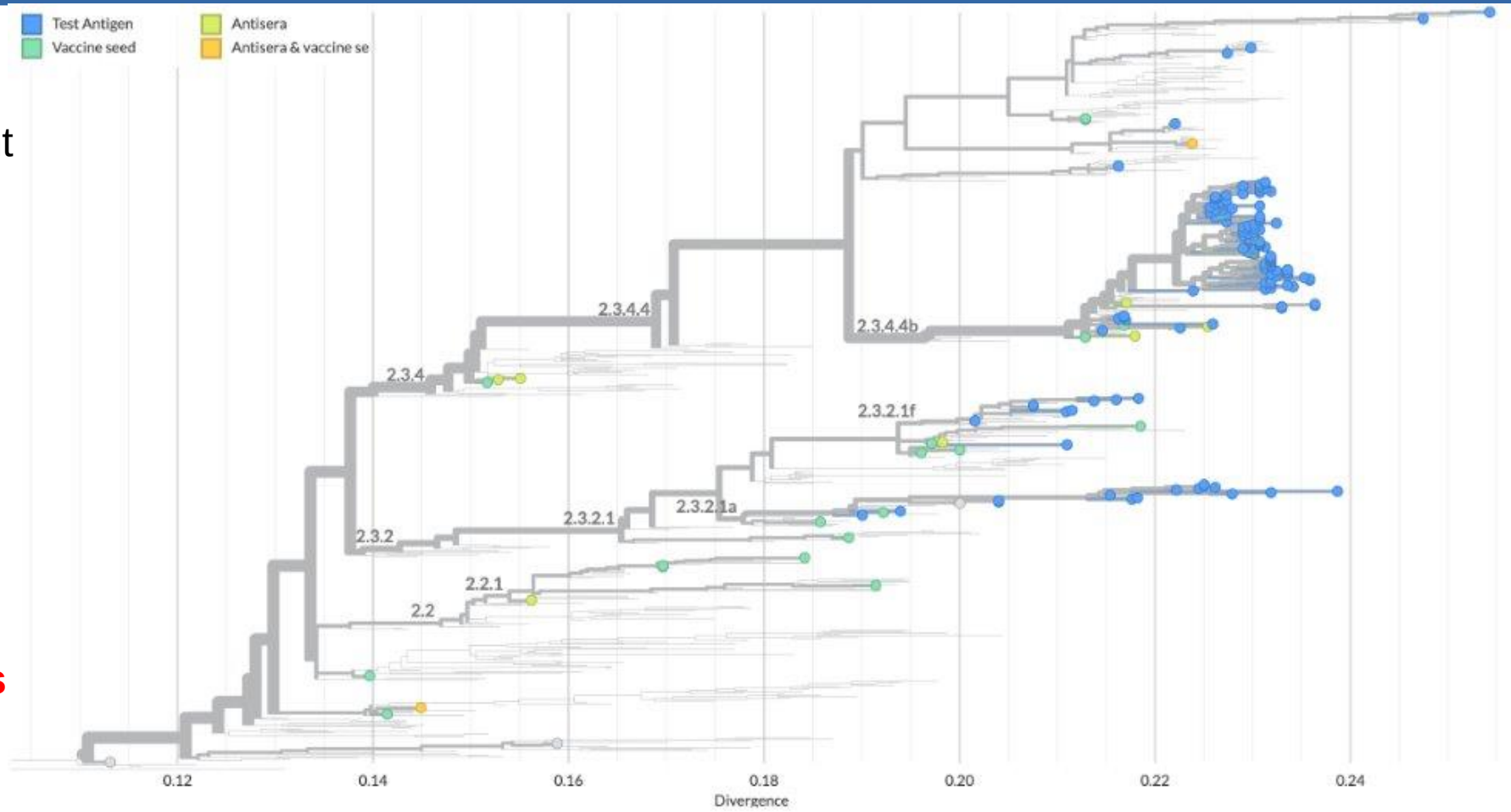
Avian influenza vaccination: why it should not be a barrier to safe trade

Executive summary

Since 2005, avian influenza has had a staggering toll, with over 500 million birds lost to the disease worldwide [1]. Its devastating impact extends beyond domestic and wild birds, threatening livelihoods, food security and public health. The recent shift in the disease's ecology and epidemiology has heightened global concern as it has spread to new geographical regions. It has also caused unusual die-offs in wild birds and led to an alarming increase in mammalian cases. The rapidly evolving nature of avian influenza and **changes in its patterns of spread** [2] require a review of existing prevention and control strategies. To effectively contain the disease, protect the economic sustainability of the poultry sector and reduce potential pandemic risks, all available tools must be reconsidered – including vaccination.

Access to sequence data is essential for initial genetic assessment

- Access to global data is the first step in virus assessment
- Strains used are close to available vaccines for assessment
- Phylogenetic analyses enable prioritisation of isolates for further assessment
- **However, genetic analyses may not always reflect antigenic relatedness**



Avian Influenza Matching (AIM) for poultry vaccines

provides up-to-date information to the poultry sector, governments, and vaccine manufacturers on antigenic characteristics of circulating avian influenza viruses including comparisons with vaccine antigens. This information facilitates selection and updating of appropriate vaccines for poultry.

offlu
WOAH FAO
network of expertise on animal influenza

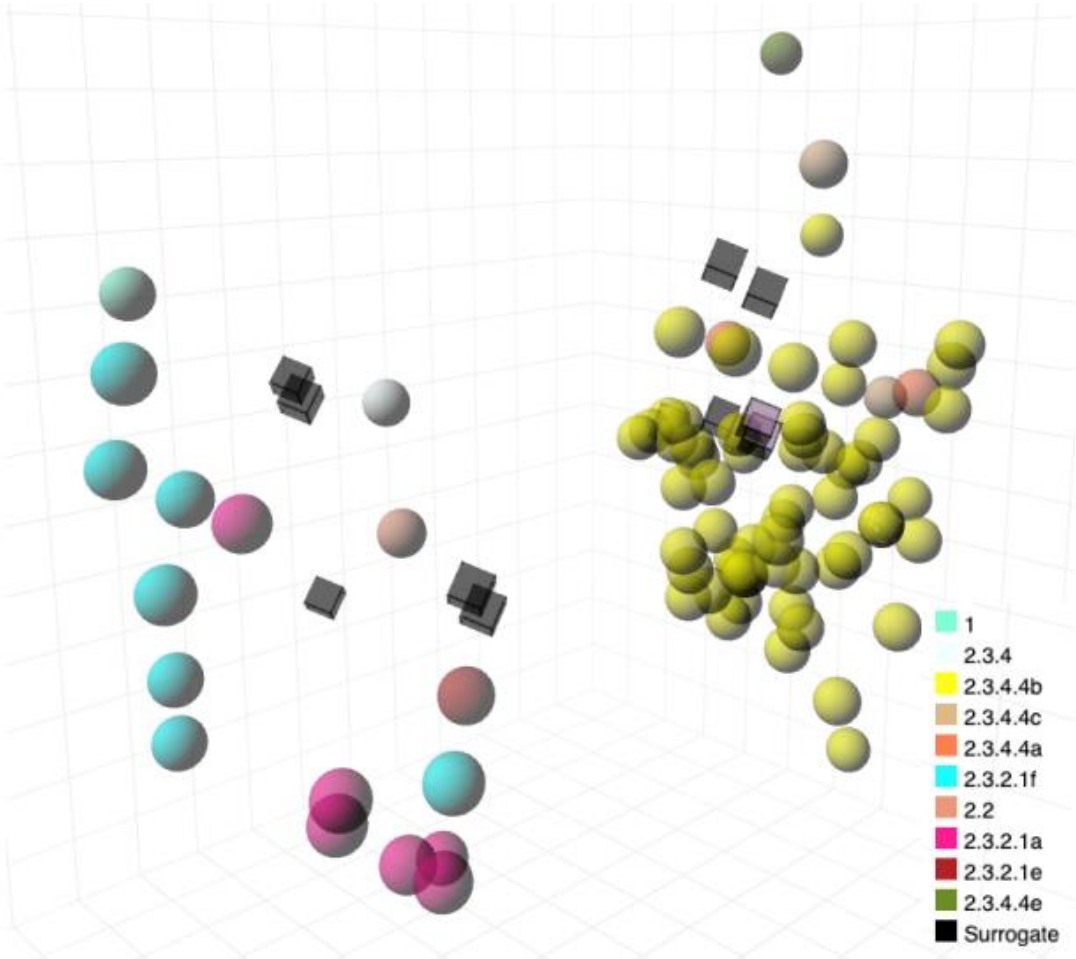
Sera
- Isolates *similar* to vaccine seed strains and contemporary viruses

HI
- Selection of globally representative contemporary viruses

Cartography
- Antigenic characterisation mapped using cartography

Report
- Summary report → OFFLU website

- Information on the antigenic characteristics of currently circulating avian influenza viruses
- Facilitate the selection of appropriate vaccines for poultry
- Requires **sharing** of viral isolates from countries
- Potential for early warning and regularly updated



Major gaps – information sharing request

Food and Agriculture Organization of the United Nations

World Organisation for Animal Health
Founded as OIE

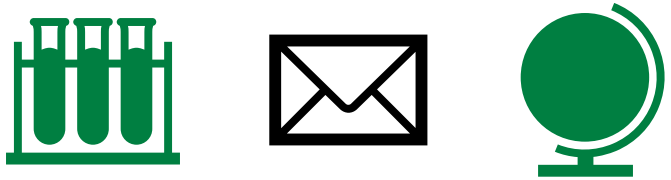
What we need from you

- Updates from the field
- Stakeholder engagement

What we can offer

- Bilateral dialogue on OFFLU AIM
- Benefits sharing

Information on vaccine seed strains which are in use (sequence data, viral isolate)



Comprehensive information and viral isolates from vaccine breakdown

MEASURING UNIT
Animal

Species		Susceptible	Cases	Deaths	Killed and Disposed of	Slaughtered/ Killed for commercial use	Vaccinated
Birds (DOMESTIC)	NEW	53952	49048	94	53858	0	15098
	TOTAL	415932	411017	554	415378	0	15098

Seed Strain / HA Gene Source	Clade[1]	Reference	Represented
A/Goose/Guangdong/96	0*	Shi et al., 2022	No
A/chicken/Vietnam/C58/04	1*	EFSA 2023	Yes
A/Vietnam/1194/2004	1*	EFSA 2023	Yes
A/Chicken/Shanxi/2/2006	7.2*	Shi et al., 2022	No
A/Chicken/Liaoning/S4092/2011	7.2	Shi et al., 2022	No
A/chicken/Legok/2003	2.1.1	EFSA 2023	Pending
A/CK/Egypt/ME1010/2016	2.2.1.1	EFSA 2023	Pending
A/Chicken/Egypt/Q1995D/2010	2.2.1.2*	EFSA 2023	Pending
A/Chicken/Egypt/RG-173 CAL/2017	2.2.1.2	EFSA 2023	Pending
A/Duck/EGYPT/M2583D/2010	2.2.1.2*	EFSA 2023	Pending
A/chicken/West Java/Pwt-Wij/2006	2.3.1.2	EFSA 2023	No
A/duck/Sukoharjo/BBVW-1428- 9/2012	2.3.2.1g[2]*	Indriani et al., 2014	Yes
A/Hubei/1/2010	2.3.2.1a[2]*	EFSA 2023	Pending
A/duck/Guangdong/S1322/2010	2.3.2.1b[2]*	Shi et al., 2022	Yes
A/chicken/Vietnam/NCVD-KA435/13	2.3.2.1c[1]/e[2]*	EFSA 2023	Pending
A/chicken/Tanggamus/031711076-65/2017	2.3.2.1c	EFSA 2023	No
A/chicken/Liaoning/SD007/2017	2.3.2.1d	Shi et al., 2022	Pending
rgCA2/2.3.2.1d	2.3.2.1d	Kang et al., 2022	No
A/duck/Anhui/SI246/2014	2.3.2.1	Shi et al., 2022	No
A/Duck/Anhui/1/2006	2.3.4*	Shi et al., 2022	Yes
A/chicken/Guizhou/4/2013	2.3.4.4/g[2]*	Shi et al., 2022	No
A/duck/Korea/ES2/2016	2.3.4.4/e[2]*	EFSA 2023	Pending
A/Waterfowl/Korea/S57/2016	2.3.4.4	Kuruppuarachchi et al., 2022	No
A/Gyrfalcon/WA/41088-6/2014	2.3.4.4c[2]*	EFSA 2023	Yes
A/chicken/Egypt/ME-2018/2018	2.3.4.4b[2]*		Yes
A/green-winged teal/Egypt/877/2016	2.3.4.4b[2]*	EFSA 2023	Yes
A/whooper swan/Shanxi/4–1/2020	2.3.4.4b[2]*	Shi et al., 2022	Yes
A/duck/Guizhou/S4184/2017	2.3.4.4h	Shi et al., 2022	Pending
A/duck/Fujian/S1424/2020	2.3.4.4h	Shi et al., 2022	Pending
rgES3/2.3.4.4h	2.3.4.4h	Kang et al., 2022	No
A/duck/Guanzou/S4184/2017	2.3.4.4h	Shi et al., 2022	Pending
A/Duck/VietNam/QB7412	unknown	EFSA 2023	No

AIM can help you but we need to work together

We would like to establish dialogue at regional country level concerned with poultry vaccination

- Veterinary authorities
- Vaccine manufacturers
- Representatives of poultry industry ; producers

We recognize different vaccine approaches by AIM highly relevant to all including inactivated vaccines

Long term vision establish country or regional level vaccine strain selection systems for improved control through vaccination

Our task is not to tell you what to use but give you the information and how you can use it

Stakeholder application of OFFLU AIM outputs

Early warning of antigenic drift in wild birds, a region/country

Trigger for post vaccination monitoring in country

Trigger for vaccine trials to be carried out

Trigger to strengthen surveillance

Spread of a new clade or variant --> Vaccine update

- ✓ **Standardised testing**
- ✓ **Saving countries money**
- ✓ **Saving time**
- ✓ Impartial data

OFFLU AVIAN INFLUENZA MATCHING (OFFLU AIM) GUIDE TO ASSESSING ANTIGENIC CHARACTERISTICS OF AVIAN INFLUENZA VIRUSES

Updated June 2024

Scope: This report provides information for national/sub-national level laboratories on how to assess antigenic characteristics of avian influenza viruses.

Avian Influenza Matching (AIM) for poultry vaccines: Developing linkages

Webinar organised on 10 July

https://www.fao.org/animal-health/news-events/events/detail/offlu-avian-influenza-matching-(aim)-for-poultry-vaccines/en

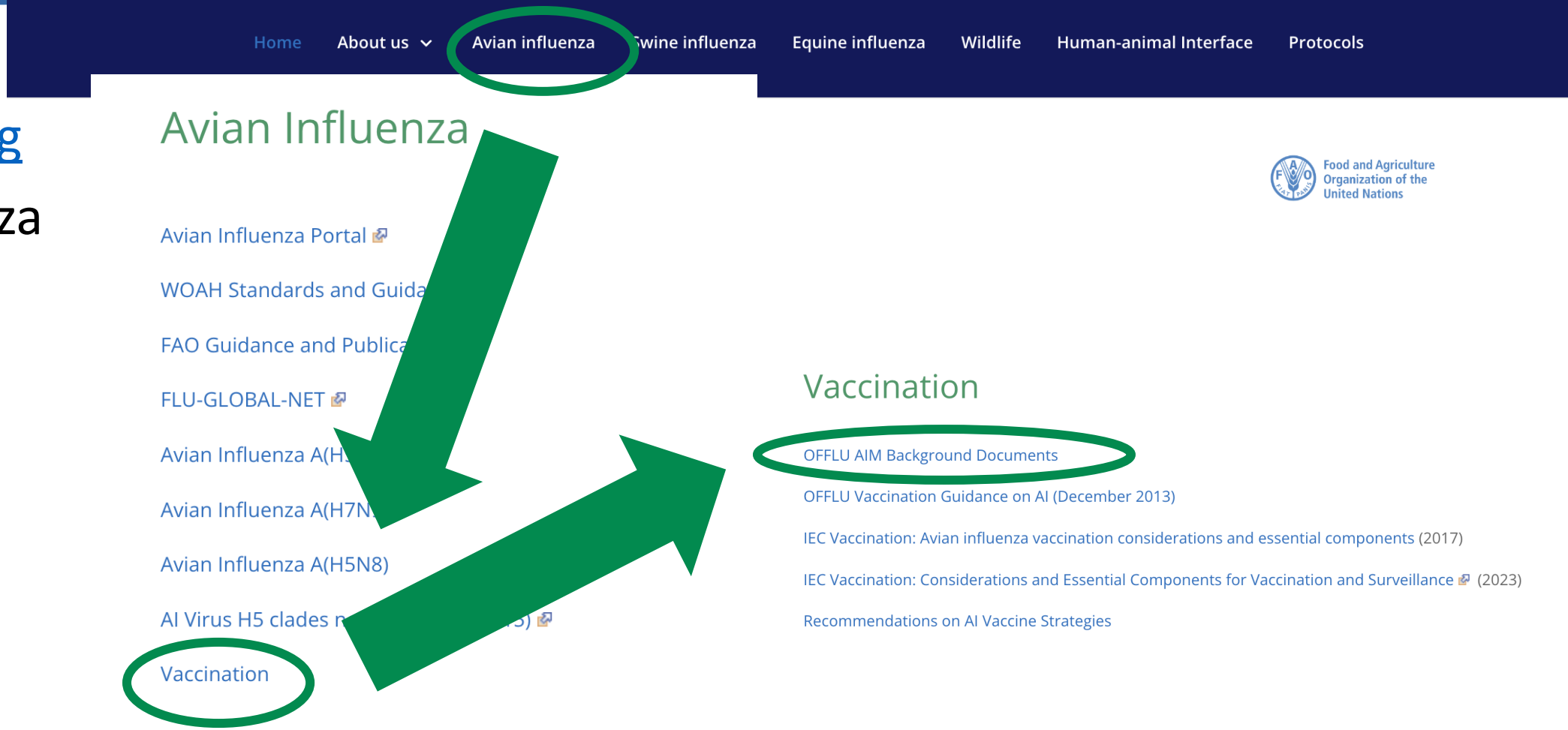
Food and Agriculture Organization of the United Nations

World Organisation for Animal Health
Founded as OIE

Where do I find the documents?

https://www.offlu.org/index.php/offlu-aim-background-documents/

- www.offlu.org
- Avian Influenza
- Vaccination
- OFFLU AIM



Thank you

Nicola Lewis, The Crick Institute, London for sharing selected presentation content

OFFLU would like to thank colleagues and contributors for continued support to OFFLU.

The OFFLU website has regular updates on animal influenza and parent organisations' publications, technical advice, protocols and many other useful links.

For any questions please contact: secretariat@offlu.org

Visit www.offlu.org for more information