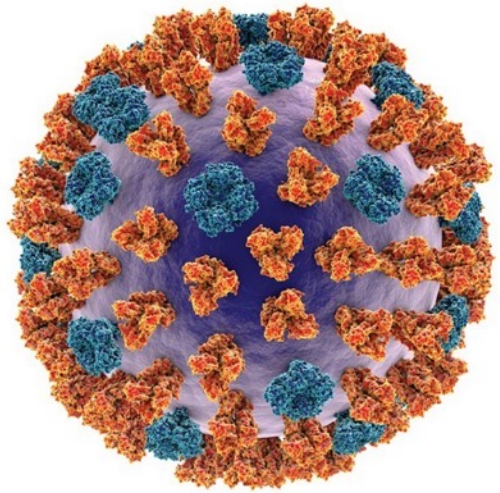

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CENTRE FOR PATHOGEN GENOMICS

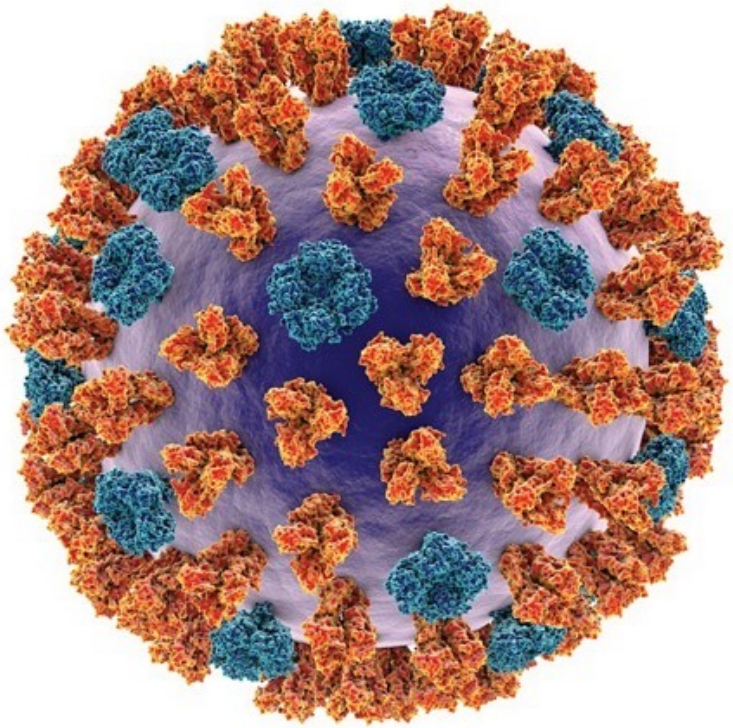
Doherty Institute

A joint venture between The University of Melbourne and The Royal Melbourne Hospital

THE UNIVERSITY OF MELBOURNE

The Royal Melbourne Hospital

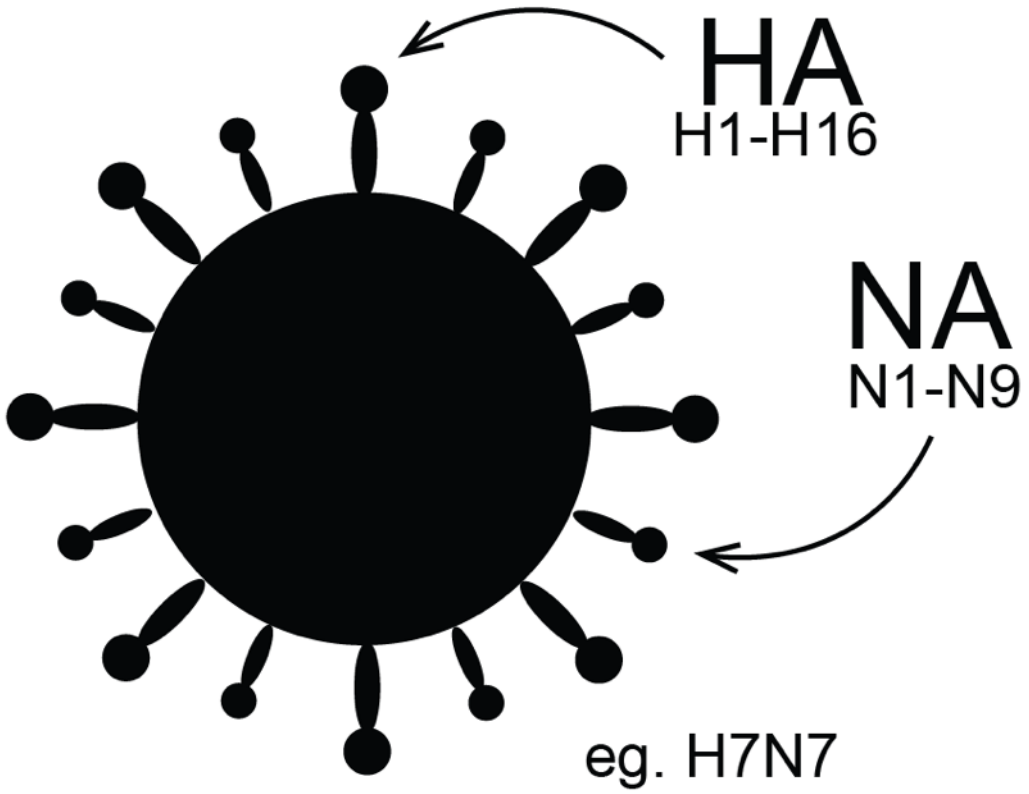
WHO Collaborating Centre for Reference and Research on Influenza VIDRL

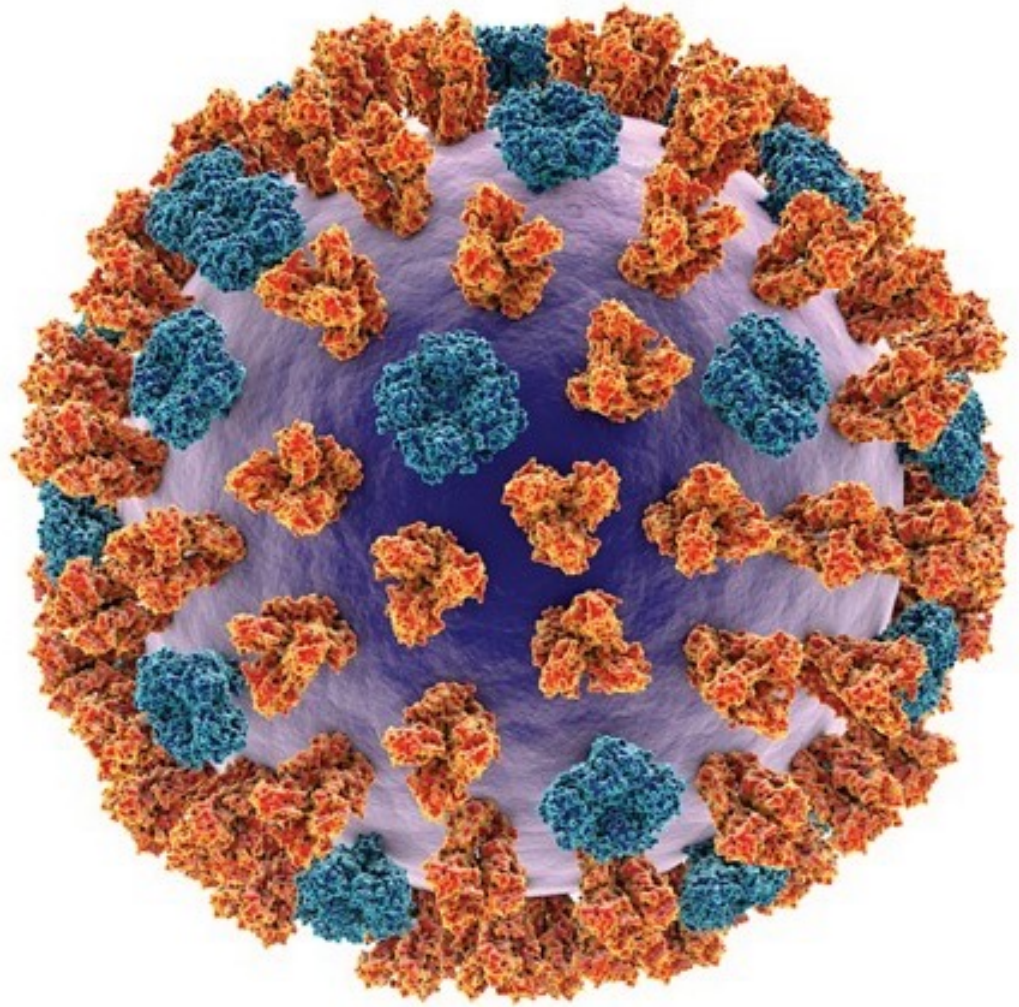


Avian influenza 101

What's in the name?

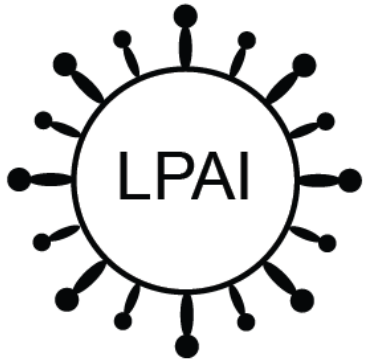
Avian influenza "subtype"



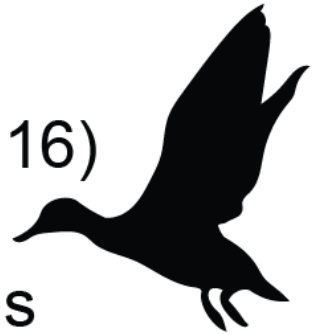


What's in the name?

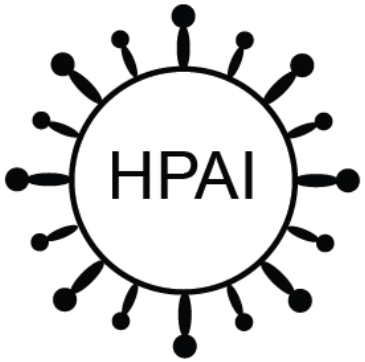
Low pathogenic



- all HA subtypes (H1-H16)
- common in wild birds
- no disease in wild birds
- occasional, mild disease in poulty



High pathogenic



- "bird flu"
- only H5 and H7 subtypes
- causes outbreaks in poultry
- associated with disease and death in poultry and wild birds

Low pathogenic
H5 or H7 from wild birds

↓

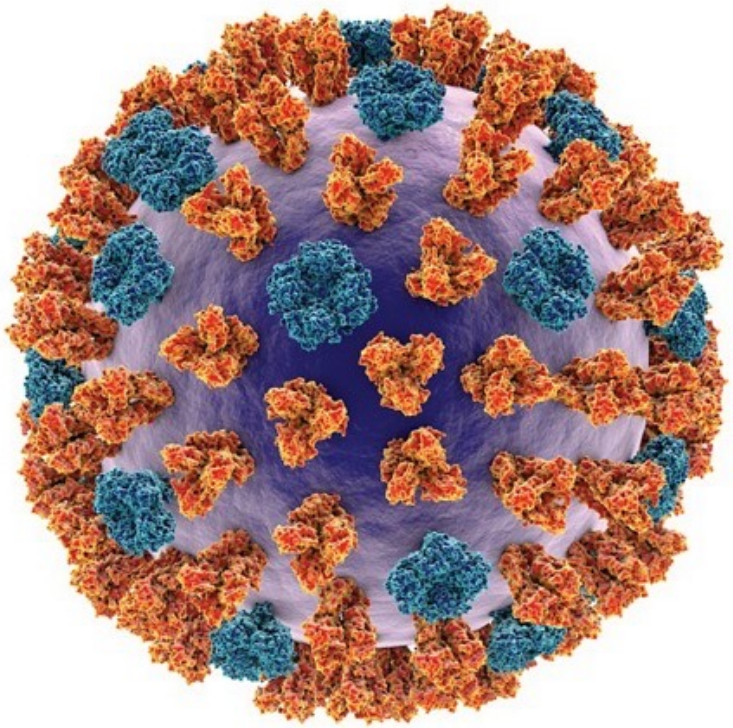
Enter poultry production

↓

Genetic changes in the HA

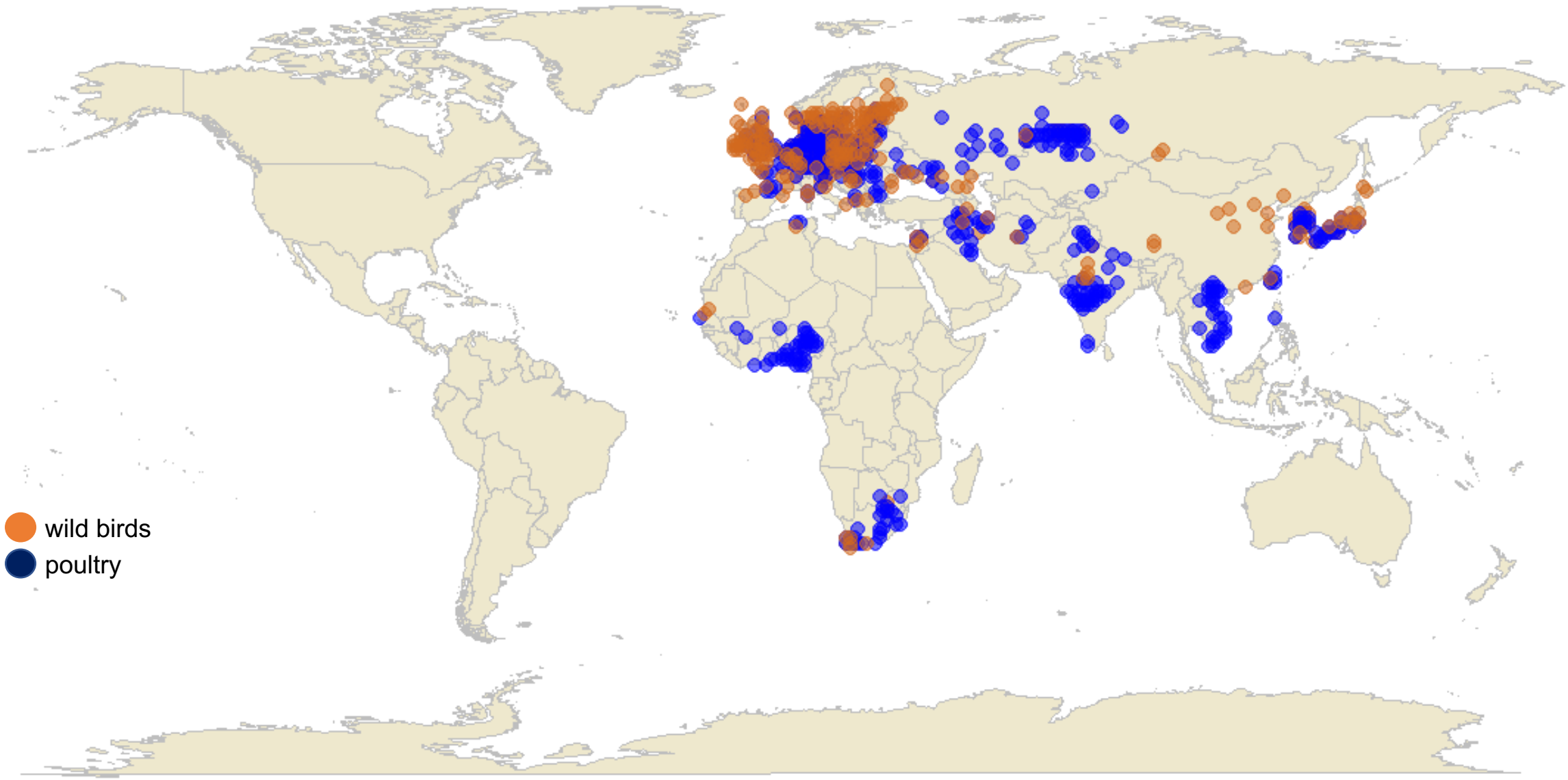
↓

Highly pathogenic
H5 or H7



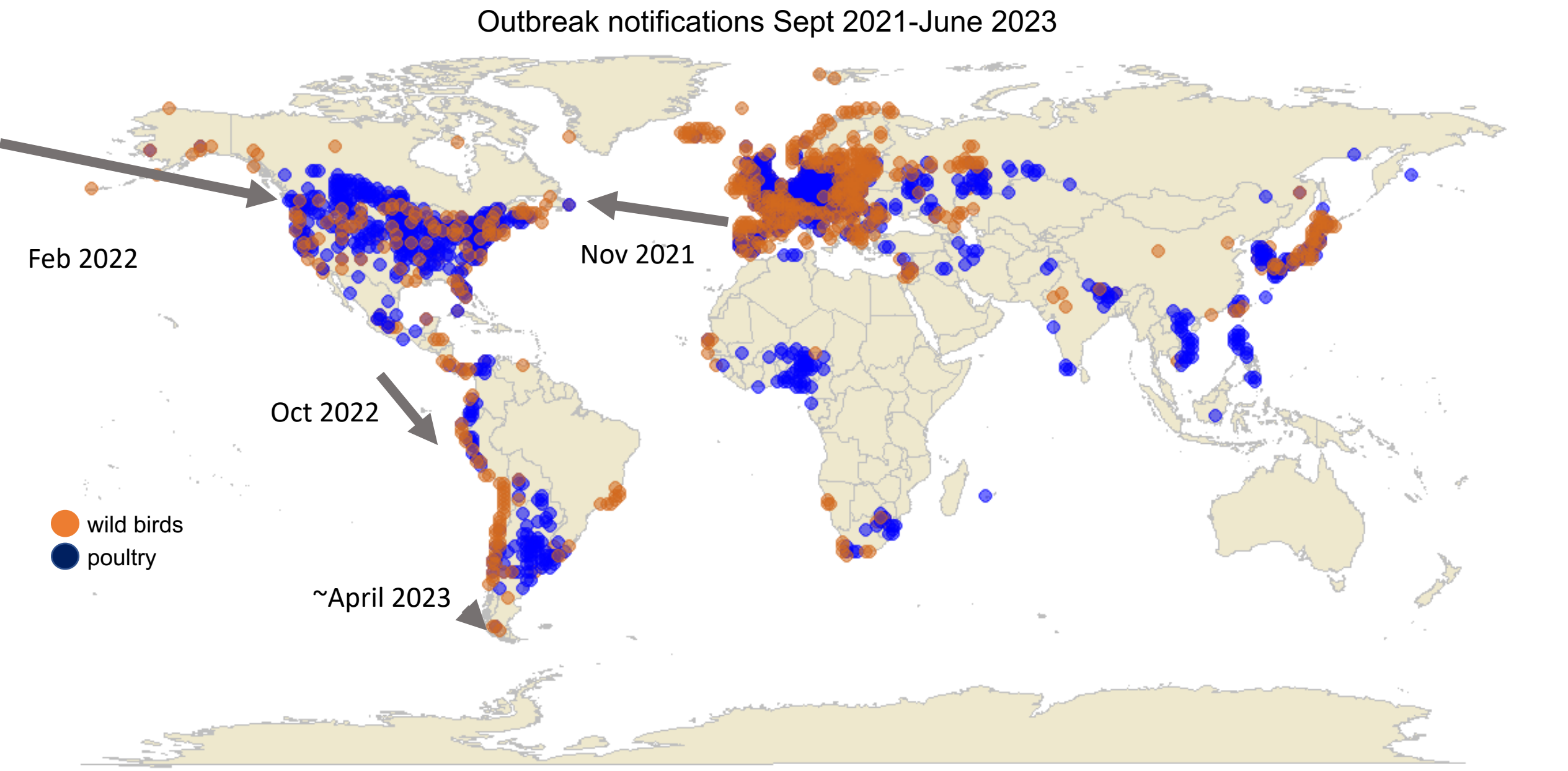
HPAI current situation

Global situation of HPAI

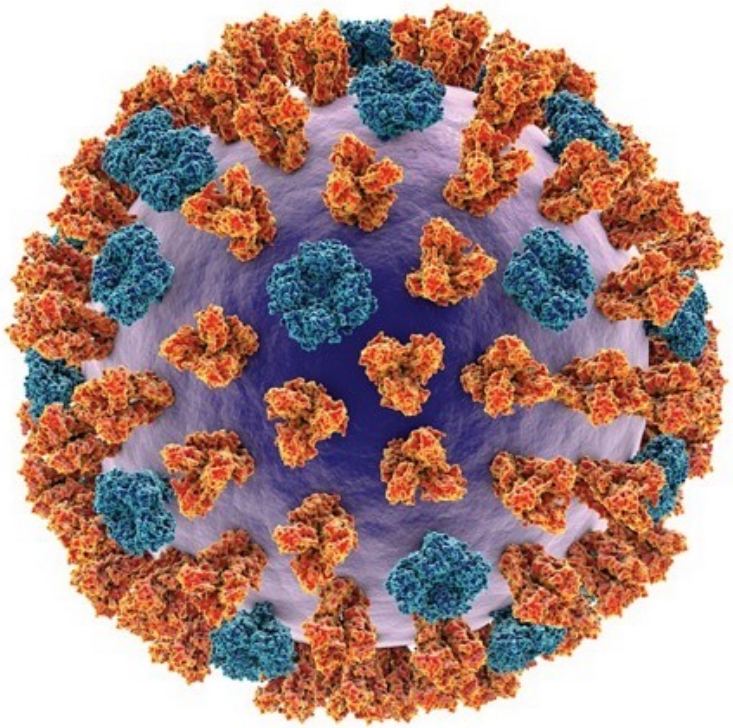


Klaassen and Wille. 2023. Nature Ecology and Evolution

Global situation of HPAI



Klaassen and Wille. 2023. Nature Ecology and Evolution

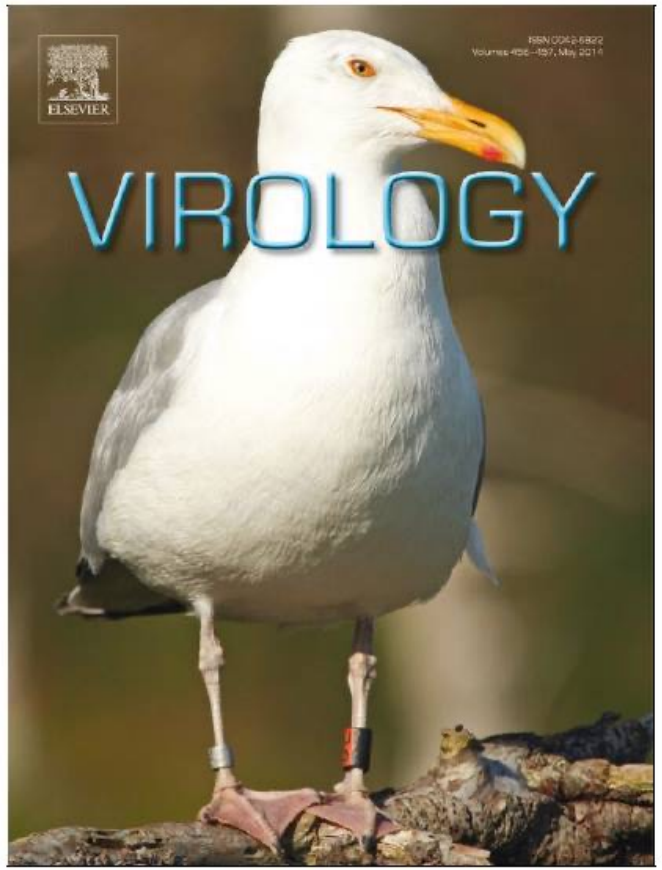


Avian influenza in seabirds: LPAI and HPAI

Seabirds are important hosts for low pathogenic avian influenza virus

Sampling Effort

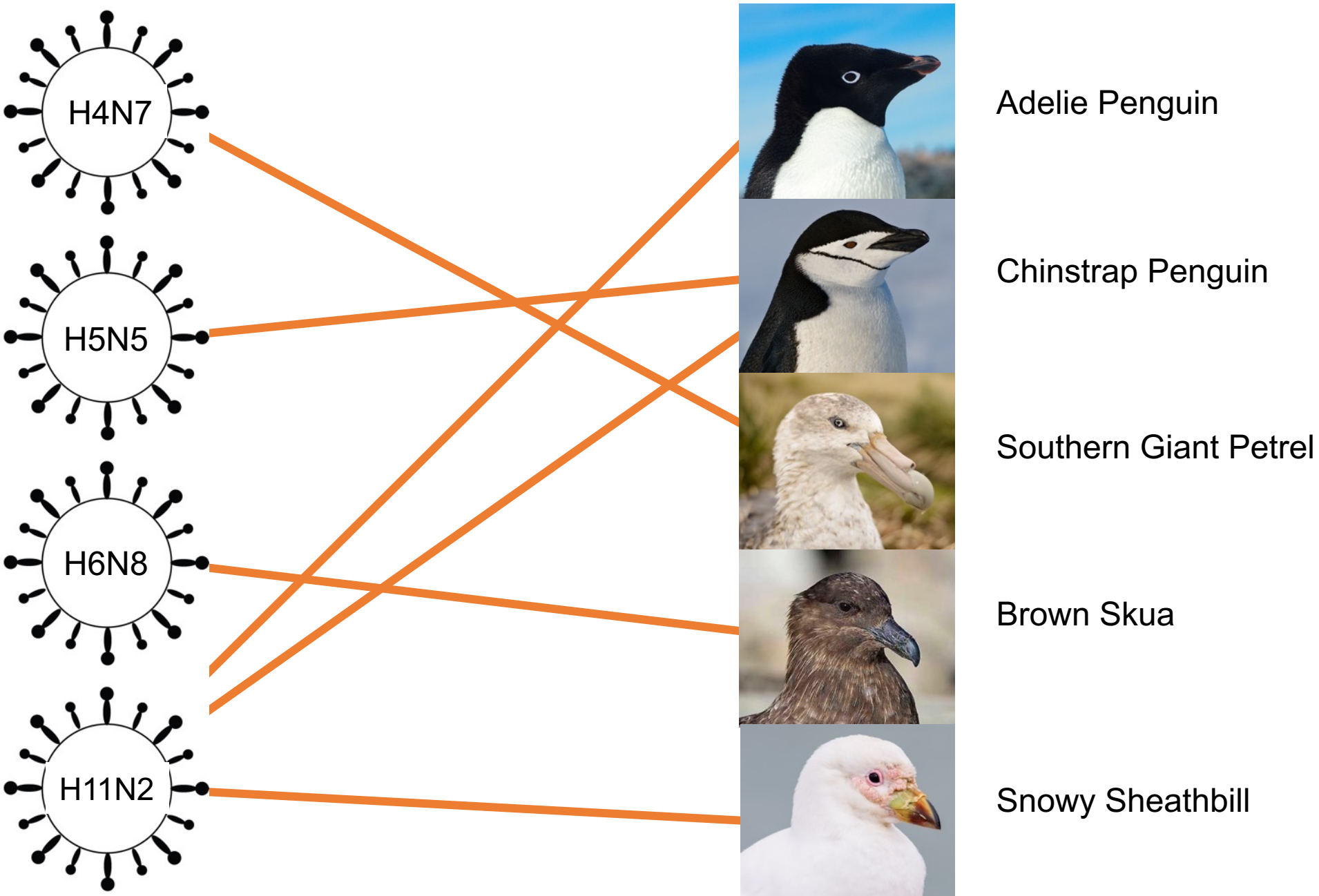
50 2500



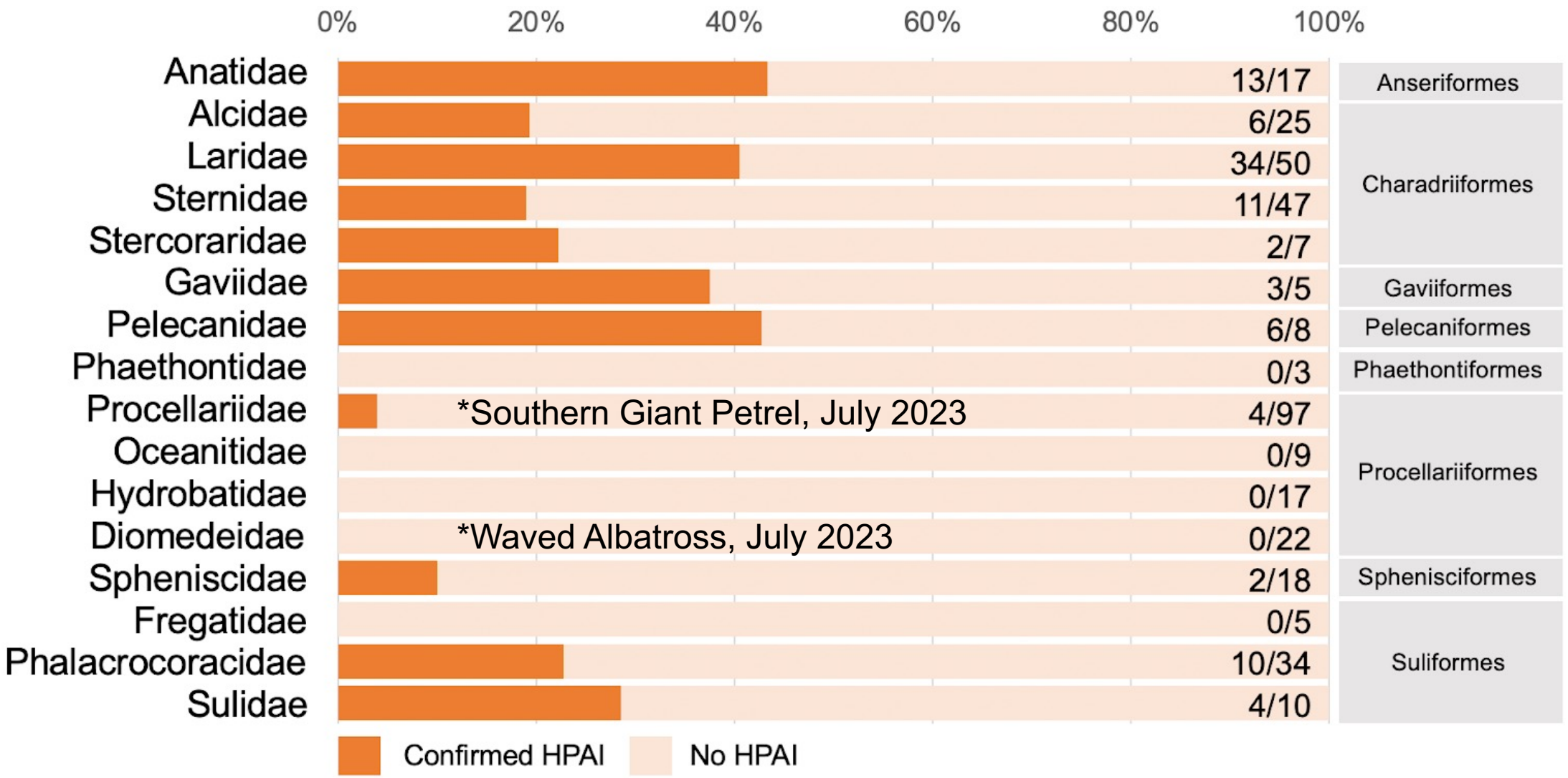
		1970	1975	1980	1985	1990	1995	2000	2005	2010
	Serum									
	Tissues									
	Swab									
	Isolates	0	0	0	0	0	0	0	0	4
	Serum									
	Tissues									
	Swab									
	Isolates	1	16	6	13[a]	0	0	7	1	9
	Serum									
	Swab									
	Isolates	3	5	1	0	0	0	0	0	0
	Serum									
	Swab									
	Isolates	1	49[b]	0	0	0	0	2	13	24

Lang et al. 2016. Assessing the role of seabirds in the ecology of influenza A virus. Avian Diseases.

Antarctic birds are important hosts for low pathogenic avian influenza virus



HPAI outbreaks in seabirds

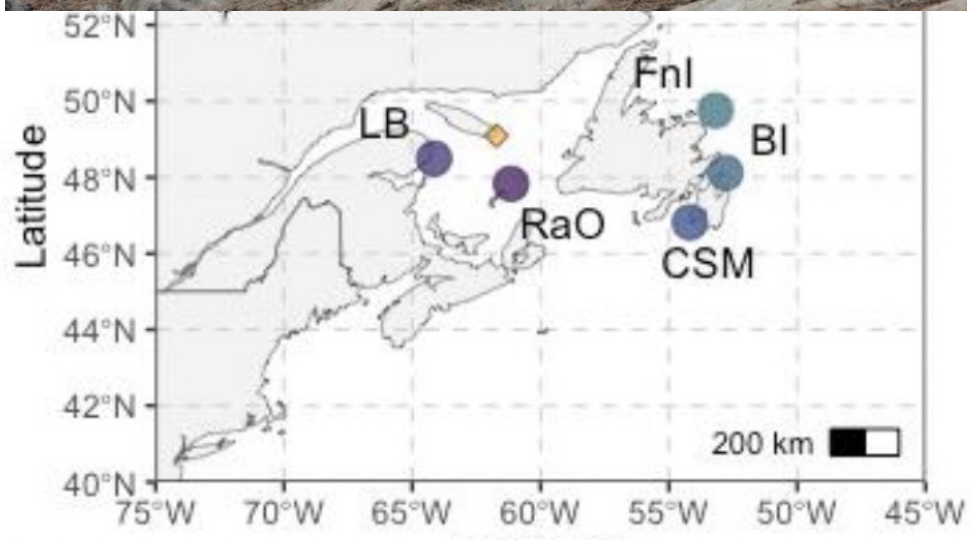


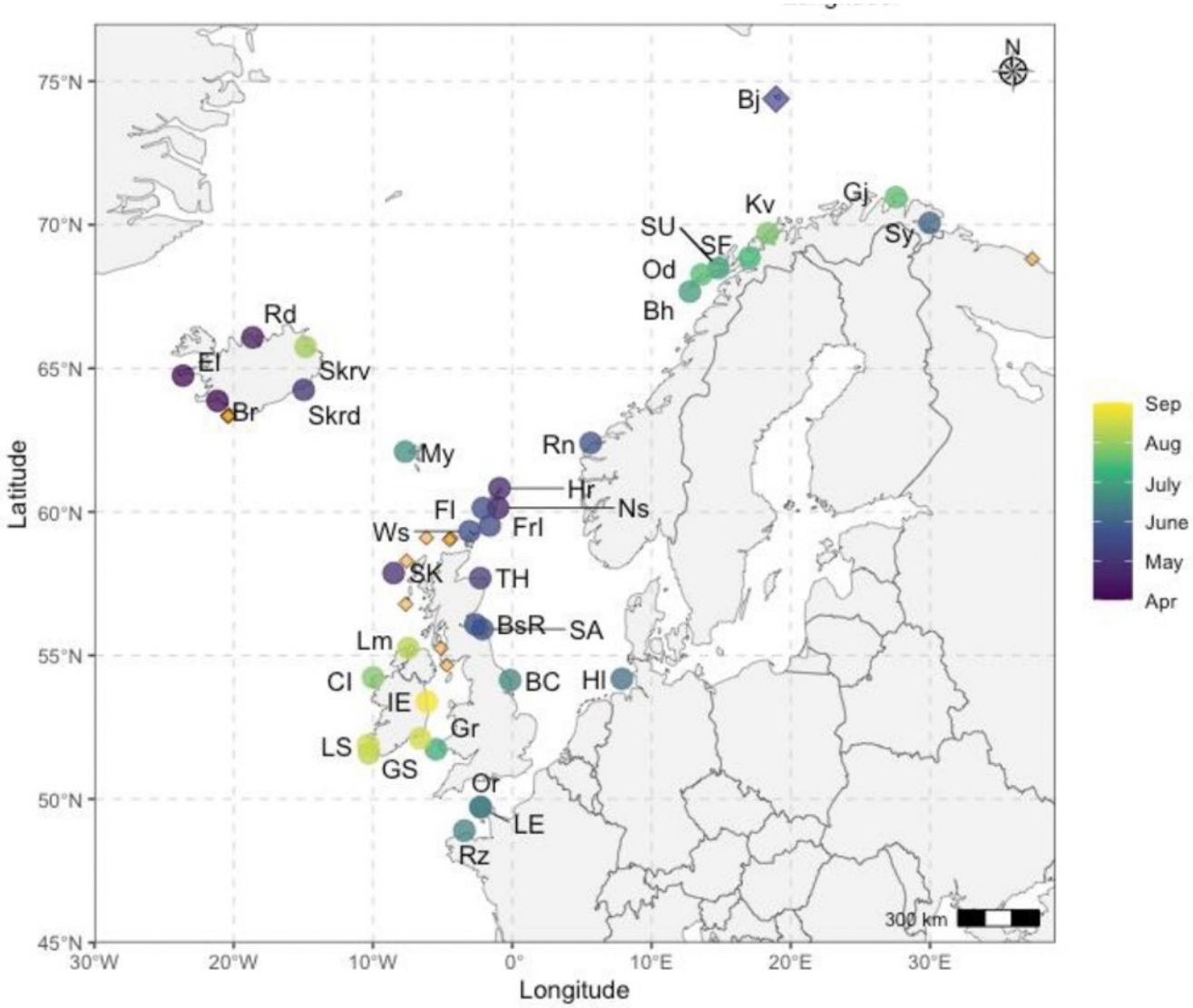
Number of seabird species identified in WAHIS, June 2023

Notable HPAI outbreaks in seabirds

Substantial geographic range in single species, within short periods of time:

Northern Gannets



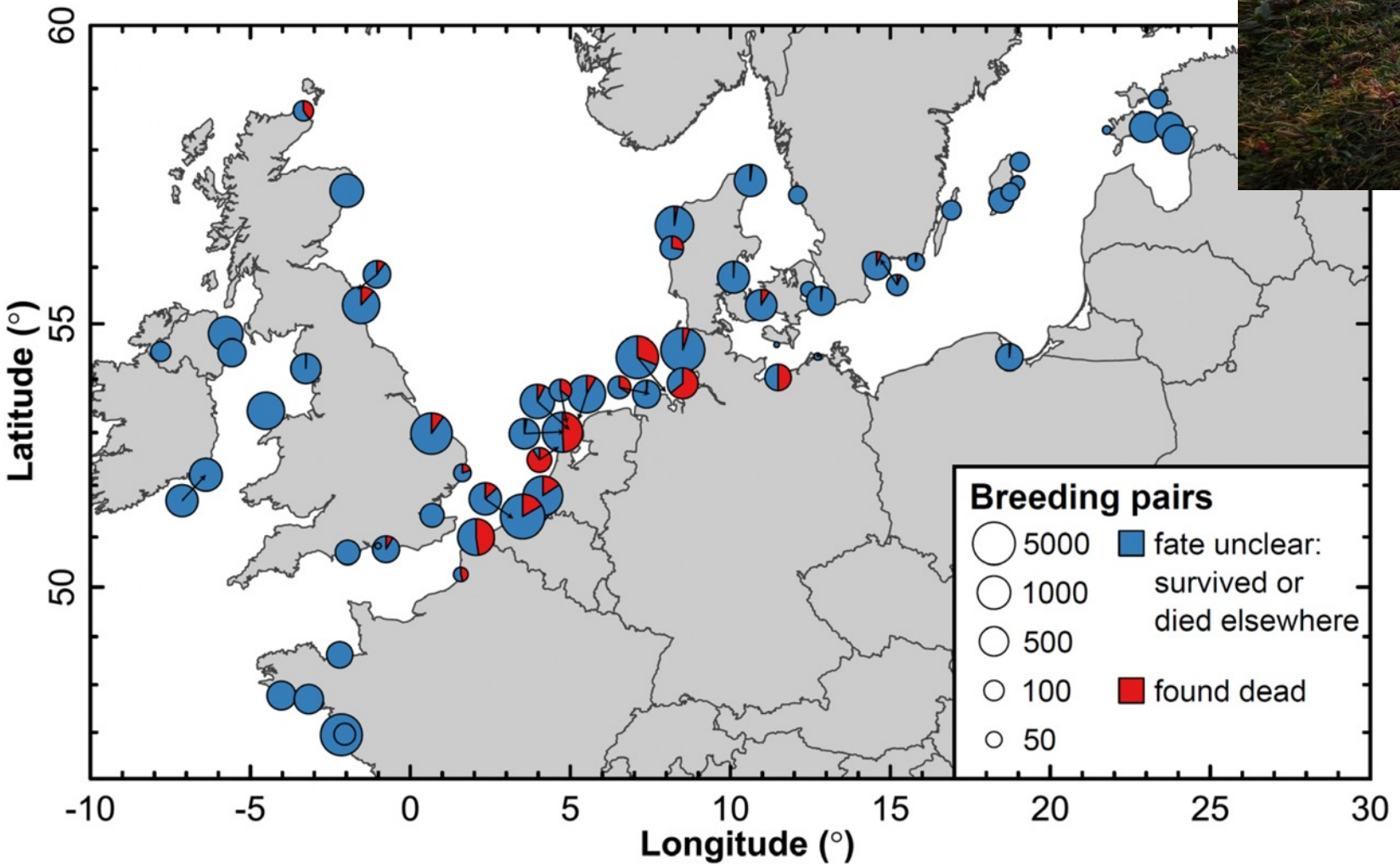


Lane et al. 2023. High pathogenicity avian influenza in Northern Gannets. bioRxiv

Notable HPAI outbreaks in seabirds

Population level effects: Sandwich Terns

17% of European population of Sandwich Terns died
Almost 100% mortality of chicks in affected colonies

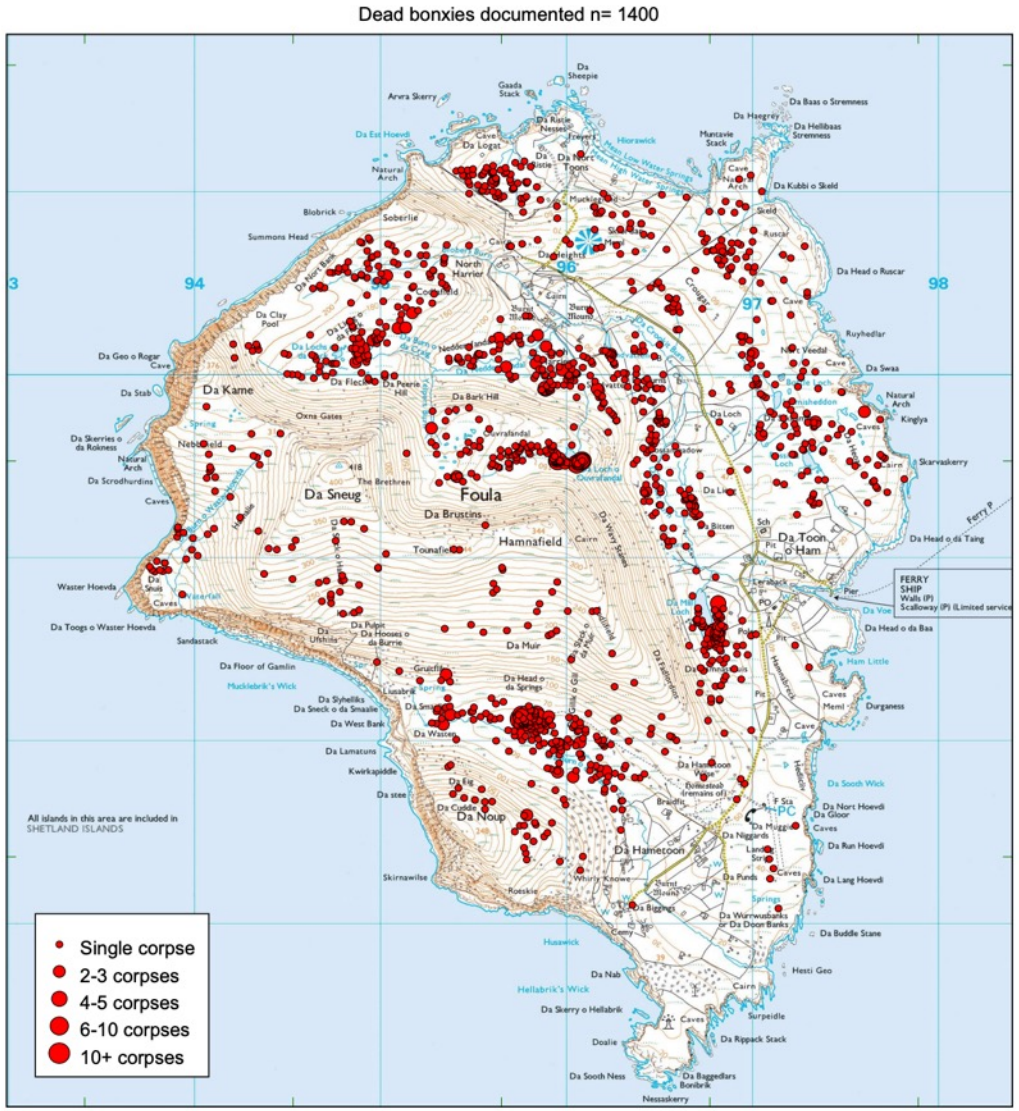


Knief et al. 2023. Highly pathogenic avian influenza causes mass mortality in Sandwich Tern breeding colonies across north Western Europe. bioRxiv

Notable HPAI outbreaks in seabirds

Population level effects: Great Skuas

1500 dead Skuas found, with a decrease of 60-70% in occupied territories



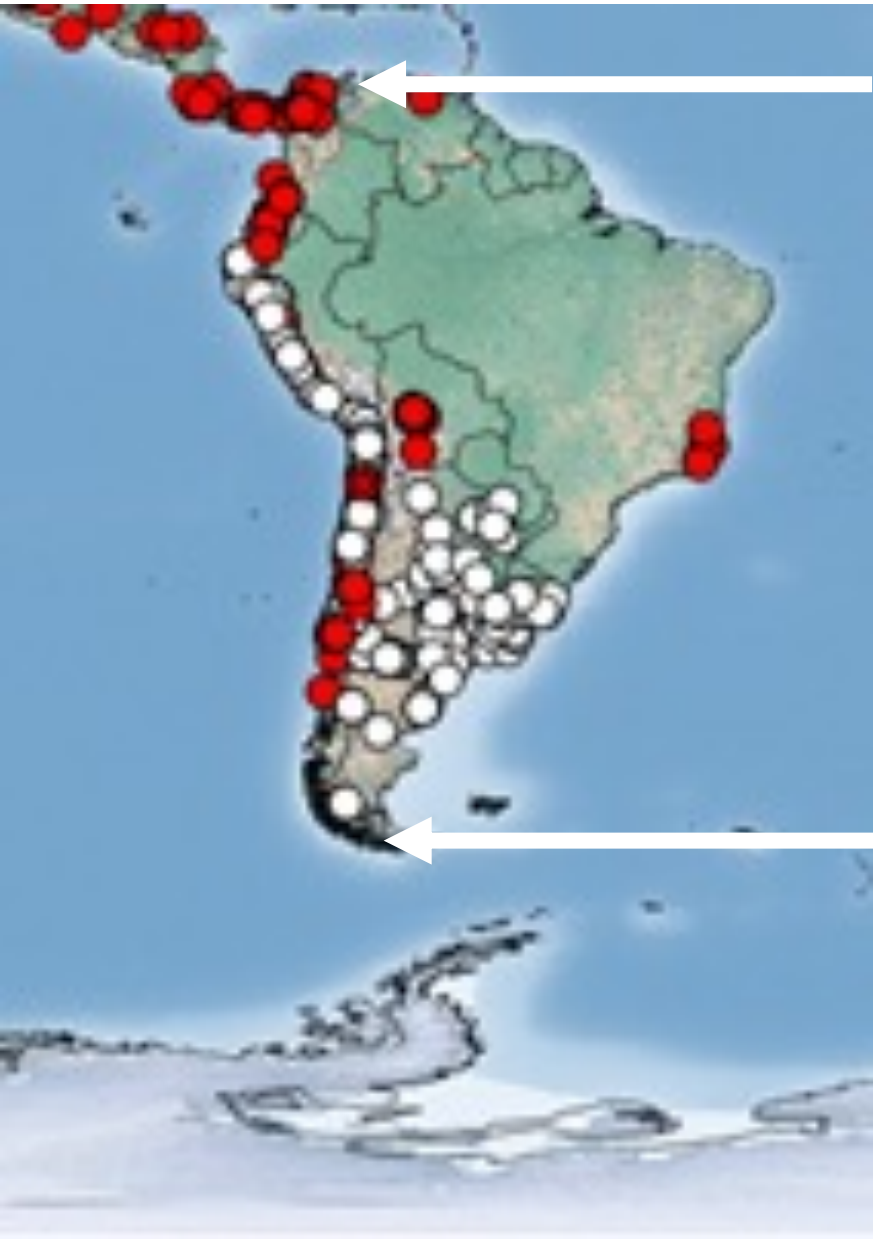
Camphuysen & Greer. 2022. Great Skuas and Northern Gannets on Foula, summer 2022. NIOOZ report

Notable HPAI outbreaks in seabirds

In Peru:
229,554 Peruvian boobies (*Sula variegata*)
201,047 guanay cormorants (*Leucocarbo bougainvillii*)
57,335 Peruvian pelicans (*Pelecanus thagus*)
5,573 Inca terns (*Larosterna inca)*

“40% of Peruvian Pelicans in Peru died due to HPAI”

Notable HPAI outbreaks in seabirds



3-4 introductions, starting ~Oct 2022

~6000km in < 6 months

First detection Tierra del Fuego, March 2022

South American outbreaks

Notable HPAI outbreaks in seabirds

Gateways to Antarctica: Africa

"By 17 January 2019, more than 200 penguin carcasses had been retrieved, several sick birds were seen on the island, and more carcasses were reported by tour boats in the surrounding waters."

Molini et al. 2020. Avian influenza H5N8 Outbreak in African Penguins, Namibia, 2019. J. Wildlife Dis

October 04, 2022 5:04 PM

Vicky Stark

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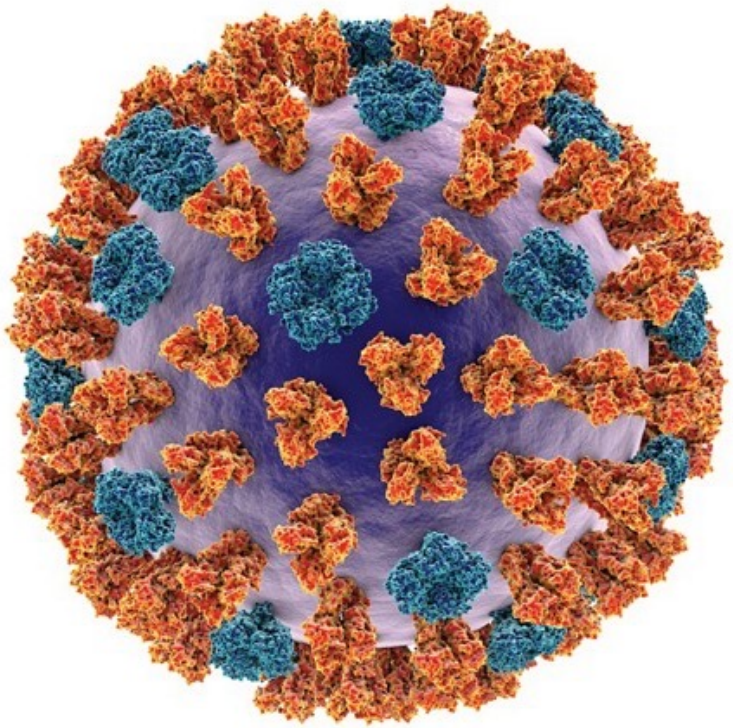
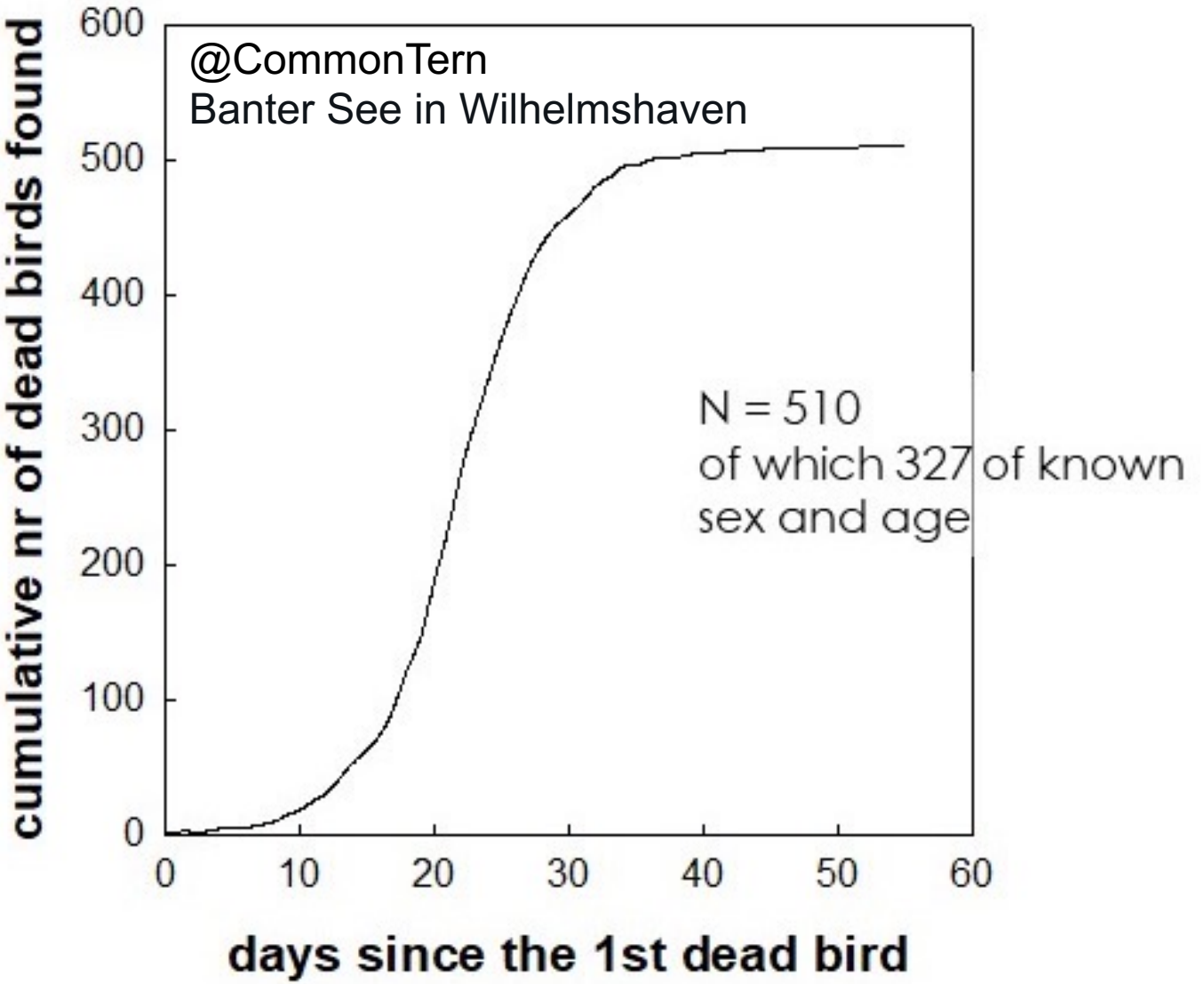
Bird Flu Hits Colony of Endangered Penguins in South Africa



HPAI disease signs

HPAI disease signs in seabirds

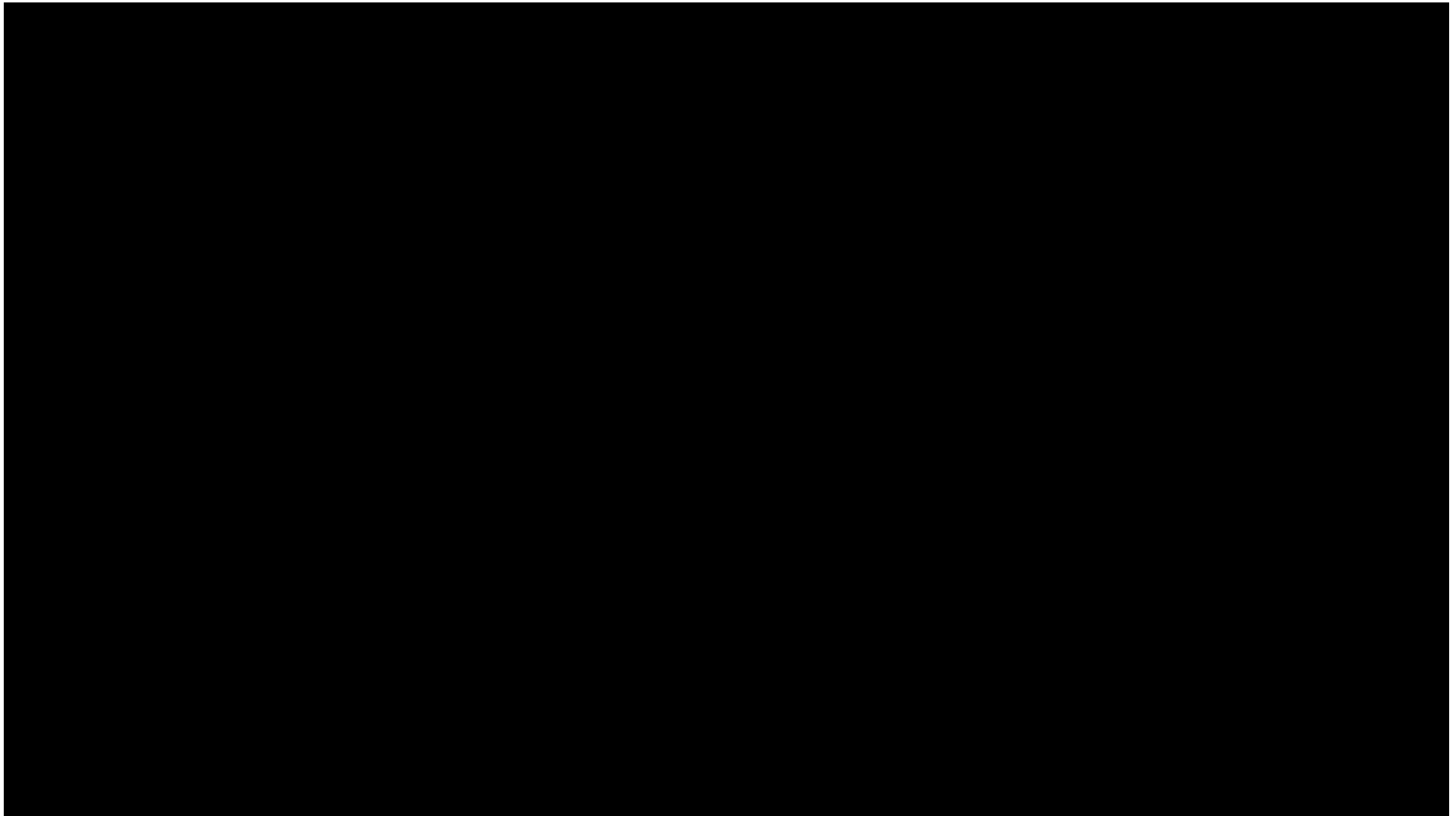
first bird found dead: 29.05.2022
last bird found dead: 20.07.2022
H5N1 confirmed



HPAI disease signs in seabirds

Rijks et al. 2022. Mass mortality caused by highly pathogenic avian influenza virus in sandwich terns, the Netherlands, 2022. EID

Jacob Davies, BTO



SANCOB

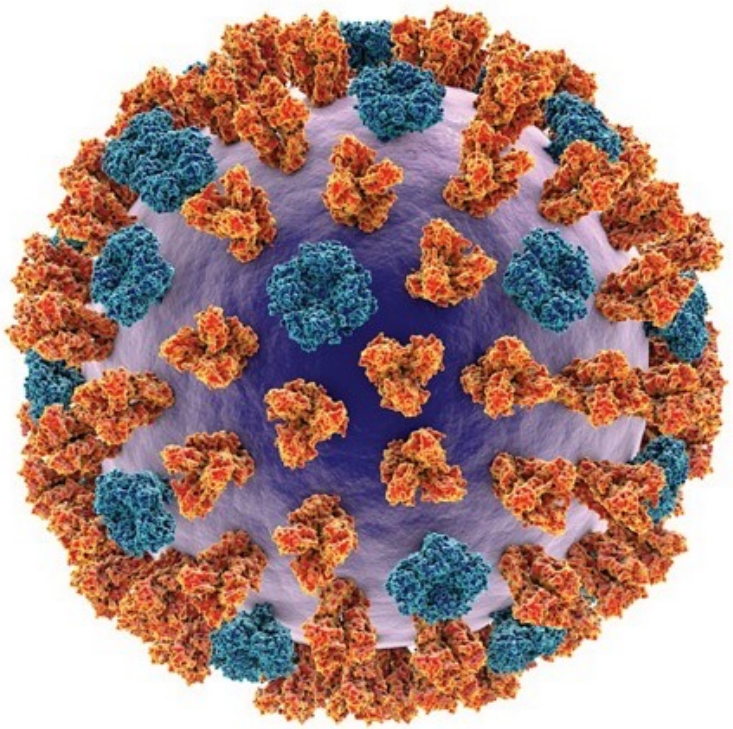
SANCOB

HPAI disease signs in seabirds

- Neurological signs such as loss of coordination and balance, trembling head and body, or twisting of the neck

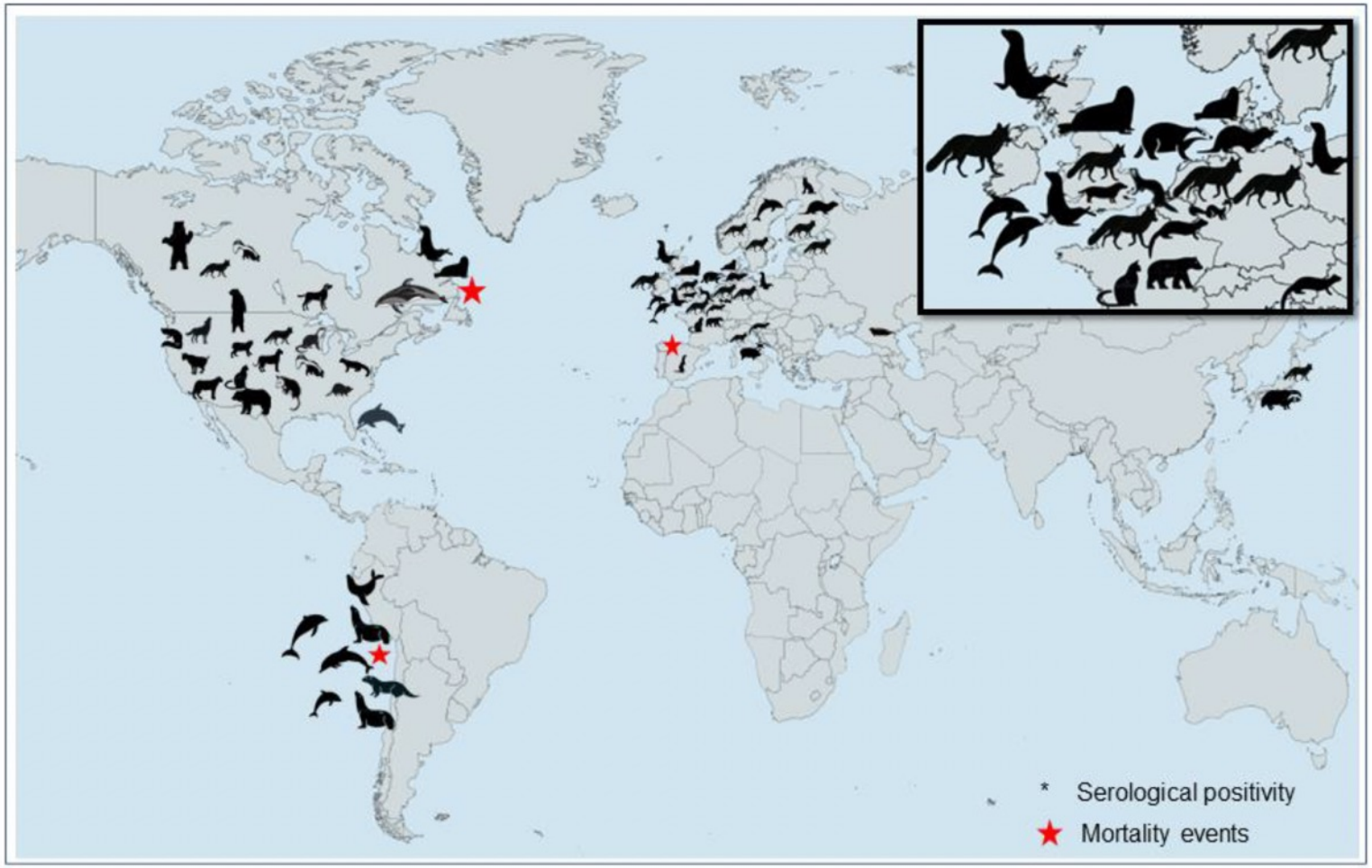
  Lethargy and depression, unresponsiveness, lying down, drooping wings, dragging legs,
- Closed and excessively watery eyes, possibly with opaque cornea or darkened iris (new symptom associated with current outbreak),
- Respiratory distress such as gaping (mouth breathing), nasal snicking (coughing sound), sneezing, gurgling, or rattling,

- Sudden and rapid increase in the number of birds found dead between visits,



HPAI in mammals

HPAI in mammals

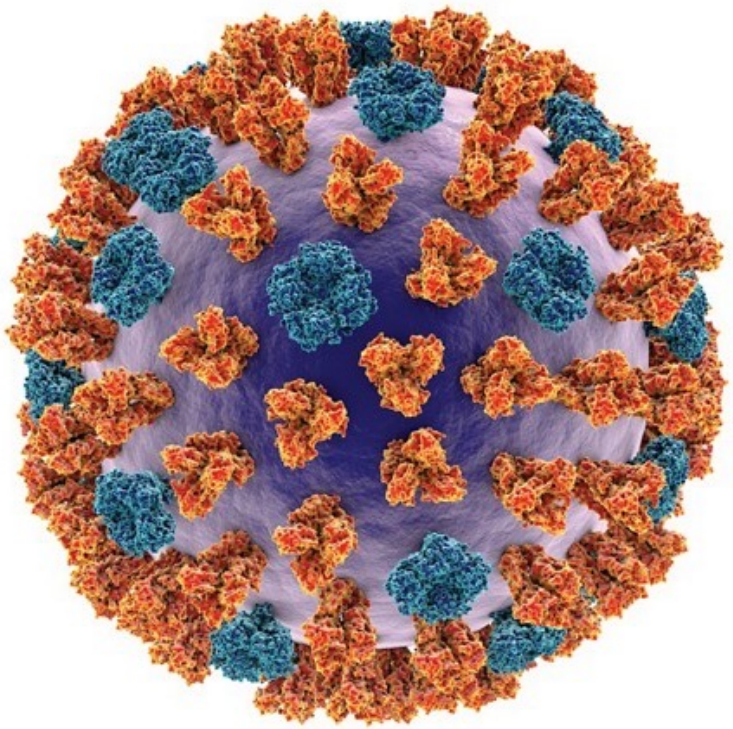


American black bear (Ursus americanus)
American mink (Neogale vison)
American pine marten (Martes americana)
Amur leopard (Panthera pardus orientalis)
Amur tiger (Panthera tigris)
Asiatic black bear (Ursus thibetanus)
Bobcat (Lynx rufus)
Beech marten (Martes foina)
Bottlenose dolphin (Tursiops truncatus)
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)

EFSA. 2023. Avian Influenza overview, May – June 2023

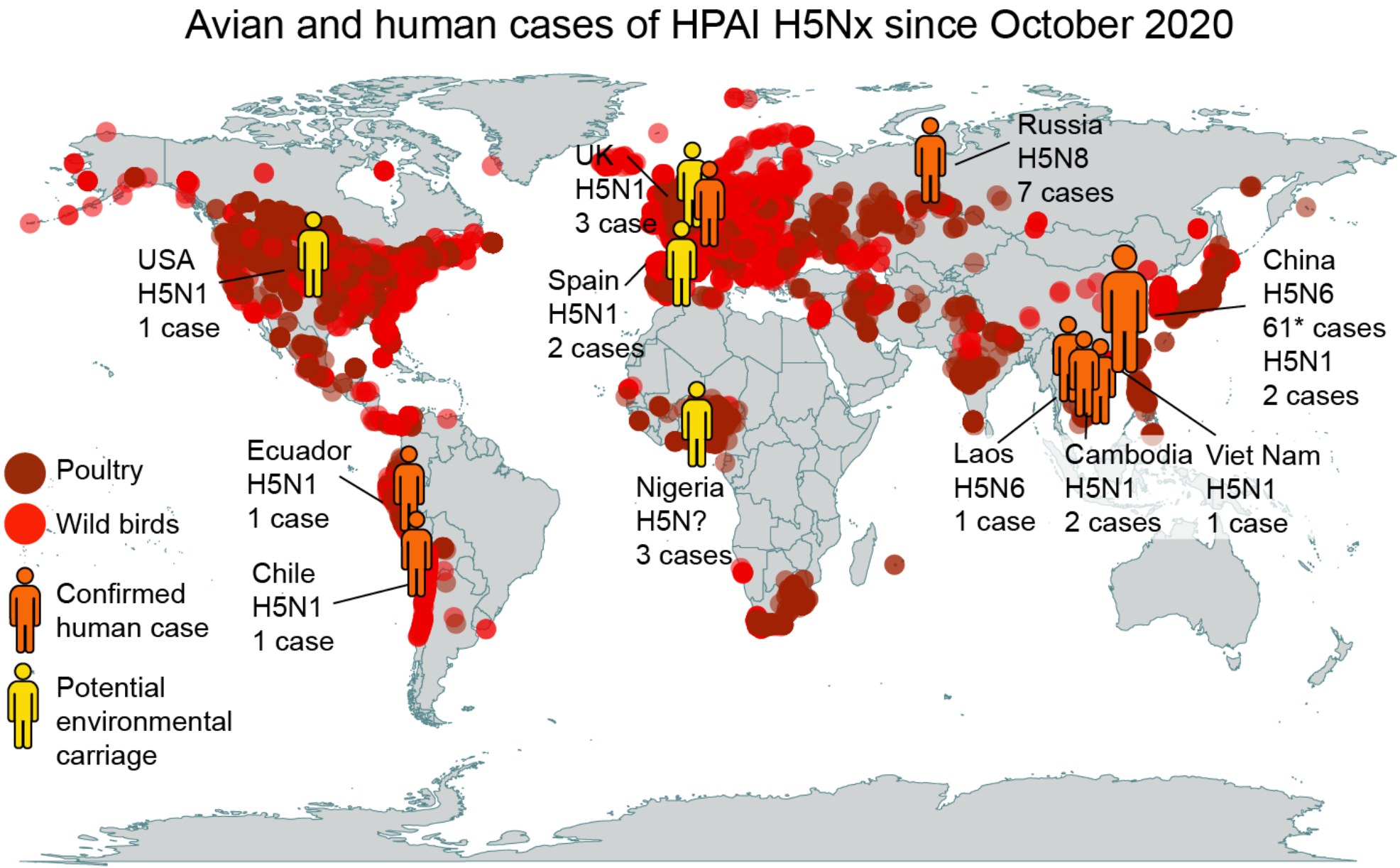
HPAI in South American SeaLions

Gamarra-Toledo et al. 2023. bioRxiv.
First Mass Mortality of Marine Mammals Caused by Highly Pathogenic Influenza Virus (H5N1) in South America



Risk to humans

HPAI is zoonotic



Wille, Barr, Klaassen. 2023. Pursuit

HPAI is zoonotic

In the event of emergence in humans:

- The WHO has a candidate vaccine virus selected, but no vaccine production yet.
- All influenza antivirals on the market (Tamiflu, Baloxavir, Zanamivir etc) work against this virus

HPAI is a category 3 pathogen = requires PPE and proper level 3 laboratory facilities