the rise of AI

TEXT **PETER RYAN & LAURA ROBERTS**

Avian influenza (AI) or 'bird flu' hit the headlines in 1996, when the evolution of a virulent new strain on a Chinese goose farm raised concerns that the virus might cause a pandemic in people. Thankfully this did not materialise, but repeated outbreaks over the past decade have had major impacts on domestic and wild birds. Since 2021, the latest strains of the H5N1 bird flu virus have caused unprecedented mortality in a wide range of birds, including several threatened species.

We've all suffered from colds and flu. Both are viral infections that manifest largely as ailments of the respiratory tract. Colds are caused by a range of viruses and their symptoms tend to be less severe than flu. Influenza viruses belong to the family Orthomyxoviridae and four types are recognised. Flu symptoms vary greatly, depending on the strain involved and the age and health of the host, but they can be severe and even fatal.

The most widespread flu virus is Type A, which occurs in birds and mammals. Types B and C infect mainly humans, and Type D occurs in cattle and pigs. Although these types are placed in separate genera, they probably evolved within the past 10 000 years. Avian influenza viruses evolve extremely rapidly, partly because there are fewer checks during the replication of their single-stranded RNA genome, and partly because swapping of gene segments can occur in hosts infected with two different viral strains. Influenza A viruses are most worrying from a human health perspective because they have been responsible for all flu pandemics. Since 1500, there have been at least 14 pandemics, of which the most severe, the Spanish flu of 1918, killed some 50 million people.

PETER RYAN

OPPOSITE Birders can help with HPAI surveillance by reporting concentrations of dead and dying birds, such as these Kelp Gulls.

Influenza A viruses are endemic in ducks and geese and in gulls, terns and shorebirds, where they usually infect epithelial cells in the lower intestinal tract and are transmitted via faecal contamination of water and food. They tend to be quite benign, causing few overt symptoms, and are termed Low Pathogenicity Avian Influenza (LPAI) viruses. However, in 1878 a novel strain of High Pathogenicity Avian Influenza (HPAI) or 'fowl plague', which caused widespread organ failure, appeared on an Italian chicken farm. Since then, HPAI outbreaks have become increasingly common with the rapid growth of industrial poultry production (see box).

Once established on a farm, HPAI can only be stopped by isolating the facility and killing all the birds. Avian flu viruses are able to survive for long periods outside hosts, especially at low temperatures, so biosecurity is important. Each poultry farm should be managed as an isolated unit, not sharing equipment, staff or birds with other farms, and contact with wild birds should be prevented.

Our knowledge of HPAI has grown substantially since the advent of modern sequencing tools, which have not only made it easier to confirm whether a bird is infected, but also to determine which strain is involved and where it could have originated. Influenza A viruses are divided into sub-types based on the structure of their two surface glycoproteins: haemagglutinin (H) >

THE PRICE OF SUCCESS

The Red-billed Quelea is currently the most abundant wild bird, although its population of some 1.5 billion individuals would have been overshadowed by the vast flocks of Passenger Pigeons in eastern North America that may have numbered up to five billion birds. Both are trivial, however, compared to the more than 30 billion chickens worldwide: some 23 billion broiler chickens raised for their meat, and eight billion egg-laying hens.

Chickens are large birds and their biomass is estimated to be three times that of all other birds combined! Bred to grow up to five times larger than their ancestor, the Indian Jungle Fowl, they also grow three times faster, which means that broiler chickens only live for 5–7 weeks before being slaughtered. Egg-producing hens might survive up to a year, laying around 250 eggs.

Overall, some 70 billion chickens are killed for their meat each year. Add to this more than 1.2 trillion chicken eggs, and chickens are now the single most important source of protein for humans. Ethics aside, industrial poultry production promotes the evolution of avian diseases that now threaten many wild bird species. We need to reduce our animal protein intake and limit food waste to reverse the steady growth in livestock production and its many environmental impacts, which range from driving habitat loss to promoting climate change.

JESSICA KEMPER (2)

DAVE NICOL

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TOP, LEFT African Penguins that died from avian influenza on Halifax Island, Namibia, in 2019 were burned in pyres to destroy the virus.

TOP, RIGHT Adult Northern Gannets that survived after contracting avian influenza in 2022 developed dark irises, allowing researchers to identify them in the field.

ABOVE, LEFT An African Penguin is tested for avian influenza by taking a cloacal swab sample.

ABOVE, RIGHT Depression, unusual docility and weakness are among the possible clinical signs of HPAI, shown here in a Common Tern.

and neuraminidase (N). Each protein has a variety of forms – H1–H18 and N1–N11 – resulting in 198 potential combinations (H1N1, H1N2, etc.) High pathogenicity forms result from mutations in the H gene, with the most destructive HPAIs in birds involving H5 and H7. By comparison, H1N1 viruses were responsible for human pandemics such as Spanish flu in 1918 and 'swine flu' in 2009.

In South Africa, H5N2 HPAI was detected in farmed Ostriches in 2004, 2006 and 2011, resulting in thousands of Ostriches being culled. Since 1991, monitoring of farmed Ostriches has detected the presence of LPAIs involving H1, H5, H6, H7, H9 and H10, indicating regular infections from wild bird populations. In the case of H7N1 infections in 2012, the source population was thought to be Sacred Ibis, which sometimes forage in Ostrich pens. Minimising contact between wild and farmed birds is a key measure to reduce the risk of cross-infection.

The first well-documented record of an HPAI outbreak among wild birds was from South Africa. Thousands of Common Terns infected with a virulent strain of influenza A died along the Cape coast between Lambert's Bay and Algoa Bay in April and May 1961. However, until 1996, such events tended to be short-lived, with HPAI viruses largely confined to poultry farms.

THE RISE OF ASIAN BIRD FLU

In 1996, a novel strain of H5N1 virus appeared in domestic geese on a farm in Guangdong, China, and spread rapidly among poultry facilities in South-East Asia. It also became established in wild bird populations and affected some mammals, including small numbers of humans. To date, Asian H5N1 bird flu has been detected in nearly 900 people worldwide. Most required hospitalisation and more than half have died.

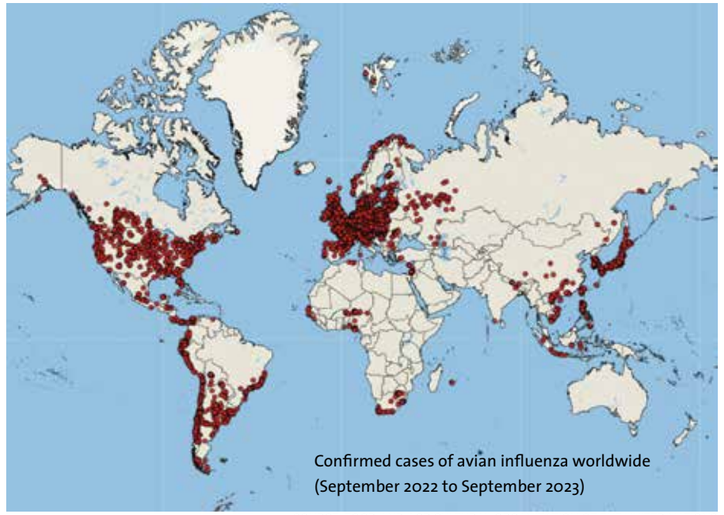
By 2008 the Guangdong H5 virus had evolved four distinct variants in Chinese poultry facilities and recombined with N2, N5, N6 and N8 strains. Clade 2.3.4.4 variants spread out of China in 2014 and were carried across Eurasia and to North America by migrating waterfowl, triggering a series of HPAI outbreaks in poultry and wild birds. The first event to have a significant impact in southern Africa started in 2016, when clade 2.3.4.4 H5N8 strains entered Africa from Eurasia. In January 2017, hundreds of White-winged Terns died on Lake Victoria. Multiple variants of this H5N8 virus reached South Africa in mid-2017, probably carried by intra-African duck movements, and caused havoc in the poultry industry. In the Western Cape, more than 70 per cent of egg-laying hens had to be killed. The virus was recorded from a variety of wild birds, including geese, ibises, herons, shorebirds, guineafowls, pigeons, crows, sparrows, cranes, hawks, falcons and owls.

It was the impact on seabirds, however, that was most worrying. During the summer of 2017/2018, at least 7000 seabirds died. Most were Greater Crested (Swift) Terns, but hundreds of endangered African Penguins, Cape Gannets and Cape Cormorants also perished. The virus reached Namibia the following summer, killing hundreds of African Penguins on Halifax, Ichaboe and Mercury islands. For the first time, avian flu was posing a significant direct threat to wild birds.

In 2021 a new clade 2.3.4.4 H5N1 variant emerged, triggering outbreaks across Eurasia and Africa. This time Cape Cormorants were hardest hit in southern Africa, with some 25 000 birds dying in South Africa and at least 6500 in Walvis Bay, Namibia. Once again, hundreds of African Penguins died, a toll their struggling population can ill afford.

Despite the scale of these mortalities, the impacts locally have been modest compared to those experienced elsewhere in the world. In Europe, 40 per cent of Dalmatian Pelicans died. In Scotland, up to 90 per cent of Great Skuas died at some colonies, as did 11 000 adult Northern Gannets from Bass Rock, the world's largest colony of the species. Seventeen per cent of Sandwich Terns died across Europe, and Belgium lost 10 per cent of its Peregrine Falcons. Unlike previous outbreaks, which tended to peter out after a few months, mortalities continued throughout 2022 and into 2023.

The virus spread to North America, killing more than 60 per cent of Caspian Terns breeding on Lake Michigan, and reached South America late in 2022. Its impact has been particularly severe along the west coast, which historically has had less exposure >



Confirmed cases of avian influenza worldwide (September 2022 to September 2023)

SOURCE: FOOD AND AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS

CURBING THE SPREAD

We can slow the spread of HPAI by:

- Rapidly detecting, reporting and responding to outbreaks.
- Composting, burying or incinerating carcasses to limit transmission.
- Enforcing strict biosecurity measures at poultry farms.
- Reducing poultry farm size and density.
- Siting poultry farms away from wetlands where waterbirds aggregate.
- Exploring the option of vaccinating poultry against HPAI.
- Improving HPAI surveillance in humans and other mammals.

Birders in particular can help by:

- Reporting large-scale bird deaths (see box overleaf), as early detection of outbreaks is crucial.
- Avoiding areas where large numbers of waterbirds breed or roost, especially where outbreaks have been confirmed.
- Avoiding ringing or handling wild birds during HPAI outbreaks. Be especially cautious when handling waterfowl or in areas near waterbodies. HPAI can be transferred between birds by contaminated hands, bird bags and other equipment.

In addition, aviculturists should prevent contact between captive and wild birds.

to avian influenza because only small numbers of waterfowl cross the Andes. Almost half of all Peruvian Pelicans died in early 2023, as well as thousands of boobies, cormorants, gulls and terns.

The current H5N1 outbreak has yet to reach Australasia or Antarctica. Australasia has even fewer waterfowl migrants than the west coast of South America, so many of the LPAI strains found there are quite distinct, having undergone isolated local evolution. However, H5N1 has reached Indonesia and is likely to get to Australia eventually.

Although Antarctica is the most isolated continent, its seabirds are exposed to avian flu, at least around the Antarctic Peninsula, due to exchanges with birds in southern South America. There is considerable concern that the current H5N1 strain could reach Antarctica and strict quarantine measures need to be enforced to limit the risk of humans introducing it to Antarctica and the sub-Antarctic islands.

Is there a silver lining? Both locally and in Europe, seabird species impacted in one year have generally been spared in the next; only African Penguins have shown continued significant mortality, albeit in different colonies. At Bass Rock, Northern Gannet numbers recovered more quickly than expected. Unfortunately, new outbreaks are still occurring. In 2023, Black-headed Gull colonies have been badly impacted across much of Europe, and in West Africa tens of thousands of West African Crested Terns, plus smaller numbers of other terns, gulls, cormorants and pelicans, have died.

Another worrying development is the diversity of mammals infected with H5N1, including cats, dogs and other canids, seals, dolphins, pigs and rodents, as well as a few people. The good news is that, to date, the viruses in infected mammals have not evolved increased specificity to mammalian receptors. Most cases involve carnivores that probably caught the disease by eating infected carcasses; the people had close contact with infected poultry. However, the increasing incidence in mammals is once again raising the spectre of a significant outbreak in humans. If a strain evolves that can transmit freely among people, pundits expect the death toll to be much greater than that of the Covid-19 pandemic.

Fortunately, commercial and conservation priorities are aligned in striving to prevent the spread of the virus. The United Nations' Food and Agriculture Organization (FAO) has called on governments to treat the avian influenza outbreak as a conservation issue, with environmental agencies taking responsibility for the wildlife aspects of the disease.

Just as these viruses constantly evolve, so do their impacts. Readers are encouraged to check the FAO and World Health Organization websites for updates. ◆

WHAT TO DO IF YOU FIND SICK OR DEAD BIRDS

If you find a bird that looks weak or tame, cannot fly or has tremors, twitches or seizures, or if its eyes are droopy or cloudy, it may have bird flu. Contact your closest seabird rehabilitation centre (listed below). Tell them your location, the species found and its symptoms. If they ask you to move the bird, wear disposable gloves or put a bag over your hands and keep the bird well away from your clothes and face. Transmission is mainly through nasal secretions, saliva or faeces, but there is a small risk of infection from breathing in viruses attached to droplets or dust in the air. Make sure you wash your hands and change your clothes as soon as possible. As HPAI cannot be treated in birds, you may be asked to take the bird to a vet to be euthanised.

Single dead birds are not unusual on beaches or at wetlands. However, it is best not to touch them and not to let pets do so. If you see five or more dead birds in the same area, there could be a problem that needs investigation. Record the date, the number and species of dead birds and the name and GPS location of the site. Take close-up photographs, especially if you are not sure of the species. Do not touch the carcasses unless you have disposable gloves or can wash your hands immediately. Report the information to the closest seabird rehabilitation centre, the local conservation authority, BirdLife South Africa or the local state veterinarian.

old.dalrrd.gov.za/Branches/Agricultural-Production-Health-Food-Safety/Animal-Health/contacts/provincialveterinary

SEABIRD RESCUE AND REPORTING ORGANISATIONS

Province	Location	Organisation	Phone	E-mail/Website
W Cape	Cape Town West coast	SANCCOB	021 557 6155 078 638 3731 (a/h)	*reception@sanccob.co.za* *sanccob.co.za*
W Cape	Gansbaai Hermanus	African Penguin & Seabird Sanctuary	072 598 7117	*apss@dict.org.za* *dict.org.za*
W Cape	Mossel Bay	SAPREC	082 364 3382	*info@saprec.co.za* *saprec.org*
E Cape	Gqeberha	SANCCOB	041 583 1830 064 019 8936 (a/h)	*reception@sanccob.co.za* *sanccob.co.za*
KZN	whole coast (penguins)	uShaka Sea World	031 328 8222 031 328 8060 (a/h)	*saambr.org.za/ushaka-sea-world*
KZN	S of Umkomaas (other seabirds)	SCAR	083 246 6765	*admin@scar-rescue.co.za* *scar-rescue.co.za*
KZN	N of Umkomaas (other seabirds)	CROW	031 462 1127 031 469 0583 083 212 5281 (a/h)	*info@crowkzn.co.za* *crowkzn.co.za*