



Animal &
Plant Health
Agency

Scientific opinion on the incursion of High Pathogenicity Avian Influenza (HPAI) H5N1 into housed or not housed poultry flocks and captive birds

Date: March 2023 (an update to the January 2023 report)

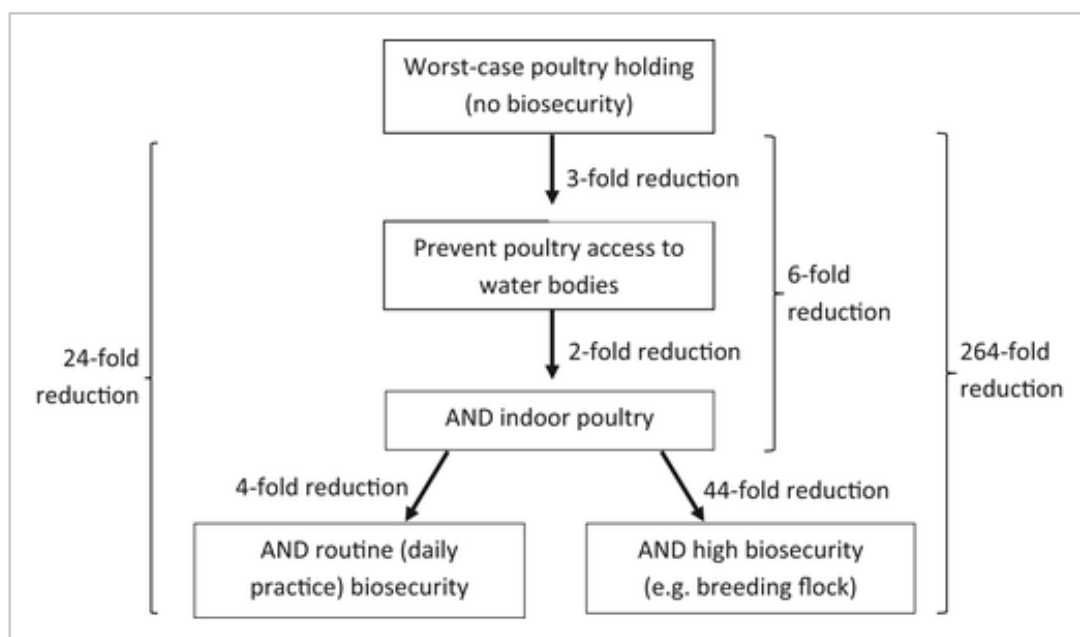
Overview

The scientific opinion on the incursion of highly pathogenic avian influenza (HPAI) H5N1 into housed and non-housed birds (domestic poultry and captive birds) in Great Britain (England, Scotland and Wales) from direct and indirect contact with wild birds in winter 2022 to 2023 is updated here to accommodate the wild bird cases and poultry outbreak reports to 31 March 2023. This scientific opinion was previously updated on [31 January 2023](#). The epidemic curve for the 2022 to 2023 season started earlier in Great Britain than in previous years with much higher numbers of reports in poultry, captive birds and wild birds in early autumn. This is consistent with the virus circulating in wild birds including seabirds over the summer of 2022 and spilling into resident wild waterbirds in the early autumn of 2022 with amplification as they gathered at their wintering sites. A housing order came into force across the whole of [England on 7 November 2022](#) and then across [Wales on 2 December 2022](#).

The [European Food Safety Authority \(EFSA\) in 2017](#) used expert opinion to assess the effectiveness of various biosecurity measures in preventing outbreaks.

As can be seen in Figure 1 from the EFSA (2017) expert opinion below, preventing access to waterbodies was thought to lead to a threefold reduction in incursions and when combined with housing a 6-fold reduction would be achieved. Where housing was combined with other biosecurity measures the risk of incursion could be reduced further.

Figure 1: Risk reductions from EFSA (2017) showing the estimated effect of implementing stepwise biosecurity measures on the protection of poultry holdings from avian influenza incursions



Housing orders have been put in place across Great Britain three times since 2016 (in the 2016 to 2017, 2020 to 2021 and 2021 to 2022 seasons) as a preventative measure to the estimated increased risk to poultry from wild birds. EFSA (2017) used expert opinion as there was insufficient published evidence to assess the efficacy of housing or biosecurity on the prevention of HPAI. The opinion concluded that housing as a standalone measure (that is in the absence of other biosecurity measures such as foot dips, cleaning equipment, preventing access to wild birds and rodent control) is likely to reduce the number of outbreaks and estimated a two-fold reduction in risk but would not prevent all outbreaks. It recommended that a suite of biosecurity measures should be implemented, alongside appropriate training. Nevertheless, the paper did highlight that outdoor poultry holdings bear an increased risk of avian influenza incursions and the applicable biosecurity measures are more limited where birds are not confined to housing.

Here the current (31 March 2023) HPAI risk levels in Great Britain are communicated, based on current control measures and the infection pressure for different areas of Great Britain from wild bird abundance. The key points relating to the current situation are:

1. The outbreak in 2021 to 2022 was unprecedented with HPAI H5N1 being identified in wild birds and holdings with kept poultry in Great Britain over the summer months of 2022. As such the risk levels in the 2021 to 2022 season never dropped below low for poultry (with high uncertainty for premises with poor biosecurity and low uncertainty for premises with stringent biosecurity), or below medium for wild birds.
2. In the 2021 to 2022 season (1 October 2021 to 30 September 2022) there were 152 infected premises (IPs).
3. HPAI H5 wild bird detections continued across Great Britain throughout the summer and into the 2022 to 2023 season, with 146 detections from 1 October 2022 to 24 October 2022. The majority were found in England (124), followed by Wales (19) and Scotland (3).
4. Since the start of the 2022 to 2023 season (1 October 2022 to 31 March 2023), there have been 174 confirmed IPs, with 148 in England, 21 in Scotland and five in Wales.
5. Following the high number of HPAI detections in wild birds and IPs in October 2022, the risk level was increased to VERY HIGH for wild birds on 21 October 2022 and the risk levels to poultry were increased to HIGH (with low uncertainty) where biosecurity is sub-optimal and increased to MEDIUM (with high uncertainty) where biosecurity is stringent (practicing the highest standards of biosecurity) on 14 October 2022.
6. Avian Influenza Prevention Zones (AIPZs) were declared in [England, Scotland, Wales, and Northern Ireland on 17 October 2022](#). The AIPZ requires keepers and personnel working with poultry to take additional biosecurity measures. The AIPZ in England is additional to the AIPZ which was declared in [Norfolk, Suffolk and parts of Essex on 27 September 2022](#), following an increase in the number of HPAI IPs with domestic poultry in the region and additional housing measures came into force for [Norfolk, Suffolk, and parts of Essex on 12 October 2022](#). This means that all bird keepers in these areas (whether they have pet birds, commercial flocks or just a few birds in a backyard flock) are currently required by law to take a range of

biosecurity precautions, including housing their birds (except in very specific circumstances). Following an increase in the number of Infected Premises in England, and ahead of the peak migration period, housing measures came into force across the whole of England on 7 November 2022 and on 2 December 2022, additional compulsory biosecurity and housing measures came into force across Wales. This means that all bird keepers in these countries (whether they have pet birds, commercial flocks or just a few birds in a backyard flock) are required by law to take a range of biosecurity precautions, including housing their birds (except in very specific circumstances).

7. There are a number of risk pathways for the introduction of HPAI from wild birds to domestic birds. Transmission between infected wild birds and kept birds can occur as a result of direct transmission where the virus spreads from one bird to another or indirect transmission (wild birds contaminate objects and the environment) which kept birds then come into contact with).
8. Spread of HPAI between premises when disease control measures and keeper awareness are high has been rare in the UK. Nevertheless, in the 2021 to 2022 season, and so far in the 2022 to 2023 season, there has been an unprecedented number of poultry outbreaks and the source of infection (lateral spread, separate incursions from wild birds or from a heavily contaminated environment) in commercial farms is still under investigation.
9. Since 01 October 2022, infection in resident wild bird species including waterfowl and gulls (such as mute swans, Canada geese, greylag geese and black-headed gulls) has continued to be reported, as well as infection in a smaller number of migratory waterbird species (mainly whooper swans, pink-footed geese and barnacle geese). Pheasants and several raptor species including common buzzard and sparrowhawk have also been reported.
10. HPAI H5N1 also continues to be reported in wild birds and poultry across northern Europe throughout the winter of 2022 to 2023. However, unlike in the autumn months, detections of HPAI in wild birds in Europe at this time of year (end of March) are of less relevance to future risks to Great Britain because all the over-wintering migratory ducks, geese and swans are starting to depart from Great Britain on their return journey through Europe to their breeding sites.
11. The risk levels for Great Britain are **HIGH** for wild birds, **MEDIUM** (with high uncertainty) where biosecurity is sub-optimal and **LOW** (with high uncertainty) where biosecurity is stringent (practicing the highest standards of biosecurity).
12. Since early January 2023 the number of wild bird cases, both reported and testing positive has fallen, from 68 positive cases in the first week of January to seven positive cases in week 13 (late March). The sensitivity of detection of wild bird cases has been at maximum since the beginning of March with the threshold for swans and geese found at the same site in England at one dead bird. The risk in wild birds is considered **HIGH**. From a risk assessment perspective at least, the poultry risk levels are expected to decrease in line with the wild bird risk. The rate of poultry IPs is roughly 1 every fortnight through March 2023 representing sporadic cases. This is markedly down from the 27 and 26 IPs in the second and third weeks of October 2022, respectively.

Introduction

This scientific opinion is aimed assess whether the continued implementation of housing of poultry is likely to reduce the number of outbreaks in Great Britain in April 2023 to aid policy decisions.

In an unprecedented 2021 to 2022 season, HPAI H5N1 persisted in Great Britain over the summer months of 2022, with the virus maintained in breeding wild birds (including colony breeding seabird populations and gulls). In early autumn 2022, detections shifted to resident waterbirds (Canada geese, greylag geese, mute swans and gulls) prior to the arrival of the autumn migratory waterbirds. Farmland and woodland bird species were also affected including 60 common buzzards and 44 pheasants. The arrival of the migratory waterbirds during November and December did not seem to markedly increase the number of wild bird detections with most cases still in the resident species, although it should be noted that in England on the 12 December 2022, the surveillance threshold for swans and geese was increased, so that a submission would only be made if five dead birds were found, where as previously the threshold had been three dead birds, and this change is likely to have reduced the number of wild waterbird submissions. This has since been changed from five to three in January 2023 and from three to one in March 2023 to increase the sensitivity of detections in wild birds. Based on reports from the dead wild bird surveillance scheme in October 2022, it appeared that the wild bird risk and infection pressure on poultry in Great Britain had increased such that the national risk level for HPAI H5 in wild birds was raised to **very high**. Also in October 2022, the risk to poultry with sub-optimal biosecurity was raised to **high** with **low uncertainty** and the risk for poultry with stringent biosecurity was raised to **medium** with **high uncertainty**, following an increase in the number of Infected Premises (IPs). Subsequently, with the availability of more data showing that the rate of IPs with stringent biosecurity was not increasing, uncertainty in the medium risk for poultry with stringent biosecurity was lowered to **low uncertainty** ([January 2023](#)).

Housing orders have been utilised in Great Britain and also in several EU countries during previous outbreaks of HPAI. **The effectiveness of housing orders on reducing exposure of poultry to virus is difficult to assess.** In the 2021 to 2022 and 2016 to 2017 seasons in Great Britain it is most likely that there would have been a higher number of outbreaks without the housing order in place. However, it is difficult to estimate how many flocks would have been exposed to the virus if the housing order had not been in place, and therefore how many were prevented as a result of the housing order.

EFSA carried out a comprehensive review of the outbreaks of HPAI H5N8 in 2016 to 2017 to assess the risk of introduction of virus into poultry from migratory and residential wild birds (EFSA, 2017).

Through the EFSA (2017) expert opinion, the impacts of various sanitary control measures were estimated, these estimates were considered to be independent of virus characteristics with the results relevant for all HPAI viruses. The relative risk reduction for

entry of the virus from wild birds to poultry was estimated to be **three-fold** by preventing access of poultry to water bodies. It was estimated by expert opinion that housing of poultry gives a further **two-fold** reduction, and by applying routine biosecurity to poultry premises there is a further **four-fold** reduction in risk while high biosecurity leads to a further **44-fold** reduction in risk.

A further supporting document to the 2017 EFSA opinion on the risk of introduction of HPAI into poultry farms in general was a systematic review of previous outbreaks to identify risk factors, this concluded that the main risk factor for introduction is contact with wild birds or fomites contaminated with wild bird faeces. Other important risk factors were poultry species (waterfowl and turkeys are higher risk); the production system, where outdoor systems are higher risk than indoor; and the presence of biosecurity flaws.

It is not possible to assess the impact of housing as a protective measure because it would require epidemiological investigations that are not possible during control of a notifiable disease. In the absence of such data, if we apply the conclusions of the EFSA 2017 paper to the 2021 to 2022 and 2016 to 2017 seasons in Great Britain, it is considered that there would have been a higher number of outbreaks without the housing order in place, as a result of more frequent contacts between poultry and wild birds. However, it is difficult to estimate how many flocks would have been exposed to the virus if the housing order had not been in place, and therefore how many were prevented as a result of the housing order.

Scientific opinion

This scientific opinion is aimed assess whether the continued implementation of housing of poultry is likely to reduce the number of outbreaks in Great Britain in April 2023 to aid policy decisions.

Hazard identification

The hazard identified is the high pathogenicity avian influenza (HPAI) virus H5N1 subtype, as this is the only subtype isolated from the UK during the current season which started on 1 October 2022. Indeed, apart from where the virus has been untyped, all the wild bird cases in Europe since 1 October 2022 have been H5N1 with the exception of H5N5 in a great black-backed gull in Norway in October.

Risk question:

“What is the risk of incursion of HPAI H5N1 into housed and non-housed birds (domestic poultry and captive birds) in England, Scotland, and Wales in April 2023 from direct and indirect contact with wild birds?”

Terminology related to the assessed level of risk

For the purpose of the report, the following terminology will apply (WOAH, 2021):

- **Negligible:** event is so rare that it does not merit consideration
- **Very low:** event is very rare but cannot be excluded
- **Low:** event is rare but does occur
- **Medium:** event occurs regularly
- **High:** event occurs very often
- **Very High:** event occurs almost certainly

Assumptions and uncertainties in H5N1 transmission in wild birds in Great Britain over the winter 2022 to 2023

1. Many of the migratory wild birds (ducks, geese and swans) that over-wintered in Great Britain have departed (late March) with the rest expected to leave by mid-April. This assumption has been taken into account in the recent reduction in the wild bird risk level from **very high** to **high**. There is low uncertainty in this assumption.
2. While no more ducks, geese and swans will enter Great Britain from Europe in March/April (with the exception of small numbers of garganey from Africa in the spring) there may be limited movement of black-headed gulls from Europe where large numbers of HPAI H5N1 cases have been reported over the last few months. There is the possibility of infected gulls flying across the English Channel. However, the numbers may be small and the **high** risk level may not be affected much by this.
3. The possible role of black-headed gulls in serving as a reservoir of transmission at their breeding sites in March through April within Great Britain and maintaining transmission through the summer by infection of other resident breeding bird species including wading bird species that share the scrape habitats with them, other larger gull species and seabirds such as gannets and auks. The role of black headed gulls is currently an unknown and unprecedented situation for Great Britain. There has been one a mass die-off of black-headed gulls has been reported in Leicestershire and Rutland in March 2023. It is not known whether this is a one-off event or if the situation in Great Britain will be similar to that observed in Europe, where multiple die-offs involving black headed gulls have been reported ([WOAH, WAHIS data](#)) (Table 1).
4. The 2022 to 2023 season is epidemiologically distinct from previous years not only because HPAI was present in resident birds in Great Britain before the migratory wild waterbirds arrived, but also because the majority of wild bird cases (irrespective of surveillance threshold) over the autumn and winter is in species resident to Great Britain (mute swans, Canada Geese and greylag geese with some

raptor species and pheasants). The increase in wild bird cases in autumn 2022 started some four weeks earlier than in autumn 2021 with high numbers of cases in wild birds (35 to 61 per week) reported each week in October 2022. Despite the high numbers of wild bird cases recorded weekly over the autumn months in 2022 and into December 2022 there has been a progressive fall in the number of wild bird cases recorded each week from early January 2023. To some extent in January, this decline may have reflected the reduced reporting of waterbird species and difficulties in recovering carcasses due to limited accessibility during the cold weather which froze many inland waters. However, the trend has continued through February and March 2023. In contrast wild bird cases did not fall significantly in January 2022. The progression and epidemiology of the current outbreak are different from previous years and it is not clear for example what effect the departure of the migratory waterbirds at this time of year (late March and early April) will have on the risk. It is anticipated that the current dispersion of wintering aggregates of resident waterfowl to their breeding sites within Great Britain together with higher temperatures and longer day lengths in April will reduce the risk in wild birds. This assumption has been taken into account in the current wild bird risk level which is at **high** and may contribute to further risk level reductions in wild bird risk in the coming weeks. However, this does not take into account the possibility of transmission in black-headed gulls and other gulls in the next few weeks and onward spread to breeding seabird species.

5. Other wild bird species including resident waterbirds (as opposed to migratory waterbirds) may be more important for the transmission of this virus in the 2022 to 2023 season than in previous years when migratory duck, geese and swan species played the role of introducing HPAIV into Great Britain. The role of pheasants is not clear, with 44 cases reported this season to 17 March 2023. The 21 sparrowhawk and six kestrel cases suggest H5N1 may also be in the resident wild bird passerine population, as they make up the main source of sparrowhawk's diet (particularly male sparrowhawks). It is interesting to note that cases in passerine species have been recorded in Europe with a house sparrow and a tree sparrow in Slovenia and a goldfinch in France. Except for 2 carrion crows, there have been no reports of HPAI H5 confirmed in passerines in Great Britain this 2022 to 2023 season. So far this season 20 cases of H5N1 have been reported in black-headed gulls in Great Britain (to 17 March 2023). This compares to 599 cases in Europe between 01 January 2023 and 30 March 2023 (Table 1). The current **high** risk level for wild birds takes into account the presence of virus in resident birds including black-headed gulls.
6. The patterns of movement of gulls are more complex than waterfowl. It is noted that a large number (Table 1) of H5N1 cases in black-headed gulls has been reported in northern Europe particularly Belgium, Switzerland, Italy and France this year. This has not occurred in previous years. Some gull species (but not all) aggregate at night-roosts (usually large waterbodies such as reservoirs) but forage and loaf across the wider landscape, often in wet pasture or tilled fields, exploiting opportunities on farms and also at anthropogenic sites where food may be abundant (sewage treatment facilities, landfill sites, food production facilities, commercial and tourist sites). Therefore, these should not be ignored as potential sites of concern

where in proximity to poultry farms. To date this season, some 64 cases of HPAI H5N1 have been reported in gull species in Great Britain, including 29 black-headed gulls and 18 herring gulls. This is consistent with the increased number of wild bird cases in 2022 to 2023 compared to previous seasons.

7. There is geographical variation in risk across Great Britain, due to the varying demographics of wild birds and poultry.
8. The evidence for the economic benefits and dis-benefits of housing birds is not part of this scientific opinion.

Table 1: Black-headed gull cases in Europe from 01 January 2023 to 30 March 2023 ([WOAH, WAHIS data](#))

Country	January	February	March	Total
Austria	5	5	8	18
Belgium	36	21	1	59
France	54	116	33	208
Ireland	1	1	2	4
Italy	8	59	43	111
Netherlands	5	41	48	94
Poland	0	1	3	4
Serbia	0	0	2	2
Slovenia	0	0	1	1
Spain	2	5	2	10
Switzerland	3	32	53	88
Total	114	281	196	599

Entry assessment

Probability that HPAI H5 is present in Great Britain currently

The 2022 to 2023 season began officially in Great Britain on 1 October 2022. Figure 2 shows that the number of IPs started to increase in the first week of October with not only a higher peak compared to autumn 2021 but also a longitudinal shift in the peak by about one month reflecting the presence of virus in resident wild birds over the summer. Since 1 October 2022 and as of 31 March 2023, there have been 174 confirmed Infected Premises (IPs) in Great Britain, with 148 in England, five in Wales and 21 in Scotland (Figure 3).

Figure 2: cumulative plot showing the number of infected premises in Great Britain in the 2020 to 2021, 2021 to 2022 and 2022 to 2023 seasons. Each season starts on the 1 October. The solid lines represent all GB (red is 2020 to 2021 season, green is 2021 to 2022 season, blue is 2022 to 2023 season). The blue short dashed line represents East Anglia in 2022 to 2023 and the blue long dashed line represents Scotland in 2022 to 2023. Circles and circles with crosses represent the start and end of an AIPZ respectively, while squares and squares with crosses represent the start and end of a housing order respectively. Please note the start of the housing order in the 2022 to 2023 season is for England only, with Wales implementing a housing order 4 weeks later and Scotland not implementing a housing order during the 2022 to 2023 season.

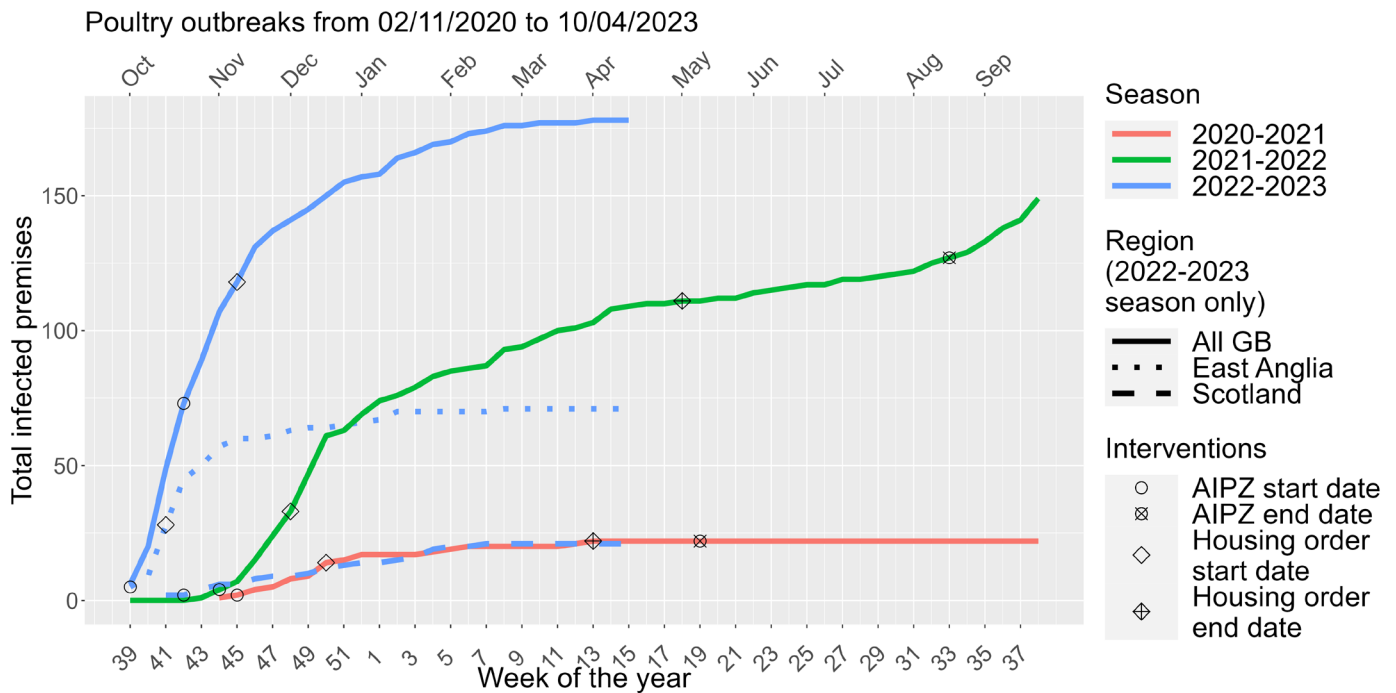
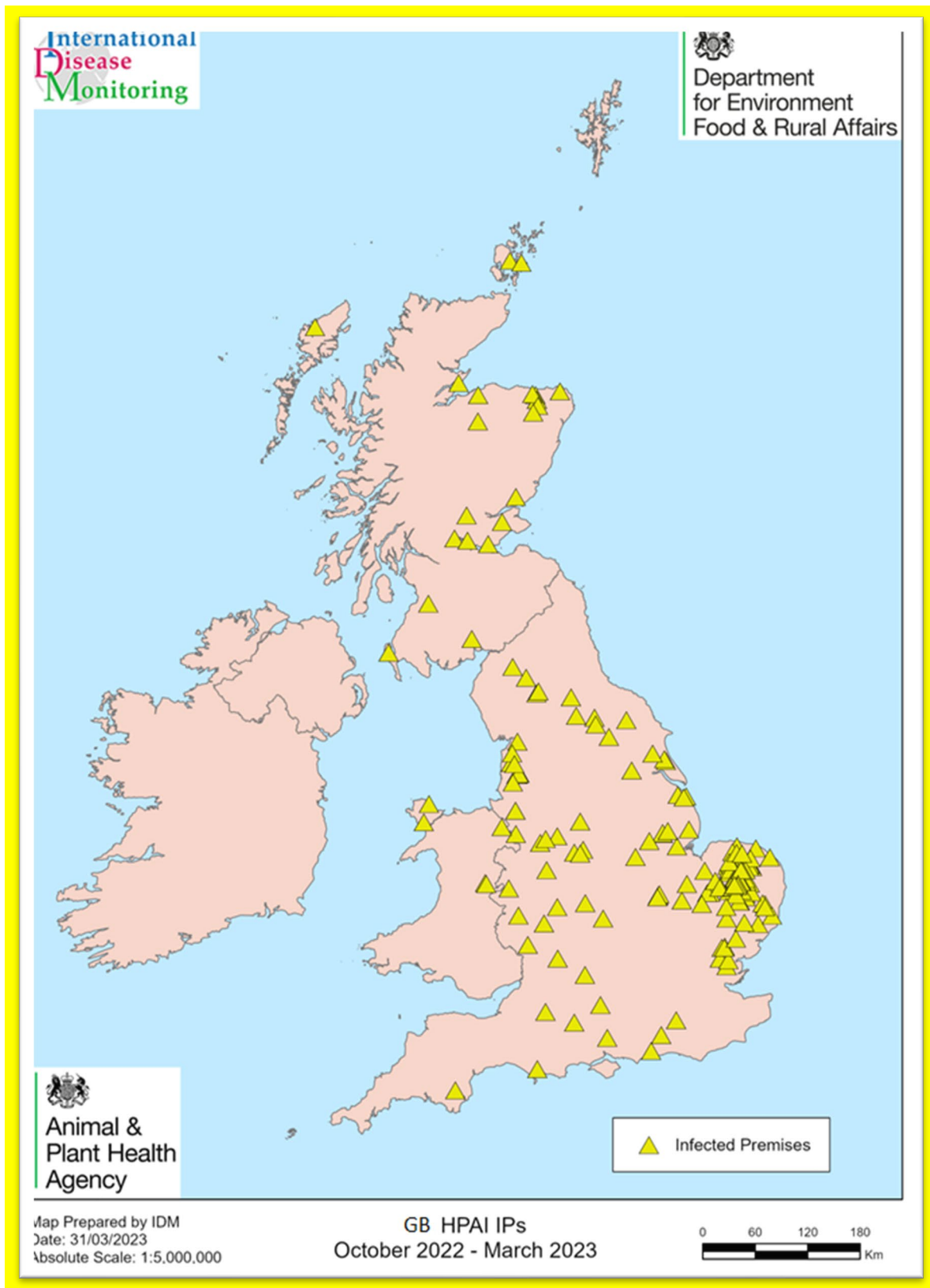


Figure 3: Outbreaks of HPAI H5N1 in domestic poultry and captive birds (as of 31 March 2023) in Great Britain from 1 October 2022. Outbreaks of HPAI H5N1 in domestic poultry and captive birds (as of 31 March 2023) in Great Britain from 1 October 2022. IPs are across all administrations in Great Britain, with the majority of IPs in England with clusters in Suffolk and Norfolk, followed by Scotland with IPs as far north as Orkney Islands and the lowest number of IPs in Wales.

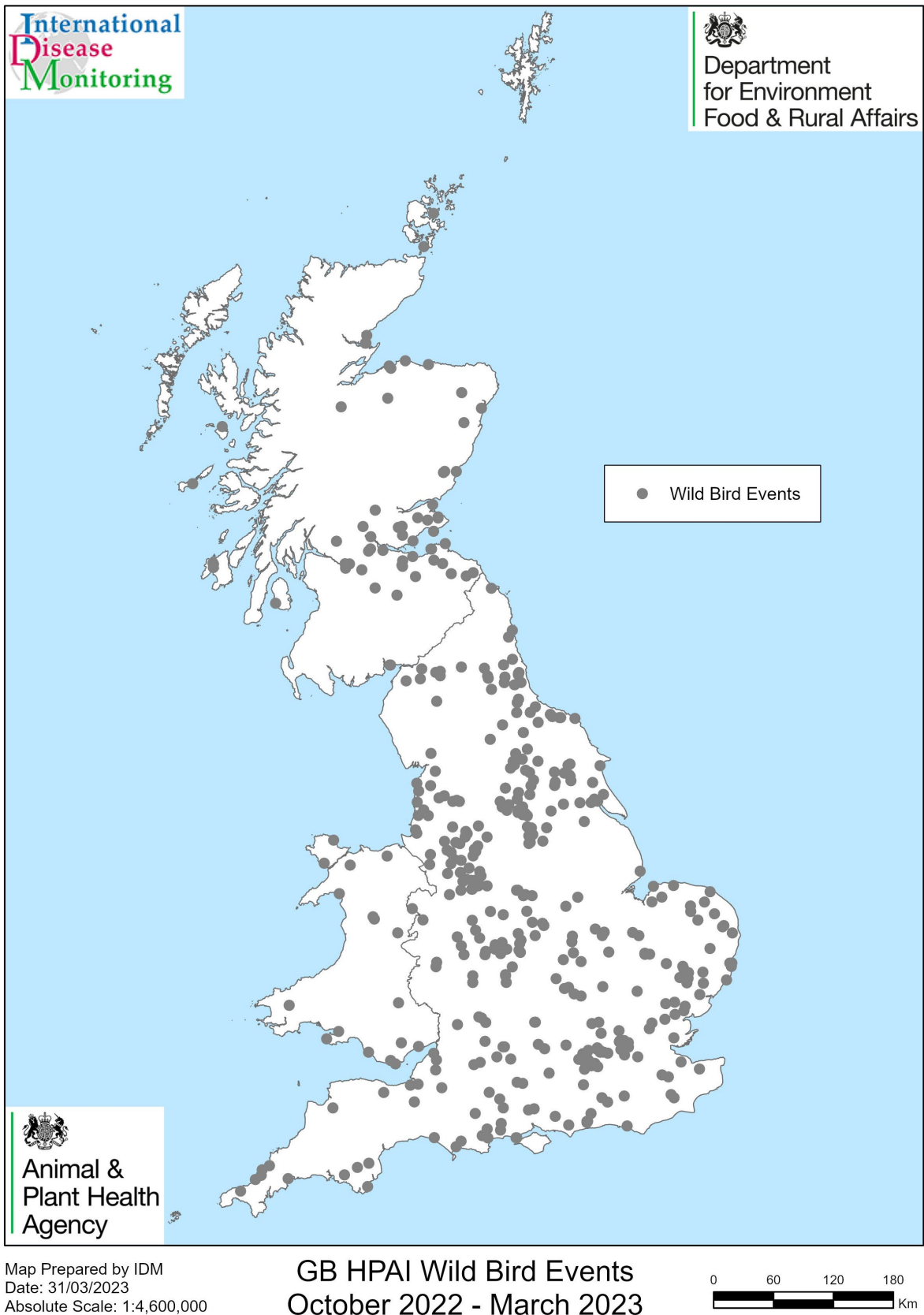


The wild waterfowl population (both resident and migratory) in Great Britain is relatively well understood. Several non-governmental organisations (NGOs) conduct regular surveys for the wild waterfowl at known wintering sites across Great Britain. In particular, the British Trust for Ornithology (BTO), The Joint Nature Conservation Councils (JNCC), the Royal Society for the Protection of Birds (RSPB) and the Wildfowl and Wetlands Trust (WWT) carry out counts of wild birds. There are 53 sites counted each with at least 20,000 birds wintering year after year across Great Britain, though this represents only a portion of wintering sites used by waterfowl in Great Britain.

Expert ornithological opinion in January 2023 considered that there have been no major differences in the populations of migratory wild waterbirds, the location of the large assemblages or the timing of arrivals of migratory waterbird populations compared to previous years. In terms of migration, the wild migratory waterfowl started arriving as usual in Great Britain from Northern Europe in late August and September with numbers peaking in December and January. While some species, such as swans, will be site loyal from one year to the next, others will be less so, and there will be some mixing between species including resident and migratory waterbirds in the large aggregation sites. Outward migration has already started (since mid March) with nearly all migratory waterbirds expected to be departed by early May and most by mid April.

There is a system for wild bird surveillance in the Great Britain, whereby found dead birds from target species are reported either by wardens at reserves and wetland sites, or by the public and then submitted for testing at the National Reference Laboratory (NRL). It is important to note that this system of passive surveillance does not provide complete knowledge of the population. Not all infected birds will die, and the detection of dead birds will vary depending on the species of bird that die (smaller birds are less likely to be noticed than large birds), the location (detection is less likely in remote areas) and the level of awareness of the people who find the dead birds (trained wardens are more likely to report than members of the general public). Once positive birds have been reported at a site, more findings may not be tested until two weeks have passed. Since 1 October 22 and as of 31 March 2023 there have been 857 HPAI H5 detections in wild birds (Figure 4) with the majority confirmed as H5N1, a few where the neuraminidase subtype is still being characterised.

Figure 4: Map showing HPAI H5 cases in wild birds (as of 31 March 2023), in Great Britain from 1 October 2022. Cases are across the whole of Great Britain, with the majority in England then Scotland and Wales

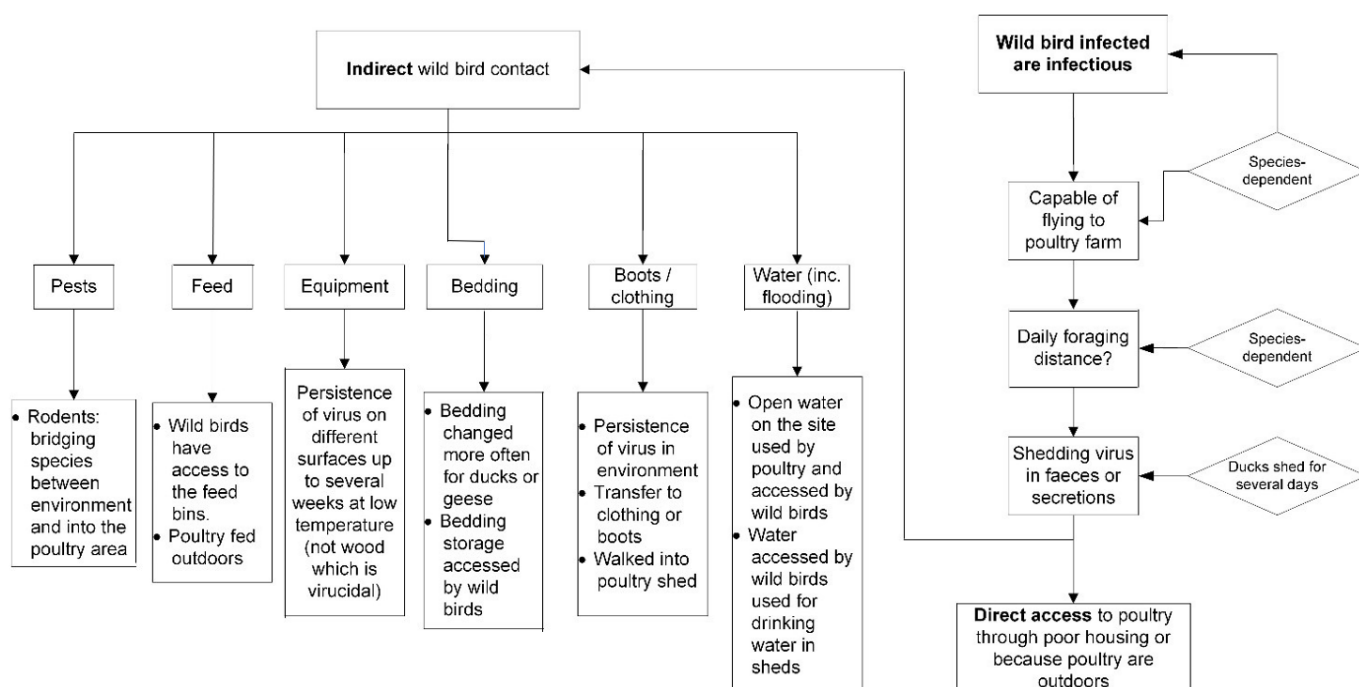


Across Europe since 01 October 2023, HPAI H5N1 infection has been detected in multiple species of wild bird with 2,229 cases in total and 1,139 outbreaks in poultry according to data from the World Organisation for Animal Health. Weekly results plotted for the EU27 show the number of poultry outbreaks falling from a peak of around 70 in week 48 of 2022 to around 25 in week 2 of 2023 ([Avian influenza in Europe: updates | EURL avian influenza Newcastle disease \(izsvenezie.com\)](#)). The number of wild bird case detections in the EU27 has increased markedly in early 2023 compared to the end of 2022, though any changes in surveillance which may impact the number of wild birds tested is unknown. In weeks 6 and 7 of 2023 there were around 200 wild bird cases per week across the EU. The number of wild bird cases has slowly declined over the last few weeks with fewer than 100 cases in week 12. Although strong second peaks often occur in wild birds in northern Europe in January to February, the reason for the strong peak this year is increasingly due to the number of black-headed gulls which peaked at 106 cases across Europe in week 11. Since all the migratory waterbirds are now departing from Great Britain or indeed have already departed, the details of cases currently in Europe are of less relevance to Great Britain compared to in the autumn. The possibility of a cold spell in Western Europe bringing more ducks, geese and swans currently wintering in the Netherlands into Great Britain can be dismissed at this time of year (late March). Therefore, discussions on the species of wild bird infected both in Great Britain and in Europe and their potential impact on the entry of the virus are less important at this stage of the season compared to in the autumn. However, there may be small numbers of black-headed gulls moving around the Channel. Reassuringly, the British population of black-headed gulls mainly stays within Great Britain with some dispersal west to Ireland and some dispersal south to West Africa (Olsen 2013). Great Britain is a wintering site for black-headed gulls which breed in Scandinavia, western Europe and Iceland (Olsen 2013). Those migratory gulls will therefore be departing Great Britain soon and may have done so already. The breeding sites for black-headed gulls are occupied in March and they nest in colonies around lakes (Olsen 2013) where the nests can be very close to each but also more spread out than other seabird species such as auks and gannets. They predate chicks of other nesting birds around the wetland sites, along with other larger gulls such as lesser black-backed gulls, and they are highly aggressive, so there is high rate of black-headed gull to black-headed gull and black-headed gull to other bird species contacts. However, there may be some immunity in the birds by now.

The current virus strain is likely to continue to circulate sporadically in wild birds in Great Britain in April, as the prevalence of infection continues to fall in late spring in line with previous epizootics. It is therefore considered that the likelihood of there being infected wild bird species present in Great Britain currently (late March 2023) is **HIGH**, and it is expected that more HPAI H5 cases in wild birds will be detected in the next month (April 2023). It remains to be seen whether H5N1 will spread in gull species, in particular black-headed gulls, and then spread to other breeding UK waterbird species over the summer including seabirds as occurred last year.

Exposure assessment

Figure 5 Exposure pathways for poultry to HPAI H5N1 via contact with wild birds



There are multiple pathways for the exposure of poultry to influenza viruses causing notifiable avian diseases via direct or indirect contact with infected wild birds

These include contact with:

- infected poultry such as live birds, hatching eggs and day-old chicks of poultry
- live infected wild birds, particularly waterfowl
- poultry products and by-products of infected poultry,
- contaminated feed, water, bedding, equipment, vermin, or clothing and footwear of people in contact with infected birds or contaminated environment.
- contaminated environment, for example contaminated ranges or flood water.

For this risk assessment, the pathways associated with trade in live poultry or poultry products (including domestic moves: first and third points above) will not be considered.

Data generated at APHA Weybridge indicates that this H5N1 virus will retain infectivity in the environment at low temperatures, for up to 55 days at 4°C (Ian Brown, APHA, Pers. Comm.). This means the environment could remain contaminated for several weeks in certain conditions.

It is concluded from sequence data that the UK H5N1 virus demonstrates no strong correlations for specific increased affinity for humans ([HAIRS, 2022](#)).

The EFSA opinion from 2017 used a combination of systematic review of all poultry outbreaks in the EU and expert knowledge elicitation from members of the poultry sectors. Experts were asked to consider four levels of biosecurity: preventing access to waterbodies; housing; carrying out “routine” daily biosecurity (boot washing, limiting visitors, rodent control, clean feed, and water) and high biosecurity as used in compartments (all the above, plus shower in and out, no visitors, reverse air pressure, dedicated staff, and equipment etc). The opinion estimated that the relative risk for entry is reduced **three-fold** by preventing access to water bodies, that housing gives a further **two-fold** reduction, and applying routine biosecurity gives a further **four-fold** reduction. The relative risk for entry is estimated to lead to a further **44-fold** decrease by applying high biosecurity measures as observed in compartment premises ([Defra compartments, British Poultry Council](#)). However, it is recognised that this level of biosecurity is not implemented to the same standard across all poultry premises and that a range of biosecurity plans are in place across Great Britain, with varying levels of efficacy, which will be impacted by the surrounding infection pressure.

In the scientific opinion presented here, we class the level of biosecurity maintained by premises in poultry compartments as stringent. Compartmentalisation is a scheme open to poultry breeding companies in Great Britain. Approval as a compartment is based on the management protocols, biosecurity systems and husbandry practises at a given premises. Depending on acceptance of compartments by importing countries, compartment status may place a company in a stronger position with regard to resumption of exports following an outbreak of Avian Influenza in Great Britain). In premises in the compartment scheme every effort is made to prevent wild bird access, foot baths and clean equipment are used, bedding is stored undercover and rodent control is applied. The compartment scheme covers those premises with the highest standards of biosecurity, which include air and door locks, shower in – shower out facilities and pristine areas in the poultry sheds. All of these are applied to the “Compartment” breeding and rearing facilities.

Direct contact with live infected wild birds

The likelihood of contact between poultry and infected wild birds will be dependent on their species, abundance in the locale, and how attractive the site is to birds for example an on-farm pond, uncovered bedding or poorly managed feed bins are three well-known factors which make the direct contact of free-range poultry with wild birds more likely. Therefore, well-constructed and maintained facilities, aimed at reducing contact between poultry and outdoor areas will reduce the direct contact with wild birds, and indirect contact via contamination of outdoor ranges, stored bedding, ponds, feed, waterers, feeders, and roosting areas with wild bird secretions. It will not prevent all pathways through which disease may enter a poultry premises, and additional biosecurity measures will be required to mitigate those risks.

Contact with contaminated feed, water, bedding, equipment, vermin or clothing and footwear of people in contact with infected birds or contaminated environment including flood water

Contamination of feed, bedding, and water by infected wild birds during an outbreak is possible on a poultry farm unless access by wild birds is prevented. For poultry which require frequent bedding changes, moving potentially contaminated bedding into the poultry house is a possible route of transmission. For poultry fed outdoors, feed may be accessed by wild birds (or wildlife acting as mechanical vectors). Contaminated water sources may also introduce virus to the poultry (for example from a local pond or reservoir). When wild bird food is scarce, if poultry are fed outdoors, it is quite likely wild birds will be attracted to the site. The roofs of poultry sheds may also be suitable loafing sites for gulls or corvids which may act as bridging species.

These pathways can be prevented by sourcing such products from safe sources (such as, where contamination from wild birds was not possible) and keeping such items in containers which no wild birds can access. The site can be made less attractive to wild birds by removing or covering any ponds on site, preventing accumulation of standing water, using drinking water from bore holes or mains water and making sure feeding areas are protected. Contact with contaminated equipment, footwear and clothing can be prevented by making sure all personnel in contact with the birds use dedicated clothes and boots and that cleansing, and disinfection are applied appropriately. This will be particularly important where birds are housed, as personnel contact with the birds may be more frequent, as feed, bedding and water must be brought into the houses and birds must be checked for welfare issues and or eggs collected from inside the houses. Visitors to the farm should be limited, and adequate records of all movements on and off the poultry premises should be kept. Other important biosecurity practices to ensure wild birds are separated from flocks, include feeding birds indoors or under cover, discouraging wild birds from landing, removing wild bird contamination, netting ponds, and draining watercourses, removing feeders and water stations from the range, ensuring good building maintenance and regular inspections for signs of wild bird and rodent access. It is not always possible to prevent flooding at a site, and ingress of flood water has been implicated as a source of virus in past outbreaks, but housing should be wherever possible, built to prevent ingress.

Above all, the EFSA opinion recommended that all personnel are trained in and practice good biosecurity, regardless of whether birds are housed or not, as housing cannot reduce transmission through fomite pathways as a standalone measure.

Domestic poultry

The poultry sector in Great Britain is complex and seasonally variable. There is a requirement for all poultry keepers in England, Scotland, and Wales with more than 50 birds to be registered with the British Poultry Register. Therefore, any data available will not include all the backyard or smallholder community. In terms of the proportion of the sector which is raised outdoors, for the egg sector, there are circa 25 to 26 million free-

range hens, and 1.5 million organic hens accounting for approximately 63.7% of UK production ([Egg info](#)). For broilers, the proportion is a lot lower, at 3 to 5% ([BCP](#)). For ducks it is estimated that around 30% are outdoor and for geese, the majority are raised outdoors.

Captive birds (non-poultry)

Captive birds, such as those held in collections, zoos or approved bodies are already semi-housed and should be kept separate from wild birds. For some, it will be difficult to prevent access to their water environment (penguins, pelicans, flamingos etc) but it is unlikely it will be possible to house indoors, so every effort should be made to prevent wild bird access. There were outbreaks in captive birds in Europe (in zoos) in 2016 to 2017 and 2020 to 2021 and a derogation exists domestic legislation in Great Britain which means birds may not have to be destroyed, unless they are in contact with the infected collection.

Ratites

Ratites, such as ostriches, cannot be housed on a long-term basis for welfare reasons, but the susceptibility of such birds to this virus is not well understood. Ratites are often considered refractory to HPAI infection however there have been cases in Germany and USA of emus showing clinical signs in a zoo and therefore these birds should also be considered susceptible.

Game birds

Once game birds are released for the shooting season they are considered wild and outside the scope of a prevention order around housing. Some will still be kept in pens and could not be housed due to welfare issues, therefore the pens themselves would need to be netted as the birds will often be able to fly out of the pens and forage locally. Game birds cannot be released in areas under a disease control zone or an AIPZ with housing measures.

It is illegal to release by hand captive birds for the purpose of being shot immediately after their liberation, under Part 1, Section 8 of the Wildlife and Countryside Act, 1981. Therefore, if gamebirds are released and then test positive when they have been shot, they are unlikely to have been infected at the premises of origin and more likely from contact with wild birds.

Summary

The number of wild bird cases of HPAI H5N1 has declined week on week since the peak in early January 2023. However, the number of positive wild bird cases is still relatively high at 7 in the last week of March with 9 to 11 cases each week for the previous three weeks. The wild bird risk level in Great Britain is therefore considered to be **HIGH** (late March 2023) although expected to fall over the coming weeks as resident waterbirds

disperse from their wintering aggregates to their breeding sites across Great Britain together with the higher temperatures and ultraviolet light intensity which reduce virus survival in the environment. The migratory water birds are now departing with many having already gone. Both the number of susceptible water birds present in Great Britain and the rates of wild bird contact have fallen.

Effective and well-maintained housing reduces the probability of poultry exposure to wild birds and their excretions, but does not completely prevent transmission of the virus, as HPAI virus could still be carried into poultry houses on clothing, footwear, feed, and bedding. Plotting the number of IPs over previous seasons following the introduction of a housing order shows a decrease in the rate of IPs after housing is introduced (and allowing for an incubation period for two weeks) (Figure 2) though it is difficult to attribute with any degree of certainty what proportion of this (if any) is due to housing birds rather than other factors such as waterfowl migration patterns and the implementation of mandatory, complementary biosecurity measures as part of the housing order. It is not possible to assess the impact of housing as a protective measure because it would require epidemiological investigations that are not possible during control of a notifiable disease.

From a risk assessment perspective at least, the poultry risk levels should also fall as the wild bird risk decreases. This is borne out by the reduction in the number of IPs in recent weeks. Given the falling infection pressure from wild birds, less favourable environmental conditions for virus survivability, and the sporadic numbers of infected poultry premises and backyard flocks over the last month, we consider the likelihood of infected premises being detected in the next month in Great Britain to be to **MEDIUM** (occurs regularly) **with high uncertainty** where biosecurity is suboptimal and there are biosecurity breaches, and **LOW** (rare but does occur) **with high uncertainty** where stringent biosecurity is applied. This takes into consideration the Avian Influenza Protection Zone (AIPZ) and assumes that bird keepers are taking the additional biosecurity measures required, though there is likely to be variability with compliance, this is not possible to collect and assess. As estimated in the EFSA opinion (EFSA 2017), a two-fold reduction in the number of IPs is anticipated where birds are housed, though this is not recommended as a standalone measure and EFSA recommends housing should be implemented in conjunction with other biosecurity measures mentioned earlier in this report alongside appropriate training. At this stage of the outbreak the effectiveness of the housing order may be reduced by the law of diminishing returns as the number of IPs each week, on average, is less than one.

As the most likely contact of poultry with wild birds will be in those areas where there are high concentrations of wild birds, where there are no large aggregations of wild birds, the risk is lower for this particular pathway, but there are still other pathways which could lead to the introduction of any notifiable avian disease.

Conclusions

The risk of HPAI H5N1 incursion into poultry premises depends on the level of biosecurity present. There are multiple pathways through which poultry could be exposed to HPAI

virus and these may not be prevented when housing is used as a control measure in the absence of any other biosecurity.

The EFSA (2017) opinion concluded that once virus is introduced to a wild bird population, a critical population size is required before virus amplification and further wild bird-associated geographical spread of the virus can take place. Therefore, there is an increased likelihood of incursion into poultry farms most closely located to large gatherings of wild birds (including but not exclusively waterfowl) during the waterbird migration season. Once the migratory birds leave (from late March onwards) the risk of poultry outbreaks in Europe and Great Britain usually reduces but in cases where non-migratory birds are still testing positive, there will be a continual, albeit lower, risk. As has been observed in previous HPAI seasons in Great Britain the risk is anticipated to decrease over the next few weeks because the large gatherings of wintering resident birds will have dispersed to their breeding sites, the migratory waterbirds will have departed, and the warmer temperatures and longer day lengths will reduce virus survival in the environment. The sustained transmission of HPAI H5N1 in breeding seabirds as was observed over the summer months of 2022 in Great Britain and northern Europe was unprecedented. It is not clear whether the recent cases in black-headed gulls will spill over into seabirds or other breeding birds in Great Britain over the summer of 2023.

Outbreaks in poultry in Great Britain are now at very low levels with one every other week (late March 2023) and significantly down from the peak of 27 IPs in the second week of October 2022.

The EFSA 2017 expert opinion suggests that following stepwise biosecurity measures, and after preventing poultry access to water bodies, housing leads to a two-fold reduction in risk, which is significant in terms of the number of outbreaks potentially prevented given the number of premises with poultry in Great Britain and the large number of outbreaks (169 to 31 March 2023) so far reported in the 2022 to 2023 season. Due to the additive nature of the 2017 EFSA expert opinion, the effect of housing may be underestimated because it also includes removing access of poultry to ponds which may have an additional three-fold effect, giving an overall six-fold reduction in risk (Figure 1). In terms of reducing the overall number of IPs, housing is likely to be most effective before the peak of the epizootic, with a law of diminishing returns at the later stages when housing may prevent only a few additional IPs. The behavioural impact of announcing a housing order is not fully understood, for some it may send a message to poultry keepers that the risk has increased significantly, increasing the uptake of daily routine biosecurity measures. Conversely, others may become lax in other biosecurity measures if housing is believed to be a panacea. As such, this needs to be followed up with clear communications on the importance of biosecurity measures and training as a whole (as suggested is most effective in the EFSA 2017 expert elicitation).

Housing birds which are not used to being housed can cause welfare issues, especially in backyard flocks. Making sure their accommodation is appropriate, their environment is enriched (for example with toys), that they have plenty of room to move, access to feed and water, clean bedding and the ability to display natural behaviours such as dustbathing are all welfare priorities. For ducks their bedding must be changed regularly as they will

mess it quickly and they need access to water so they can clean their feathers. If the birds become stressed, they may be more prone to infections or other behaviours which impact on welfare. Certain species cannot be housed for welfare reasons or because they are already considered wild: geese, ratites and gamebirds.

It should be noted that there are studies and expert opinion assessments which confirm that housing is only part of the biosecurity continuum (EFSA, 2017). Housing, in addition to directly reducing contact with wild birds, also enables the application of more stringent biosecurity measures. For example, a foot bath and change of clothes is likely to be more effective at mitigating indirect transmission when birds are housed, compared to when poultry are let out and wild birds can also access the range. If stringent biosecurity is applied, the risk to poultry is substantially reduced and housing of poultry will further reduce that risk.

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