



Department
for Environment
Food & Rural Affairs

Rapid risk assessment on incursion of H5Nx HPAI into housed or not housed poultry flocks and captive birds

November 2021



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Summary

1. There is a heightened risk of an incursion of avian influenza H5Nx to the UK. This is evidenced by the wild bird cases occurring across Northern, Eastern and Central Europe and outbreaks in poultry in Netherlands, Italy, Czechia, Finland and Germany. In early October 2021 the risk of wild bird incursion was increased to MEDIUM.
2. Since then, the report of HPAI H5N1 in a wild bird rescue centre in Worcestershire (AIV 2021/07) and a game bird establishment in Wrexham (AIV 2021/08) on 26 October and 1 November resp. and five other wild bird reports from areas of Southport, Preston, Fife, Edinburgh and Wrexham are the first confirmed events of HPAI H5N1 in GB since July 2021. **Therefore, the risk level was increased to HIGH for wild birds on the 29 October 2021 with low to medium for exposure to poultry, depending on biosecurity.**
3. There has been a pattern of spread consistent with previous disease epidemics in which wild bird transmission was a factor. There is good evidence that spread to the UK by migrating wild waterfowl has happened in the past.
4. There are a number of risk pathways for the introduction of disease to kept birds, and contact, whether direct or indirect, with infected wild birds is the most important one, especially with respect to a primary introduction to domestic birds. Secondary spread in the UK with our disease control measures and keeper awareness is a rare event; only one proven event of secondary spread has occurred, and that was in 2007, where spread between two units of the same business occurred through shared workers.
5. Housing free range poultry could reduce the likelihood of infection incursion, from reducing the direct contact with wild waterfowl or with their contaminated environment. An EFSA analysis following the 2016/2017 epidemic concluded that housing birds gave a two-fold reduction in risk.
6. However, to be effective, housing must be accompanied by thorough biosecurity measures to prevent the disease from being introduced to the poultry by contaminated people or other things that are taken into or enter the housing. EFSA concluded that stringent biosecurity measures, which include housing, bring a 44-fold reduction in risk.
7. Under some circumstances, poultry will not be able to be housed, whether for practical or welfare reasons relating to their husbandry needs, and so housing will not be universally achieved.

8. Comparing the last two seasons when poultry cases were reported in the UK (2016/17 and 2020/21) a housing order was in place but only after 14 December 2020 before which there were seven commercial outbreaks in 2020/21 but none in 2016/17, when the housing requirement was put in place on 12 December 2016. However, the difference in the number of cases is probably related to the wider geographic area, infection pressure, earlier start and longer duration of the outbreak in 2020/21.
9. The geographical extent of any housing requirement can be determined on the basis of proximity to large aggregates of wild waterfowl over the coming weeks as well as on the basis of practicality/feasibility and sustainability. It is not possible to say at this stage whether the infection pressure will increase over the coming weeks, whether the season will last for as long as it did in 2020/21 and what the geographic extent will be. Nevertheless, given the early start and wild bird cases already detected, this does appear to be a long season approaching.
10. Any legal requirement to house and take biosecurity measures should be kept under review and adapted as needed to reflect emerging evidence, including levels of compliance with housing and biosecurity measures and the disease picture across Europe.

Background

Across Northern Europe and Russia since September 2021, HPAI H5N1 infection has been detected in multiple species of wild bird sometimes prior to the detection of the same virus in various types of domestic poultry. The OIE Reference Laboratory at Weybridge has confirmed this strain is very similar but not identical to the HPAI H5N1 virus found in wild birds in the UK and Europe last season and different to the viruses circulating in 2016/2017. The latest number of outbreaks and cases (wild birds) in Europe are shown below:

September: HPAI H5N1 and H5 in wild birds and poultry in Russia, Kazakstan and Georgia

September - October: HPAI H5N1 and H5 in poultry in Ukraine and Czechia and in wild birds in Finland

October: HPAI H5N1 in wild birds – Eurasian Wigeons in Western Germany; first of several poultry farms in Northern Italy

[For ref during report production – web map here updated each morning – [Microsoft Power BI](#)]

Throughout the summer months there were occasional cases in wild birds of H5N1 in Estonia Finland, Germany, Latvia, Netherlands and Sweden but these were endemic birds, or captive backyard birds and not in the migratory species. It is clear that two migration pathways are currently carrying infected wild birds. One is the Black Sea Mediterranean pathway, which explains the findings the Middle East (Israel) as birds move from Europe to Africa at this time of year; European countries along this route would include those in Central and Southern Europe. The other is the East Atlantic route which would include the North European countries, particularly Scandinavia, Germany, Denmark, Poland and the UK. There are not clear boundaries between these migration routes and the birds will mix between them. Multiple waterfowl species will be found at the same sites.

To date, a housing order has been put in place in the Netherlands, where there has been a single report of HPAI H5N1 in commercial poultry on 26 October. In the epizootic of 2016/2017, many EU MSs put in place a housing order. The orders may cover just certain sectors of commercial poultry and certain high risk areas.

The effectiveness of a housing order is difficult to assess. In 2016/2017 it is possible there would have been a higher number of outbreaks without an order in place, while during 2020/21 the decrease in outbreaks after the housing order on the 14 December may have been helped by a housing order, or simply that it signified poultry keepers needed to take biosecurity seriously. However, in 2016/17, France, Germany and Hungary were countries with the highest number of outbreaks and with housing orders in place, there was secondary spread, indicating poor biosecurity in some sectors, rather than primary contact with wild birds *per se*. This year, Italy has had multiple cases in the meat turkey sector in the North and there is no housing order in place. The EU has warned in the past that secondary spread between establishments keeping Anseriformes species is observed (PAFF website and communication from Cion). There has only been one case in GB where secondary spread of HPAI H5Nx between infected establishments was reported, through the movement of personnel. This was in 2007 and since then, the GB poultry industry has improved general biosecurity advice.

EFSA carried out a comprehensive review of the outbreaks of HPAI H5N8 in 2016/17 to assess the risk of introduction into poultry from migratory and residential wild birds (EFSA, 2017). The 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 of target species.

The opinion also concluded that the relative risk reduction for entry is **three fold** by preventing access to water bodies, that housing gives a further **two fold** reduction, and by applying routine biosecurity there is a further **four fold** reduction in risk while high biosecurity is a **44 fold** reduction in risk.

Biosecurity measures for housed birds which should be applied are: separating from wild birds; separate waterfowl from gallinaceous poultry; provide potable drinking water; implement a hygiene lock for each poultry house and provide biosecurity training to all personnel. For non-housed birds, it was recommended to restrict access to birds for people and provide biosecurity training to personnel as the most feasible and sustainable measures. At all times, feed must be provided indoors only, wild bird access should be restricted; avoid contact with people and limit contacts with other poultry premises. Feed and water could be provided under a roof or a horizontal fabric for non-housed birds. The opinion used expert knowledge elicitation to gather evidence on the biosecurity measures and what was commonly reported was that a lack of biosecurity awareness in the staff on sites was common.

A further supporting document to the EFSA opinions on the risk of introduction (EFSA, 2017a) carried out a systematic review of previous outbreaks to identify risk factors and 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); production system where outdoor systems are higher risk than indoor; and presence of biosecurity flaws.

This rapid risk assessment is aimed at providing advice around the most appropriate form of prevention zone order for the different sectors and establishing whether there is evidence to help make the decision around mandatory housing. Any prevention order would only be put in place in an area not already under restriction for a notifiable avian disease.

Under article 6(1) of the Avian Influenza and Influenza of Avian Origin in Mammals (England) (No 2) Order 2006 ("the Order"), the Secretary of State must carry out a risk assessment in order to declare an Avian Influenza Prevention Zone. This article is respectively present also in the legislation for Wales and Scotland. The measures to reduce the risk of transmission of avian influenza are based on a risk assessment and must include those:

- to prevent direct or indirect contact which wild birds might otherwise have with poultry and other captive birds;
- to reduce the risk of feed and water provided to poultry and other captive birds being contaminated with avian influenza virus; and
- to reduce the risk of the spread of avian influenza between premises.
- to require poultry and other captive birds to be housed or otherwise kept separate from wild birds;
- to require poultry or other captive birds or categories of such birds specified in the declaration or notice to be housed or otherwise kept separate from other poultry and captive birds;
- to require that poultry and other captive birds are provided with feed and water to which wild birds have no access;
- to require keepers of poultry and other captive birds and others who come into contact with such birds to cleanse and disinfect their footwear and take such other biosecurity measures as a veterinary inspector or an inspector under the direction of a veterinary inspector may require;
- to ban or limit the collection of poultry or other captive birds at any fair, market, show, exhibition, race or other gathering;
- to ban or limit the use of birds of the orders *Anseriformes* (including ducks, geese and swans) and *Charadriiformes* (including gulls, murrets, terns, avocets, puffins, woodcock, oystercatchers, sandpipers, plovers, surfbirds, snipes and skimmers) as decoys during bird hunting.

Hazard identification

The hazard identified is the avian influenza virus, HPAI H5Nx subtype. Although the HPAI H5N1 virus has been isolated from the UK during the current season it is possible other strains will be detected in the coming months. HPAI H5N8 has been detected in Estonia, Finland, France and Sweden in the last few weeks. The OIE/WHO RL (Weybridge) has undertaken some preliminary sequence analysis of the GB virus. The virus maps across the whole genome with the H5N8 viruses (reported by the lab as part of an international collaboration) found in the Netherlands, Iraq, Russian Federation and Kazakhstan during the last 4 months (and therefore distinct from the strain that caused widespread outbreaks in the EU in the first part of this year).

- Weybridge analysed the available full genome sequence data of a H5N1 HPAIV obtained from a UK avian influenza disease investigation (A/chicken/England/053052/2021 and A/mute swan/England/053070/2021) and compared them with the CDC (Atlanta) H5N1 genetic changes inventory and Suttie et al. 2019 to identify genetic mutations that determine viral phenotypic characteristics of importance that may increase virulence, signal adaptation to mammalian species or alter susceptibility to existing antivirals. This totals 240 mutations or combinations of mutations.
- They observed 39 mutations/combinations of mutations. It should be noted that all of these genetic changes identified were also present in a representative UK H5N1 from 2020 (A/chicken/England/043315/2020) as well as H5N1 sequences provided from the Czechia (A/goose/Czech Republic/1850-1/2021 and A/duck/Czech Republic/1850-2/2021) and Russia (A/goose/Chelyabinsk/1341-3/2021 and A/Common Teal/Chelyabinsk1379-1/2021). However, in addition to the mutations reported, one or both of the sequences from Russia contained additional substitutions in the PA (Q400P) and NP (I41V) proteins. These mutations are not expected to substantially alter the tropism of these viruses.
- For the proteins of the polymerase complex, thirteen, two and four mutations/combinations of mutations were identified in PB2, PB1 and PA, respectively. The majority of these genetic changes are reported to increase polymerase activity and virulence in mammals and chickens, but there were also mutations reported to decrease virulence in mice. However, important markers of zoonotic risk, PB2 E627K and D701N substitutions were not identified.
- Unlike European H5N8 and H5N5 HPAIVs from 2020, these H5N1 sequences, as with those from elsewhere in Europe across 2020/2021, contain a full-length PB1-F2 protein; an accessory protein with multiple functions including apoptosis and modulation of host immune responses and demonstrated to be a virulence factor in mammalian models. However, UK H5N8 HPAIVs from 2014 and 2016/2017 also had a full-length PB1-F2 protein, and these were not associated with increased risk of human infections. One substitution was also identified in this protein, which has been associated with enhanced virulence in mice. However, this substitution was also present in the aforementioned UK H5N8 sequence from 2014-2017 and is not thought to contribute to increased risk of mammalian tropism.

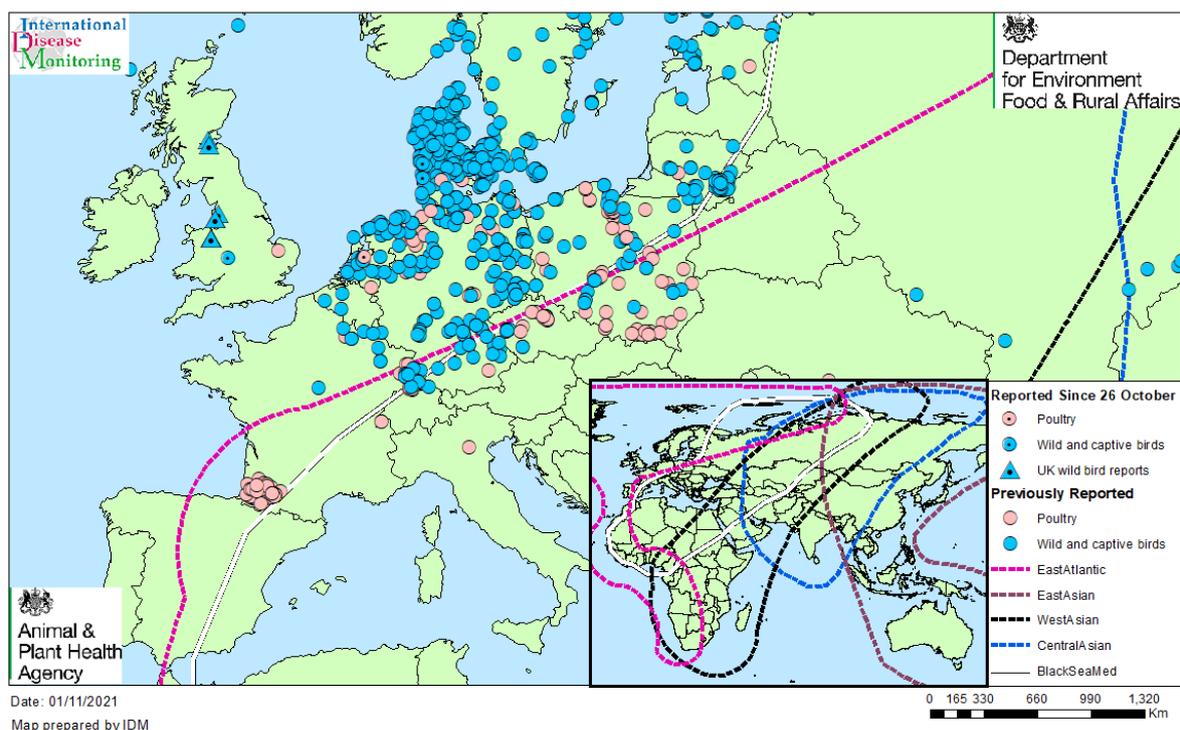
- The eight mutations identified in the HA protein are reported to increase binding to mammalian α 2-6 receptors, with the T156A mutation being the only change that has also been observed in the Asian H5N6 viruses. However, the T156A mutation was also present in previous European H5Nx viruses. Nevertheless, all eight HA mutations are not considered characteristic of enabling the binding to α 2-6 receptors in the literature. Therefore, it is predicted that the HA of these H5N1 viruses, will bind to avian α 2-3 receptors, as with European H5Nx viruses circulating in 2020/2021.
- The two mutations identified in NP are associated with increased virulence in chickens and do not have any reported impact on mammalian adaptation.
- Mutations in NA reported to affect zanamivir and oseltamivir susceptibility were not found.
- Within M1, three mutations associated with increased virulence in mice, chickens and ducks were identified. However, no mutations reported to effect amantadine and rimantadine susceptibility in M2 were identified.

There is a lack of a deletion in NS1 at amino acid positions 80-84 that is conserved among contemporary H5 viruses, possibly decreasing the zoonotic potential of the H5N1 viruses in question. However, five mutations reported to increase virulence and decrease antiviral responses in mammals and chickens were identified.

In conclusion, whilst there are notable differences to contemporary H5Nx viruses, the UK H5N1 virus demonstrates no strong correlates for specific increased affinity for humans.

Current Situation

This year to date, there is a lack of evidence for whether there are species of wild waterfowl which are not showing clinical signs with infection and in which the virus can continue to circulate in either migratory or non-migratory, sedentary birds.



Highly pathogenic avian influenza in Poultry, Captive and Wild birds
May - October 2021
Overlay: migratory bird flyways

This pattern of geographical distribution (see map below) follows a similar pattern of transmission in wild birds and spill-over into domestic poultry as observed for the epizootic of H5N1 HPAI in 2005-2008 in Europe, and in H5N8 HPAI in 2016-2017 and then 2020/21 in Europe. In those years, spread occurred along a similar route of migratory wild waterfowl causing wild bird die-offs in North and Central Europe. It can be expected that the current H5Nx HPAI epizootic will continue to cause issues with the poultry sector for several months to come, if not for many months, if the virus continues to circulate in migratory and then in non-migratory waterfowl in Europe.

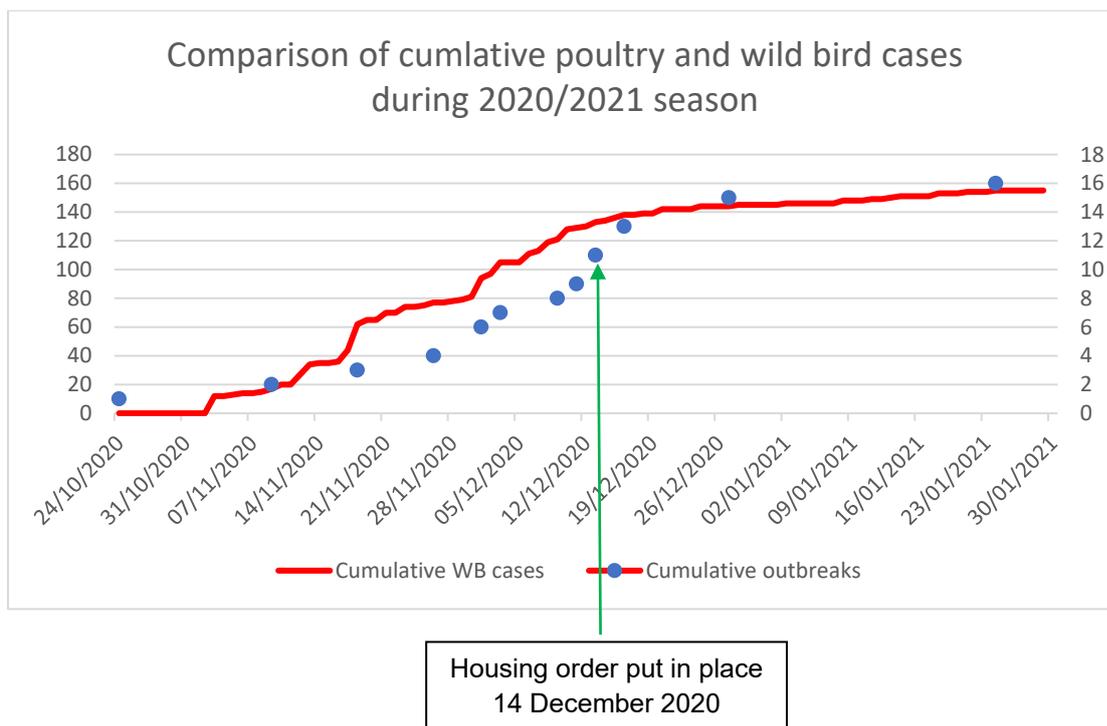


Figure 1 Comparing wild bird and poultry cases in 2020/2021 and the timing of implementing of a housing order

Risk Question

- 1) What is the risk of incursion of H5NX HPAI into housed and non-housed birds (domestic poultry and captive birds) from contact with migratory wild birds from Europe during the 2020/2021 winter season?

Terminology related to the assessed level of risk

For the purpose of the risk assessment, the following terminology will apply (OIE, 2004):

- **Negligible:** So rare that it does not merit to be considered
- **Very low:** Very rare but cannot be excluded
- **Low:** Rare but does occur
- **Medium:** Occurs regularly

- **High:** Occurs often
- **Very high:** Event occurs almost certainly

Entry assessment

The wild waterfowl population in the UK is relatively well understood. Several NGOs conduct regular surveys for the wild waterfowl at known wintering and breeding sites across the UK. 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. The study shows the sites of the largest waterbird aggregations in the UK. The Wash is one of the premier sites for wintering waterbirds in the UK with over 300,000 birds counted each year, while other top ten sites include the Somerset levels, the Dee estuary, the Humber estuary and the Ribble, Alt and Mersey estuaries, but there is a variation of at least 10% from one year to the next, attributed to the winter weather conditions. There are 53 sites with at least 20,000 birds wintering year after year across the UK.

Recent expert ornithological opinion is that there have been no major differences in the populations of migratory wild birds, the location of the large assemblages or the timing of arrivals of migratory populations compared to last year (Figure 2a).

In terms of migration, the wild waterfowl will have been arriving in the UK from Northern Europe since August / September and generally peak in December to 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 mixing between species in the large aggregation sites. Outward migration will start again in March to May.

Expert opinion from the JNCC and BTO suggests that Eurasian wigeon, which is the species of migratory waterfowl present as non-breeding birds in Europe, are most abundant in Netherlands and the UK and which have been testing positive for HPAI H5N1. These wigeon will already have started to arrive in the UK (Figure 2b).

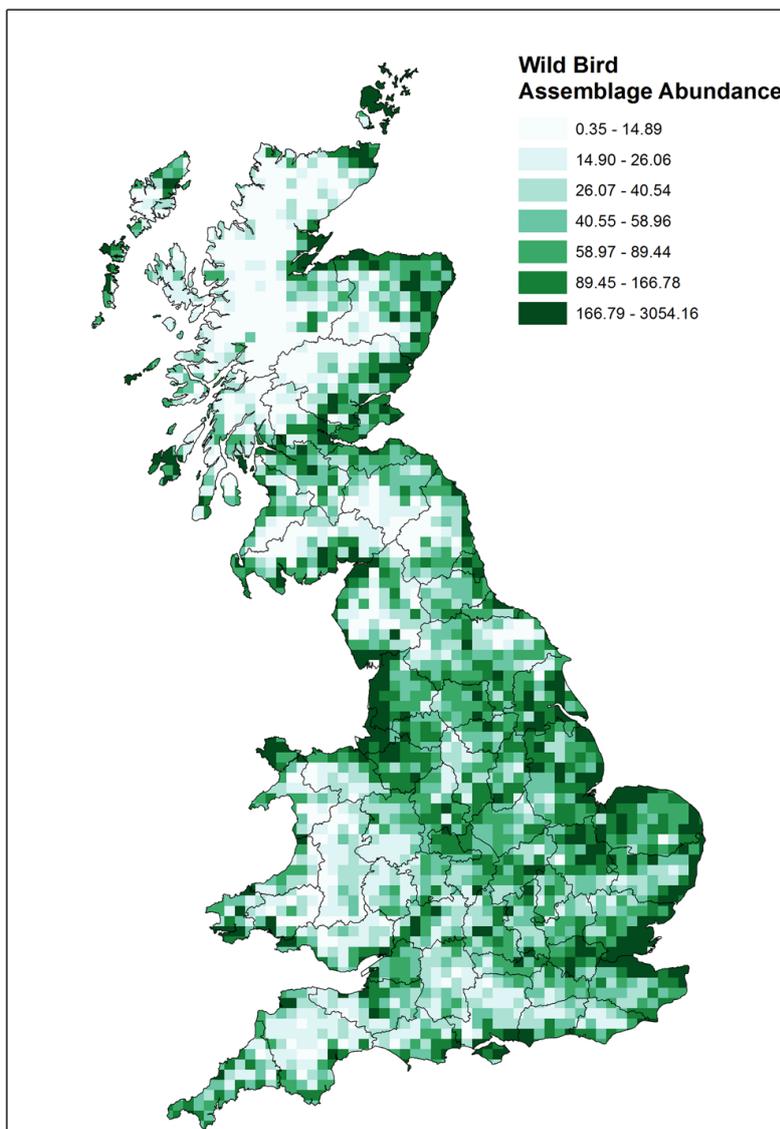


Figure 2a. Wild bird assemblage abundance in GB, derived from 109 species considered most relevant for the transmission of AI to poultry flocks (From Hill et al. (2019) Scientific Reports 9:19973)

EFSA has been mapping the Eurasian wigeon movements as indicators species for early migration and as a result, highlighted the high risk period for NW Europe starting in September (Figure 2b from European Commission, 2021 [PowerPoint Presentation \(europa.eu\)](#)).

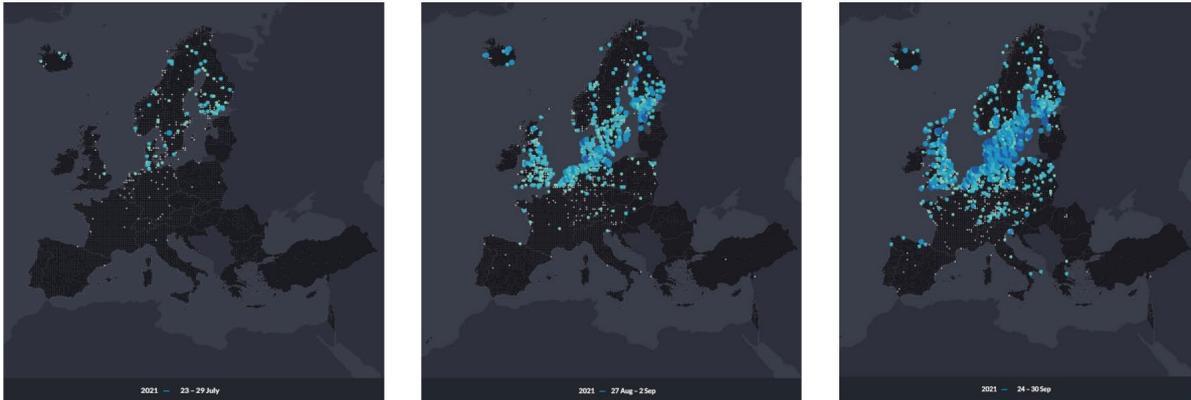


Figure 2b: Counts of Eurasian Wigeon by month (blue dots) according to Euro Bird Portal

See Annex 2 for estimated numbers of wild birds entering GB in comparison to the Netherlands and Italy in any year (Flutest project 2014). It can be seen from these data that for most migratory species, fewer birds arrive here than to the Netherlands in any one year, nevertheless there are still significant numbers. Although these data are some years old, at present, we are seeing a usual seasonal flow of migratory birds, and this is not affected by any cold weather conditions in Europe.

The frequency of peak occurrence of waterbird species by month and by county are available on the Wetland Bird Survey website <http://app.bto.org/webs-reporting/> For example, the monthly frequency of the common teal and the Eurasian wigeon (the two highest risk species according to Flutest) are shown here, based on the 2018/19 survey of sighted ringed birds:

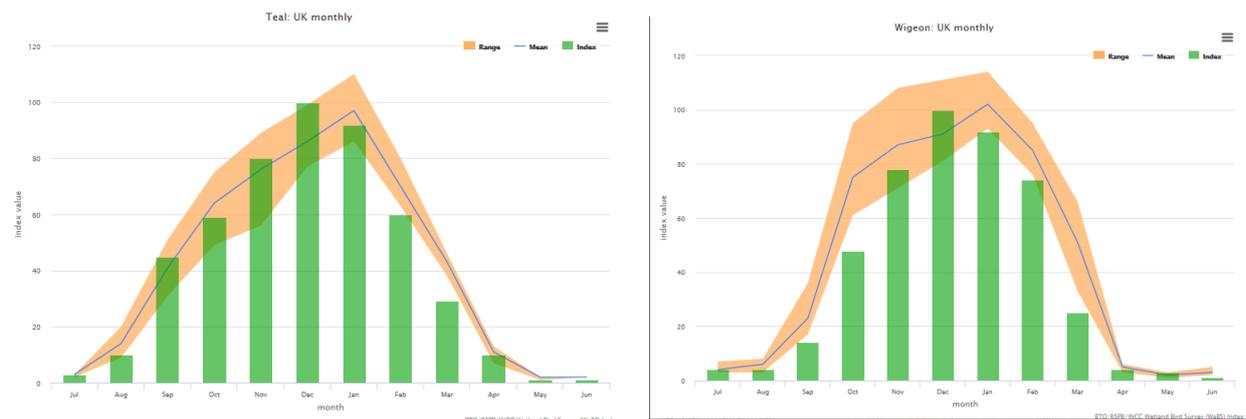


Figure 3a&b: Monthly counts of teal (a) and Eurasian wigeon (b) as migratory species

Given the daily increase in wild bird reports from NW Europe and Scandinavia that we have seen over the past four weeks, increasing numbers of wild birds being found dead in

Europe and the total populations involved, it is likely that there are birds which are not showing clinical signs and are able to migrate, in which case, some of those birds are likely to already be present in the UK and may still be viraemic or have passed the viraemic period but have been the source of virus circulation in other birds at the aggregation sites. There is a system for wild bird surveillance in the UK, whereby found dead birds from target species are reported either by wardens at reserves and wetland sites, or by the public for testing at the NRL. To date there have been five reports of positive tests from such birds, and the levels of submissions reflects similar numbers we see year upon year. There is still considerable uncertainty around the transmission of AI from migratory species to endemic species. However, of the cases found so far in GB, three are in endemic species (pheasants, a curlew and a mute swan), two in migratory species (Whooper swan and greylag goose) and one in a gull (unspecified species) which have long daily flight patterns.

An estimate of the qualitative likelihood of migrating birds arriving in GB from various areas of Europe and Africa are shown below, by species (from the Flutest project). Those in red are the ones which have tested positive for HPAI H5N1 either in the UK or in Europe.

The Barnacle geese in the Netherlands are different populations from the UK ones, and probably come through the Baltic from Norway/western Siberia, while the ones that winter in Scotland either come from Greenland via Iceland or from Svalbard via north Norway.

Table 1: Qualitative estimation of number of High Risk Species, according the EFSA list, migrating from different regions of the world to GB, the Netherlands and Italy (per year) (*n*). Negligibles are excluded. [Flutest results]

Species	W/E	E/E	NAEA	WA	ESA
Bewick's swan	L	L	VL		
Whooper swan	L	VL	VL		
Mute swan	M	VL			
Greater white-fronted goose	VL	VL	VL		
Greylag goose	VL				
Red-breasted goose			VL		
Eurasian wigeon	H	M	M	L	
Common teal	H	L	L	L	

Species	W/E	E/E	NAEA	WA	ESA
Bewick's swan	L	L	VL		
Whooper swan	L	VL	VL		
Mallard	M	L	L	VL	
Northern pintail	M	L	L	L	VL
Garganey	VL	VL	VL	VL	VL
Northern shoveler	L	VL	L	VL	
Common pochard	L	L	L	VL	
Tufted duck	M	L	L		
Black-headed gull	H	L	L		

W/E Western Europe, E/E Eastern Europe, NAEA North Asia and Eurasia, ESA Eastern and Southern Africa. Number of individual birds in each qualitative category: >1,000,000 Very high (VH); 100,001 - 1,000,000 High (H); 10,001 – 100,000 Medium (M); 1,001 – 10,000 Low (L); 1 - 1,000 Very Low (VL); 0 Negligible (excluded)

Between September and November, across Europe, other wild bird species testing positive for either HPAI H5N1 or HPAI H5N8 were: barnacle goose, Canada goose, pink footed goose, grey heron, herring gull, several different raptors and multiple pheasants.

We therefore consider the likelihood of there being infected wild waterfowl present in the UK is high as a country-wide assessment. However, there will be regional variation, based on the proximity to aggregation sites for non-breeding wild waterfowl.

Exposure assessment

There are multiple pathways for the exposure of poultry to notifiable avian diseases via aerosol, direct or indirect contact.

These include:

- Contact with infected poultry such as live birds, hatching eggs and day old chicks of poultry
- Contact with live infected wild birds, particularly waterfowl

- Contact with poultry products and by-products of infected poultry,
- Contact with contaminated feed, water, bedding, equipment, vermin or clothing / footwear of people in contact with infected birds or contaminated environment.

For the purpose of this risk assessment, the pathways associated with trade in live poultry or poultry products (including domestic moves) will not be considered. There have not been any records of the legal trade in poultry or poultry products giving rise to an outbreak of HPAI in GB.

Biosecurity advice which poultry keepers should practice at all times of the year are focussed on these pathways as there is a constant low risk of incursion from any notifiable avian disease being introduced into poultry because LPAI viruses circulate constantly in wild birds. The EFSA report from 2017 used a combination of systematic review of all poultry outbreaks and expert knowledge elicitation from members of the poultry sectors. The opinion also concluded that the relative risk reduction for entry is **three fold** by preventing access to water bodies, that housing gives a further **two fold** reduction, and by applying routine biosecurity there is a further **four fold** reduction in risk while high biosecurity is a **44 fold** reduction in risk.

Contact with live infected wild birds, particularly waterfowl:

Housing birds will reduce the direct contact with wild waterfowl. It will not prevent any of the other pathways through which disease may enter a poultry premises. Other biosecurity measures will be more important. The likelihood of contact with wild waterfowl will be dependent on the number of such species in the near environment and how attractive the site is to such birds. The presence within the poultry premises of a pond or open feed bins are two well-known factors which make the direct contact with wild waterfowl more likely for poultry with access to the outside environment.

Expert opinion is that the virus will retain infectivity in the environment at low temperatures, for up to 55 days at 4°C (Ian Brown, EURL, Pers. Comm.). This means the environment could remain contaminated for several weeks at least.

Incursion through imported live animals or products:

For the other pathways, contact with other live birds (ie trade in poultry, hatching eggs, day old chicks) will be dependent on the business itself and the commercial activities. The contact with products or by-products from infected birds will be dependent on the activities of people entering the premises and bringing such products with them and it should be noted that swill feeding is not legal. These will not be addressed in detail for this assessment. However, housing birds will not impact on this risk.

Contact with fomites:

Fomites include contaminated feed, water, bedding, equipment, vermin or clothing / footwear of people in contact with infected birds or contaminated environment

Contamination of feed, bedding and water by wild birds can be prevented by sourcing such products from safe sources (ie 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 waterfowl by removing or covering any ponds on site 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 disinfectants appropriately. This will be particularly important where birds are housed, as contact with the birds is more frequent, as feed, bedding and water must be brought into the houses and birds must be checked for welfare issues or eggs collected from inside the houses. Visitors to the farm should also be recorded for security. Other biosecurity practices to ensure wild birds are separated from flocks such as 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/rodent access.

Above all, what was recommended by the EFSA opinion, was to make sure all personnel are trained in and practice good biosecurity. Regardless of whether birds are housed or not.

Domestic poultry

The GB poultry sector 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 25-26 million free range hens, and 1.5 million organic hens accounting for approx. 58% of UK production. For broilers, the proportion is a lot lower, at 3-5%. For ducks around 30% are outdoor and for geese, the majority are raised outdoors.

The poultry sector can be designated in the following way with the various populations according to the 2018 poultry register:

Poultry Type	Number of Birds	As proportion of total population	Number of holdings	As proportion of total poultry holdings
Total Chickens	270986618	85.45%	10125	51.98%

Poultry Type	Number of Birds	As proportion of total population	Number of holdings	As proportion of total poultry holdings
Outdoor Chickens	33500062	10.56%	5879	30.18%
Layers	47186064	14.88%	5454	28.00%
Broilers	166134899	52.39%	1663	8.54%
Total Turkeys	8462070	2.67%	1069	5.49%
Outdoor turkeys	1642191	0.52%	443	2.27%
Total ducks	4108083	1.30%	1364	7.00%
Outdoor ducks	981325	0.31%	878	4.51%
Total geese	146332	0.05%	187	0.96%
Outdoor geese	116826	0.04%	125	0.64%
Total CDGT	283703103	89.46%	12745	65.43%
Total Pheasant	23918729	7.54%	4733	24.30%
Total Partridge	9512172	3.00%	2001	10.27%
Total Poultry	317134004		19479	

Note: the “outdoor” label is only an estimate and the NCP Salmonella survey estimates the free range population to be 55% of the layer birds and 18% of turkeys.

Captive birds

Captive birds, such as those held in collections, zoos or approved bodies are already semi-housed and should be kept separate from wild waterfowl. For some, this 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 waterfowl access. There were outbreaks in captive birds in Europe (in zoos) in 2016/2017 and 2020/2120 and a derogation exists in GB domestic legislation 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, but the susceptibility of such birds to this virus is not known at present. Ratites are often refractory to HPAI infection from other viruses. However, there has been a case in Germany of an emu showing clinical signs in a zoo and therefore these birds should also be considered susceptible.

Game birds

The majority of game birds have already been released for the shooting season and therefore are considered wild birds 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.

Captive birds used as decoys would be at risk of increased contact with wild waterfowl. If they remain at one place for the duration of the fowling season, then they will not come into contact with domestic poultry. However, if the birds are moved around to other sites or spend any time at a premises where domestic poultry are kept, this is an increased risk for the poultry. 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.

Given the large poultry population and the proportion which are outdoor and in the regions close to the high aggregations of wild waterfowl, we consider the risk of exposure of poultry across the whole UK to be medium where biosecurity is less than stringent. There have been five reports from West England, Eastern Scotland and Mid-Wales of cases of HPAI H5N1 in wild birds and an infected premises has been identified in mid-Wales. Again there will be regional variations and a difference in the biosecurity arrangements at the establishment level. However, the pathways which lead to disease incursion are not prevented by housing per se, but housing birds is a risk reduction measure.

Consequence assessment

Any outbreak of notifiable avian disease has a significant impact on the UK poultry industry, through the trade and economic impacts on the producer. This is the same for any notifiable avian influenza virus. Average costs to government may be between £2 and £4 million per outbreak, depending on the number of birds involved and time taken to complete secondary C&D and return to disease free status.

As the most likely contact of poultry with wild waterfowl will be in those areas where there are high concentrations of these species, the likelihood of direct contact with wild waterfowl would be greater for poultry in close proximity or with sites attractive to wild waterfowl. Therefore, where there are no large aggregations of wild waterfowl, 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. It is worth reiterating that LPAI H7 viruses which circulate in wild waterfowl, when introduced into housed layer hens, have been known to mutate into HPAI which is a more disruptive infection to control, due to the increased size in control zones.

Housing birds which are not used to housing can cause welfare issues. Making sure their environment is enriched (e.g., with toys), that they have plenty of room to move, access to feed and water, clean bedding and the ability to display natural behaviours 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.

The UK is required to deliver surveillance for H5 and H7 LPAI incursions in poultry (including H5 and H7 HPAI in Anseriformes) under domestic legislation (and retained Commission Decision 2010/367/EU). An option for Risk Based Surveillance is available and has been applied in the UK since 2012. The output of the model used for the risk based targeting of surveillance in poultry identified 2231 10km grid squares where wild birds and registered poultry flocks are co-located as identified from 2016 “Sam” (APHA’s registration database) and British Trust for Ornithology data. For these grid squares, a risk score >0 could be assigned and then ranked into 6 bands of equal numbers of grid squares (approximately 373 in each rank) – please see the output in the map in Annex 1 where Rank 1 represents the lowest and rank 6 the highest risk. The remaining areas of GB where no poultry premises were registered have been assigned a “zero risk” score even though non-commercial poultry may be resident and wild birds abundant. The actual risk of AI incursion therefore will not be “zero” in these areas.

The area of any prevention order which included housing could be done under a Ministerial Order, as a national, regional or county level or at a smaller area level. In terms of delineating these areas, it makes most sense to use the risk-based poultry survey model, which already takes into account the areas of high wild waterfowl populations. It should also consider the different poultry populations which could be housed without compromising welfare. A national order or even regional order would be of significant consequence to the poultry sector where the risk is not considered to be above the normal background level. That consequence is around the possible increase in risk of the other pathways which could bring avian disease into contact with the poultry, through increasing

the level of contact with workers, increasing transmissibility of viruses between the birds when they are in close contact with one another and this would increase the risk of mutation of LPAI viruses into HPAI viruses as seen with previous outbreaks in Europe for H7 viruses.

Options are therefore considered as follows:

- For all poultry and captive birds, a national or regional housing order may not be appropriate, based on the impact to the sector versus the proportionality of the reduction in risk.
- For chickens, turkeys, ducks, other small poultry, it would be possible to implement a housing order at the county level, and this is easy to mandate, but not all premises are at the same risk level. Smaller areas with a 10x10 km² area is preferred but very difficult to implement.
- For geese, gamebirds and ratites which are normally raised outdoors, a housing order is very difficult, from a welfare perspective, and not recommended.
- For captive birds, at the county level and smaller zones, it is possible to require separation from wild birds by netting aviaries.

In the 2020/2120 season, an Avian Influenza Prevention Zone without a housing order was put in place on the 11th November, after the risk was raised for incursions in wild birds on the 4th November. That season, there was one commercial poultry farm in Cheshire which tested positive prior to the AIPZ being put in place. The second case was on the 12th November in Herefordshire, the 3rd on the 19th in Gloucestershire and the 4th on the 22nd November in Leicestershire, then a cluster in early December meant a Housing Order was put in place on the 14 December for three months. A total of 15 (inc. one in Northern Ireland) commercial outbreaks in commercial farms, 7 in backyard farms or rescue centres and 1 in a special category wildlife park and two strains (H5N8 and H5N1).

Geographically, there was a wider area involved, from Co Antrim in Northern Ireland, to Devon in England, Orkney in Scotland and Norfolk in England and Anglesey in Wales. Cases lasted from October until June.

In the 2016/2017 season, an Avian Influenza Prevention Zone with a housing order was put in place on 6th December 2016. The first outbreak was reported on the 19th December 2016 in Lincolnshire. The second commercial outbreak was 16th January in Lincolnshire. Total of 7 commercial outbreaks in commercial farms, 6 in backyard farms all involving the same strain, HPAI H5N8. Geographically, the disease was limited to England and just one case in South Wales, while the duration of cases was from December to May/June.

It is difficult to compare the two seasons and the effectiveness of housing. The 2020/2120 season was unusual in the duration of circulating virus, both starting earlier and finishing later than previous seasons. Therefore, the higher number of cases observed in 2020/21 in commercial premises (14 vs 7) was probably due to the length of the season (from

longer viral persistence in the environment), high infection pressure and the wider geographic area. EFSA suggested that this was mainly due to two peaks of infection in wild birds, whereby the juveniles were becoming infected from the adults, leading to a second wave of cases across Europe.

Conclusions

Housing should only be applied in conjunction with other biosecurity measures, but it should be noted that it will not be effective if used as a single measure. The trigger for such an order should not be associated with a primary case in a wild bird, but with widespread and increased infection pressure. In the current outbreak we now have multiple reports in wild birds several report cases (not confirmed) in domestic poultry, and one confirmed. There is not enough information yet to determine the source of infection in the single domestic poultry outbreak.

It should only be applicable to those species where the welfare of the birds is not compromised.

In GB the sensitivity of our wild bird avian influenza surveillance has been increased in recent days to ensure collection and analyses of any number of targeted species of wild birds (essentially ducks, geese, swans, gulls and birds of prey) known to carry risk of infection with AI viruses. Single dead birds of target species where possible will be collected and tested.

If the weather deteriorates significantly in the coming weeks, both in North Europe and in the UK, wild waterfowl will move towards the UK and inland from the coast to look for better wintering sites. This would change the estimated risk areas alluded to in this document.

If the HPAI H5Nx virus circulates in native sedentary wild waterfowl and becomes established, as happened with HPAI H5N1 in 2005-2008 and in 2020-2021 then housing could not be applied for such a long period. The survival of the virus in the environment during winter means the risk will not decrease for a period of weeks at the earliest.

If the risk has not changed and no new outbreaks or cases have been detected in the UK, despite passive surveillance and testing of wild birds found dead, the prevention order should be reviewed after the peak migratory wild waterfowl occurrence is past.

It is important to note that none of these uncertainties listed below are likely to impact the "exit strategy" from the imposition of a housing order. If a housing order were to be applied, an exit strategy is required and this should also be based on a risk assessment. Rather than relying purely on the prevalence of infection in wild birds, which we consider will always be underestimated, instead we would use three scientific measures to inform

the risk assessment. Firstly, the time of year and if our migrant non-breeding waterfowl have left the UK; secondly if time has lapsed since the last reported case and there is a significant reduction in infection pressure from the Continent; thirdly if the temperature has started to increase, with high sunlight levels then the environmental contamination would be reduced.

Assumptions and Uncertainties

- The wild bird counts for this year are not known and we are using an annual assessment based on previous years.
- Other wild waterfowl species (although this assessment considers the most abundant) may also be important for the transmission of this virus.
- The patterns of movement of gulls are more complex than waterfowl. They prefer to roost around land tips and reservoirs therefore these should not be ignored as potential sites of concern for proximity to poultry farms.
- The evidence for the economic benefits and dis-benefits of housing birds is not part of this assessment.
- The 2016/2017 epidemic allowed experts to analyse the likely risk factors leading to an incursion of avian influenza and while housing birds was assessed as giving a two fold reduction, other factors such as preventing access to wild birds (three fold) and improving biosecurity (four fold) are also significant.
- Comparing 2016/17 to 2020/21, the higher number of cases observed in 2020/21 was probably related to the increased infection pressure starting earlier in the season.
- While housing may prevent direct contact with wild waterfowl, it could increase indirect contact with contaminated environment and the birds may be under stress, leading to more disease transmission and greater likelihood of viral mutation. Regular contact with wild birds and their LPAI viruses may produce an environmental “vaccine” protection against HPAI

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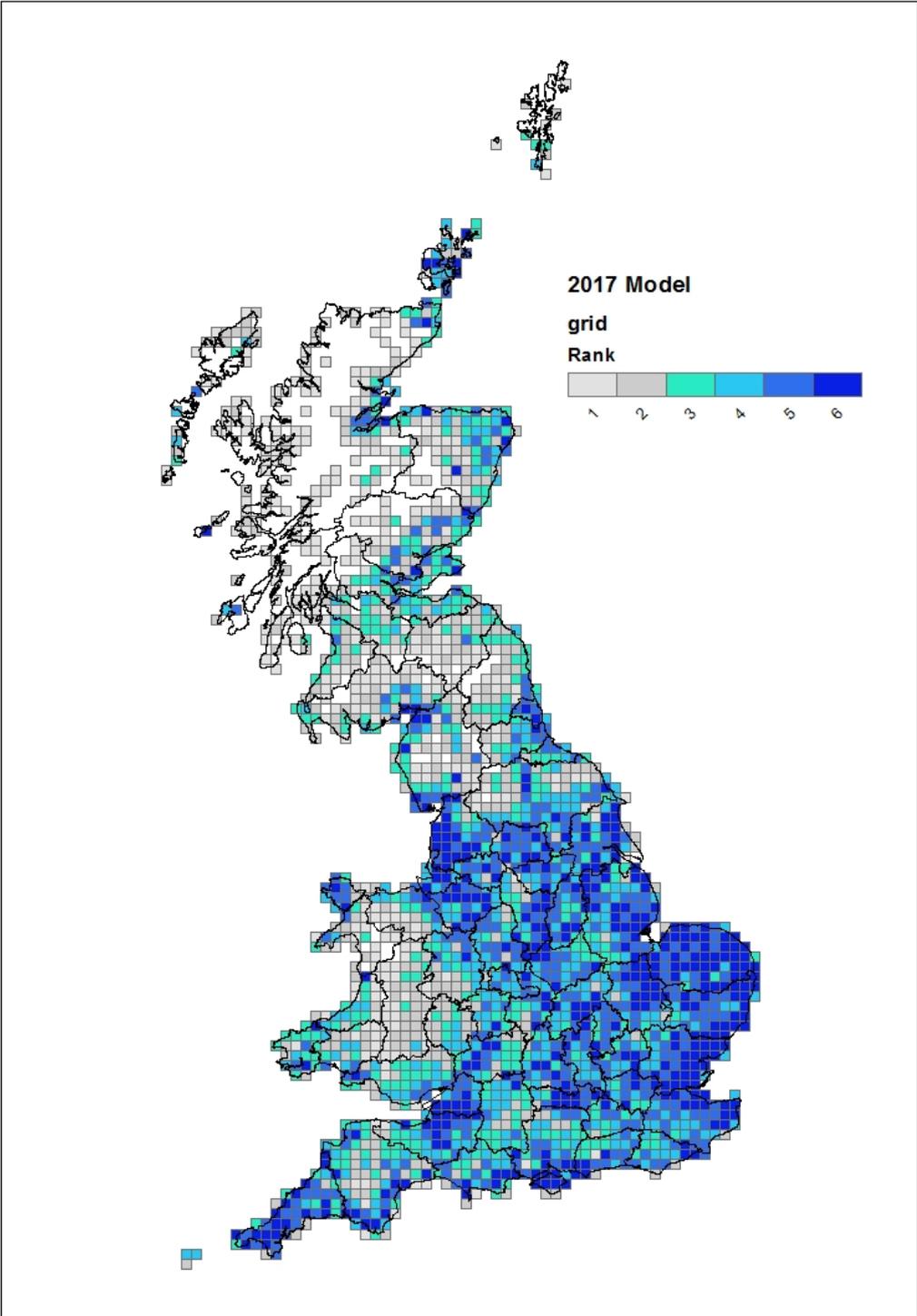
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Annex 1

Map of the high risk areas for targetting wild bird surveillance based on wild bird scores for high risk species and poultry density. Adapted from Hill et al. 2017



Annex 2

Table 2: Numbers of migratory birds (per year) entering GB, the Netherlands and Italy calculated as the difference between totals of monthly counts (maximum - minimum)

Higher Risk Bird Species	GB	The Netherlands	Italy
Bewick's Swan <i>Cygnus columbianus</i>	3,775	13,000	0
Whooper Swan <i>Cygnus cygnus</i>	7,428	2,000	0
Mute Swan <i>Cygnus olor</i>	11,542	5,000	3,248
Greater White-fronted Goose (European race) <i>Anser albifrons albifrons</i>	1,341	600,000	11,049
Greylag Goose <i>Anser anser</i>	72,980	150,000	5,392
Red-breasted Goose <i>Branta ruficollis</i>	4	7	4
Eurasian Wigeon <i>Anas penelope</i>	324,097	600,000	123,936
Common Teal <i>Anas crecca</i>	126,498	50,000	97,529
Mallard <i>Anas platyrhynchos</i>	97,872	180,000	208,000
Northern Pintail <i>Anas acuta</i>	25,344	20,000	12,781
Garganey <i>Anas querquedula</i>	38 (May) + 47 (Aug)*	80 (Apr) + 110 (Aug)*	223
Northern Shoveler <i>Anas clypeata</i>	11,200	10,000	22,811
Common Pochard <i>Aythya ferina</i>	24,160	45,000	42,189
Tufted Duck <i>Aythya fuligula</i>	46,429	150,000	7,725
Black-headed Gull <i>Larus ridibundus</i>	150,555	150,000	217,468

*Spring and autumn migration