

APPROVED: 20 December 2021

doi: 10.2903/j.efsa.2021.7108

Avian influenza overview September – December 2021

European Food Safety Authority,
European Centre for Disease Prevention and Control and
European Union Reference Laboratory for Avian Influenza

Cornelia Adlhoch, Alice Fusaro, José L Gonzales, Thijs Kuiken, Stefano Marangon, Éric Niqueux, Christoph Staubach, Calogero Terregino, Inma Aznar, Irene Muñoz Guajardo and Francesca Baldinelli

Abstract

Between 16 September and 8 December 2021, 867 highly pathogenic avian influenza (HPAI) virus detections were reported in 27 EU/EEA countries and the UK in poultry (316), in wild (523) and in captive birds (28). The detections in poultry were mainly reported by Italy (167) followed by Hungary and Poland (35 each). The majority of the detections in wild birds were reported by Germany (280), Netherlands (65) and United Kingdom (53). The observed persistence and continuous circulation of HPAI viruses in migratory and resident wild birds will continue to pose a risk for the poultry industry in Europe for the coming months. The frequent occurrence of HPAI A(H5) incursions in commercial farms (including poultry production types considered at low avian influenza risk) raises concern about the capacity of the applied biosecurity measures to prevent virus introduction. Short-term preparedness and medium- and long-term prevention strategies, including revising and reinforcing biosecurity measures, reduction of the density of commercial poultry farms and possible appropriate vaccination strategies, should be implemented. The results of the genetic analysis indicate that the viruses characterised during this reporting period belong to clade 2.3.4.4b. Some of the characterized HPAI A(H5N1) viruses detected in Sweden, Germany, Poland and United Kingdom are related to the viruses which have been circulating in Europe since October 2020; in North, Central, South and East Europe novel reassortant A(H5N1) virus has been introduced starting from October 2021. HPAI A(H5N1) was also detected in wild mammal species in Sweden, Estonia and Finland; some of these strains characterised so far present an adaptive marker that is associated with increased virulence and replication in mammals. Since the last report, 13 human infections due to HPAI A(H5N6) and two human cases due to LPAI A(H9N2) virus have been reported from China. Some of these A(H5N6) cases were caused by a reassortant virus of clade 2.3.4.4b, which possessed an HA gene closely related to the A(H5) viruses circulating in Europe. The risk of infection for the general population in the EU/EEA is assessed as low, and for occupationally exposed people, low to medium, with large uncertainty due to the high diversity of circulating viruses in the bird populations.

© 2021 European Food Safety Authority, European Centre for Disease Prevention and Control, European Union Reference Laboratory for Avian Influenza

Keywords: avian influenza, HPAI/LPAI, monitoring, poultry, captive birds, wild birds, humans

Requestor: European Commission

Question number: EFSA-Q-2021-00790

Correspondence: ALPHA@efsa.europa.eu

Acknowledgements: In addition to the listed authors, EFSA, ECDC and the EURL wish to thank the following: Member State representatives who provided epidemiological data on avian influenza outbreaks or shared sequence data: Mieke Steensels (Belgium), Aleksandra Miteva (Bulgaria), Lucie Kalášková, and Alexander Nagy (Czechia), **Tihana Miškić, Gordana Nedeljković**, Vladimir Savic (Croatia), Lise Uldall Bak Simonsen, Francisco Fernando Calvo Artavia, Pernille Dahl Nielsen, Charlotte Kristiane Hjulsager (Denmark), Kärt Jaarma (Estonia), Imbi Nurmoja (Estonia), Niina Tammiranta (Finland), Béatrice Grasland, Audrey Schmitz, Anne Van de Wiele, Yves Lambert and Andrea Jimenez (France), Franz Conraths, Christoph Staubach, Timm Harder (Germany), Georgina Helyes, Tamás Lancsák (Hungary), Laura Garza Cuartero, Eithne White and Sunita Jeawon (Ireland), Scolamacchia Francesca, Dorotea Tiziano, Fornasiero Diletta, Mulatti Paolo, Bianca Zecchin and Isabella Monne (Italy), Sadik Heta, Bafti Murati, Armend Cana, Kujtim Uka, and Xhavit Merovci (Kosovo), Siri Løtvedt, Grim Romo, Britt Gjerset (Norway), **Magdalena Gawędzka**, and **Krzysztof Śmietanka (Poland)**, Marcel Spierenburg and Nancy Beerens (The Netherlands), Onita Iuliana (Romania), Martin Chudy, Vilem Kopriva, Siamak Zohari (Sweden); Ian Brown from Animal and Plant Health Agency (United Kingdom), Ilya Chvala from Federal Center for Animal Health (FGBI 'ARRIAH', Russia); the many hundreds of people who sampled birds in the field for avian influenza; the working group AImpact2021 for the data on mortality in the Netherlands; Paolo Tizzani from OIE for the support provided with WAHIS data, Grazina Mirinaviciute from ECDC and Eleonora Chinchio from EFSA for the support provided to this scientific output; we gratefully acknowledge the authors, originating and submitting laboratories of the sequences from **GISAID's EpiFlu™ Database**, which is used for this assessment.

Note: Kosovo – this designation is without prejudice to positions on status and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence.

Suggested citation: EFSA (European Food Safety Authority), ECDC (European Centre for Disease Prevention and Control), EURL (European Reference Laboratory for Avian Influenza), Adlhoch C, Fusaro A, Gonzales JL, Kuiken T, Marangon S, Niqueux É, Staubach C, Terregino C, Aznar I, Muñoz Guajardo I and Baldinelli F, 2021. Scientific report: Avian influenza overview September – December 2021. 94 pp. <https://doi.org/10.2903/j.efsa.2021.7108>

ISSN: 1831-4732

© 2021 European Food Safety Authority, © European Centre for Disease Prevention and Control, and © European Union Reference Laboratory for Avian Influenza. *EFSA Journal* is published by John Wiley and Sons Ltd on behalf of the European Food Safety Authority.

This is an open access article under the terms of the Creative Commons Attribution-NoDerivs Licence, which permits use and distribution in any medium, provided the original work is properly cited and no modifications or adaptations are made.

Figures 1–15, 17–18, 20 and Tables 1, 3 © EFSA; Figures 16, 19, 21–23 and Table 2 © ECDC



The EFSA Journal is a publication of the European Food Safety Authority, an agency of the European Union.



Table of contents

1.	Introduction.....	4
2.	Main observation and conclusions	4
2.1.	Main observations	4
2.2.	Conclusions	5
3.	Options for response	6
4.	Results	8
4.1.	Overview of HPAI outbreaks in Europe during the previous and current seasons.....	8
4.2.	HPAI and LPAI detections in Europe, 16 September to 10 December 2021 (TOR 1 and TOR 2)	14
4.2.1.	HPAI detections in poultry, other captive birds and wild birds	14
4.2.2.	Genetic characterisation of avian influenza viruses	27
4.3.	Human cases and transmission to other mammal species due to A(H5Nx) viruses detected in Europe	28
4.3.1.	Human cases reported within clade 2.3.4.4 A(H5Nx) viruses globally	29
4.4.	Prevention and control measures applied in Europe, 16 September to 1 December 2021 (ToR 3)	29
4.5.	The avian influenza situation in other countries not reporting via ADNS, 16 September to 8 December 2021 (ToR 4)	30
4.5.1.	HPAI A(H5N1).....	31
4.5.2.	HPAI A(H5N2) and A(H5N5)	33
4.5.3.	HPAI A(H5N6).....	34
4.5.4.	HPAI A(H5N8).....	36
4.5.5.	HPAI–LPAI A(H7N9)	38
4.5.6.	LPAI A(H9N2)	39
4.6.	Scientific analysis of avian influenza spread from non-EU/EEA countries and within the EU/EEA	41
4.7.	Monitoring, diagnosis of human infections and public health, occupational health and safety measures for infection prevention and control in the EU/EEA	43
4.7.1.	Occupational health and safety measures	43
4.7.2.	Monitoring and options for public health measures	43
4.7.3.	Diagnosis.....	44
4.7.4.	Reporting	45
4.7.5.	Sharing of sequences	45
4.7.6.	Candidate vaccine viruses	45
4.8.	ECDC risk assessment for the general public in the EU/EEA	45
	References.....	47
	Abbreviations	54
	Appendix A – Terms of Reference	55
	Appendix B – Data and Methodologies.....	57
	Annex A – Characteristics of the HPAI A(H5N8) and A(H5N1)-positive poultry establishments.	60
	Annex B – Applied prevention and control measures on avian influenza	64
	Annex C – Data on wild birds	93

1. Introduction

This scientific report provides an overview of highly pathogenic avian influenza (HPAI) virus detections in poultry, captive and wild birds as well as noteworthy outbreaks of low pathogenic avian influenza (LPAI) virus in poultry and captive birds, and human cases due to avian influenza virus, occurred in and outside Europe between 16 September and 8 December 2021.

The background, Terms of Reference and their interpretation are described in Appendix A, and the data and methodologies are reported in Appendix B.

2. Main observation and conclusions

A description of the avian influenza outbreaks in European countries and in other countries of interest taking place between 16 September and 8 December 2021, is presented below.

2.1. Main observations

- In Europe, between 16 September and 8 December 2021 (based on the Animal Disease Information System (ADIS), OIE World Animal Health Information System (OIE-WAHIS), and information provided by affected countries) 867 HPAI A(H5) detections¹ were reported in poultry, and captive and wild birds:
 - 316 outbreaks in poultry, in Italy (167), Hungary (35), Poland (35), Germany (27), United Kingdom (22), Netherlands (8), Czechia (6), Bulgaria (4), Ireland (3), France (2), Norway (2), Croatia, Denmark, Estonia, Kosovo² and Slovakia (1 each);
 - 523 detections in wild birds, in Germany (280), Netherlands (65), United Kingdom (53), Ireland (23), Denmark (22), Sweden (12), Belgium (11), Finland (11), Estonia (8), Italy (7), Czechia (5), France (5), Serbia (6), Hungary (4), Norway (3), Luxemburg (2), Romania (2), Slovakia (2), Bosnia and Herzegovina and Poland (1 each);
 - 28 outbreaks in captive birds in Netherlands (7), Croatia (4), United Kingdom (3), Denmark (2), Germany (2), Poland (2), Austria, Bulgaria, France, Hungary, Portugal, Sweden, Switzerland and Ukraine (1 each).
- Norway reported for the first time ever detections of HPAI virus in poultry; also, for the first time since 2017, Bosnia Herzegovina and Serbia were affected by HPAI viruses.
- HPAI A(H5N1) was also detected in wild mammal species, red fox (*Vulpes vulpes*) and Eurasian otter (*Lutra lutra*), in Sweden, Estonia and Finland. Some of these viruses show genetic adaptation to replication in mammals, as previously observed (Manzoor et al., 2009; Kim et al., 2010; Herfst et al., 2012; Suttie et al., 2019).
- The increased detections of HPAI A(H5) in wild birds in Europe, starting in the second week of October and peaking in the first week of November, coincided with the autumn migration of waterbirds and arrival at their wintering grounds in Europe.
- Considering outbreaks in poultry, Italy is by far the most affected country in this reporting period, with 167 outbreaks mainly in fattening establishments of chickens and turkeys in densely poultry populated areas and more than 8 million birds affected, followed by Hungary (35 outbreaks and around 837,000 birds affected), and Poland (35 outbreaks and more than one million birds affected).
- In Italy, the HPAI A(H5N1) outbreaks in broilers were mostly detected by monitoring activities in response to outbreaks or testing before slaughter. No evident clinical signs or increased mortality were observed in the detected outbreaks which could be a result of early detection due to surveillance, with infected flocks detected early in the infection process (low prevalence)

¹ The date of suspicion was used as the reference date, when the date of suspicion was not available then the date of confirmation was used as the reference date.

² This designation is without prejudice to positions on status and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence.

when mortality is still low. Alternatively, there were also reports from an outbreak in layers in France where a slow increase in mortality was reported. This observation together with the observations in broilers in Italy could indicate a longer incubation period (or time from infection to death, and therefore longer infectious period) for this A(H5N1) strain than previous virus strains (Beerens et al., 2021). A longer incubation period or time from infection to death may delay detection based on mortality increasing thereby the risk of secondary transmission.

- All the HPAI (H5N1) viruses characterized during this reporting period (September-December) belong to clade 2.3.4.4b. Whole genome sequencing indicates the occurrence of new A(H5N1) virus introductions in North, Central, South and East Europe starting from October 2021, as well as the persistent circulation in Northern Europe of the A(H5N1) genotype which has been circulating in Europe since October 2020.
- As in the last report (EFSA et al., 2021a), the virus type HPAI A(H5N1) dominates the notified outbreaks in domestic and wild birds from outside the EU. More than half of the outbreaks were reported in two African countries, Nigeria and South Africa. Furthermore, cases have been detected worldwide outside Europe in domestic and wild birds in Togo, India, Israel, Japan, Korea and especially Russia. In contrast to the previous reporting period, no further increase in the number of cases could be observed.
- 13 human infections due to HPAI A(H5N6) and two human cases due to LPAI A(H9N2) virus have been reported from China since the last report.
- Some of the A(H5N6) viruses responsible for the human cases in China in 2021 were represented by a reassortant virus of clade 2.3.4.4b viruses, which possessed an HA gene closely related to the A(H5) viruses circulating in Europe and Asia.

2.2. Conclusions

- The viruses characterised to date retain a preference for avian-type receptors; however, the high level of reassorted viruses currently circulating in Europe are of concern for public health.
- The transmission of A(H5) clade 2.3.4.4b viruses to humans in Russia and Nigeria, the increasing number of transmission events of A(H5) viruses to wild mammals reported from different European countries and the recent upsurge of human cases due to A(H5N6) in China underline the continuous risk of avian influenza viruses to transmit to humans also in Europe and that these viruses may adapt further to mammals.
- The risk of infection for the general population in the EU/EEA is assessed as *low*, and for occupationally exposed people *low to medium* with high uncertainty due to the high diversity of circulating avian influenza viruses in bird populations.
- The risk of transmission to humans by exposure to contaminated poultry products is considered *negligible* as also outlined in a previous EFSA assessment (EFSA AHAW Panel, 2017).
- In addition to continued low-level HPAI A(H5) circulation in resident wild bird populations in Europe since the previous reporting period, the spatiotemporal pattern of HPAI A(H5) detections in this reporting period suggests new virus incursions with migratory waterbirds both in **northeast Europe (consistent with the 'East Atlantic flyway')** and in **southeast Europe (consistent with the 'Mediterranean-Black Sea flyway')**. **In the coming months, virus detections in wild birds** may be expected to extend to the southern and western limits of outbreaks observed in previous years, and the low temperature of winter may facilitate the environmental survival of these viruses in Europe.
- The frequent occurrence of HPAI A(H5) virus incursions in commercial farms where birds are kept indoors including poultry production types considered at low avian influenza risk (e.g. broilers and breeders) raises concern about the capacity of applied biosecurity measures to prevent virus introduction.
- Since October 2021, 854 HPAI detections by 27 European countries were reported overall, of which 316 were in poultry; in the same period in 2020, overall, 759 HPAI detections were reported, with only 51 occurred in poultry. In 2021, more than half (167 out of 316) of the poultry outbreaks were identified in northern Italy in commercial poultry establishments in areas with high poultry densities in the Veneto Region. In this reporting period, an increased number

of outbreaks was detected in fattening establishments of chickens and turkeys (50% of the reported outbreaks)

- Limited number of secondary infections have been reported in Czechia (1), Germany (1), Ireland (1) and Norway (1), whilst considerable number of secondary outbreaks were reported in Poland (7), Hungary (22) and likely also in Italy (with virus isolated from several farms genetically related). In order to prevent large epidemics, as the A(H5N8) epidemics previously experienced in France and Poland (EFSA et al., 2021a; EFSA et al., 2021c), it is important to strengthen biosecurity standards across the different production chains and enhance surveillance to ensure early detection.

3. Options for response

- The persistence and continuous circulation of HPAI A(H5) viruses in migratory and resident wild birds will continue to pose a health risk for poultry in Europe. HPAI A(H5) seasonal epidemics are difficult to predict and may not occur every year in Europe, but if they do, they may be expected to start around the end of September or beginning of October, with the arrival of migratory waterbirds in Europe. Considering the high negative impact of these HPAI epidemics in the last years, short-term preparedness and medium- and long-term prevention strategies should be identified and implemented, primarily in densely populated poultry areas and poultry production systems highly susceptible to avian influenza exposure.
- Preparedness strategies include:
 - Passive and active surveillance in wild birds focus on sick or dead birds of the target species (EFSA et al., 2017). Nonetheless, during the 2020–2021 epidemic, wild bird species not included in this list tested positive for HPAI viruses (including barnacle goose, greylag goose, red knot, great skua, and golden eagle). This highlights the need to also consider clinically healthy (hunted/trapped) birds and other wild bird species of relevance when designing a surveillance strategy. EFSA is on the process of revising the existing target list of wild bird species for passive surveillance of avian influenza to take into account the recent developments, and a new list will be published in early 2022.
 - The rate of HPAI A(H5) in species targeted for hunting, including greylag geese, mallards, Eurasian wigeons and Eurasian teals (some birds of these species being asymptomatic) should be taken into account prior to issuing permissions to hunt waterbirds. At times of high risk or following an outbreak in an area, consideration should be given to the suspension of hunting, both to reduce disturbance, and to reduce possibilities of spreading infection from the wild into the domestic setting when moving infected hunted birds (UNEP/CMS/FAO, 2021). Privately managed hunting areas, often near the densely poultry populated areas, have increased in the last years in Italy. This has resulted in an increase in the number of populations that can act as reservoir species of HPAI viruses (e.g. wild ducks) consequently increasing the risk of introduction of avian influenza viruses. A more in-depth analysis of this phenomenon should be done. The ban on hunting of wild birds for those who keep poultry should be considered to reduce the risk of connections between potentially avian influenza contaminated wild environments and susceptible domestic animals.
 - Appropriate early detection and rapid response, together with sustainable and effective biosecurity in poultry and captive birds. These measures should be applied to reduce the high-risk period of an epidemic and to prevent the secondary spread of avian influenza from affected establishments, particularly in high-risk areas and production sectors. Veterinary authorities in the Member States should ensure high awareness among all stakeholders in the poultry production sector, and the implementation of effective measures to minimise exposure risk for farmers and other occupationally exposed people.
 - Systems for culling operations and disposal of dead animals and contaminated waste, appropriate to the number of poultry holdings present, should be promptly available in each MS in case of epidemic events in order not to delay the extinction of outbreaks and mitigate the risks of secondary spread.

- Timely generation and sharing of complete viral genome sequences from wild birds, poultry, and captive birds. This is crucial to promptly detect novel virus introductions (i.e. distinguishable from viruses that have remained present in birds in Europe since winter 2020–2021) and to detect emergence of novel reassortant viruses. Continued monitoring together with in-depth analyses on virus evolution and genetic mutations, resulting in changes in viral properties that are relevant for animal and public health, are of utmost importance. More efforts should be made by reporting countries to genetically characterise a significant number of samples based on the size, duration, and relevant features of the epidemic in each country.
- Surveillance in mammals and humans that can potentially be exposed to infected birds. This should be strengthened to facilitate the early identification of virus transmission events from birds to wild or domestic mammals and/or humans, and subsequently between humans. Cross-sectoral cooperation and communication between animal and public health and occupational safety and health (OSH) authorities is recommended (One Health approach) to initiate rapid response, follow-up, and control measures.
- Prevention strategies include:
 - Biosecurity measures for poultry and captive birds. Biosecurity standards should be revised and reinforced, and their implementation regularly checked.
 - Reduction of the density of commercial poultry farms. This is primarily important in densely populated poultry areas and areas close to wetlands.
 - Reorganization of poultry production systems highly susceptible to avian influenza exposure. This will minimize the risk of virus introduction and further spread.
 - Possible application of appropriate vaccination strategies.
 - Avian influenza viruses have been identified in different wildlife species such as wild birds, seals and foxes. People living in areas where avian influenza outbreaks have been detected should avoid touching such sick (e.g. showing neurological symptoms) or dead animals or bird droppings unprotected. Wearing personal protective equipment (PPE, face mask, goggles/face shield/protective glasses, gloves and gown/overall) when directly exposed to birds, their products or droppings, which may potentially be infected or contaminated with avian influenza viruses, will minimise any residual risk. Where hunting wild waterbirds is permitted, these measures are relevant to hunters also.
 - People potentially exposed to infected poultry or captive birds, e.g. during culling operations, should be adequately protected and actively monitored or at least self-monitor for respiratory symptoms or conjunctivitis for 10 days following exposure and immediately inform local health and occupational health or other preventive services to initiate testing and follow-up. Antiviral pre- or post-exposure prophylaxis should be considered for exposed people according to national recommendations.
 - Occupational health and safety measures should be set according to national legislation. Health monitoring should be offered according to national requirements (see Section 4.6.1 for more detail).
 - The initiation of sero-epidemiological studies in exposed people following HPAI outbreaks is strongly encouraged to identify transmission events and support risk assessments.

4. Results

4.1. Overview of HPAI outbreaks in Europe during the previous and current seasons

Figures 1, 2 and 3 show the HPAI detections reported in birds (poultry, and wild and captive birds) in Europe and reported via ADNS, ADIS or OIE WAHIS for seasons 2016–2017, 2017–2018, 2018–2019, 2019–2020 and 2020–2021 by month of suspicion and geographical distribution. A season is in this document considered as the period that starts in week 40 (the beginning of October) and ends in week 39 (the end of September) of the following year, based on observed starting points of epidemic peaks in wild birds in Europe in 2016–2017, 2020–2021, and 2021–2022. For the current season, 2021–2022, data reported are truncated on 8 December 2021, as the season is still ongoing. A comparison among the geographical distribution of HPAI detections from September to December 2021 and the same period during the 2016–2017 and the 2020–2021 epidemics that were the previous largest recorded in the EU/EEA in terms of number of poultry outbreaks, geographical spread and number of dead wild birds, is shown in Figure 4.

The analysis of the characteristics of the previous 2020–2021 and current 2021–2022 avian influenza seasons, from October 2020 to 8 December 2021, is reported in Figure 5 by week of suspicion, virus subtype and host population; the distribution of HPAI outbreaks in poultry in Europe by affected bird species and sampling programme leading to the outbreak detection is showed in Figure 6.

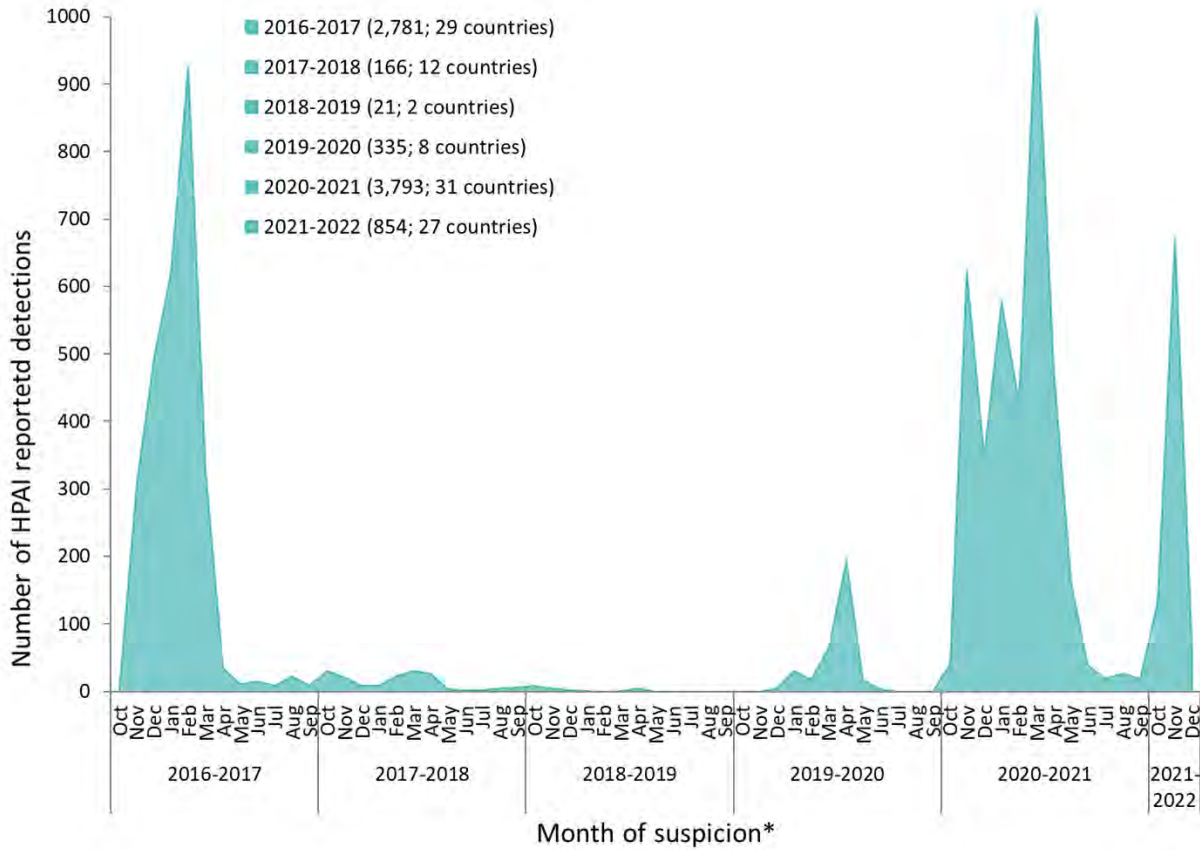
End of September to beginning of October was the start of the epidemic peaks in the 2016–2017, 2020–2021, and of the current 2021–2022 epidemic. There were no obvious epidemic peaks in 2017–2018 and 2018–2019, while the beginning of December was the start of the epidemic peak in the smaller 2019–2020 outbreak, involving only poultry (Figure 1). In the 2016–2017 season, the epidemic peaks in wild and domestic (poultry and captive) birds were approximately simultaneous. In the 2020–2021 season, the epidemic peak in wild birds preceded that in domestic birds and so far, appears to be the case also in the 2021–2022 outbreak (Figure 2).

The large 2016–2017 and 2020–2021 outbreaks were widespread in Europe and had similar northern (Finland), western (Ireland and the Iberian Peninsula), southern (Italy, Greece) and eastern limits (Ukraine, Romania, Bulgaria). So far, the 2021–2022 outbreak seems to become as extensive, with the same northern and western limits, but has not yet reached as far south as south Italy or Greece (Figure 3).

The geographical and temporal detections of HPAI in wild birds (stars) show similar patterns in the 2016–2017, 2020–2021, and 2021–2022 outbreaks. Starting in September or October, HPAI is detected in wild birds in northwest Europe along a broad band starting in Estonia and Finland in the east, following the coasts of the Baltic Sea and the North Sea coasts of Denmark, Germany, and the Netherlands, across the United Kingdom, and ending in Ireland in the west. The detections in wild birds along this band increase in November and decrease again in December (no data yet for December 2021). Above the band is consistent with the so-called 'East Atlantic flyway' (Olsen et al., 2006). Slightly later, starting in October or November, HPAI is detected in wild birds in southeast Europe along a broad band starting along the Black Sea coasts of the Ukraine and Romania in the east, across the Balkans, the north Adriatic Sea coast of Italy, and ending in the Po Valley of north Italy. Above the is consistent with the so-called 'Black Sea-Mediterranean flyway' (Olsen et al., 2006). In addition, HPAI is detected in wild birds in other locations in Europe, with a concentration of detections along the shores of Lakes Constance, Neuchatel, and Geneva in Switzerland, in 2016 (Figure 4).

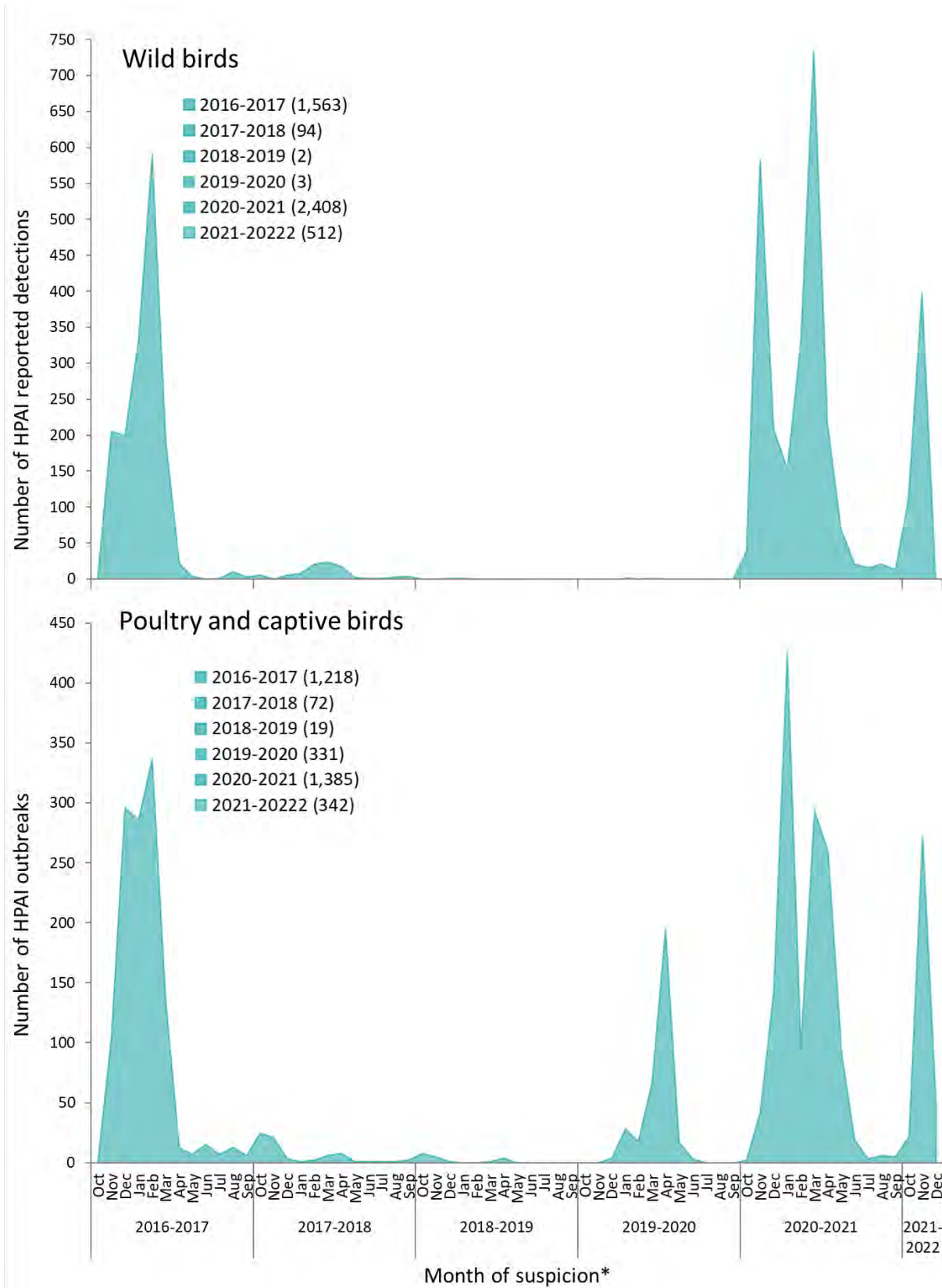
The predominant subtype A(H5N8) in the 2020–2021 epidemic season was replaced mainly by subtype A(H5N1) in the current 2021–2022 epidemic; in both cases, poultry farms were affected regardless of the domestic bird species. Regarding wild birds, HPAI was detected predominantly in waterfowl, with smaller numbers of detections in raptors and other wild bird species (Figure 5).

Considering only HPAI outbreaks in poultry, so far approximately 12,100,000 birds have been affected in the current epidemic season since October 2021.



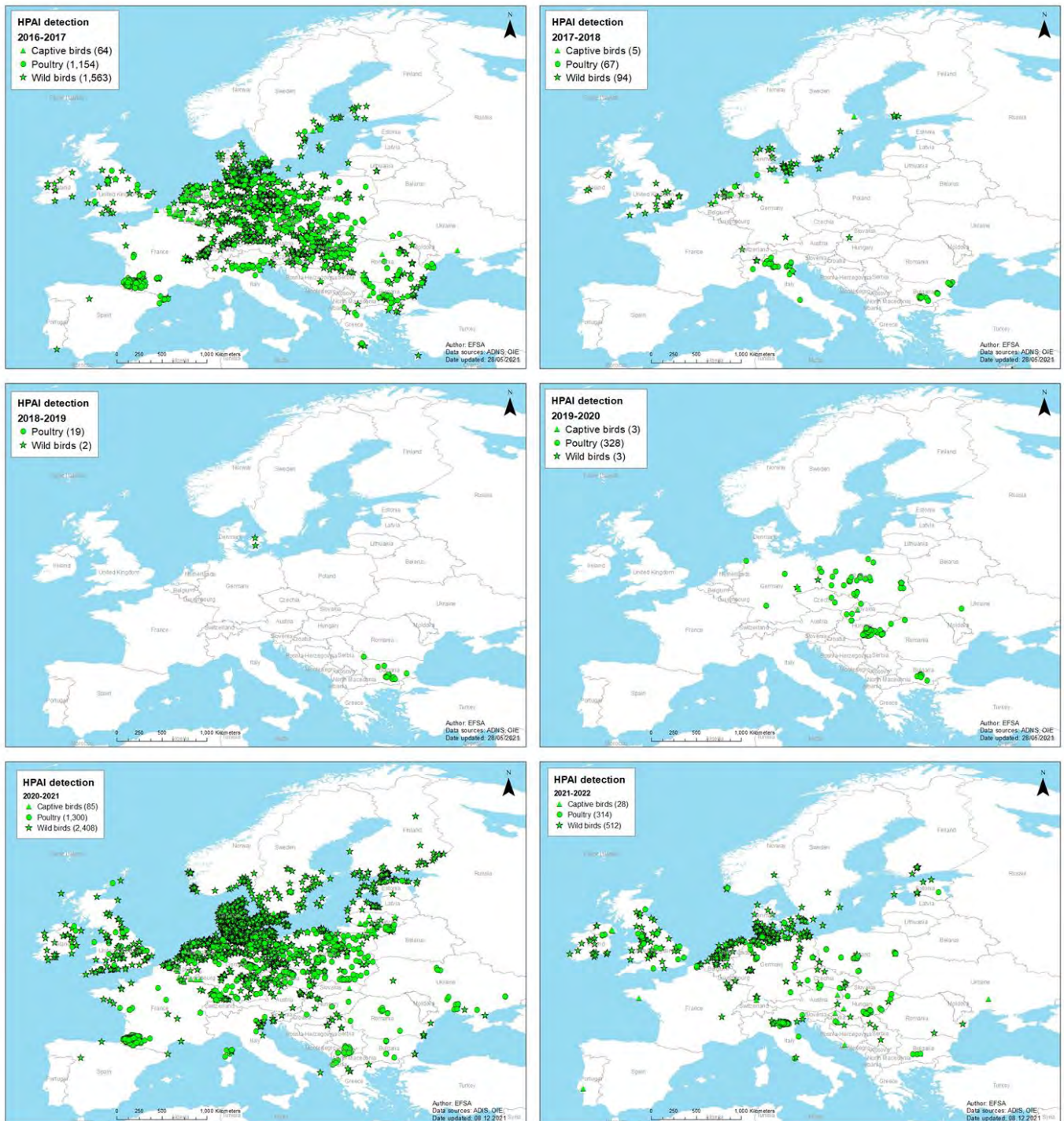
*When the date of suspicion is not available then the date of confirmation is used to assign the week of suspicion. United Kingdom data are from ADNS up to 31 December 2020. From 1 January 2021 onwards, the data source was ADNS for Northern Ireland and World Animal Health Information System (OIE-WAHIS) for Great Britain. Data source: ADIS and OIE (data extraction carried out 8 December 2021).

Figure 1: Distribution of the number of HPAI virus detections reported in Europe in the seasons 2016–2017, 2017–2018, 2018–2019, 2019–2020 and 2020–2021 by month of suspicion, 1 October 2016 to 8 December 2021 (7,948)



Note that the scale of the vertical axes is specific to each bird population.

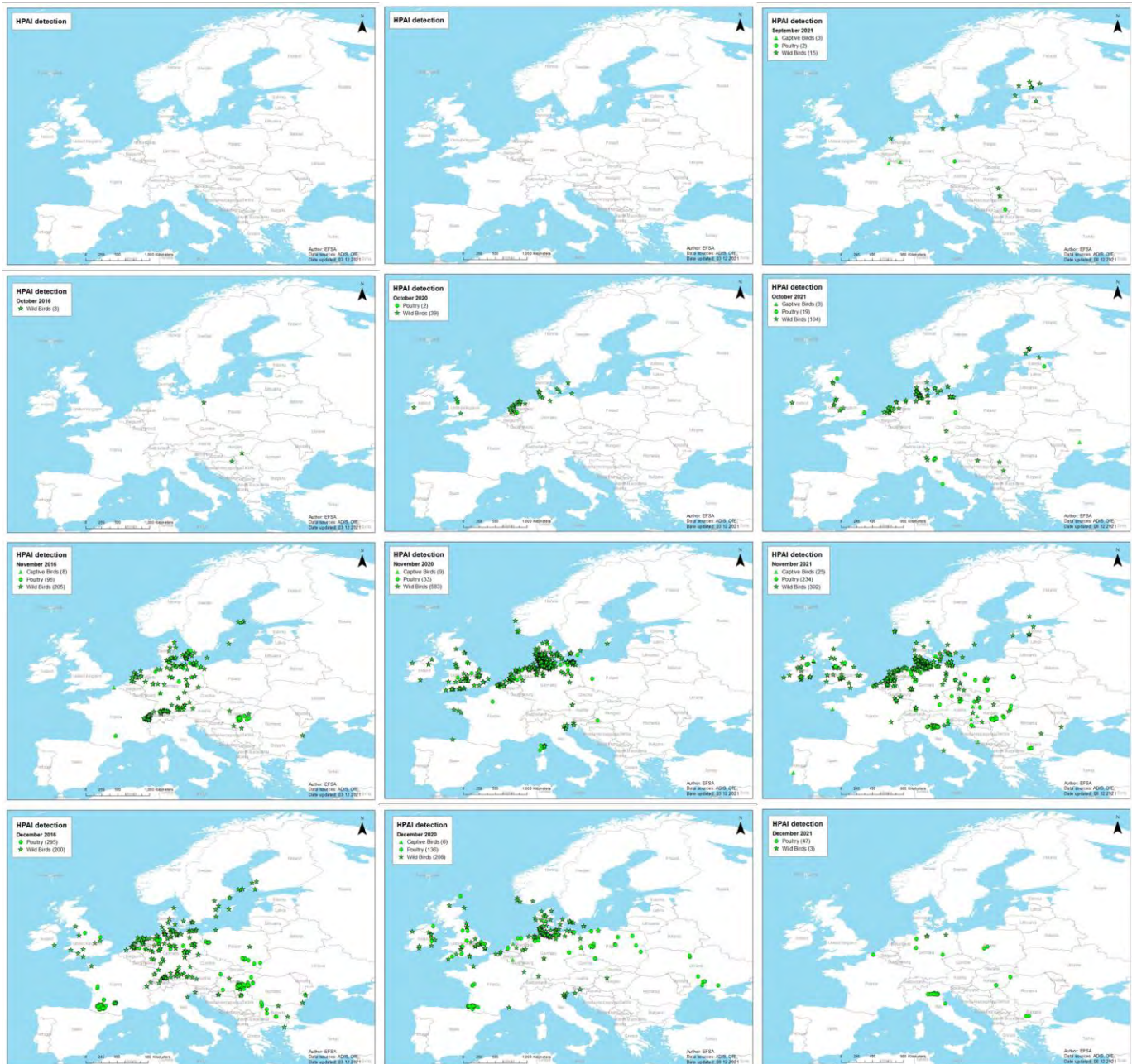
Figure 2: Distribution of total number of HPAI virus detections reported in Europe in the seasons 2016–2017, 2017–2018, 2018–2019, 2019–2020, 2020–2021 and beginning of 2021–2022 by month of suspicion in (upper) wild birds (4,581) and (lower) domestic birds (poultry and captive birds) (3,367), from 1 October 2016 to 8 December 2021



*This designation is without prejudice to positions on status and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence.

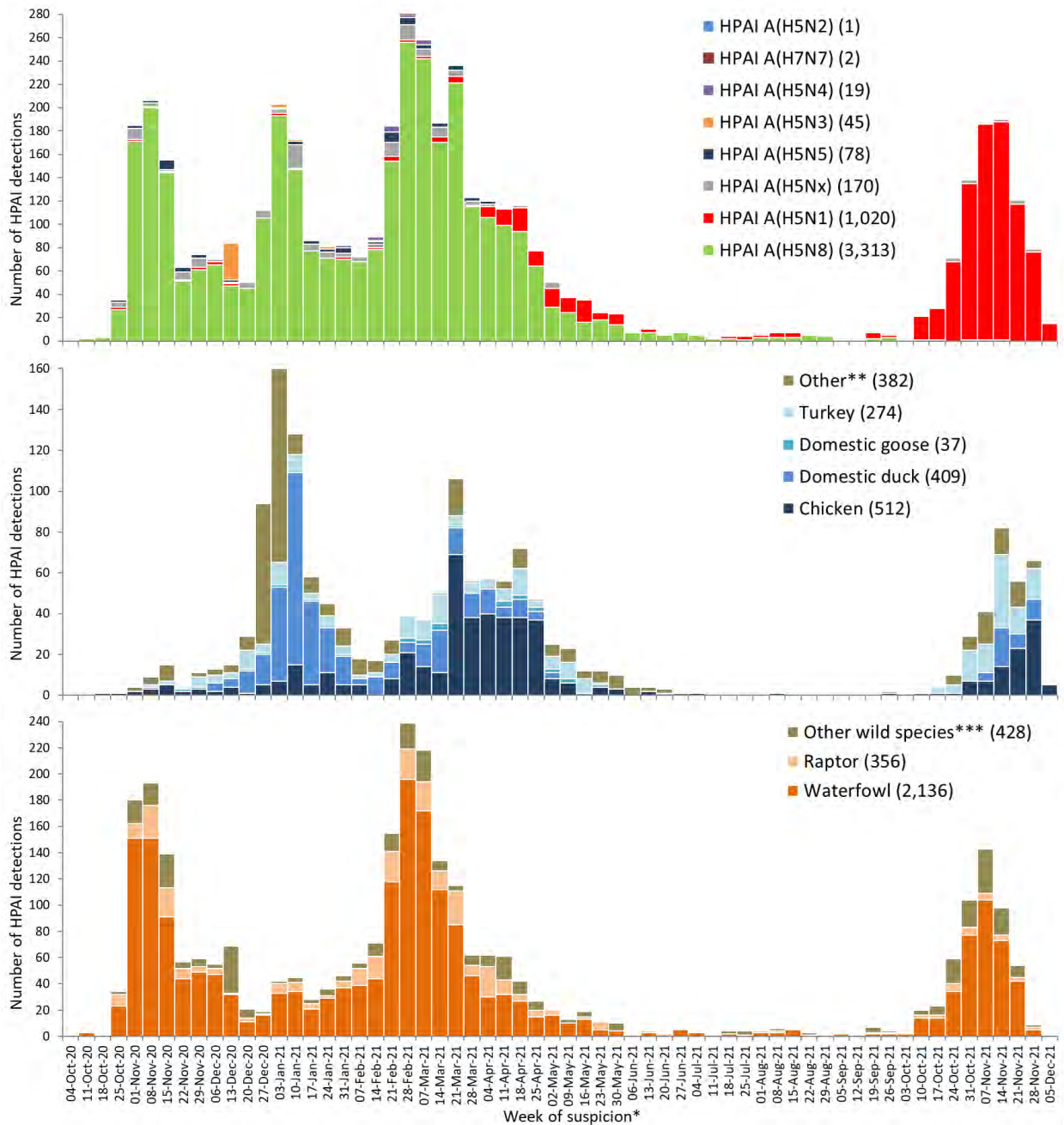
United Kingdom data are from ADNS up to 31 December 2020. From 1 January 2021 onwards, the data source was ADNS for Northern Ireland and OIE WAHIS for Great Britain.

Figure 3: Geographical distribution, based on available geocoordinates, of HPAI detections in Europe in seasons 2016–2017 (2,781), 2017–2018 (166), 2018–2019 (21), 2019–2020 (334), 2020–2021 (3,792) and 2021–2022 (854) in poultry (circles), wild birds (stars) and captive birds (triangles) (1 October 2016 to 8 December 2021)



*This designation is without prejudice to positions on status and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence. United Kingdom data are from ADNS up to 31 December 2020. From 1 January 2021 onwards, the data source was ADNS for Northern Ireland and OIE WAHIS for Great Britain.

Figure 4: Geographical distribution, based on available geocoordinates, of HPAI detections in Europe by month of suspicion in 2016 (left column), in 2020 (central column) and in 2021 (right column). Note that data on December 2021 are up to 8 December.



*When the date of suspicion is not available then the date of confirmation is used to assign the week of suspicion.

**'Other domestic species' category contains mixed, unknown bird species, or categories different from those displayed (i.e. guinea fowl, peacock, pheasant and quail).

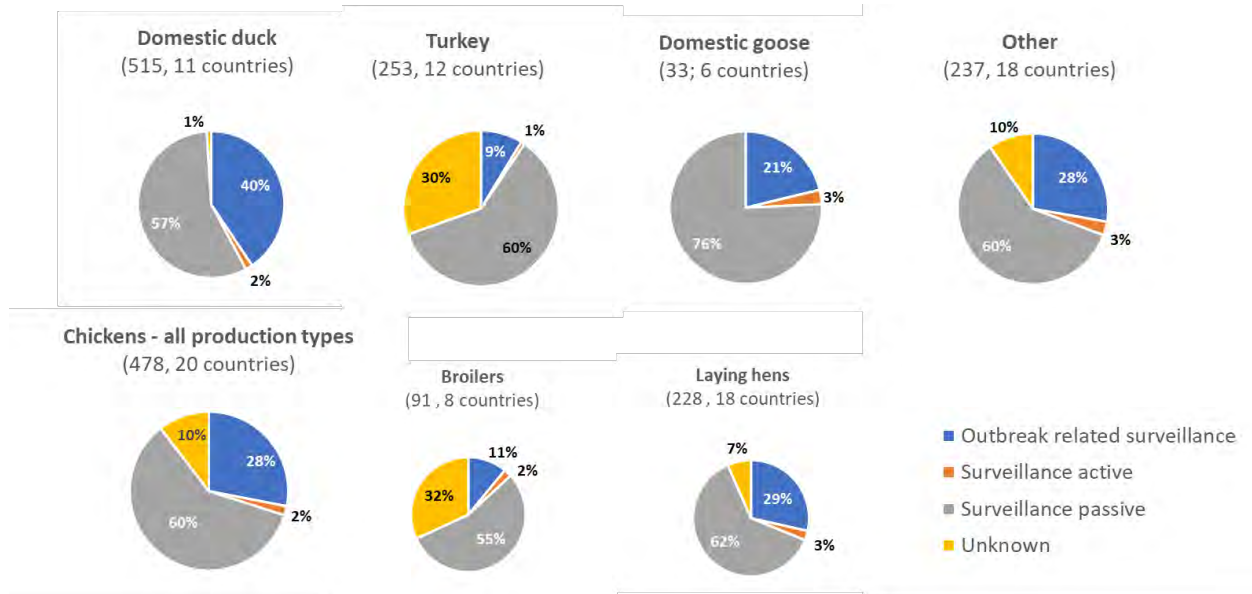
***'Other wild species' category contains mixed, unknown bird species, or categories different from those displayed. The complete list of species by each wild bird category is reported in table C.1 in Annex C.

United Kingdom data are from ADNS up to 31 December 2020. From 1 January 2021 onwards, the data source was ADNS for Northern Ireland and OIE WAHIS for Great Britain.

The HPAI A(H7N7) outbreak notified by the Lithuanian Health Authorities on 26 March 2021 was not confirmed by AI-ND EURL due to the very low viral load in the samples and the lack of other samples on which to repeat the analysis.

Data source: ADNS, ADIS and OIE (data extraction carried on 8 December 2021), EFSA.

Figure 5: Distribution of total number of HPAI virus detections reported in Europe by week of suspicion (dates indicate the first day of the week) and (upper) virus subtype (4,647), (middle) affected poultry categories (1,614), (lower) affected wild bird categories (2,920), 4 October 2020 to 8 December 2021. Note that the scale of the vertical axes is specific to each category



*'Other poultry species' contains mixed, unknown, or bird species different from those displayed.

Data source: EFSA.

Figure 6: Frequency distribution of HPAI outbreaks in poultry in Europe, by bird species (domestic goose, domestic duck, chicken, turkey and other poultry species) and sampling programme leading to the outbreak detection, in season 2020–2021 from October 2020 to 1 December 2021 (1,517)

4.2. HPAI and LPAI detections in Europe, 16 September to 10 December 2021 (ToR 1 and ToR 2)

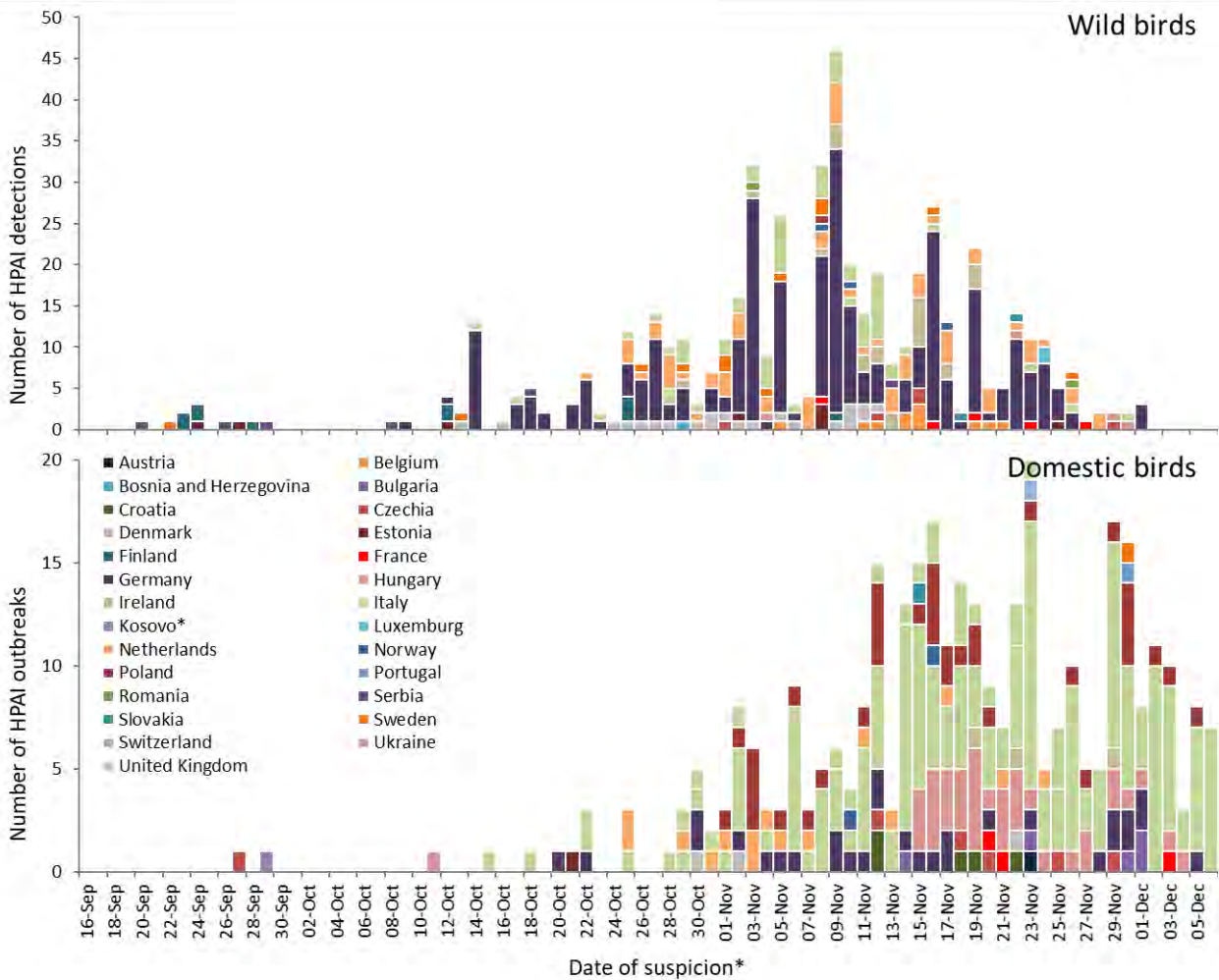
4.2.1. HPAI detections in poultry, other captive birds and wild birds

From 16 September to 8 December 2021, 867 HPAI A(H5) virus detections were notified in poultry (316), captive (28) and wild birds (523) in 27 countries in Europe, and were reported via the ADIS or OIE WAHIS, as presented in Table 1. Overall, approximately 1 million birds were affected in HPAI poultry outbreaks.

The timelines, virus subtypes, locations and the affected bird categories of the avian influenza detections are presented in Figures 7, 8 and 9. This is the first time ever that HPAI virus is detected in the poultry sector in Norway; also, the first detections since 2017 in Bosnia Herzegovna and Serbia. Characterisation of HPAI-affected poultry establishments³ is reported in Section 4.2.1.1; the description of the HPAI detections in wild birds is reported in Section 4.2.1.2.

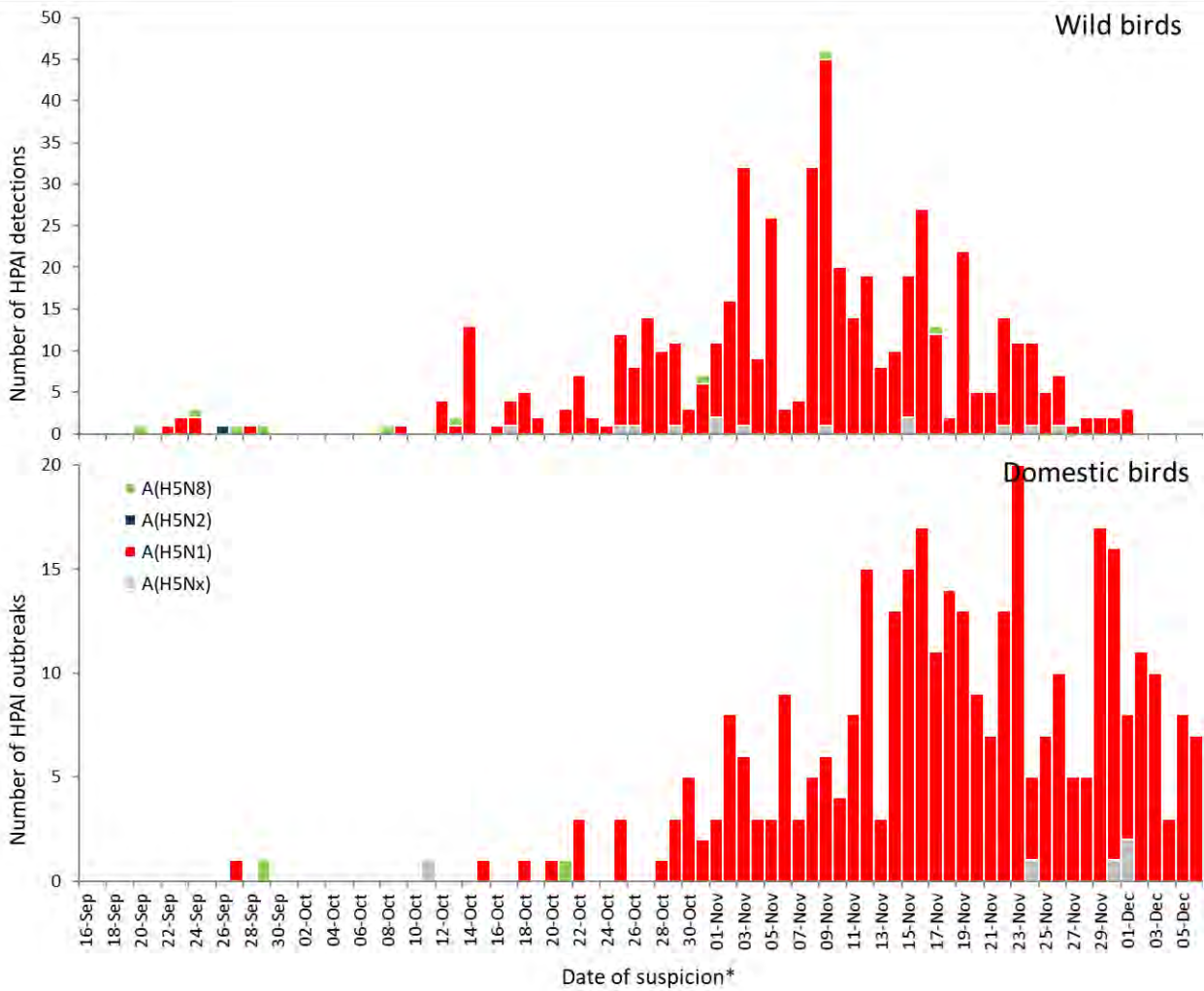
In this reporting period, 32 poultry outbreaks were notified as secondary in Hungary (27), Poland (5), Germany (3), Czechia, France, Ireland and Norway (1 each). In Hungary, the later spread mostly affected the domestic duck and goose and the turkey sectors.

³ According to Regulation (EU) 2016/429 'establishment' means any premises, structure, or, in the case of open-air farming, any environment or place, where animals or germinal products are kept, on a temporary or permanent basis, except for: (a) households where pet animals are kept; (b) veterinary practices or clinics. Regulation (EU) 2016/429 of the European Parliament and of the Council of 9 March 2016 on transmissible animal diseases and amending and repealing certain acts in the area of animal health ('Animal Health Law'). OJ L 84, 31.3.2016, p. 1–208.



*When the date of suspicion is not available then the date of confirmation is used to assign the week of suspicion.
 **This designation is without prejudice to positions on status and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence.
 ***United Kingdom data were extracted from ADNS until 31 December 2020. From 1 January 2021 onwards, the data source was ADNS for Northern Ireland and OIE WAHIS for Great Britain.
 Data source: EFSA, ADIS and OIE (data extraction carried on 8 December 2021).

Figure 7: Distribution of the highly pathogenic avian influenza detections in Europe, by day of suspicion and country in (upper) domestic birds (poultry and captive birds) (344) and (lower) wild birds (523), from 15 September to 8 December 2021. Note that the scale of the vertical axes is specific to each bird population



*If suspicion is not available then the date of confirmation is used to assign the week of suspicion.

**This designation is without prejudice to positions on status and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence.

***United Kingdom data were extracted from ADNS until 31 December 2020. From 1 January 2021 onwards, the data source was ADNS for Northern Ireland and OIE WAHIS for Great Britain.

Data source: EFSA, ADIS and OIE (data extraction carried on 8 December 2021).

Figure 8: Distribution of the highly pathogenic avian influenza detections in Europe, by day of suspicion and virus subtype in (upper) domestic birds (poultry and captive birds) (344) and (lower) wild birds (523), from 16 September to 8 December 2021. Note that the scale of the vertical axes is specific to each bird population

Table 1: Number of highly pathogenic avian influenza outbreaks in Europe, by country, virus subtype and affected sub-population, 15 September – 8 December 2021

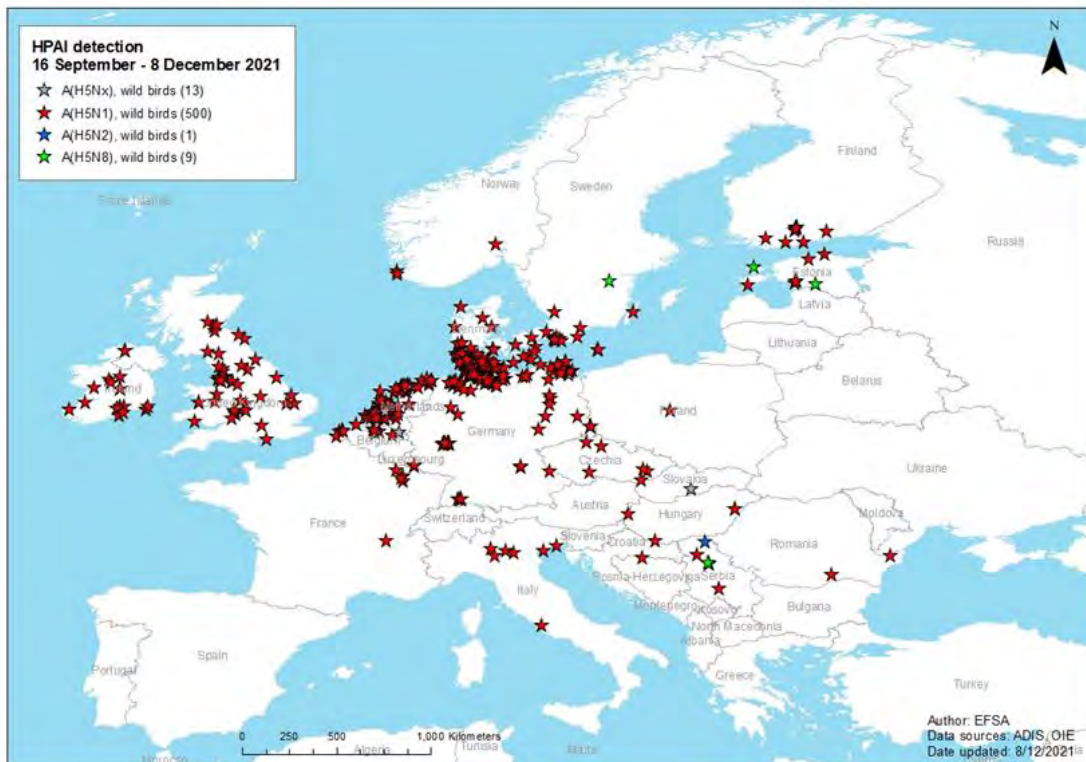
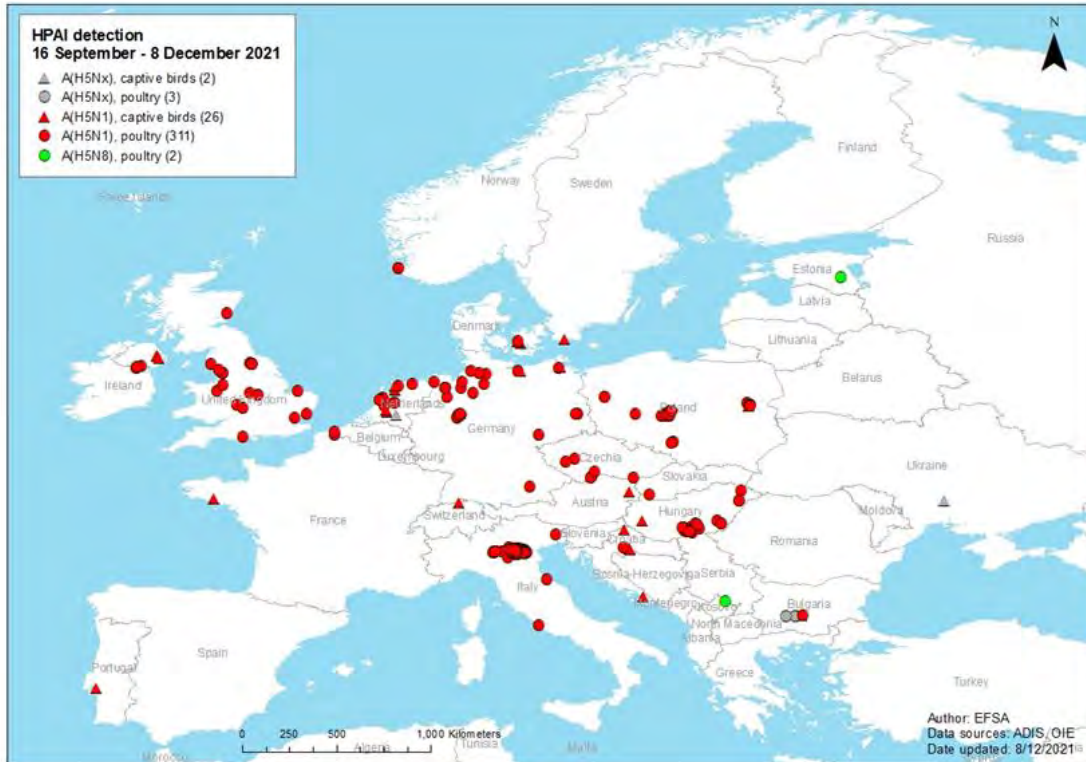
Country	Captive birds (28)		Poultry (316)			Wild birds (523)				Total
	A(H5Nx)	A(H5N1)	A(H5Nx)	A(H5N1)	A(H5N8)	A(H5Nx)	A(H5N1)	A(H5N2)	A(H5N8)	
Austria		1								1
Belgium						2	9			11
Bosnia and Herzegovina							1			1
Bulgaria		1	3	1						5
Croatia		4		1						5
Czechia				6			5			11
Denmark		2		1			22			25
Estonia					1		6		2	9
Finland							10		1	11
France		1		2			5			8
Germany		2		27		4	276			309
Hungary		1		35			4			40
Ireland				3			23			26
Italy				167			7			174
Kosovo ^(a)					1					1
Luxembourg							2			2
Netherlands	1	6		8		6	57		2	80
Norway				2			3			5
Poland		2		35			1			38
Portugal		1								1
Romania							2			2
Serbia							2	1	3	6
Slovakia				1		1	1			3
Sweden		1					11		1	13
Switzerland		1								1
Ukraine	1									1
United Kingdom ^(b)		3		22			53			78
Total	2	26	3	311	2	13	500	1	9	867

(a): This designation is without prejudice to positions on status, and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence.

(b): United Kingdom data were extracted from ADNS until 31 December 2020. From 1 January 2021 onwards, the data source was ADNS for Northern Ireland and OIE WAHIS for Great Britain.

(c): The HPAI A(H7N7) outbreak notified by the Lithuanian Health Authorities on 26 March 2021 was not confirmed by AI-ND EURL due to the very low viral load in the samples and the lack of other samples on which to repeat the analysis.

Data source: EFSA, ADNS and OIE (data extraction carried on 8 December 2021).



*This designation is without prejudice to positions on status, and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence. United Kingdom data were extracted from ADNS until 31 December 2020. From 1 January 2021 onwards, the data source was ADNS for Northern Ireland and OIE WAHIS for Great Britain.

Figure 9: Geographical distribution, based on available geocoordinates, of highly pathogenic avian influenza detections reported by virus subtype in poultry and captive birds (344) (upper panel) and in wild birds (523) (lower panel) in Europe between 16 September and 8 December 2021

4.2.1.1. HPAI in domestic birds

Characterisation of the HPAI-affected poultry establishments

In this section a detailed analysis of the HPAI affected poultry establishments is presented. Due to the time needed to carry out the data collection, the reporting period presented in this section is different and shorter than that of the whole report: only the outbreaks reported between 16 September 2021 and 1 December 2021 are thoroughly described (the earliest suspicion date was 27 September 2021). Outbreaks notified prior to 16 September 2021 were covered in the previous EFSA report (EFSA et al., 2021a), and the outbreaks occurred later than 1 December 2021 will be included in the next publication.

From 16 September to 1 December 2021, 219 HPAI outbreaks in poultry were notified in 15 countries through ADIS: 117 in Italy, 27 in Poland, 30 in Hungary, 20 in Germany, 8 in the Netherlands, 6 in Czechia, 2 in Norway and Ireland, one in Bulgaria, Croatia, Denmark, Estonia, France, Kosovo², and Slovakia (Figure 10A), with Italy accounting for 53% of the number of total outbreaks and 67% of the number of poultry birds affected (Figure 10B).

Compared with the previous reporting period (1 May to 15 September 2021) where 103 outbreaks were reported by affected countries, more than the double of the number of outbreaks occurred within this reporting period, with almost three times the birds affected: 8,038,099 in this reporting period *versus* 2,761,543 in the previous one (EFSA et al., 2021a).

Two subtypes were reported: A(H5N1) in 217 outbreaks, and A(H5N8) in the two outbreaks in Estonia and Kosovo, with a total reversal of the situation respect to the previous reporting period, where most of the outbreaks were A(H5N8) type, and only three outbreaks were A(H5N1) type.

The description of the bird species and the production category of these HPAI-affected establishments are shown in Figure 11. In total, 18 establishments were housing more than 100,000 birds (575,630 birds in the largest farm), 22 holdings belong to the housing category of 50,001-100,000 birds, 115 holdings belong to the housing category of 10,001-50,000 birds, 43 holdings belong to the housing category of 1,001–10,000 birds, and 20 establishments were keeping less or equal to 1,000 birds. Data for one farm in Poland were not available. Compared with the last reporting period, a higher proportion of number of large farms (i.e. those with more than 10,000 birds) was involved, in particular those housing 50,001-100,000 birds accounted for the 10% of the total number of affected farms in this reporting period vs 2% in the last one, and those housing 10,001–50,000 birds accounted for the 53% of the total number of affected farms in this reporting period vs 26% in the last one. Also, a lower proportion of small farms (i. d. those with less than 1,000 birds) was involved (9% of the total number of affected farms in this reporting period vs 48% in the last one). Of note, 38% and 15% of the total poultry outbreaks (219) were detected in respectively fattening turkeys and broilers establishments, whereas in the same period in 2020 they accounted for only the 9% and 6% of the total number of outbreaks (33).

Out of 219 outbreaks, 198 HPAI outbreaks were reported from commercial farms and 16 in non-commercial farms (the information is not known for five farms). Overall, 17 were in farms in which animals had outdoor access (six in Czechia, two in Poland, Hungary, Italy and the Netherlands and one each in Croatia, Estonia, and Slovakia), 78 did not have outdoor access and for the remaining 126 farms the information was unknown at the time of publication of this report.

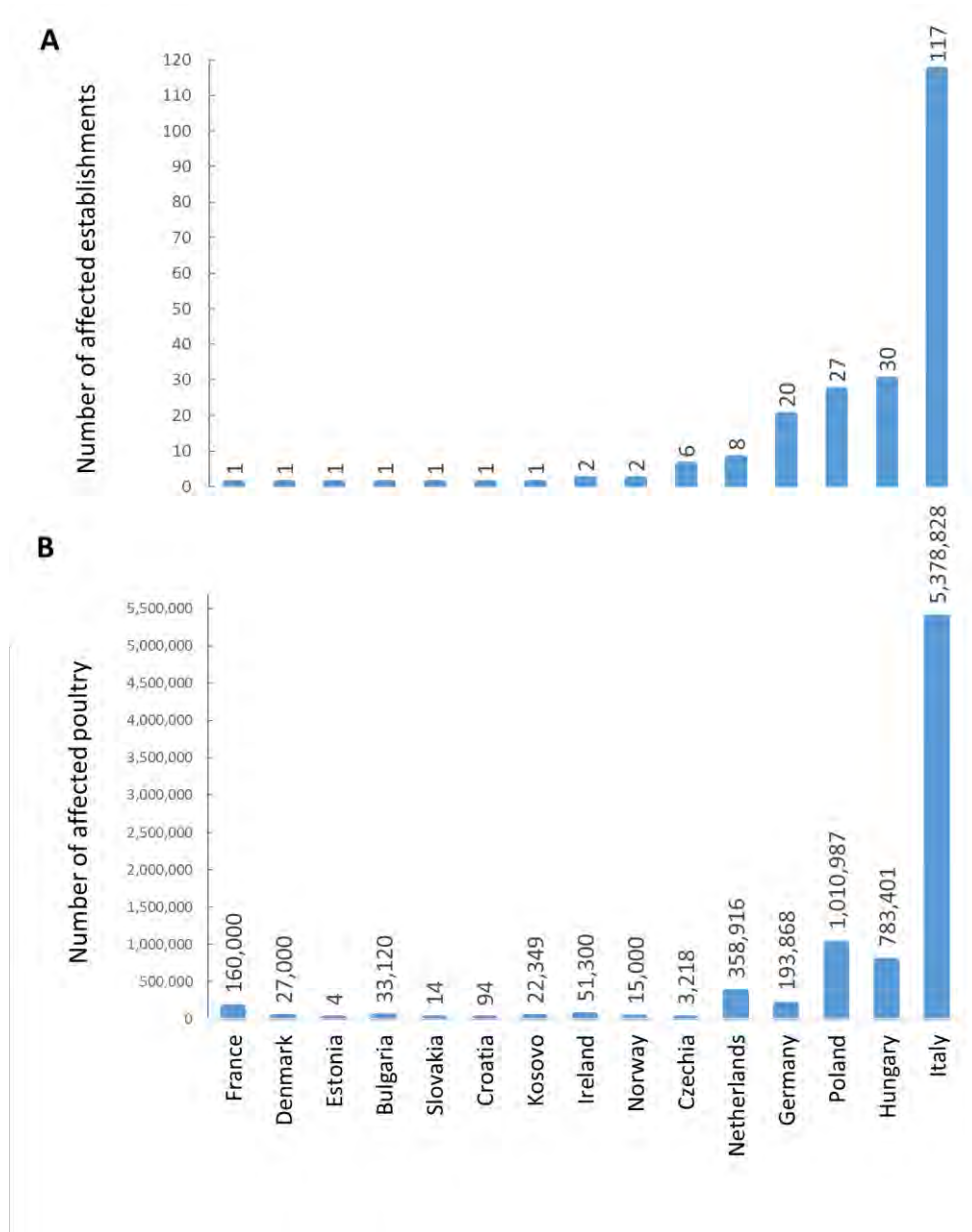
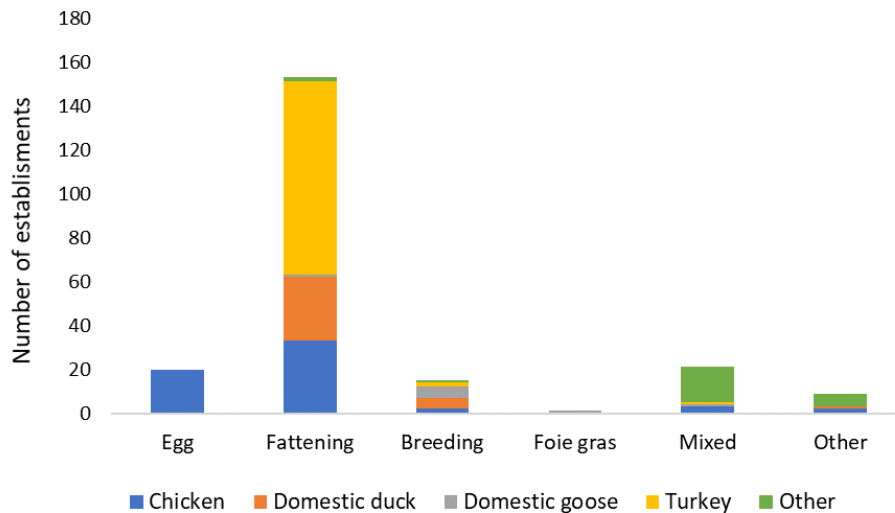


Figure 10: Number of establishments (A) and domestic birds (poultry) (B) affected by HPAI in the EU between 16 September 2021 and 1 December 2021 (219).



*'Other' species category contains mixed, unknown bird species, or categories different from those displayed (i.e. guinea fowl, quail, Muscovy duck). 'Other' production type contains unknown or different production type from those displayed (i.e. egg, fattening, breeding, foie gras, and mixed).

Figure 11: Poultry species and production category of establishments affected by HPAI between 16 September 2021 and 1 December 2021 (n = 219).

HPAI A(H5N1)-affected poultry establishments in Bulgaria

On 15 November 2021, one primary HPAI A(H5N1) outbreak was confirmed in a commercial farm with more than 33,000 laying hens located in the Plovdiv region in Bulgaria. Increased mortality (more than 400 hens died) and clinical signs were reported. The source of infection in the holdings had not been determined at the time of publication of this report, and it is not known whether the farm had outdoor access. Five people were exposed to the outbreak. The characteristics of the affected establishments and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1)-affected poultry establishments in Croatia

On 26 November 2021, one primary HPAI A(H5N1) outbreak was confirmed in a backyard farm with 94 poultry birds (63 laying hens, three roosters and 28 breeding geese) located in the Sisacko-Moslavacka region. Increased mortality and clinical signs were observed in laying hens and geese (31 hens and six geese died). Clinical signs and a drop in feed/water intake has been observed in both chickens and geese. The most likely source of infection remains unknown, but the affected holding had outdoor access and is situated near a river where wild waterfowl reside. The housing order entered in place on 5 December 2021. No data were available on the number of exposed people. The characteristics of the affected establishment and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1)-affected poultry establishments in Czechia

Between 27 September and 1 December 2021, five HPAI A(H5N1) primary outbreaks and one HPAI A(H5N1) secondary outbreak were confirmed in poultry holdings in the South Bohemian Region (3), South Moravian Region (1), Central Bohemian region (1) and Plzeň region (1). Four outbreaks occurred in backyard holdings with a median number of 82 birds of different species (chickens, ducks, geese, quails and guinea fowls), and two in commercial holdings with respectively 1,225 among breeding geese, ducks, and laying hens, and more than 1,600 breeding geese. All the farms had outdoor access, and the most likely source of virus introduction has been identified as indirect (4) or direct (2) contact with wild birds. Housing order has been implemented in the entire country on 23 November, and four out of six outbreaks occurred before the housing order was in place (suspicion dates of respectively 25 and 29 November). Increased mortality and/or clinical signs were reported in ducks, geese and laying hens of five out of six farms. In total, 127 people were exposed to the cases, the vast majority of which were

in the outbreaks involving commercial farms. The characteristics of the affected establishment and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1)-affected poultry establishments in Denmark

On 1 November 2021, one HPAI A(H5N1) outbreak was confirmed in a commercial farm in the region of Sjælland, with 27,600 turkeys for fattening. Mortality was reported in 300 birds, and a drop in food and water intake was also observed. Some animals showed lethargy and were unusually quiet. The establishment did not have outdoor access and the most likely source of viral introduction was indirect contact with wild birds. No data were available on the number of exposed people in HPAI outbreaks in poultry in Denmark. The characteristics of the affected establishment and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N8)-affected poultry establishments in Estonia

On 22 October 2021 one HPAI A(H5N8) outbreak was confirmed in a backyard farm in the region of Tartu, with three chickens for egg production and one rooster. Clinical signs and drop in feed and water intake were observed. As the farm had outdoor access and the outdoor cage was covered with net of wire, indirect contact with wild birds was considered the most likely source of virus. In total, five people were exposed to the cases. The characteristics of the affected establishment and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1)-affected poultry establishments in France

On 26 November 2021, one HPAI A(H5N1) outbreak was confirmed in a commercial farm with 160,000 laying hens in the region of Hauts-de-France. Approximately 19% of the diseased animals had died by the date of ADIS notification (15,000 of approximately 80,000 susceptible birds in the affected barn) but mortality was still ongoing and had risen up to 80% in the most affected sections of the barn, separated by wire-mesh fences in 8 sections and 2 levels of 5,000 birds each. Clinical signs, a drop in feed/water intake and in egg production were also observed. However, mortality was low at the onset, remained initially restricted to a few sections of the barn and increased only slowly: observed daily mortality rose above 1% only on the fourth day after mortality was first observed. The other initially reported clinical signs, decreased feed and water intake and egg drop with discoloured eggshells, were not specific and began only after mortality was detected. The most frequently observed gross lesions (congestive and haemorrhagicovaritis, haemorrhagicnephritis and spleen hypertrophy) were also non-specific (Jean-Luc Guérin, ENVT, personal communication). The farm had no outdoor access, and the most likely source of virus introduction was considered to be indirect contact with wild birds: this hypothesis is supported by the presence of water bodies and wetlands, occupied by wild birds, near the contaminated poultry establishment and by its proximity with waterfowl hunting lodges. No data were available on the number of exposed people. The characteristics of the affected establishment and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1) affected poultry establishments in Germany

Between 23 October and 29 November 2021, 20 HPAI A(H5N1) outbreaks in the five regions of Niedersachsen, Nordrhein-Westfalen, Schleswig-Holstein, Brandenburg and Mecklenburg-Vorpommern occurred. All the outbreaks were primary, except one in the Nordrhein-Westfalen region. The majority of the outbreaks involved commercial farms (17/20), while only three involved backyard farms. Mono-species commercial holdings were farming fattening turkeys (6), laying hens (2), breeding turkeys (1), fattening geese (1), breeding geese (1), and fattening ducks (1), while five farms were farms with multiple species, including laying hens (4/5), broilers (2/5), fattening geese (2/5) and fattening ducks (4/5). The median number of birds in commercial farms was approximately 11,400. For backyard farms, two were farming laying hens, ducks and geese for fattening, and one laying hens and ducks for breeding, with a median number of 59 birds. All the farms for which the information about outdoor access was available (13/17 commercial farms), had no outdoor access. The most likely source of virus introduction was direct contact with infected poultry for the only secondary outbreak, indirect/direct contact with wild birds in six outbreaks and the remained unknown at the time of publication of this report for the other outbreaks. Data related to the number of exposed people were not available at the time of publication of this report. The characteristics of the affected establishment and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1)-affected poultry establishments in Hungary

Between 16 November and 1 December 2021, 30 HPAI A(H5N1) outbreaks occurred in five regions of Hungary: Bács-Kiskun, Békés, Csongrád, Hajdú-Bihar and Szabolcs-Szatmár-Bereg), mostly in the Bács-Kiskun region. Regarding the outbreaks in Bács-Kiskun, three were primary and 22 were secondary. The remaining five outbreaks in the other regions were all primary. Most of the outbreaks were detected in commercial holdings with no outdoor access (28/30), with only two outbreaks occurring in backyard holdings with mixed poultry species. Out of the commercial holdings affected, the vast majority were fattening holdings (18/28) of domestic ducks (14/18) and turkeys (4/18), with a median number of animals of respectively more than 40,000 and almost 20,000 birds. Increased mortality was detected in **almost all the fattening domestic ducks' holdings (12/14), with a 9% mortality rate, and 2% mortality rate in two out of four fattening turkeys' holdings**. Clinical signs have been detected in 6 out of 12 **fattening domestic ducks' holdings and in only one out of four fattening turkeys' holdings**. The remaining commercial farms were a holding with domestic geese for foie gras production with 620 birds, where the 15% of the birds died, and nine breeding holdings of domestic geese (4/9, with a median number of animals of approximately 5,300 birds), domestic ducks (3/9, with a median number of animals of more than 17,500 birds), turkeys (1/9, a farm with almost 5,000 birds), and chickens (1/9, a farm with almost 20,000 birds). Increased mortality was detected in all breeding establishment except for one geese farm, and clinical signs were detected in 2/4 geese farms and in 2/3 duck' farm. A drop in water/feed intake has been observed only in two farms (the chicken breeding farm and one fattening ducks' farms), and a drop in egg production was observed only in one fattening duck farm. For the backyard farms, mortality was observed in one of them, and clinical signs in both of them. The most likely source of virus introduction was considered to be direct contact with infected poultry for the secondary outbreaks, and indirect contact with wild birds for the primary ones. No data were available on the number of exposed people in the HPAI outbreaks in Hungary. The characteristics of the affected establishments and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1)-affected poultry establishments in Ireland

On 20 and 24 November 2021 two HPAI H5N1 outbreaks (one primary and one secondary) were confirmed in two commercial holdings in close proximity in the Monaghan region. The two farms kept respectively 36,500 fattening turkey and 14,800 breeding chickens. Clinical signs, increased mortality and drop in feed/water intake were observed in both farms. Both farms where the outbreaks occurred did not have outdoor access. The most likely cause of virus introduction for the primary outbreak on the fattening turkey farm was indirect contact with wild birds, as positive A(H5N1) wild birds were present in the area. The outbreak on the second farm which was located within 1km of the primary outbreak is likely to be secondary infection. In total, 26 people were exposed to the virus during culling and destructions operations in Ireland. The characteristics of the affected establishments and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1)-affected poultry establishments in Italy

Between 19 October 2021 and 29 November 2021, a total of 117 A(H5N1) virus outbreaks were reported into the ADIS system for Italy, mostly in the Veneto region (112/117), four in Lombardy region and one in Lazio region. The outbreaks involved almost 5,379,000 birds. Most of the outbreaks were detected in commercial holdings (110/117), with only two occurring in backyard holdings. Information related to the holding production category was not available for five outbreaks. Out of the commercial holdings affected for which data were available (109/110), the vast majority were fattening holdings of turkeys (67/109), followed by broilers holdings (28/109), and egg production facilities with laying hens (9/109). Other farms were keeping domestic quails (1/109), guinea fowls (2/109), domestic ducks (1/109), and pheasants (1/109). For broilers, it is worth mentioning that often the outbreaks were detected following laboratory tests for monitoring or before loading for the slaughterhouse, and that in most of the cases, scarce to no signs were observed. The two non-commercial establishments kept poultry for home food production or hobby purpose. Data from epidemiological investigations and the number of exposed people were not available at the time of publication of this report. The characteristics of the affected establishment and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N8)-affected poultry establishments in Kosovo²

On 30 September 2021, one primary HPAI A(H5N8) outbreak was confirmed in a commercial holding in Prishtina with 22,349 laying hens. The 89% of the hens died and clinical signs have been detected. It is not known if the farm had outdoor access, and the most likely source of virus introduction remains unknown. No data were available on the number of exposed people in HPAI outbreaks in poultry in Kosovo². The characteristics of the affected establishment and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1)-affected poultry establishments in the Netherlands

Between 26 October and 21 November 2021, eight HPAI A(H5N1) outbreaks were confirmed in chickens (6) and domestic duck (2) farms in five regions (Flevoland, Noord-Holland, Groningen, Friesland and Utrecht). Seven out of eight farms were commercial, farming laying hens (3), broilers (2), and fattening ducks (2), with a median number of approximately 35,000 birds. One outbreak was confirmed in a non-commercial farm keeping more than 300 chickens. Increased mortality, clinical signs and drop in feed and water intake were observed in all the affected farms. Drop in egg production was observed in three farms. Two farms, one commercial and the non commercial one, had outdoor access, and at the time of suspicion of the outbreaks (respectively 31 October and 7 November 2021), the housing order was in place in the whole country since 26 October (when the HPAI was confirmed in wild birds). The most likely cause of viral introduction has not been determined by the time of publication of this report. No data were available on the number of exposed people in the HPAI outbreak. The characteristics of the affected establishments and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1)-affected poultry establishments in Norway

On 12 and 18 November 2021, two HPAI A(H5N1) outbreaks, one primary and one secondary, were confirmed in the region of Rogaland. Both the outbreaks occurred in commercial farms with 7500 laying hens each, of which 1500 and 100 died. Increased mortality, clinical signs, drop in feed and water intake and in egg production were observed in both farms. In both farms the animals had no outdoor access, and the most likely cause of viral introduction has been considered to be indirect contact with wild birds for the primary outbreak. For the secondary outbreak, the most likely source of virus introduction is still unknown at the time of publication of this report. No data were available on the number of exposed people in the HPAI outbreak. The characteristics of the affected establishments and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1)-affected poultry establishments in Poland

Between 2 November 2021 and 29 November 2021, 27 HPAI A(H5N1) outbreaks were notified in Poland, in the regions of **Mazowieckie, Wielkopolskie, Lubuskie, Łódzkie and Śląskie**. Twenty of these outbreaks were considered primary and seven secondary (in the two regions of Mazowieckie and Wielkopolskie), affecting almost 1,010,987 birds. All the outbreaks, except one, were in commercial farms. Out of the commercial holdings affected, the majority (24/26) were fattening holdings (12 kept domestic ducks, eight turkeys, three broilers and one both turkeys and domestic geese), while the remaining two were breeding establishments of domestic ducks. Out of the outbreaks that occurred in commercial establishments, birds had outdoor access only in the farm keeping fattening turkeys and domestic geese. At the time of the outbreak, housing order was not in place. The most likely source of virus introduction in the holding was considered to be indirect contact with wild birds in 15 cases, indirect contact with poultry in nine cases, and remains unknown in three cases. For the outbreaks detected in fattening establishments, mortality was observed in 10/12 domestic ducks' holdings, with an average mortality rate of 9%, and in four out of eight holding with turkeys for which the information was available, with an average mortality rate of 3%. In the three broilers establishments, mortality was observed only in one case, where the 1% of the birds died. In the one turkey and geese establishments, mortality was observed, the 21,5% of the birds died. Clinical signs were observed in 9/12 fattening ducks' farms, 3/8 turkeys' farms and in 1/3 broiler farms. Most of the turkeys (7/8) and domestic ducks farms (7/12), also a drop in food/water intake has been observed. The only backyard farm was keeping 160 chickens, 20 domestic ducks, four guinea fowls and four quails for mixed production type. Of these, 62 chickens and one domestic duck died. No mortality was observed in guinea fowls and quails. Clinical signs were observed in all the species except for quails. Birds had access to outdoor runs with water reservoir, so the most likely source of virus introduction is considered to be indirect contact with wild birds (at the time of the outbreak, housing order was not in place). In total, 331 people were exposed to the virus

during culling and destructions operations in Poland. The characteristics of the affected establishments and species reared are presented in Table A.1 in Annex A.

HPAI A(H5N1)-affected poultry establishments in Slovakia

On 19 November 2021, one HPAI A(H5N1) outbreak was confirmed in a backyard farm in the region of Trnavský with 14 laying hens. As the farm had outdoor access, contact with wild birds was suggested to be the most likely cause of virus introduction. No housing order was in place at the time at which the outbreak was suspected. An increased mortality has been observed, but nor clinical or other type of signs. No data were available on the number of exposed people in the HPAI outbreak. The characteristics of the affected establishments and species reared are presented in Table A.1 in Annex A.

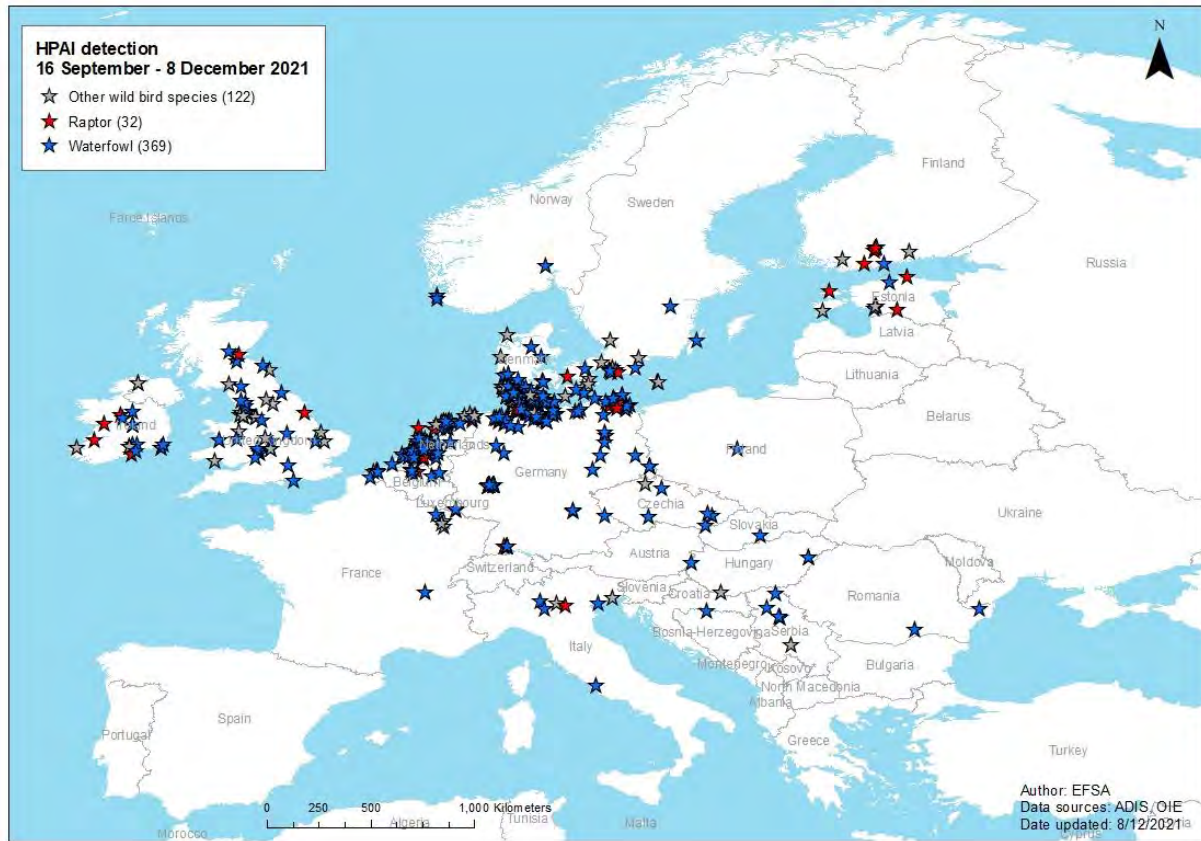
Information extracted from the scientific literature

Tarek et al. (2021) inoculated 0.1 mL of positive allantoic fluid containing 106 EID₅₀/mL of each of two isolates of HPAI A(H5N8) clade 2.3.4.4b similar to that circulating in Europe, one from a chicken---A/chicken/Egypt/S30/2019 (chicken/S30), the other from a Muscovy duck---A/duck/Egypt/SMG4/2019 (duck/SMG4)---virus, into the veins of White Leghorn chickens of unspecified age. All 10 chickens inoculated with chicken/S30 died within 3 days, resulting in an intravenous pathogenicity index (IVPI) of 2.83, while with the duck/SMG4, only 9 chickens died, resulting in an IVPI of 2.41. Both groups of chickens had similar gross lesions, including multifocal petechiae and necrosis in the pancreas and multifocal petechiae in the bursa of Fabricius. Microscopic lesions were more severe in chicken/S30-infected chickens than in duck/SMG4-infected chickens. The most relevant microscopic lesions were lymphocytic depletion and necrosis in spleen and cecal tonsils, and neuronal necrosis in the brain. Further research was recommended to understand the mechanism underlying the higher pathogenicity of the chicken/S30 isolate.

4.2.1.2. HPAI in wild birds

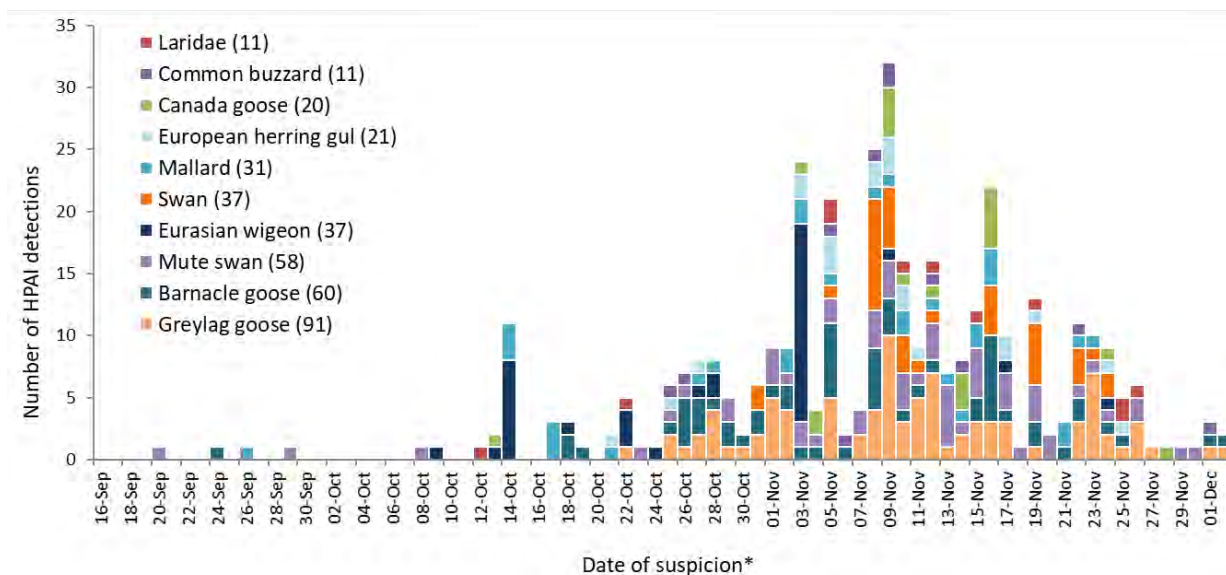
Between 16 September and 8 December 2021, 523 HPAI virus detections in sick, dead or hunted wild birds were reported to the ADIS and OIE by EU/EEA and the UK (Figure 12). The overall geographical pattern shows a concentration of reported cases in a band from the Baltic Sea coast of Germany in the east, across Denmark, the Netherlands and Belgium, to the Channel coast of France in the west. The overall temporal pattern shows an increase starting in the week of 10 October, peaking in the weeks of 7 and 14 November, and decreasing in subsequent weeks (Figures 5 and 11). For subtypes involved, A(H5N1) predominated: among 523 notifications only nine referred to A(H5N8) detected in Serbia (3), Estonia (2), Netherlands (2), Finland (1) and Sweden (1) from 20 September to 17 November; the following species were A(H5N8)- positive: barnacle goose (*Branta leucopsis*), Canada goose (*Branta canadensis*), greylag goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), mute swan (*Cygnus olor*), northern goshawk (*Accipiter gentilis*), and Eurasian eagle-owl (*Bubo bubo*). At least 18 waterfowl species (369 detections), at least 13 other wild bird species (122 detections) and at least eight raptor species (32 detections) were involved. The complete list of HPAI detection by wild bird species is reported in Table C.1, Annex C. Of the wild bird species reported, those involved in ten or more detections were greylag goose (91), barnacle goose (60), mute swan (*Cygnus olor*, 58), Eurasian wigeon (*Mareca penelope*, 37), mallard (*Anas platyrhynchos*, 31), European herring gull (*Larus argentatus*, 21), and Canada goose (20), common buzzard (11) (Figure 13). Also, 37 HPAI detections were reported as unspecified swan, 11 as Laridae and in 33 detections more than one wild bird species was involved. New species in which HPAI was detected are pied avocet (*Recurvirostra avosetta*, 1), ferruginous duck (*Aythya nyroca*, 1) which is a near-threatened species, and merlin (*Falco columbarius*, 1).

The numbers provided are not representative for the number of wild birds that died from HPAI A(H5) infection. For example, a mass mortality event was reported in northeast France (Meuse and Meurthe-et-Moselle), mainly on a single lake. Mortality was first observed on 8 November and was still ongoing on 8 December. At this lake and neighbouring lakes where HPAI A(H5N1) was detected, 349 carcasses of 10 species, mainly mute swan (310) and greylag goose (20) were found, and HPAI A(H5N1) was confirmed in selected carcasses.



*This designation is without prejudice to positions on status, and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence.

Figure 12: Geographical distribution, based on available geocoordinates, of highly pathogenic avian influenza detections in wild birds in Europe, by species category, 15 September to 8 December 2021 (523)



* When the date of suspicion is not available then the date of confirmation is used to assign the week of suspicion. Data source: EFSA, ADIS and OIE (data extraction carried on 8 December 2021).

Figure 13: Number of reported detections of highly pathogenic avian influenza virus A(H5) in wild birds of the most affected wild bird species (i.e. those involved in five or more detections) in the EU/EEA

and the UK, by date of suspicion, from 16 September to 8 December 2021. Note that in one single reported detection of HPAI in wild birds more than one bird might be involved

Information extracted from the scientific literature

Duff et al. (2021) performed postmortem examinations on multiple species of wild birds diagnosed with HPAI A(H5) infection in 2020-2021 in the U.K. Some had macroscopic lesions including widespread haemorrhages in internal organs, fibrin on the surface of the liver, pericarditis, pancreatitis, excess serosanguineous fluid in body cavities, pulmonary oedema and airsacculitis. Other birds showed no macroscopic abnormalities. On histopathological and immunohistochemical analyses, abundant viral antigen was expressed in multiple organs, including heart and brain, suggesting death from peracute infection. In some birds, virus antigen expression was co-localised with areas of pancreatic or splenic necrosis. The authors emphasized that besides establishing cause of death in HPAI A(H5)-positive birds, it was important to establish cause of death in HPAI A(H5)-negative wild birds, because it adds surveillance value in detecting potential new and re-emerging threats, building capability to characterise and assess the risk of future threats.

4.2.2. Genetic characterisation of avian influenza viruses

Description of the nomenclature of the HPAI A(H5) viruses used in the document

The HA gene of clade 2.3.4.4 A(H5) viruses has rapidly evolved since the most recent official update of the nomenclature of the A/goose/Guangdong/1/1996-lineage H5Nx virus (Smith et al., 2015). This clade emerged in China in 2008 and since then it has acquired various neuraminidase subtypes, including N1, N2, N3, N4, N5, N6 and N8, by reassortments with other enzootic avian influenza viruses from different regions, and evolved into several subgroups. While a revised nomenclature of clade 2.3.4.4 viruses is pending, in previous reports we used the genetic clustering described in 2018 by Lee and co-authors, who recognised four groups (a–d) within clade 2.3.4.4 (Lee et al., 2018). Recently, an update to the unified nomenclature for clade 2.3.4.4 A(H5) viruses has been proposed by WHO (WHO, 2020b) and eight genetic groups (a–h) have been recognised. To align the nomenclature system between international organisations this classification has been adopted for this report. Based on this proposed clustering, A(H5) viruses of clades 2.3.4.4a and d–h have mainly been circulating in poultry in Asia, while clades 2.3.4.4b and 2.3.4.4c have spread globally through wild bird migrations during 2014–2015 (2.3.4.4c) and from 2016 to the present (2.3.4.4b).

Genetic characterisation of HPAI viruses of the A(H5) subtype circulating in Europe

The topology of the HA phylogenetic tree shows that all the genetically characterized HPAI viruses collected between September and December 2021 in Europe and Russia, most of which belonging to the prevalent virus subtype A(H5N1), and fall within clade 2.3.4.4b. Sequences were generated from viruses collected in 13 Member States, the United Kingdom, Norway and Russia (sequence sources: GISAID accessed on 9 December 2021, National Reference Laboratories or EURL). Phylogenetic analyses of the complete genome indicate a persistent presence in Northern Europe of the A(H5N1) and A(H5N8) viruses, which have been circulating in Europe since October 2020. However, starting from October 2021 A(H5N1) viruses with at least eight different gene constellations (genotypes), probably originating from multiple reassortment events with LPAI viruses, have been characterised in North, Central, South and East Europe. Some of these genotypes were identified in September–October 2021 in East and Central Russia, suggesting the occurrence of multiple introductions from Russia to Europe through the autumn migration of wild birds; however, local reassortment events or other ways of virus introduction cannot be excluded.

The investigation on the A(H5N1) viruses that are causing multiple outbreaks in northern Italy indicates the occurrence of at least six distinct virus introductions into the domestic population, with some of the genetically characterised cases detected in the Veneto Region showing a high genetic relationship.

Transmission events of HPAI avian influenza A(H5N1) viruses to wild mammals have been reported from Estonia (fox), Finland (two foxes and one otter) and Sweden (fox). Some of these viruses possessed a mammalian adaptive marker, associated with increased virulence and replication in mammals (Manzoor et al., 2009; Kim et al., 2010; Herfst et al., 2012; Suttie et al., 2019) (Suttie et al., 2019; Herfst et al., 2012; Kim et al., 2010; Manzoor et al., 2009). As in previously identified transmission

events, it is important to analyse viral mutations associated with mammalian adaptation that can rapidly emerge after transmission to mammals to support public health risk assessment.

Mutations associated with mammalian adaptation have only been sporadically identified in the analysed viruses from avian species collected between October 2020 and August 2021, as previously reported (EFSA et al., 2021). In the current circulating A(H5N1) viruses, two mutations (NP-N319K and PB2-K482R) associated to increase polymerase activity in mammalian cells (Gabriel et al., 2005; Gabriel et al., 2008; Yamayoshi et al., 2014; Yamayoshi et al., 2018) have been detected in one virus collected from a wild bird (Eurasian wigeon) in Italy. Moreover, a mutation (M2-V27A) related to reduced susceptibility to amantadine and rimantadine (Abed et al., 2005; Ilyushina et al., 2005; Cheung et al., 2006; Lan et al., 2010) was identified in the M2 protein of one virus collected from a mallard in Germany at the end of October 2021.

Genetic characterisation of LPAI viruses of the A(H5) subtype circulating in Europe

Genetic analyses of seven LPAI viruses of the A(H5N1, H5N2, H5N3) subtypes collected between August and November 2021 from domestic and wild birds in northern Italy showed that the viruses cluster separately in all the eight phylogenies and are closely related to LPAI viruses circulating mostly in wild birds from Europe and Asia.

4.3. Human cases and transmission to other mammal species due to A(H5Nx) viruses detected in Europe

Since 16 September and as of 1 December 2021, data from five countries has been reported on the total number of people exposed to infected birds (e.g. during culling activities). They reported a total of 494 exposed people.

On 20 February 2021, Russian authorities identified seven occupationally exposed workers infected with A(H5N8) virus at a poultry farm in south Russia, one of the viruses was further characterised and clustered in clade 2.3.4.4b (Pyankova et al., 2021; WHO, 2021f). The workers were exposed during an outbreak of A(H5N8) in a bird flock in December 2020. The cases were reported as asymptomatic or with mild symptoms. No human-to-human transmission has been observed (TASS, online). ECDC published a Threat Assessment Brief in February 2021 that assessed the risk as very low for the general public and low for occupationally exposed people (ECDC, 2021b). The high diversity and ongoing reassortment events add a high uncertainty to the assessment and transmission events to humans cannot be excluded. The World Health Organization (WHO) assessed the risk as low (WHO, online-a) and a recent risk assessment by the United States Centers for Disease Control and Prevention (US CDC) placed the risk in the low to moderate category (CDC, online-b, a). The WHO issued a risk assessment on the increase in human cases due to A(H5N6) virus infections in 2021 and raise awareness to remain vigilant about zoonotic infections and share unsubtypeable influenza A viruses from human infections with the WHO Collaborating Centres (WHO, 2021b). Also, a recent publication aimed to raise awareness among clinicians in the EU to zoonotic avian influenza virus infections (Adlhoch et al., 2021).

No human infection with avian influenza viruses, as currently detected in wild birds and poultry in Europe, has been identified in the EU/EEA countries during the period covered by this report or has been previously reported (EFSA et al., 2021a). Other transmission events to different mammal species have been increasingly reported as mentioned above and in previous reports (Table X). So far foxes and seals have been majorly found to be infected with avian influenza viruses of clade 2.3.4.4b displaying neurological signs leading to death or already found dead.

Table 2: Avian influenza virus A(H5Nx) detections in other mammal species related to circulating viruses in Europe, 2016-2021

Date	Country	Animal (species)	Virus	Reference
November 2016, April 2017	Poland	2 grey seals (<i>Halichoerus grypus</i>)	A(H5N8) clade 2.3.4.4b	(Shin et al., 2020)
December 2016 to May 2017	France	Domestic pigs (<i>Sus scrofa</i>), serological detection	A(H5N8) clade 2.3.4.4b	(Herve et al., 2021)
2017	Germany	Wild boar serological detection	A(H5N8)	(Schüle et al., 2021)
Late 2020	The United Kingdom	4 juvenile common seals (<i>Phoca vitulina</i>), 1 juvenile grey seal (<i>Halichoerus grypus</i>), 1 juvenile red fox (<i>Vulpes vulpes</i>)	A(H5N8) clade 2.3.4.4b	(Floyd et al., 2021)
April, February, and September 2021	Sweden	1 gray seal (<i>Halichoerus grypus</i>), 2 red foxes (<i>Vulpes vulpes</i>)	A(H5N8) clade 2.3.4.4b, A(H5N1) clade 2.3.4.4b, A(H5N1)*	(SVA, online: Personal communication by Siamak Zohari, SVA)
May 2021	Netherlands	2 red fox cubs (<i>Vulpes vulpes</i>)	A(H5N1) clade 2.3.4.4b	(Rijks et al., 2021)
August 2021	Germany	3 harbour seals (<i>Phoca vitulina</i>)	A(H5N8) clade 2.3.4.4b	(Ärztblatt, online)
September and November 2021	Finland	2 fox (<i>Vulpes vulpes</i>), 1 otter (<i>Lutra lutra</i>)	A(H5N1) clade 2.3.4.4b	(FFA, online)
November 2021	Estonia	Fox (<i>Vulpes vulpes</i>)	A(H5N1) clade 2.3.4.4b	(OIE, online-b)
November 2021	Italy	Domestic pigs (<i>Sus scrofa</i>) (serological detection in HPAI poultry outbreak)	A(H5N1) clade 2.3.4.4b	EURL

* No information on the clade of HPAI A(H5N1) detected in the second red fox is currently available

4.3.1. Human cases reported within clade 2.3.4.4 A(H5Nx) viruses globally

Viruses within clade 2.3.4.4 have diversified over the last years, so that WHO has suggested a classification system to separate the viruses into subclades a–h (WHO, 2020b). In total, 42 HA sequences from human cases due to H5Nx [41 A(H5N6) and one A(H5N8)] viruses of clade 2.3.4.4 have been submitted to the global sequence database GISAID between 2014 and 2021. Seven A(H5N8) case reported in Russia in 2020, three A(H5) in Nigeria (WHO, 2021e) and 10 A(H5N6) cases identified in China in 2017 and 2021 belonged to subclade 2.3.4.4b, which is the same subclade where A(H5Nx) viruses detected in wild birds and poultry in Europe clustered. All other human A(H5N6) cases described in the A(H5N6) Section 4.5.3.2 clustered in other subclades (Table 2). Publications provide further sequence analysis details about recent A(H5N6) cases in China of clade 2.3.4.4b (CCDC, 2021). WHO outlined in the latest risk assessment that all human cases reported in 2021 with A(H5N6) infection from China were of clade 2.3.4.4b (WHO, 2021b).

4.4. Prevention and control measures applied in Europe, 16 September to 1 December 2021 (ToR 3)

The description of the control and prevention measures applied in the affected Member States on outbreaks occurred from 16 September to 1 December 2021 is presented in Annex B, thanks to the countries that were willing to collaborate with EFSA and kindly provided the information here reported. Outbreaks occurred before 16 September 2021 are described in the previous EFSA report (EFSA et al., 2021c).

4.5. The avian influenza situation in other countries not reporting via ADNS, 16 September to 8 December 2021 (ToR 4)

An overview of the HPAI detections notified from other countries not reporting via ADIS but via the OIE or national authorities from 16 September to 8 December 2021 is presented in Table 3 and Figure 14. For the purposes of this report, only findings of avian influenza viruses occurring in countries that are considered to be of epidemiological interest for the EU/EEA or of public health relevance are described.

Table 3: Number of HPAI detections in other countries not reporting via ADIS, by virus subtype and country, 16 September to 8 December 2021 (n = 153)

Region	Country	Domestic birds				Wild birds			Total
		A(H5Nx)	A(H5N1)	A(H5N5)	A(H5N8)	A(H5Nx)	A(H5N1)	A(H5N8)	
Africa	Nigeria		28						28
	South Africa		18				7		25
	Togo		1						1
Asia	China						1		1
	Chinese Taipei			2					2
	India						2	1	3
	Iran			4	2				6
	Israel		5				2		7
	Japan		4		2			1	7
	Kazakhstan	5							5
	Korea		10				5		15
	Pakistan	4							4
Europe	Russia	34	11			4			49
Total		43	77	6	4	4	17	2	153

Data source: ADIS and OIE WHAIS (data extraction carried out on 8 December 2021).

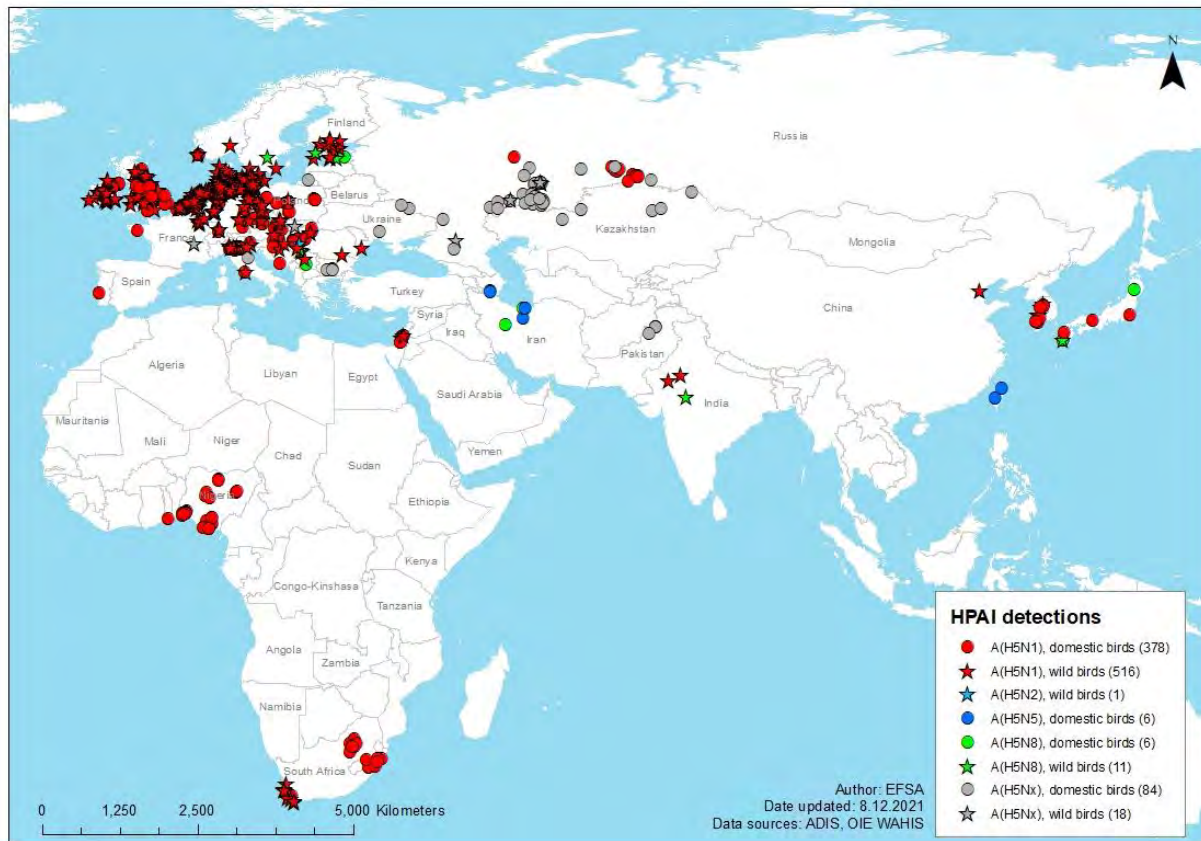


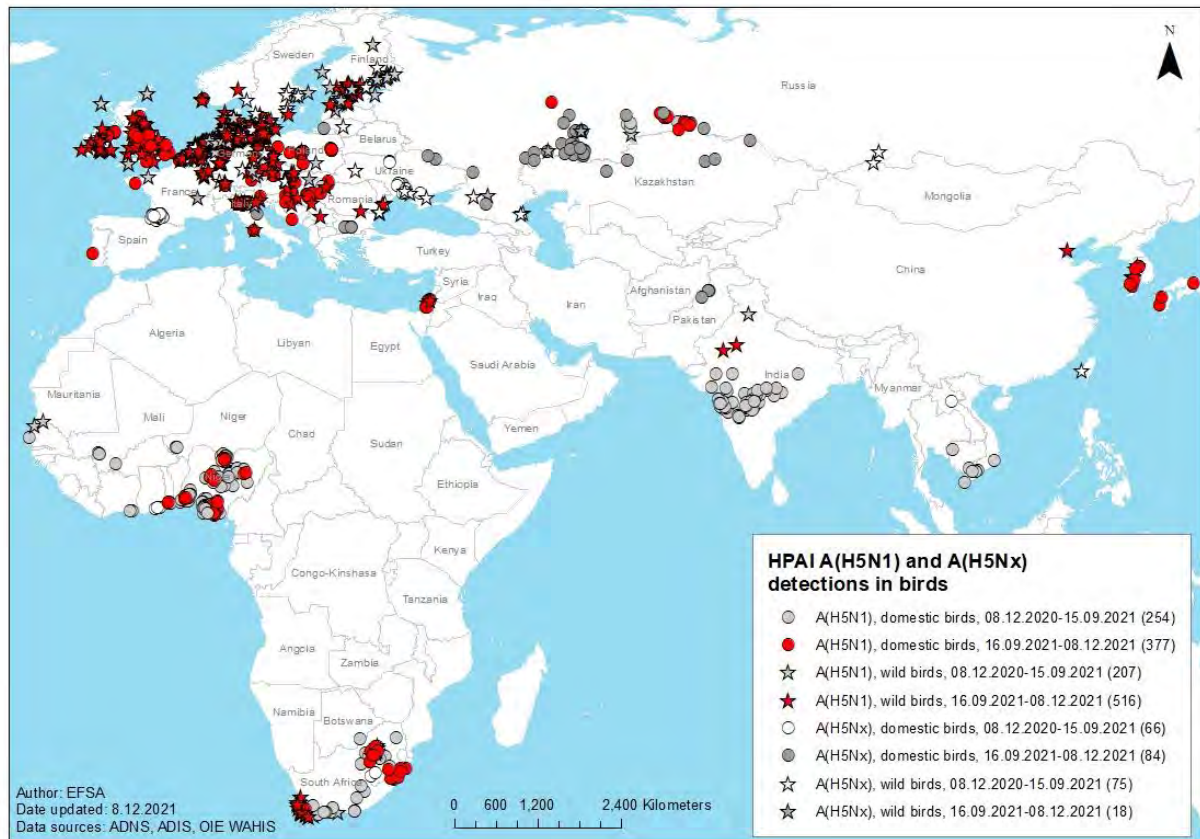
Figure 14: Geographical distribution, based on available geocoordinates, of HPAI detections reported in domestic birds (2,406) and wild birds (2,612) in Europe, Asia and Africa, by virus type, 16 September to 8 December 2021

4.5.1. HPAI A(H5N1)

4.5.1.1. Domestic and wild birds in previously affected regions

Detections

The epidemic of HPAI A(H5N1) in Nigeria and South Africa continued on numerous medium-sized and individual very large poultry farms in the relevant time period for this report. Contrary to the last report, only Togo notified another outbreak in domestic birds to OIE. South Africa detected cases of HPAI A(H5N1) in several wild bird species as e.g. Cape cormorant (*Phalacrocorax capensis*), white-breasted cormorant (*Phalacrocorax lucidus*), Cape gannet (*Morus capensis*), Hartlaub's gull (*Chroicocephalus hartlaubii*), northern giant petrel (*Macronectes halli*) and kelp gull (*Larus dominicanus*). From 16 September to 8 December 2021 three Asian countries and Russia notified the detection of HPAI A(H5N1) in domestic and wild birds. The outbreaks in Israel and Korea continued and new cases were detected on medium-sized and large poultry farms. Furthermore, Japan detected several cases of HPAI A(H5N1) in a backyard holding and several commercial poultry farms. Russia notified outbreaks in several small holdings and one very large poultry farm to the OIE. In addition, Asian countries and Russia detected HPAI A(H5) and HPAI A(H5N1) in several wild bird species as e.g. , common teal (*Anas crecca*), mandarin duck (*Aix galericulata*), common shelduck (*Tadorna tadorna*), great crested grebe (*Podiceps cristatus*), demoiselle crane (*Anthropoides virgo*), house sparrow (*Passer domesticus*), common pigeon (*Columba livia*), great white pelican (*Pelecanus onocrotalus*), house crow (*Corvus splendens*) and common crane (*Grus grus*) (Figure 15).



Red and dark grey symbols indicate outbreaks that occurred between 16 September and 8 December 2021, grey and with symbols indicate outbreaks that occurred between 8 December 2020 and 15 September 2021 (ref OIE WHAIS).

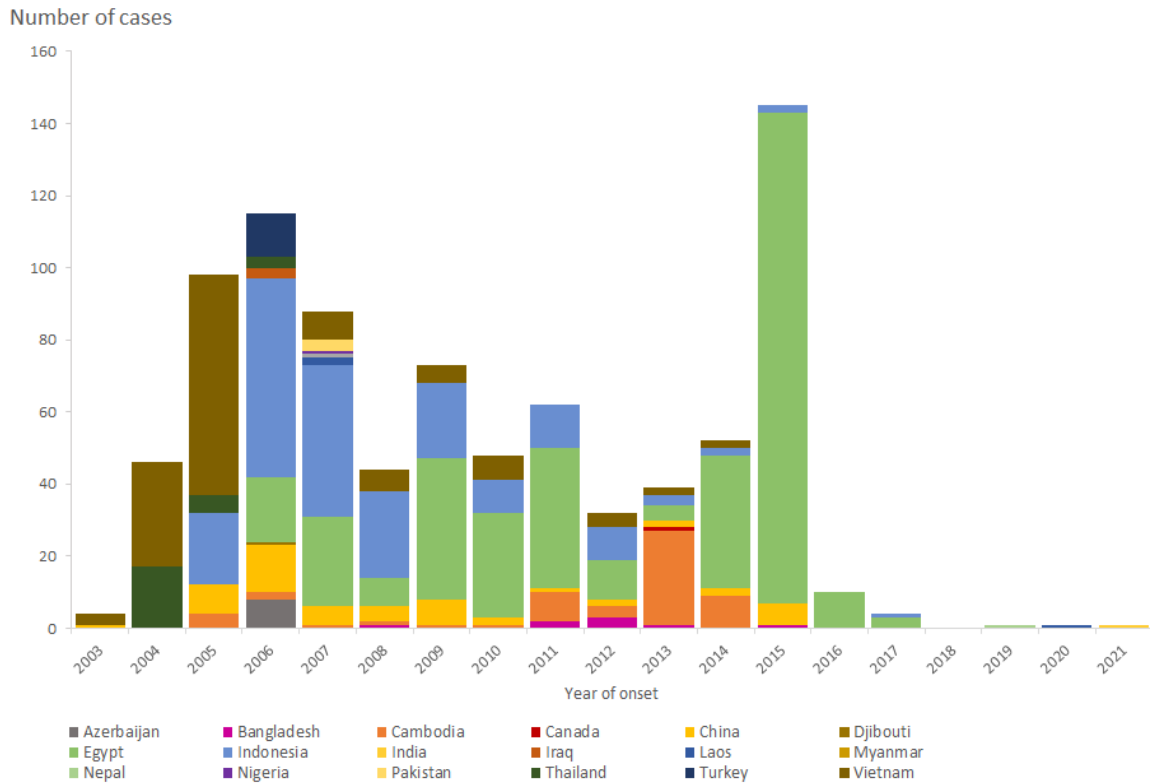
Figure 15: Geographical distribution, based on available geocoordinates, of HPAI A(H5N1) and A(H5Nx) detections reported in domestic birds (circles) and wild birds (stars) (1,598)

Information extracted from the scientific literature

Ripa et al. (2021) generated the full genome sequences of four HPAI A(H5N1) viruses identified from oropharyngeal swabs collected from clinically affected chicken flocks recruited in south-eastern Bangladesh between October 2017 and April 2019. All viruses (including two cases identified in 2019) belonged to clade 2.3.2.1a and sequences from all segments clustered together with a similar set of other Bangladeshi virus isolates present during the same time period of sample collection, suggesting emergence from endemic strains circulating in Bangladesh. A single molecular marker associated with resistance to amantadine and rimantadine was present in the M2 protein of the newly sequenced viruses. In addition to the polybasic H5 cleavage site, several amino acid markers were identified in the other seven segments, linked with enhanced adaptation and virulence in mammals: however, amino acids characteristic of avian strains were retained for the key PB2 627 position and for markers of the preferential α -2,3 sialic acid receptor binding.

4.5.1.2. Human infections due to A(H5N1)

No human case due to avian influenza A(H5N1) have been reported since the last report. Since 2003, and as of 10 December 2021, 863 laboratory-confirmed cases of human infection with avian influenza A(H5N1) virus, including 456 deaths, have been reported from 18 countries outside the EU/EEA (WHO, 2021a) (Figure 16).



Data source: WHO (WHO, 2021c, a, online-b).

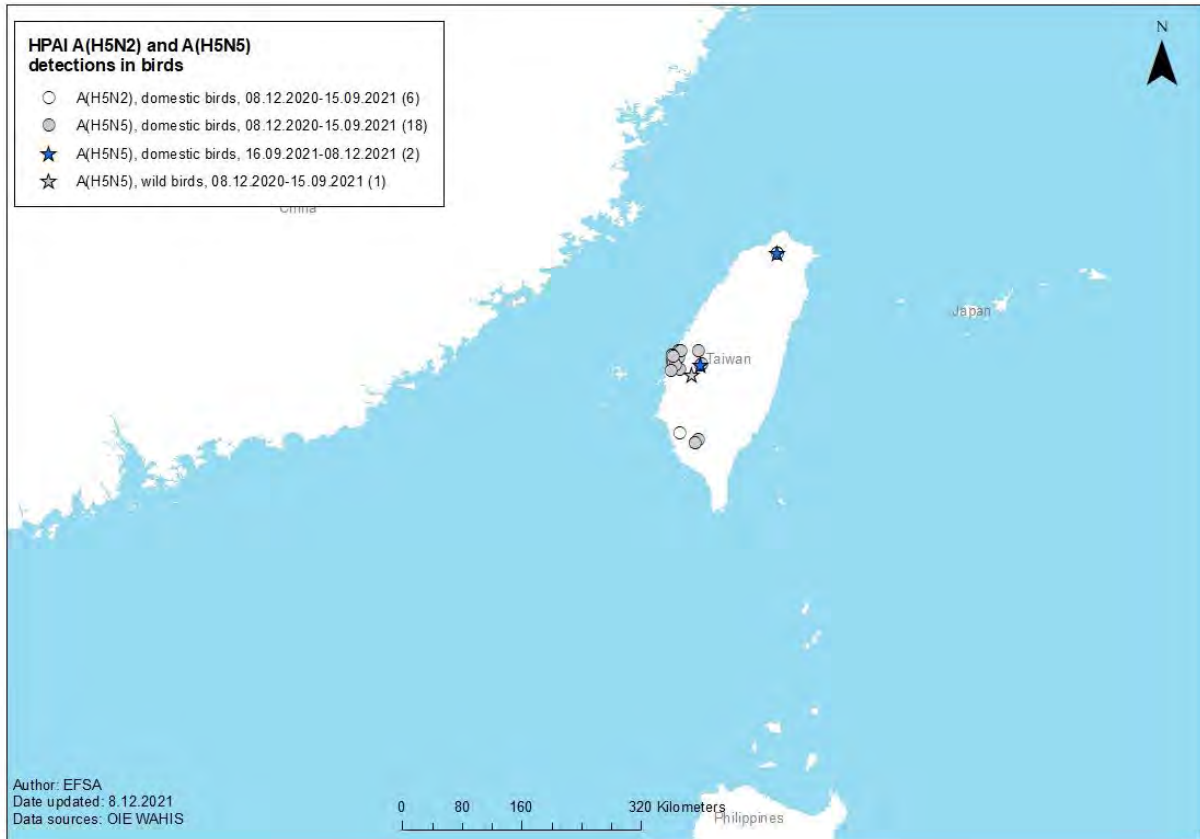
Figure 16: Distribution of confirmed human cases of A(H5N1) by year and country of reporting, 2003 to 10 December 2021 (863)

4.5.2. HPAI A(H5N2) and A(H5N5)

4.5.2.1. Domestic and wild birds

Detections

Taiwan notified two new outbreaks of HPAI A(H5N5) in a medium sized poultry and one backyard farm to the OIE. The Taiwanese lineages of HPAI A(H5N2) and HPAI A(H5N5) (clade 2.3.4.4) differed from the Eurasian HPAI A(H5N2) and A(H5N5) lineages (Li et al., 2020); the latter belonging to clade 2.3.4.4b, which has been detected, with different genotypes, in Egypt and Russia as well as in Asian countries between 2016 and 2019 (EFSA et al., 2019) and in Bulgaria in 2020. In the relevant reporting period, Iran detected 4 outbreaks of the Eurasian lineage HPAI A(H5N5) in two backyard and two medium-sized poultry holdings. In contrast to the previous reporting period, no outbreaks of HPAI A(H5N2) or wild bird cases were reported between 16 September and 8 December 2021 (Figure 17).



Dark and light grey symbols indicate HPAI A(H5N5) and A(H5N2) detections between 8 December 2020 and 15 September 2021, respectively, blue symbols indicate HPAI A(H5N5) detections between 16 September and 8 December 2021 (ref OIE WHAIS).

Figure 17: Geographical distribution, based on available geocoordinates, of HPAI A(H5N2) and A(H5N5) detections reported in domestic birds in Taiwan (27)

Information extracted from the scientific literature

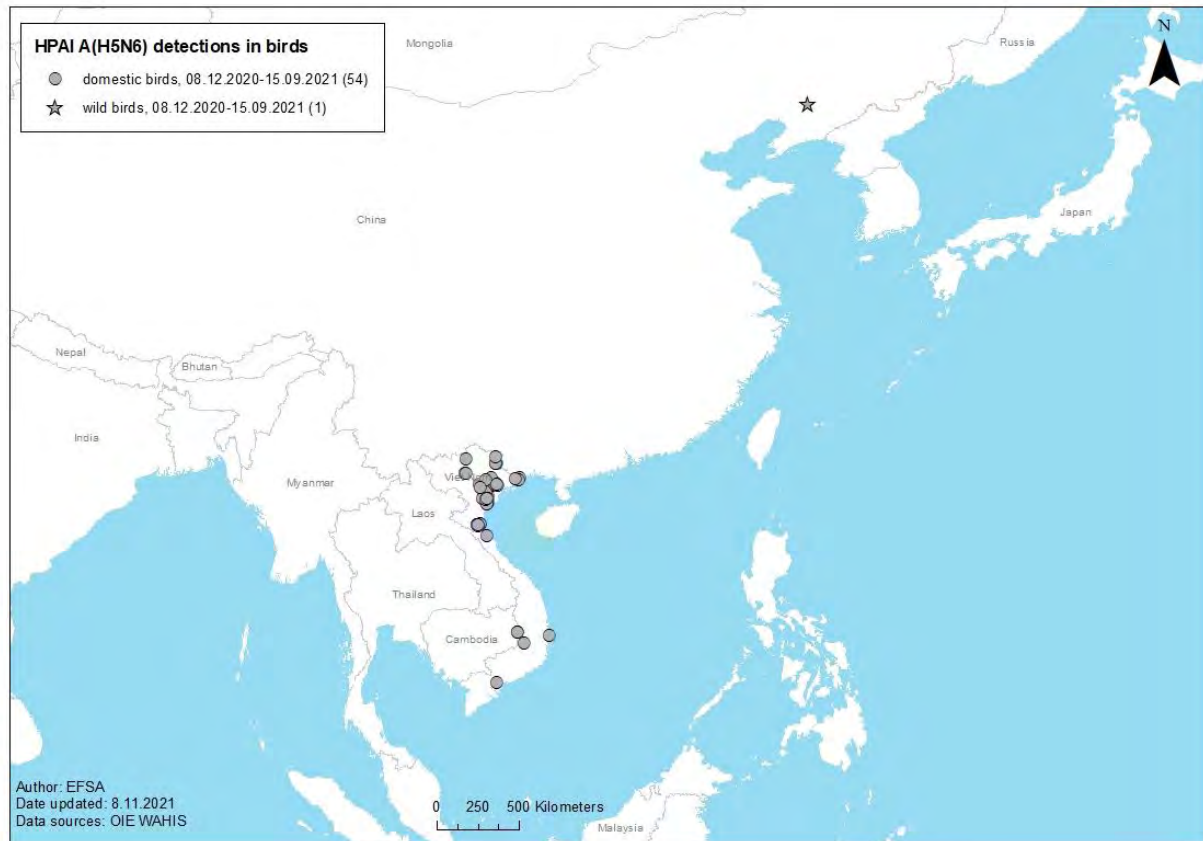
During the reporting period, no new relevant information was published on the phenotypic and genetic characterisation of HPAI A(H5N2) and A(H5N5) viruses circulating in countries outside the EU/EEA, for domestic and wild birds.

4.5.3. HPAI A(H5N6)

4.5.3.1. Domestic and wild birds

Detections

Contrary to the last report, no outbreaks of the zoonotic reassortment of HPAI A(H5N6) clade 2.3.4.4c were notified to the OIE. New human cases of A(H5N6) in the current reporting period (chapter 4.5.3.2) might suggest underreporting of poultry outbreaks in the Asian region. (Figure 18).



Grey symbols indicate outbreaks that occurred between 9 December 2020 and 15 September 2021 (ref OIE WAHIS).

Figure 18: Geographical distribution, based on available geocoordinates, of HPAI A(H5N6) detections reported in domestic birds (55)

Information extracted from the scientific literature

Turner et al. (2021) reported the characterization of the complete genome sequences from 40 clade 2.3.4.4h HPAI A(H5N6) viruses identified in apparently healthy wild birds and in apparently healthy domestic Khaki Campbell ducks sampled in Bangladesh during January-February 2020. All sequences shared a high level of identity between themselves (99.4%-100%) and a representative sequence, A/ferruginous duck/Bangladesh/42380/2020 (H5N6), was closely related (99.6%-99.9% nucleotide identity) to clade 2.3.4.h HPAI A(H5N6) viruses identified in China and Mongolia, in January 2020 and April 2002 respectively. A common ancestor for the viruses from China, Mongolia and Bangladesh may have emerged in mid-2019, in a currently unknown location. All isolates from Bangladesh shared a mutation in their H5 protein, commonly found in clade 2.3.4.4h viruses isolated from humans and associated with a human-type receptor binding specificity. Deletions in the stalk region of the N6 protein and in the NS1 protein were also present, previously associated with enhanced pathogenicity in birds. Ferret antisera against one of the selected A(H5N6) viruses reacted with the WHO candidate clade 2.3.4.4h vaccine strain A/Guangdong/18SF020/2018.

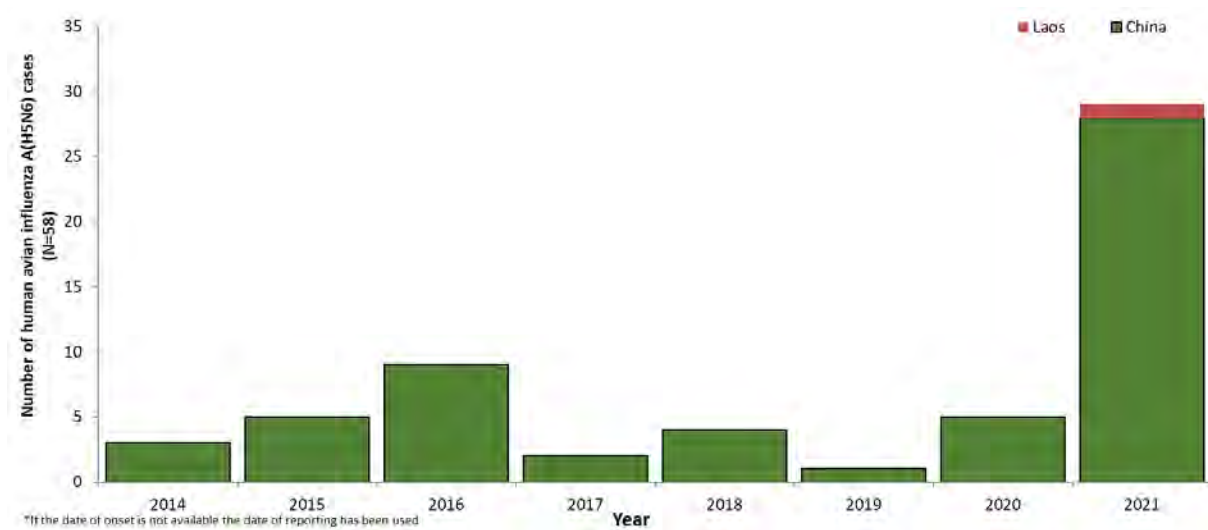
Ankhanbaatar et al. (2021) also characterised the full genomes of three clade 2.3.4.4h HPAI A(H5N6) viruses identified from dead wild birds (two whooper swans, *Cygnus cygnus*, and one swan goose, *Anser cygnoides*) collected in April 2020 in Western and Central Mongolia. All sequences were closely related to each other and to the above-mentioned A(H5N6) viruses from China, Mongolia and Bangladesh.

Sengkeopraseuth et al. (2021) summarised the results of laboratory investigations performed during the epidemiological follow-up of a HPAI A(H5N6) virus infection in a 5-year old child in Laos, confirmed on 18 March 2021. Three HPAI A(H5N6) viruses were detected from cloacal swabs collected in domestic Muscovy ducks in a neighbouring village: full genome sequencing showed that these viruses belonged to clade 2.3.4.4h and were closely related to viruses detected in poultry in Vietnam and Laos.

4.5.3.2. Human infections due to A(H5N6)

Thirteen new human cases due to avian influenza A(H5N6) have been notified since the last EFSA report, all from China (WHO, 2020c; CHP, 2021b; WHO, 2021d; GovHK, online-a, b).

Since 2014, and as of 16 December 2021, 58 laboratory-confirmed cases of human infection with avian influenza A(H5N6) viruses of clade 2.3.4.4 circulating in South-East Asia have been reported in China (57 cases) and Laos (1) with 25 of them being fatal (CHP, 2021c) (Figure 19). Twelve deaths due to A(H5N6) had been reported between 2014 and 2017 (Jiang et al., 2017). A household cluster with two infections was observed in a couple preparing a duck for meal purchased from a live-bird market. The case fatality ratio overall is estimated at 41% with 31% fatal cases reported in 2021 (limitation: case reports might not have been a complete picture with updated information and fatal cases labelled as recovered).



Source: ECDC line list (see Appendix B.2).

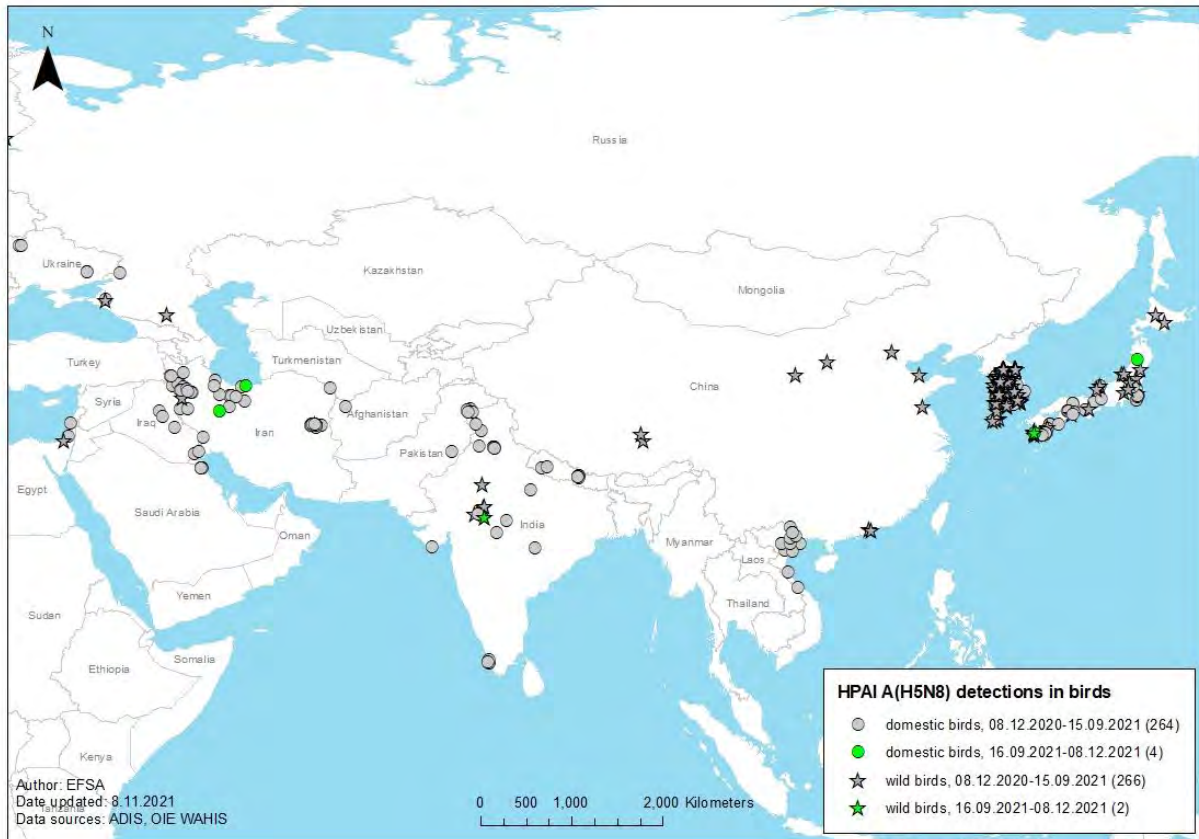
Figure 19: Number of human cases due to A(H5N6) infection by year of onset, 2014 to 16 December 2021 (58)

4.5.4. HPAI A(H5N8)

4.5.4.1. Domestic and wild birds

Detections

In contrast to the previous reporting period, only 6 outbreaks of HPAI A(H5N8), clade 2.3.4.4b, from poultry and wild birds were notified by only three countries. Iran detected outbreaks of HPAI A(H5N8) on two medium-sized poultry farms and Japan on two large poultry holdings. Singular wild bird cases have been reported by India (house crow, *Corvus splendens*) and Japan (hooded crane, *Grus monacha*) (Figure 20)



Green symbols indicate outbreaks that occurred between 16 September and 8 December 2021, grey symbols indicate outbreaks that occurred between 8 December 2020 and 15 September 2021 (OIE, online-a).

Figure 20: Geographical distribution, based on available geocoordinates, of confirmed HPAI A(H5N8) outbreaks in domestic birds (circles) and wild birds (stars) (536)

Information extracted from the scientific literature

Cui et al. (2021) isolated 36 HPAI A(H5N8) viruses following a large-scale active surveillance program in wild birds and domestic poultry in China between September 2020 and June 2021: 22 viruses were identified in dead wild bird and wild bird faeces samples, 14 viruses were isolated from domestic waterfowl (ducks and geese) swabs. All of these viruses belonged to clade 2.3.4.4b and could be divided into two genotypes: 35 viruses (genotype G1) were directly related to each other and to the HPAI A(H5N8) viruses detected in Iraq in May 2020 and subsequently in Russia, Europe, Africa and Asia since July 2020; a single virus (genotype G2) isolated in a whooper swan in January 2021 was related to viruses that circulated in Eastern and Central Europe during the first semester 2020. All viruses had three or four amino acid substitutions in their H5 protein, associated with an increased affinity for human-type sialic acid receptors; all or a majority of these viruses also had markers in PB2, NP or NS1 that have been reported to increase virus replication, virulence or transmission in mammals. Increased amantadine resistance markers were also found in two viruses belonging to genotype G1.

In vivo replication and virulence in 6-week-old SPF White Leghorn chickens, in 6-week-old SPF Shaoxing shelducks and in 6-week-old female BALB/c mice was compared for three selected genotype G1 viruses and for the genotype G2 virus: inoculations were performed intranasally with a 10^6 EID₅₀ dose for excretion and organ tropism studies, and with 10-fold serial 10^1 to 10^6 dose for the LD₅₀ determination in mice. For all four tested viruses, all inoculated chickens died within 4 days post inoculation (dpi), and oropharyngeal swabs, cloacal swabs and internal organs including brains sampled at 3 dpi were positive with infectious titres up to $10^{6.4}$ EID₅₀/ml. However, pathogenicity and virus replication and tropism were variable in ducks and mice, depending on the inoculated virus. All tested viruses induced only limited mortality in SPF ducks: four or five ducks survived out of five inoculated subjects. All three genotype G1 viruses replicated in duck and were detected in all tested oropharyngeal and cloacal swabs and in most of the tested organs including brains. The genotype G2 virus replicated less efficiently, was not

constantly detected in swabs at 3 dpi and was not detected in the liver and brain of any tested duck, although it could be detected in some samples from lungs and other internal organs from inoculated ducks. In mice, two of the genotype G1 viruses induced mortality in all subjects inoculated with the highest EID₅₀ dose: LD₅₀ ranged from 10^{2.3} to 10^{3.3} EID₅₀, and virus could be detected in all five tested organs (nasal turbinates, lung, spleen, kidney and brain) at 3 dpi. Another tested genotype G1 virus was less virulent in mice: LD₅₀ was 10^{5.7} EID₅₀, (resulting in the death of 3 mice / 5 inoculated with the highest dose) and the virus was detected only in nasal turbinates, lungs and spleens of infected mice. The genotype G2 virus did not induce mortality (LD₅₀ ≥ 10^{6.5} EID₅₀) and replicated only in the respiratory tract but not the internal organs.

All four selected viruses showed a 5 log₂ antigenic cross-reactivity divergence in HI tests against the current vaccine seed strain Re-11, derived from clade 2.3.4.4h A/duck/Guizhou/S4184/2017 (H5N6), using a polyclonal chicken antiserum specific for this last strain.

He et al. (2021) also reported detection of HPAI A(H5N8) belonging for all their segments to the same two sublineages of clade 2.3.4.4b as above, in apparently healthy wild ducks sampled in November 2020 in eastern China, based on the full genome sequences of 5 selected viruses. The major amino acid markers in the PB2 protein and in the receptor binding site of the H5 protein suggested that the viruses would have kept an avian-type receptor binding preference and have not adapted to mammals.

Four HPAI A(H5N8) viruses from dead whooper swans and fecal samples collected in November 2020 in central China were also identified by Li et al. (2021) as closely related to the HPAI A(H5N8) viruses detected in Iraq in May 2020 and subsequently in Russia, Europe and Asia since July 2020. A single amino acid marker in the H5 protein was associated with enhanced affinity for human-type receptors. No amino acid markers associated with higher replication in mammals or with resistance to anti-viral drugs were found in the PB2 protein or the N8 and M2 proteins, respectively.

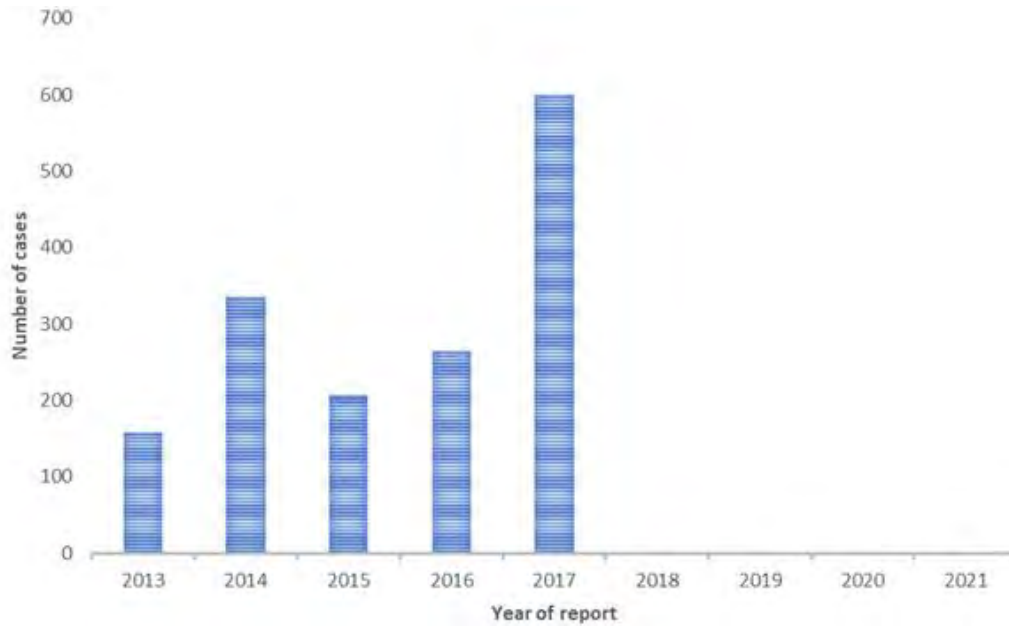
4.5.5. HPAI–LPAI A(H7N9)

4.5.5.1. Domestic and wild birds

No LPAI or HPAI A(H7N9) cases were notified in poultry or wild birds within the relevant time period for this report. The last case was reported from Shandong province, China, in October 2020. The nationwide A(H7N9) vaccination campaigns for poultry, with the exception of poultry in AI-free zones and export farms, started extensively in September 2017 (FAO, online).

4.5.5.2. Human infections due to A(H7N9)

No human cases due to avian influenza A(H7N9) have ever been reported from Europe and no human case has been reported globally since 2019 (WHO, 2020d, a). Since February 2013, a total of 1,568 human cases have been reported from outside of Europe (Figure 21), including at least 615 deaths (39%) (CHP, 2021a) (WHO, 2019a, b). The last case was reported in March 2019 (one case). Of all human cases, 32 had been infected with HPAI virus A(H7N9), 13 of them were fatal, according to the Chinese National Influenza Center (Chinese National Influenza Center et al., 2018).



Source: ECDC line list (see Appendix B.2).

Figure 21: Number of human cases due to A(H7N9), infection by year, 2013 to 2021 (1,568)

4.5.6. LPAI A(H9N2)

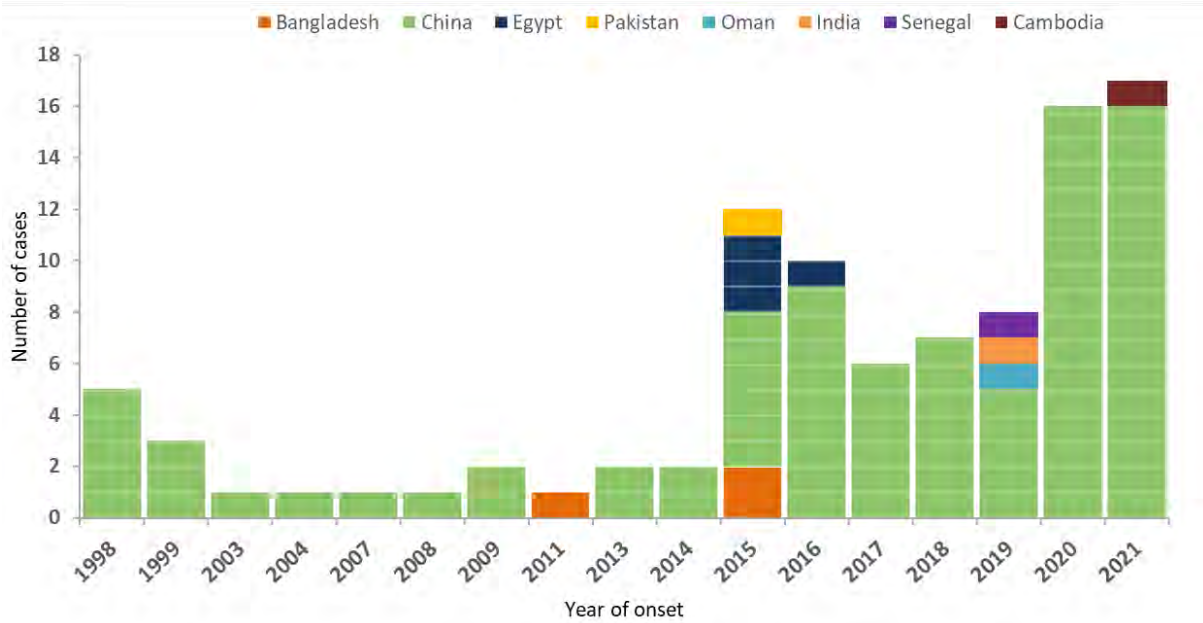
4.5.6.1. Domestic and wild birds

Detection

As mentioned in previous EFSA reports, A(H9N2) is the most commonly detected non-notifiable subtype of influenza virus in poultry in Asia, the Middle East and Africa (Zecchin et al., 2017; Bonfante et al., 2018; Chrzastek et al., 2018; Xu et al., 2018; Zhu et al., 2018; Awuni et al., 2019; Kariithi et al., 2019). These regions remained LPAI (H9N2) endemic at least until 10 December 2021.

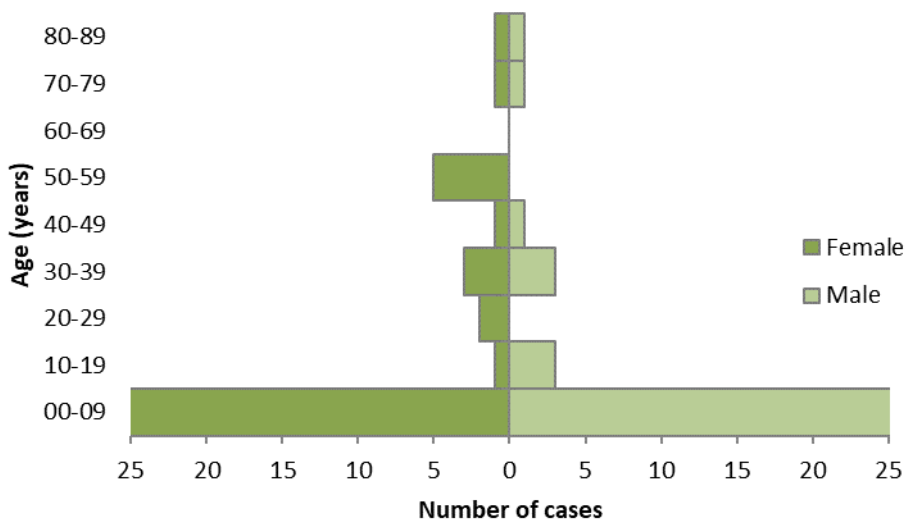
4.5.6.2. Human infections due to A(H9N2)

Since the last EFSA report, two human cases of infection have been reported from China, in an eight-year-old girl and in a 39-year-old patient, who died (WHO, 2020c; CHP, 2021b; ECDC, 2021a). Since 1998, and as of 10 December 2021, 95 laboratory-confirmed cases of human infection with avian influenza A(H9N2) virus, including two deaths, have been reported globally. Cases were reported from China (83), Egypt (4), Bangladesh (3), Cambodia (1), India (1), Oman (1), Pakistan (1) and Senegal (1) (ECDC line list; see Appendix B.2) (Figure 22). Exposure to live or slaughtered poultry or contaminated environment has been reported. The age group most affected by A(H9N2) infections in humans was children under 10 years of age, who developed only mild symptoms (Figure 23).



Data source: ECDC line list

Figure 22: Distribution of confirmed human cases of A(H9N2) by reporting country, 1998 to 10 December 2021 (95)



Data source: ECDC line list.

Figure 23: Distribution of confirmed human cases of A(H9N2) by age group, 1998 to 29 November 2021 (95)

4.6. Scientific analysis of avian influenza spread from non-EU/EEA countries and within the EU/EEA

Since 2014, HPAI viruses of the A(H5) subtype have been introduced in the European territory almost once a year. In 2016–2017 and 2020–2021, two devastating HPAI A(H5) epidemics affected numerous European countries with thousands of outbreaks in poultry and heavy mortality in wild birds:

- 2016–2017 epidemic with 1,285 outbreaks in poultry and captive birds, at least 9 million domestic birds affected, and 1,563 detections in wild birds in 29 European countries;
- 2020–2021 epidemic with 1,395 outbreaks in poultry and captive birds, 22,9 million birds affected, and 2,408 detections in wild birds in 31 European countries.

Since October 2021, hundreds of cases in domestic (332 outbreaks) and wild birds (512 detections) have already occurred in 27 European countries (Figure 1, 2 and 7). More than half (167 out of 314) of affected poultry establishments have been identified in northern Italy.

In particular, since 19 October 2021, 167 HPAI A(H5N1) outbreaks affecting more than 8 million birds have occurred in commercial poultry establishments in areas with high poultry densities (DPPAs) in the Po Valley (Veneto region). The emergence of infection was related to at least three new virus introductions into the poultry population of these areas. This initial virus exposure has been followed by the rapid spread of infection among highly susceptible poultry species and poultry production systems (e.g. fattening turkeys) (Busani et al., 2009). Indeed, all cases detected in the affected provinces of the Veneto Region (Verona, Padova, and Vicenza provinces) and characterised so far, have shown a high genetic relationship. Of note during this epidemic is that outbreaks in broilers were mostly detected by monitoring activities in response to outbreaks or testing before slaughter. No evident clinical signs or increased mortality were observed in the detected outbreaks which could be a result of early detection due to surveillance or virus properties associated with a longer incubation period and time from infection to death. The latter may be also in line with reports from an outbreak in layers in France where a slow increase in mortality was reported. This observation together with the observations in broilers in Italy could indicate a longer incubation period or time from infection to death for this A(H5N1) strain than previous virus strains (Beerens et al 2021). A longer incubation period and/or time from infection to death may result in a longer infectious period and delayed detection based on increased mortality. Thereby, increasing the risk of secondary transmission.

Italy repeatedly experienced the circulation of HPAI and LPAI viruses in the last decade, mainly due to high poultry densities in limited geographic areas situated along migratory flyways and close to extended wetlands. Nevertheless, the infection dynamics of these epidemics were notably different and characterised by an initial virus exposure occurring at the fringes of the DPPAs and close to the coastal area of the Adriatic Sea. For instance, in the 2016–2017 season, the epidemic started between December 2016 and January 2017, and HPAI A(H5N8) virus was initially detected in a laying hen and in two fattening turkey premises situated in proximity to the Po delta and the Venetian lagoon, which are widely frequented by migratory waterfowl (Fusaro et al., 2017; Mulatti et al., 2018). Only later (mid-February), the virus was introduced in two fattening turkey farms in the DPPAs at approximately 100 km from the initial outbreaks without the rampant spread of the virus that has characterized the current epidemic. In 2020–2021, only three (H5N8) HPAI outbreaks occurred in backyards, despite the HPAI A(H5) virus detection in wild birds at the fringes of the DPPAs (EFSA, 2021). However, inferences about the virus properties regarding between flock transmission for this epidemic could not be drawn, since it has been previously observed that backyard flocks play a marginal role in the transmission of HPAI (Bavinck et al., 2009). The speed of diffusion of the A(H5N1) virus in the DPPAs in Italy observed this year, combined with the observations in broilers discussed above, raises the need to deepen the knowledge on the characteristics of the new HPAI viruses circulating in the populations of wild birds and poultry, and identify new strategies to adequately counter them.

Comparing the dynamics of the current epidemic with those observed in 2016–2017 and 2020–2021 and taking account of the ongoing migratory season, it appears that the persistent HPAI A(H5) virus presence in wild birds and in the environment at low winter temperatures will continue to pose a risk for the poultry industry in Europe for the coming months. This comparison also suggests that we may carefully speak of a 'HPAI A(H5) season' in Europe, which will likely pose risks for the poultry industry in Europe in coming years. Such seasonal epidemics may not occur every year, but if they do, they may

be expected to start around the end of September or beginning of October, with the arrival of migratory waterbirds at their wintering areas in Europe.

Both epidemiological and genetic analyses suggest that HPAI A(H5) is being maintained in wild bird populations in Eurasia. Epidemiological monitoring showed that in between the 2020–2021 and 2021–2022 epidemics in Europe, HPAI A(H5) viruses were detected in resident wild birds in Europe. Phylogenetic analysis indicates that the HPAI A(H5N1) virus currently circulating in Europe is genetically highly related to the viruses that were already present in Europe in October 2020. The rate of virus detection in greylag goose and barnacle goose, species in which HPAI A(H5) were hardly detected before 2020, continued to be high this autumn. The involvement of these two wild waterbird species in the epidemiology of HPAI A(H5) is relevant, since population numbers in Europe are high: 519,000–853,000 for the greylag goose (BirdLifeInternational, online-c), and 392,000–494,000 mature individuals for the barnacle goose (BirdLifeInternational, online-b). However, these numbers are still about a factor ten lower than the European population of mallards: 5,700,000–9,220,000 (BirdLifeInternational, online-a). Anecdotal information (Personal communication by Thijs Kuiken on data from AImpact2122) suggests that the wild bird mortality associated with HPAI A(H5) infection in wild bird populations in the Netherlands is associated with lower mortality this autumn than in the autumn of 2021. This may be in part due to increased population immunity against HPAI A(H5) in relevant wild bird populations.

Considering the frequent occurrence of devastating HPAI A(H5) epidemics in Europe that can jeopardise the sustainability of the entire poultry sector, medium-term and long-term avian influenza mitigation strategies should be identified and implemented primarily in densely populated poultry areas and poultry production systems that are at high avian influenza risk. These mitigation strategies should at least encompass: (i) the definition of appropriate biosecurity, surveillance and early detection measures to be continuously enforced in different poultry production systems along the whole value chain, (ii) the improvement of the capacity and the level of preparedness of the veterinary infrastructure for a prompt eradication of any avian influenza outbreaks, (iii) the reduction of the density of commercial poultry farms primarily in areas close to wetlands, (iv) the reorganisation of poultry production systems highly susceptible to avian influenza exposure to minimise the risk of virus introduction and further spread and (v) the possible application of appropriate vaccination strategies.

Based on the temporal dynamics of the 2016–2017, 2019–2020 and 2020–2021 epidemic seasons, it is expected that the risk of HPAI infections will remain high for the coming winter months. Therefore, we recommend that the housing order is kept for this winter period particularly in high risk areas.

The virus type HPAI A(H5N1) was detected in most of the outbreaks in domestic and wild birds from outside the EU. For other virus types, such as A(H5N5) and A(H5N8), only low numbers of cases were reported to the OIE. Compared to the previous reporting period (EFSA et al., 2021x), no outbreaks of the Taiwanese lineage A(H5N2) or the zoonotic reassortment of A(H5N6) occurred worldwide. HPAI A(H5) and HPAI A(H5N1) were also detected in domestic and several wild bird species in Kazakhstan and western Russia linked to key migration areas of wild waterbirds.

Furthermore, within this reporting period HPAI A(H5) was detected in wild mammal species in two EU countries. The viruses characterised so far present adaptive markers that are associated with improved replication in mammals (Manzoor et al., 2009; Kim et al., 2010; Herfst et al., 2012; Suttie et al., 2019). As in previously identified transmission events, it is important to analyse viruses on mutations associated with mammalian adaptation that can rapidly emerge after transmission to mammals to support public health risk assessment

The evolution of HPAI A(H5) viruses in wild birds in Europe should be constantly kept under scrutiny. Since October 2020, HPAI A(H5) viruses of numerous genotypes had circulated among wild birds and poultry populations in several European countries. Some of these genotypes persisted throughout the summer period and are still circulating in Northern Europe, with the A(H5N1) becoming the most prevalent one. With the increasing number of cases, starting from October 2021, genetic analyses indicate the occurrence of multiple novel A(H5N1) introductions in North, East, Central and South of Europe, likely through the westward movement of wild migratory birds. During wild bird migration, timely genetic characterization and sharing of the sequences should be strengthened to promptly identify introductions of viruses with high zoonotic potential.

4.7. Monitoring, diagnosis of human infections and public health, occupational health and safety measures for infection prevention and control in the EU/EEA

4.7.1. Occupational health and safety measures

When there is a potential risk of exposure to these viruses from infected birds (whether in an agricultural or other setting), the workplace risk assessment should be revised taking into account all risks, including the increased physical load on workers from wearing PPE and appropriate measures should be taken, prioritising technical and organisational measures over personal measures. The measures should be consulted with the health and safety committee when available or with workers' representatives. These may include technical measures such as physical distancing, enhanced ventilation, dust- and aerosol-avoiding measures (for example when cleaning and handling litter) and using appropriate PPE, when other measures do not sufficiently protect workers. Work clothing and street clothing should be stored separately and a separation of potentially contaminated areas from clean areas ensured (black/white areas) and appropriate hygiene measures applied. In agricultural settings, care should be taken to avoid contamination of domestic areas, for example through contaminated work clothing. Appropriate PPE should be provided by employers and properly stored and disposed of, and workers should be trained in its use. Specific measures should be set out for culling operations and for the handling of dead animals and waste.

At premises where workers may be exposed to the above-mentioned viruses, for example when directly exposed to birds, their products or droppings, which may potentially be infected or contaminated with avian influenza viruses, the workplace risk assessment should be revised by employers and appropriate OSH measures should be set⁴, taking into account all risks, including those from additional physical load when wearing PPE. Appropriate PPE should be provided by employers and workers should be trained in its use and disposal. PPE should be properly stored. At poultry farms, it should be ensured that living areas are not contaminated, for example through work clothing, e.g. to avoid additional risk to family workers and relatives.

4.7.2. Monitoring and options for public health measures

Surveillance of avian influenza viruses in wild birds and poultry in the EU/EEA is important to detect newly introduced and circulating viruses and reduce the possible risk of exposure of humans to infected birds. Sequencing efforts of avian influenza viruses should be increased related to outbreaks and wild bird detections to monitor the evolution of the viruses and identify mutations in the virus genome that indicate human transmissibility or pathogenicity.

It is important to remain vigilant, to prevent any transmission and identify any possible early transmission events to humans. People at risk are mainly those in direct contact/handling of diseased birds or poultry, or their carcasses (e.g. farmers, agricultural workers at poultry farms, veterinarians and labourers involved in culling and rendering).

Avian influenza viruses have been identified in different wildlife species such as wild birds, seals and foxes. People living in areas where avian influenza outbreaks have been detected should avoid touching such sick (e.g. showing neurological symptoms) or dead animal species or bird droppings unprotected. Hunters should be cautious when hunting wild birds and foxes in areas with recent avian influenza detection.

Countries are urged to implement follow-up and testing of exposed people. People developing respiratory symptoms including conjunctivitis within 10 days after contact with infected birds should be tested for influenza viruses. Other A(H5Nx) viruses have shown high severity and mortality, so that the evolution of these viruses needs to be closely monitored and human-to-human transmission identified and reported as early as possibly to implement public health control and worker protection.

⁴ An extensive body of occupational safety and health (OSH) legislation applies to the protection of workers. Employers' obligations are set out in the OSH framework Directive 89/391/EC and its daughter directives, in particular directive 2000/54/EC 000 on the protection of workers from risks related to exposure to biological agents at work. These Directives are minimum requirements and are implemented in national regulations. There may be specific guidance for poultry workers in the Member states and they may also include requirements for appropriate health surveillance for instance.

Workers should wear PPE (face mask, goggles/face shield/protective glasses, gloves and gown/overall) and avoid unprotected direct contact with sick or dead birds, carcasses, faeces as well as potentially contaminated environments. National public health and OSH guidelines might detail the required level of protection and equipment. Appropriate measures should also be set for culling operations, which should cover the disposal of dead animals and waste. National public health and occupational health and safety guidelines might detail the required level of protection and equipment.

Occupationally and people otherwise exposed to birds with avian influenza virus infection should be identified and monitored for development of influenza-like symptoms. Local health authorities and occupational health services should consider active monitoring these groups, particularly during and after culling operations. Workers should have access to appropriate health surveillance according to national OSH requirements and the occupational health services or physicians should be consulted. Health monitoring of exposed workers should be offered in accordance with national OSH requirements at the affected holdings⁵. Additionally, people with direct exposure at affected holdings or to likely infected wild birds should be monitored for a minimum of 10 days to document possible related symptoms, including influenza-like illness (ILI) with fever and cough or conjunctivitis. As a minimum, all persons exposed to the likely infected birds should be instructed to report any symptoms to local health and occupational health or other preventive services.

Avian influenza viruses circulating in the EU/EEA have not shown any resistance to antivirals such as neuraminidase inhibitors. Early or presumptive treatment with neuraminidase inhibitors should always be considered for suspect or confirmed cases, in line with relevant national and international recommendations. Antiviral prophylaxis could also be considered depending on the local risk assessment (i.e. intensity of exposure).

It is recommended that confirmed cases, including family workers at farms and relatives, are followed-up, tested and offered post-exposure prophylaxis as recommended by relevant national/international guidelines. Healthcare workers managing symptomatic exposed (or possible) cases should follow standard, contact and respiratory precautions, depending on the local risk assessment. Workplace prevention measures should be set accordingly. A protocol to investigate non-seasonal influenza has been published by WHO (WHO, 2018).

The initiation of sero-epidemiological studies following HPAI virus outbreaks is strongly encouraged to identify transmission events and support risk assessments. Sero-epidemiological studies should focus on exposed groups like hunters, bird ringers, cullers, farmers and others with relevant bird exposure.

4.7.3. Diagnosis

People in the EU presenting with severe respiratory or influenza-like infection and a history of exposure to poultry or wild birds will require careful investigation, management and infection control. Reports of neurological symptoms in avian influenza virus infected mammals suggested also testing for influenza in severely sick patients with unusual including neurological symptoms. Appropriate samples for influenza tests should be rapidly taken and processed from patients with relevant exposure history within 10 days preceding symptom onset. If positive specimens cannot be subtyped, those should be shared with the national reference laboratory (National Influenza Centres; NICs).

With routine diagnostic laboratory assays, human infection with A(H5Nx) viruses should be detected as positive for influenza A virus, and negative for influenza B, A(H1), A(H1)pdm09 and A(H3) viruses and therefore classified as unsubtypeable influenza A virus if no-specific A(H5) diagnostic test is performed. Such unsubtypeable influenza A virus isolates or clinical samples that cannot be subtyped should be sent to NICs, and further to a WHO Collaborating Centre for Reference.

⁵ Directive 2000/54/EC of the European Parliament and of the Council of 18 September 2000 on the protection of workers from risks related to exposure to biological agents at work (seventh individual directive within the meaning of Article 16(1) of Directive 89/391/EEC)-OJ L 262, 17.10.2000, p. 21–45

4.7.4. Reporting

Human infections with avian influenza viruses are notifiable under EU legislation within 24 hours through the Early Warning and Response System (EWRS) according to EU Decision 1082/2013/EU⁶. Reporting is also required through the International Health Regulations (IHR) notification system (WHO, 2017): 'Each State Party shall notify WHO, by the most efficient means of communication available, by way of the National IHR Focal Point, and within 24 hours of assessment of public health information, of all events that may constitute a public health emergency of international concern within its territory according to the decision instrument, and any health measure implemented in response to those events.'

Information should also be shared with local OSH authorities.

4.7.5. Sharing of sequences

The timely characterisation of viruses and the sharing of sequence information remain crucial for the monitoring of virus evolution and for virus vaccine development. Sharing of sequence data through the GISAID EpiFlu (GSAID, online) or other sequence databases and virus isolates with WHO Collaborating Centres are important for public health assessment, improvement of diagnostics and the development of candidate vaccines. Sharing of influenza viruses is through the Global Influenza Surveillance and Response System (GISRS) (WHO, online-c).

4.7.6. Candidate vaccine viruses

Candidate vaccine viruses (CVV) developed, under development or proposed are listed in a report from WHO (WHO, 2021e).

4.8. ECDC risk assessment for the general public in the EU/EEA

Avian influenza A(H5N8) viruses have caused large outbreaks in birds and poultry since 2014 [14]. ECDC has published a Threat Assessment Brief on 24 February 2021 (ECDC, 2021b).

Over the last year, there have been several thousands of exposure events of people who were involved in e.g. culling activities of infected birds or other related activities, but no documented transmission to humans has been reported in the EU/EEA so far.

The risk assessment is based on the likelihood of infection and disease severity: the likelihood of infection is related to direct unprotected exposure to infected wild birds or poultry (or other mammals infected with avian influenza virus such as foxes and seals) and is considered low for the general population and low to medium for people occupationally exposed to infected birds or other potentially infected mammals. The disease severity has been described as asymptomatic or mild in human cases with A(H5N8) infection in Russia and Nigeria, therefore the impact based on severity has been considered low but with high uncertainty due to the high diversity of circulating avian influenza viruses and the switch from mainly A(H5N8) to A(H5N1) circulating viruses in birds as well as the high severity observed in human cases infected with A(H5N6) in China.

This risk to the general public of human transmission due to avian influenza A(H5N8) is therefore assessed as *low* and to occupationally exposed people *low to moderate*.

Avian influenza virus transmission to humans is a rare event and the risk is considered very low for viruses adapted to avian species. However, the detection of viruses carrying markers for mammal adaptation, and correlated with increased replication and virulence in mammals, is of concern. The additional reports of transmission events to mammals, e.g. seals and foxes in several EU countries as well as seroepidemiological evidence of transmission to wild boar and domestic pigs, could indicate evolutionary processes including mammal adaptation with the possibility to acquire the ability to transmit to humans.

⁶ Commission Implementing Decision of 8 August 2012 amending Decision 2002/253/EC laying down case definitions for reporting communicable diseases to the Community network under Decision No 2119/98/EC of the European Parliament and of the Council (notified under document C(2012) 5538) - OJ L 262, 27.9.2012

However, direct and unprotected exposure to possible infected birds and poultry and their products including blood remains limited to particular mostly occupationally exposed groups of people in the European countries.

The uncertainty of this risk assessment is high due to the high variability of the avian influenza viruses of clade 2.3.4.4 with many reassorted subtypes and genetic lineages co-circulating in Europe and globally. Reassortment events will continue and zoonotic transmission of avian influenza viruses cannot be fully excluded in general when avian influenza viruses are present in birds. People should avoid touching sick or dead birds or their droppings unprotected or wear PPE when in direct contact. Workers should be protected following an updated workplace risk assessment and prevention measures set accordingly⁷. Using personal protective measures for people exposed to birds infected with avian influenza viruses will minimise any residual risk. Follow-up measures and testing should be initiated as described above.

The risk of travel-related importation of human avian influenza cases from countries where the viruses are detected in poultry or wild birds is *very low*. Sporadic human cases infected with A(H9N2) LPAI or A(H5N6) HPAI viruses outside Europe underline the risk of transmission whenever people are exposed to infected birds.

⁷ Council Directive 2005/94/EC of 20 December 2005 on Community measures for the control of avian influenza and repealing Directive 92/40/EEC. OJ L 10, 14.1.2006, p. 16.

References

- Abed Y, Goyette N and Boivin G, 2005. Generation and characterization of recombinant influenza A (H1N1) viruses harboring amantadine resistance mutations. *Antimicrob Agents Chemother*, 49, 556-559. doi:10.1128/AAC.49.2.556-559.2005
- Adlhoch C, Baldinelli F, Fusaro A and Terregino C, 2021. Avian influenza, a new threat to public health in Europe? *Clin Microbiol Infect*. doi:10.1016/j.cmi.2021.11.005
- Ankhanbaatar U, Sainnokhoi T, Settypalli TBK, Datta S, Gombo-Ochir D, Khanui B, Dorj G, Basan G, Cattoli G, Dundon WG and Lamien C, 2021. Isolation and Identification of a Highly Pathogenic Avian Influenza H5N6 Virus from Migratory Waterfowl in Western Mongolia. *J Wildl Dis*. doi:10.7589/jwd-d-21-0003210.7589/JWD-D-21-00032.
- Ärztblatt D, online. Bird flu virus detected in dead seals. Available online: <https://www.aerzteblatt.de/nachrichten/127460/Vogelgrippevirus-bei-toten-Seehunden-nachgewiesen> [Accessed: 29 September 2021]
- Awuni JA, Bianco A, Dogbey OJ, Fusaro A, Yingar DT, Salviato A, Ababio PT, Milani A, Bonfante F and Monne I, 2019. Avian influenza H9N2 subtype in Ghana: virus characterization and evidence of co-infection. *Avian Pathology*, 48, 470-476. doi:10.1080/03079457.2019.1624687
- Bavinck V, Bouma A, van Boven M, Bos ME, Stassen E and Stegeman JA, 2009. The role of backyard poultry flocks in the epidemic of highly pathogenic avian influenza virus (H7N7) in the Netherlands in 2003. *Prev Vet Med*, 88, 247-254. doi:10.1016/j.prevetmed.2008.10.007
- Beerens N, Germeraad EA, Venema S, Verheij E, Pritz-Verschuren SBE and Gonzales JL, 2021. Comparative pathogenicity and environmental transmission of recent highly pathogenic avian influenza H5 viruses. *Emerg Microbes Infect*, 10, 97-108. doi:10.1080/22221751.2020.1868274
- BirdLifeInternational, online-a. Species factsheet: *Anas platyrhynchos*. Downloaded from <http://www.birdlife.org> on 21/12/2021. Available
- BirdLifeInternational, online-b. Species factsheet: *Branta leucopsis*. Downloaded from <http://www.birdlife.org> on 21/12/2021. Available
- BirdLifeInternational, online-c. Species factsheet: *Anser anser*. Downloaded from <http://www.birdlife.org> on 21/12/2021. Available
- Bonfante F, Mazzetto E, Zanardello C, Fortin A, Gobbo F, Maniero S, Bigolaro M, Davidson I, Haddas R, Cattoli G and Terregino C, 2018. A G1-lineage H9N2 virus with oviduct tropism causes chronic pathological changes in the infundibulum and a long-lasting drop in egg production. *Veterinary Research*, 49, 83. doi:10.1186/s13567-018-0575-1
- Busani L, Valsecchi MG, Rossi E, Toson M, Ferre N, Pozza MD and Marangon S, 2009. Risk factors for highly pathogenic H7N1 avian influenza virus infection in poultry during the 1999-2000 epidemic in Italy. *Vet J*, 181, 171-177. doi:10.1016/j.tvjl.2008.02.013
- CCDC (Chinese Center for Disease Control and Prevention), 2021. Genetic Characterization of Two Human Cases Infected with the Avian Influenza A (H5N6) Viruses-Guangxi Zhuang Autonomous Region, China, 2021. *China CDC Weekly* CCDC, 6 pp. Available online: <http://weekly.chinacdc.cn/fileCCDCW/journal/article/ccdcw/newcreate/CCDCW210169.pdf>
- CDC (Centers for Disease Control and Prevention), online-a. Update on A(H5N6) Bird Flu: How is the U.S. CDC Monitoring A(H5N6) Infections and Contributing to Global Pandemic Preparedness? Available online: <https://www.cdc.gov/flu/spotlights/2021-2022/H5N6.htm> [Accessed: 21 December 2021]
- CDC (Centers for Disease Control and Prevention), online-b. Summary of Influenza Risk Assessment Tool (IRAT) Results. Available online: https://www.cdc.gov/flu/pandemic-resources/monitoring/irat-virus-summaries.htm?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fflu%2Fpandemic-resources%2Ftools%2Firat-virus-summaries.htm#H5N8clade [Accessed: 21 December 2021]
- Cheung CL, Rayner JM, Smith GJ, Wang P, Naipospos TS, Zhang J, Yuen KY, Webster RG, Peiris JS, Guan Y and Chen H, 2006. Distribution of amantadine-resistant H5N1 avian influenza variants in Asia. *J Infect Dis*, 193, 1626-1629. doi:10.1086/504723
- Chinese National Influenza Center, WHO Collaborating Center for Reference and Research on Influenza and National Institute for Viral Disease Control and Prevention China, 2018. *Chinese Influenza Weekly Report* week 44, 2018. 6 pp. Available online:

- <http://www.chinaivdc.cn/cnic/en/Surveillance/WeeklyReport/201811/P020181109515197928770.pdf>
- CHP (Center for Health Protection Hong Kong), 2021a. Avian Influenza Report, Reporting period: Apr 18, 2021 – Apr 24, 2021 (Week 17). CHP, Hong Kong. 12 pp. Available online: https://www.chp.gov.hk/files/pdf/2021_avian_influenza_report_vol17_wk17.pdf
- CHP (Center for Health Protection Hong Kong), 2021b. Avian Influenza Report, Reporting period: Nov 14 – Nov 20, 2021 (Week 47). CHP, Hong Kong. 13 pp. Available online: https://www.chp.gov.hk/files/pdf/2021_avian_influenza_report_vol17_wk47.pdf
- CHP (Center for Health Protection Hong Kong), 2021c. Avian Influenza Report, Reporting period: Jan 31, 2021 – Feb 6, 2021 (Week 06). CHP, Hong Kong. 11 pp. Available online: https://www.chp.gov.hk/files/pdf/2021_avian_influenza_report_vol17_wk06.pdf
- Chrzastek K, Lee DH, Gharaibeh S, Zsak A and Kapczynski DR, 2018. Characterization of H9N2 avian influenza viruses from the Middle East demonstrates heterogeneity at amino acid position 226 in the hemagglutinin and potential for transmission to mammals. *Virology*, 518, 195-201. doi:10.1016/j.virol.2018.02.016
- Cui P, Zeng X, Li X, Li Y, Shi J, Zhao C, Qu Z, Wang Y, Guo J, Gu W, Ma Q, Zhang Y, Lin W, Li M, Tian J, Wang D, Xing X, Liu Y, Pan S, Zhang Y, Bao H, Liu L, Tian G, Li C, Deng G and Chen H, 2021. Genetic and biological characteristics of the globally circulating H5N8 avian influenza viruses and the protective efficacy offered by the poultry vaccine currently used in China. *Sci China Life Sci*. doi:10.1007/s11427-021-2025-y10.1007/s11427-021-2025-y.
- Duff P, Holmes P, Aegerter J, Man C, Fullick E, Reid S, Lean F, Núñez A, Hansen R, Tye J, Stephan L, Brown I and Robinson C, 2021. Investigations associated with the 2020/21 highly pathogenic avian influenza epizootic in wild birds in Great Britain. *Vet Rec*, 189, 356-358. doi:10.1002/vetr.114610.1002/vetr.1146.
- ECDC (European Centre for Disease Prevention and Control), 2021a. Communicable Disease Threats Report - Week 46, 14-20 November 2021. ECDC: Stockholm. 14 pp. Available online: <https://www.ecdc.europa.eu/sites/default/files/documents/Communicable-disease-threats-report-week%2046-2021.pdf>
- ECDC (European Centre for Disease Prevention and Control), 2021b. Threat Assessment Brief: First identification of human cases of avian influenza A(H5N8) infection. 24 February 2021, ECDC: Stockholm. 9 pp. Available online: <https://www.ecdc.europa.eu/sites/default/files/documents/First-identification-human-cases-avian-influenza-A-H5N8-infection.pdf>
- EFSA, ECDC, EURL, Adlhoch C, Fusaro A, Gonzales JL, Kuiken T, Marangon S, Niqueux E, Staubach C, Terregino C, Aznar I, Munoz Guajardo I and Baldinelli F, 2021a. Scientific Report: Avian influenza overview May – September 2021. *Efsa Journal*, 76 pp.,doi: <https://www.efsa.europa.eu/en/efsajournal/pub/9979> Available
- EFSA, ECDC, EURL, Adlhoch C, Fusaro A, Gonzales JL, Kuiken T, Marangon S, Niqueux E, Staubach C, Terregino C and Baldinelli F, 2021b. Scientific Report: Avian influenza overview December 2020 – February 2021. *Efsa Journal*, 19(2):6497, 73 pp.,doi: 10.2903/j.efsa.2020.6379 Available
- EFSA, ECDC, EURL, Adlhoch C, Fusaro A, Gozales JL, Kuiken T, Marangon S, Niqueux E, Staubach C, Terregino C, Aznar I, Munoz Guajardo I and Baldinelli F, 2021c. Scientific Report: Avian influenza overview February – May 2021. *Efsa Journal*, 103 pp. Available online: <https://www.efsa.europa.eu/sites/default/files/2021-05/9989.pdf>
- EFSA, ECDC, EURL, Adlhoch C, Fusaro A, Kuiken T, Niqueux E, Staubach C, Terregino C, Munoz Guajardo I and Baldinelli F, 2020. Scientific Report: Avian influenza overview November 2019 – February 2020. *Efsa Journal*, 18(3):6069, 54 pp.,doi: doi:10.2903/j.efsa.2020.6069 Available
- EFSA, ECDC, EURL, Brown I, Mulatti P, Smietanka K, Staubach C, Willeberg P, Adlhoch C, Candiani D, Fabris C, Zancanaro G, Morgado J and Verdonck F, 2017. Scientific report: Avian influenza overview October 2016 – August 2017. 15(10):5018, *EFSA Journal* 2017. 101 pp.,doi: 10.2903/j.efsa.2017.5018 Available

- EFSA AHAW Panel (EFSA Panel on Animal Health and Welfare), 2017. Scientific opinion on avian influenza. *Efsa Journal*, 15, 4991, 233 pp. doi: [10.2903/j.efsa.2017.4991](https://doi.org/10.2903/j.efsa.2017.4991) Available
- European Commission, online. Animal Disease Notification System (ADNS). Available online: https://ec.europa.eu/food/animals/animal-diseases/not-system_en [Accessed: 17 December 2019]
- FAO (Food and Agriculture Organization), online. H7N9 situation update. Available online: http://www.fao.org/ag/againfo/programmes/en/empres/h7n9/situation_update.html [Accessed: 26 February 2021]
- FFA (Finnish Food Authority), online. Avian influenza cases in Finland. Available online: <https://www.ruokavirasto.fi/en/farmers/animal-husbandry/animal-health-and-diseases/animal-diseases/poultry/avian-influenza/avian-influenza-in-finland/> [Accessed: 21 December 2021]
- Floyd T, Banyard AC, Lean FZX, Byrne AMP, Fullick E, Whittard E, Mollett BC, Bexton S, Swinson V, Macrelli M, Lewis NS, Reid SM, Núñez A, Duff JP, Hansen R and Brown IH, 2021. Systemic infection with highly pathogenic H5N8 of avian origin produces encephalitis and mortality in wild mammals at a UK rehabilitation centre. *bioRxiv*, 2021.2005.2026.445666. doi:10.1101/2021.05.26.445666
- Fusaro A, Monne I, Mulatti P, Zecchin B, Bonfanti L, Ormelli S, Milani A, Cecchettin K, Lemey P, Moreno A, Massi P, Dorotea T, Marangon S and Terregino C, 2017. Genetic Diversity of Highly Pathogenic Avian Influenza A(H5N8/H5N5) Viruses in Italy, 2016-17. *Emerging Infectious Diseases*, 23, 1543-1547. doi:10.3201/eid2309.170539
- Gabriel G, Dauber B, Wolff T, Planz O, Klenk HD and Stech J, 2005. The viral polymerase mediates adaptation of an avian influenza virus to a mammalian host. *Proc Natl Acad Sci U S A*, 102, 18590-18595. doi:10.1073/pnas.0507415102
- Gabriel G, Herwig A and Klenk HD, 2008. Interaction of polymerase subunit PB2 and NP with importin alpha1 is a determinant of host range of influenza A virus. *PLoS Pathog*, 4, e11. doi:10.1371/journal.ppat.0040011
- GovHK (release TGoHKSARP), online-a. CHP closely monitors human case of avian influenza A(H5N6) in Mainland. Available online: <https://www.info.gov.hk/gia/general/202112/08/P2021120800472.htm> [Accessed: 21 December 2021]
- GovHK (release TGoHKSARP), online-b. CHP closely monitors four human case of avian influenza A(H5N6) in Mainland. Available online: <https://www.info.gov.hk/gia/general/202112/15/P2021121500580.htm> [Accessed: 21 December 2021]
- GSAID, online. GISAID EpiFlu™ Database. Available online: <https://www.gisaid.org/epiflu-applications/submitting-data-to-epiflutm/>** [Accessed: 26 February 2021]
- He G, Ming L, Li X, Song Y, Tang L, Ma M, Cui J and Wang T, 2021. Genetically Divergent Highly Pathogenic Avian Influenza A(H5N8) Viruses in Wild Birds, Eastern China. *Emerg Infect Dis*, 27, 2940-2943. doi:10.3201/eid2711.20489310.3201/eid2711.204893.
- Herfst S, Schrauwen EJ, Linster M, Chutinimitkul S, de Wit E, Munster VJ, Sorrell EM, Bestebroer TM, Burke DF, Smith DJ, Rimmelzwaan GF, Osterhaus AD and Fouchier RA, 2012. Airborne transmission of influenza A/H5N1 virus between ferrets. *Science*, 336, 1534-1541. doi:10.1126/science.1213362
- Herve S, Schmitz A, Briand FX, Gorin S, Queguiner S, Niqueux E, Paboeuf F, Scoizec A, Le Bouquin-Leneveu S, Etteradossi N and Simon G, 2021. Serological Evidence of Backyard Pig Exposure to Highly Pathogenic Avian Influenza H5N8 Virus during 2016-2017 Epizootic in France. *Pathogens*, 10. doi:10.3390/pathogens10050621
- Ilyushina NA, Govorkova EA and Webster RG, 2005. Detection of amantadine-resistant variants among avian influenza viruses isolated in North America and Asia. *Virology*, 341, 102-106. doi:10.1016/j.virol.2005.07.003
- Jiang H, Wu P, Uyeki TM, He J, Deng Z, Xu W, Lv Q, Zhang J, Wu Y, Tsang TK, Kang M, Zheng J, Wang L, Yang B, Qin Y, Feng L, Fang VJ, Gao GF, Leung GM, Yu H and Cowling BJ, 2017. Preliminary Epidemiologic Assessment of Human Infections With Highly Pathogenic Avian Influenza A(H5N6) Virus, China. *Clinical Infectious Diseases*, 65, 383-388. doi:10.1093/cid/cix334
- Kariithi HM, Welch CN, Ferreira HL, Pusch EA, Ateya LO, Binopal YS, Apopo AA, Dulu TD, Afonso CL and Suarez DL, 2019. Genetic characterization and pathogenesis of the first H9N2 low

- pathogenic avian influenza viruses isolated from chickens in Kenyan live bird markets. *Infection, Genetics and Evolution*, 104074. doi:10.1016/j.meegid.2019.104074
- Kim JH, Hatta M, Watanabe S, Neumann G, Watanabe T and Kawaoka Y, 2010. Role of host-specific amino acids in the pathogenicity of avian H5N1 influenza viruses in mice. *J Gen Virol*, 91, 1284-1289. doi:10.1099/vir.0.018143-0
- Lan Y, Zhang Y, Dong L, Wang D, Huang W, Xin L, Yang L, Zhao X, Li Z, Wang W, Li X, Xu C, Yang L, Guo J, Wang M, Peng Y, Gao Y, Guo Y, Wen L, Jiang T and Shu Y, 2010. A comprehensive surveillance of adamantane resistance among human influenza A virus isolated from mainland China between 1956 and 2009. *Antivir Ther*, 15, 853-859. doi:10.3851/IMP1656
- Lee EK, Lee YN, Kye SJ, Lewis NS, Brown IH, Sagong M, Heo GB, Kang YM, Cho HK, Kang HM, Cheon SH, Lee M, Park BK, Kim YJ and Lee YJ, 2018. Characterization of a novel reassortant H5N6 highly pathogenic avian influenza virus clade 2.3.4.4 in Korea, 2017. *Emerging Microbes & Infections*, 7, 103. doi:10.1038/s41426-018-0104-3
- Li J, Zhang C, Cao J, Yang Y, Dong H, Cui Y, Yao X, Zhou H, Lu L, Lycett S, Wang X, Song H, Liu W, Gao GF, Shi W and Bi Y, 2021. Re-emergence of H5N8 highly pathogenic avian influenza virus in wild birds, China. *Emerg Microbes Infect*, 10, 1819-1823. doi:10.1080/22221751.2021.1968317.1080/22221751.2021.1968317.
- Li YT, Chen CC, Chang AM, Chao DY and Smith GJD, 2020. Co-circulation of both low and highly pathogenic avian influenza H5 viruses in current poultry epidemics in Taiwan. *Virus Evol*, 6, veaa037. doi:10.1093/ve/veaa037
- Manzoor R, Sakoda Y, Nomura N, Tsuda Y, Ozaki H, Okamatsu M and Kida H, 2009. PB2 protein of a highly pathogenic avian influenza virus strain A/chicken/Yamaguchi/7/2004 (H5N1) determines its replication potential in pigs. *J Virol*, 83, 1572-1578. doi:10.1128/JVI.01879-08
- Mulatti P, Fusaro A, Scolamacchia F, Zecchin B, Azzolini A, Zamperin G, Terregino C, Cunial G, Monne I and Marangon S, 2018. Integration of genetic and epidemiological data to infer H5N8 HPAI virus transmission dynamics during the 2016-2017 epidemic in Italy. *Sci Rep*, 8, 18037. doi:10.1038/s41598-018-36892-1
- OIE (World Organisation for Animal Health), online-a. World Animal Health Information Database (WAHIS) Interface. Available online: https://www.oie.int/wahis_2/public/wahid.php/Wahidhome/Home/indexcontent/newlang/en [Accessed: 26 June 2020]
- OIE (World Organisation for Animal Health), online-b. Immediate notification Highly pathogenic influenza A viruses (Inf. with)(non-poultry including wild birds)(2017-), Estonia. Available online: <https://wahis.oie.int/#/report-info?reportId=44804> [Accessed: 21 December 2021]
- Olsen B, Munster VJ, Wallensten A, Waldenstrom J, Osterhaus AD and Fouchier RA, 2006. Global patterns of influenza a virus in wild birds. *Science*, 312, 384-388. doi:10.1126/science.1122438
- Pyankova OG, Susloparov IM, Moiseeva AA, Kolosova NP, Onkhonova GS, Danilenko AV, Vakalova EV, Shendo GL, Nekeshina NN, Noskova LN, Demina JV, Frolova NV, Gavrilova EV, Maksyutov RA and Ryzhikov AB, 2021. Isolation of clade 2.3.4.4b A(H5N8), a highly pathogenic avian influenza virus, from a worker during an outbreak on a poultry farm, Russia, December 2020. *Eurosurveillance*, 26, 2100439. doi:doi:<https://doi.org/10.2807/1560-7917.ES.2021.26.24.2100439>
- Rijks JM, Hesselink H, Lollinga P, Wesselman R, Prins P, Weesendorp E, Engelsma M, Heutink R, Harders F, Kik M, Rozendaal H, van den Kerkhof H and Beerens N, 2021. Highly Pathogenic Avian Influenza A(H5N1) Virus in Wild Red Foxes, the Netherlands, 2021. *Emerg Infect Dis*, 27, 2960-2962. doi:10.3201/eid2711.211281
- Ripa RN, Sealy JE, Raghwanji J, Das T, Barua H, Masduzzaman M, Saifuddin A, Huq MR, Uddin MI, Iqbal M, Brown I, Lewis NS, Pfeiffer D, Fournie G and Biswas PK, 2021. Molecular epidemiology and pathogenicity of H5N1 and H9N2 avian influenza viruses in clinically affected chickens on farms in Bangladesh. *Emerg Microbes Infect*, 1-408. doi:10.1080/22221751.2021.2004865.1080/22221751.2021.2004865.
- Schülein A, Ritzmann M, Christian J, Schneider K and Neubauer-Juric A, 2021. Exposure of wild boar to Influenza A viruses in Bavaria: Analysis of seroprevalences and antibody subtype specificity

- before and after the panzootic of highly pathogenic avian influenza viruses A (H5N8). Zoonoses and Public Health, n/a. doi:<https://doi.org/10.1111/zph.12841>
- Sengkeopraseuth B, Co KC, Leuangvilay P, Mott JA, Khomgsamphanh B, Somoulay V, Tsuyuoka R, Chiew M, Ketmayoon P, Jones J, Pusch E, Jang Y, Barnes J, Davis CT, Phommachanh P, Khamphaphongphane B, Olsen SJ and Xangsayyarath P, 2021. First human infection of avian influenza A(H5N6) virus reported in Lao People's Democratic Republic, February-March 2021. Influenza Other Respir Viruses. doi:10.1111/irv.1293410.1111/irv.12934.
- Shin J, Kang S, Byeon H, Cho SM, Kim SY, Chung YJ and Jung SH, 2020. Highly pathogenic H5N6 avian influenza virus subtype clade 2.3.4.4 indigenous in South Korea. Scientific Reports, 10, 7241. doi:10.1038/s41598-020-64125-x
- Smith GJ, Donis RO, World Health Organization/World Organisation for Animal Health and Agriculture Organization HEWG, 2015. Nomenclature updates resulting from the evolution of avian influenza A(H5) virus clades 2.1.3.2a, 2.2.1, and 2.3.4 during 2013-2014. Influenza Other Respir Viruses, 9, 271-276. doi:10.1111/irv.12324
- Suttie A, Deng YM, Greenhill AR, Dussart P, Horwood PF and Karlsson EA, 2019. Inventory of molecular markers affecting biological characteristics of avian influenza A viruses. Virus Genes, 55, 739-768. doi:10.1007/s11262-019-01700-z
- SVA (National Veterinary Institute Sweden), online. Highly pathogenic bird flu - the past season and the infection situation for the coming season. Available online: <https://www.sva.se/statsepizootologien-kommenterar/hogpatogen-fagelinfluensa-den-gangnasasongen-och-smittlaget-infor-kommande-sasong/> [Accessed: 21 December 2021]
- Tarek M, Naguib MM, Arafa AS, Tantawy LA, Selim KM, Talaat S and Sultan HA, 2021. Epidemiology, Genetic Characterization, and Pathogenesis of Avian Influenza H5N8 Viruses Circulating in Northern and Southern Parts of Egypt, 2017-2019. Animals (Basel), 11. doi:10.3390/ani1108220810.3390/ani11082208.
- TASS (Russian News Agency), online. The world's first case of human infection with influenza A (H5N8) has been detected in Russia. Available online: <https://tass.ru/obschestvo/10751041> [Accessed: 26 February 2021]
- Turner JCM, Barman S, Feeroz MM, Hasan MK, Akhtar S, Jeevan T, Walker D, Franks J, Sellar P, Mukherjee N, Kercher L, McKenzie P, Lam T, El-Shesheny R and Webby RJ, 2021. Highly Pathogenic Avian Influenza A(H5N6) Virus Clade 2.3.4.4h in Wild Birds and Live Poultry Markets, Bangladesh. Emerg Infect Dis, 27, 2492-2494. doi:10.3201/eid2709.21081910.3201/eid2709.210819.
- UNEP/CMS/FAO (United Nations Environment Programme/Convention on Migratory Species and the United Nations Food and Agriculture Organization), 2021. Scientific Task Force on Avian Influenza and Wild Birds statement on: H5N8 (and other subtypes) Highly Pathogenic Avian Influenza in poultry and wild birds Winter of 2020/2021 with focus on management of protected areas in the African Eurasian region. . 12 February 2021, 8 pp. Available online: https://www.cms.int/sites/default/files/document/Scientific_Task_Force_AI_Wild_Birds_Statement_Feb2021_0.pdf
- WHO (World Health Organization), 2017. Operational Guidance on Sharing Influenza Viruses with Human Pandemic Potential (IVPP) under the Pandemic Influenza Preparedness (PIP) Framework. WHO, Geneva. 20 pp. Available online: <http://apps.who.int/iris/bitstream/handle/10665/259402/WHO-WHE-IHM-GIP-2017.3-eng.pdf;jsessionid=FF66316FB599ADA38D34499AA56765FA?sequence=1>
- WHO (World Health Organization), 2018. Protocol to investigate non-seasonal influenza and other emerging acute respiratory diseases. Geneva. 73 pp. Available online: <https://apps.who.int/iris/bitstream/handle/10665/275657/WHO-WHE-IHM-GIP-2018.2-eng.pdf?ua=1>
- WHO (World Health Organization), 2019a. Influenza at the human-animal interface - Summary and assessment, from 25 June 2019 to 27 September 2019. WHO, Geneva. 3 pp. Available online: https://www.who.int/influenza/human_animal_interface/Influenza_Summary_IRA_HA_interface_27_09_2019.pdf?ua=1

- WHO (World Health Organization), 2019b. Avian Influenza Weekly Update Number 713. WHO, Geneva. 3 pp. Available online: <https://iris.wpro.who.int/bitstream/handle/10665.1/14328/AI-20191101.pdf>
- WHO (World Health Organization), 2020a. Influenza at the human-animal interface; Summary and assessment, from 28 February to 8 May 2020. Geneva. 3 pp. Available online: https://www.who.int/influenza/human_animal_interface/Influenza_Summary_IRA_HA_interfac_e_08_05_2020.pdf?ua=1
- WHO (World Health Organization), 2020b. Antigenic and genetic characteristics of zoonotic influenza A viruses and development of candidate vaccine viruses for pandemic preparedness. Geneva. 8 pp. Available online: https://www.who.int/influenza/vaccines/virus/202002_zoonotic_vaccinevirusupdate.pdf?ua=1
- WHO (World Health Organization), 2020c. Influenza at the human-animal interface; Summary and assessment, from 9 August to 1 October 2021. Geneva. 7 pp. Available online: https://cdn.who.int/media/docs/default-source/influenza/human-animal-interface-risk-assessments/influenza_summary_ira_ha_interface_oct_2021.pdf?sfvrsn=5da1328d_9&download_ad=true
- WHO (World Health Organization), 2020d. Influenza at the human-animal interface - Summary and assessment, from 21 January to 28 February 2020. Geneva. 4 pp. Available online: https://www.who.int/influenza/human_animal_interface/Influenza_Summary_IRA_HA_interfac_e_28_02_2020.pdf?ua=1
- WHO (World Health Organization), 2021a. Cumulative number of confirmed human cases for avian influenza A(H5N1) reported to WHO, 2003-2021 (22 June 2021). WHO, Geneva. 4 pp. Available online: https://cdn.who.int/media/docs/default-source/influenza/h5n1-human-case-cumulative-table/2021_june_tableh5n1.pdf?sfvrsn=839e65a9_10&download=true
- WHO (World Health Organization), 2021b. Assessment of risk associated with influenza A(H5N6) virus, 29 November 2021. Available online: [https://cdn.who.int/media/docs/default-source/influenza/avian-and-other-zoonotic-influenza/a\(h5n6\)-risk-assessment.pdf?sfvrsn=e945a0b9_7&download=true](https://cdn.who.int/media/docs/default-source/influenza/avian-and-other-zoonotic-influenza/a(h5n6)-risk-assessment.pdf?sfvrsn=e945a0b9_7&download=true) [Accessed: 21 December 2021]
- WHO (World Health Organization), 2021c. Influenza at the human-animal interface; Summary and assessment, from 23 June to 8 August 2021. Geneva. 13 pp. Available online: https://cdn.who.int/media/docs/default-source/influenza/human-animal-interface-risk-assessments/influenza_summary_ira_ha_interface_08_08_2021.pdf?sfvrsn=5aa110_5&download_ad=true
- WHO (World Health Organization), 2021d. Human infection with avian influenza A(H5) viruses. Geneva. 4 pp. Available online: https://www.who.int/docs/default-source/wpro---documents/emergency/surveillance/avian-influenza/ai-20211210.pdf?sfvrsn=30d65594_186
- WHO (World Health Organization), 2021e. Antigenic and genetic characteristics of zoonotic influenza A viruses and development of candidate vaccine viruses for pandemic preparedness September 2021. Geneva. 13 pp. Available online: https://cdn.who.int/media/docs/default-source/influenza/who-influenza-recommendations/vcm-southern-hemisphere-recommendation-2022/202110_zoonotic_vaccinevirusupdate.pdf?sfvrsn=8f87a5f1_11
- WHO (World Health Organization), 2021f. Influenza at the human-animal interface; Summary and assessment, from 22 May to 22 June 2021. Geneva. 7 pp. Available online: https://cdn.who.int/media/docs/default-source/influenza/human-animal-interface-risk-assessments/influenza_summary_ira_ha_interface_june_2021.pdf?sfvrsn=bf6f707e_6&download_ad=true
- WHO (World Health Organization), online-a. Assessment of risk associated with influenza A(H5N8) virus, 17 November 2016. Available online: https://www.who.int/influenza/human_animal_interface/avian_influenza/riskassessment_AH5_N8_201611/en/ [Accessed: 26 June 2020]
- WHO (World Health Organization), online-b. Human infection with avian influenza A(H5N1) – India. Available online: [https://www.who.int/emergencies/disease-outbreak-news/item/human-infection-with-avian-influenza-a\(h5n1\)-%EF%BD%B0-india](https://www.who.int/emergencies/disease-outbreak-news/item/human-infection-with-avian-influenza-a(h5n1)-%EF%BD%B0-india) [Accessed: 29 September 2021]
- WHO (World Health Organization), online-c. Global Influenza Surveillance and Response System (GISRS). Available online: https://www.who.int/influenza/gisrs_laboratory/en/ [Accessed: 26 February 2021]
- Xu C, Ye H, Qiu W, Lin H, Chen Y, Zhang H and Liao M, 2018. Phylogenetic classification of hemagglutinin gene of H9N2 avian influenza viruses isolated in China during 2012–2016 and

- evaluation of selected candidate vaccine strains. *Poultry Science*, 97, 3023-3030. doi:10.3382/ps/pey154
- Yamayoshi S, Kiso M, Yasuhara A, Ito M, Shu Y and Kawaoka Y, 2018. Enhanced Replication of Highly Pathogenic Influenza A(H7N9) Virus in Humans. *Emerg Infect Dis*, 24, 746-750. doi:10.3201/eid2404.171509
- Yamayoshi S, Yamada S, Fukuyama S, Murakami S, Zhao D, Uraki R, Watanabe T, Tomita Y, Macken C, Neumann G and Kawaoka Y, 2014. Virulence-affecting amino acid changes in the PA protein of H7N9 influenza A viruses. *J Virol*, 88, 3127-3134. doi:10.1128/JVI.03155-13
- Zecchin B, Minoungou G, Fusaro A, Moctar S, Ouedraogo-Kabore A, Schivo A, Salviato A, Marciano S and Monne I, 2017. Influenza A(H9N2) Virus, Burkina Faso. *Emerging Infectious Diseases*, 23, 2118-2119. doi:10.3201/eid2312.171294
- Zhu C, Hu C, Gui B, Chen Q, Zhang S and He G, 2018. Genetic characteristics of H9N2 avian influenza viruses isolated from free-range poultry in Eastern China, in 2014-2015. *Poultry Science*, 97, 3793-3800. doi:10.3382/ps/pey187

Abbreviations

ADIS	Animal Disease Information System
ADNS	Animal Disease Notification System
CVO	Chief Veterinary Officer
CVV	Candidate vaccine viruses
DDPA	Densely populated poultry area
DVFA	Danish Veterinary and Food Administration
ECDC	European Centre for Disease Prevention and Control
EEA	European Economic Area
EFSA	European Food Safety Authority
EU	European Union
EURL	European Union Reference Laboratory
EWRS	Early Warning and Response System
FAO	Food and Agriculture Organization
FFA	Finnish Food Authority
GISRS	Global Influenza Surveillance and Response System
HPAI	Highly pathogenic avian influenza
IHR	International Health Regulations
IVPP	Influenza Viruses with Human Pandemic Potential
LPAI	Low pathogenic avian influenza
NRL	National Reference Laboratory
NVWA	Netherlands Food and Consumer Product Authority
OIE	World Organisation for Animal Health
OSH	Occupational safety and health
PCR	Polymerase chain reaction
PPE	Personal protective equipment
SVFA	State Veterinary and Food Administration
ToR	Term of Reference
WHO	World Health Organization

Appendix A – Terms of Reference

A.1. Background and Terms of Reference as provided by the requestor

Avian influenza is an infectious viral disease in birds, including domestic poultry. Infections with avian influenza viruses in poultry cause two main forms of that disease that are distinguished by their virulence. The low pathogenic (LPAI) form generally only causes mild symptoms, while the highly pathogenic (HPAI) form results in very high mortality rates in most poultry species. That disease may have a severe impact on the profitability of poultry farming.

Avian influenza is mainly found in birds, but under certain circumstances infections can also occur in humans even though the risk is generally very low.

More than a decade ago, it was discovered that virus acquired the capability to be carried by wild birds over long distances. This occurred for the HPAI of the subtype A(H5N1) from South East and Far East Asia to other parts of Asia, Europe and Africa as well as to North America. In the current epidemic the extent of the wild bird involvement in the epidemiology of the disease is exceptional.

Since late October 2016 up to early February 2017, highly pathogenic avian influenza (HPAI) of the subtype A(H5N8) has been detected in wild migratory birds or captive birds on the territory of 21 Member States, namely Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. In 17 Member States the virus has spilled over to poultry holdings leading also to lateral spread between holdings in a few Member States, in particular in those with a high density of duck and geese holdings where the poultry cannot sufficiently be protected against contacts with wild birds. A second HP AI subtype A(H5N5) has been detected in wild birds and recently also in poultry holdings in Germany.

The number of infected migratory wild birds found dead and the geographical extent of these findings are posing an immense threat for virus introduction into poultry or captive birds holdings as demonstrated by the high number of outbreaks (~700 as of 08/02/2017).

In the event of an outbreak of avian influenza, there is a risk that the disease agent might spread to other holdings where poultry or other captive birds are kept. As a result it may spread from one Member State to other Member States or to third countries through trade in live birds or their products.

There is knowledge, legislation⁸, technical and financial tools in the EU to effectively deal with outbreaks of avian influenza in poultry and captive birds. However, the very wide virus spread by wild birds and the increased risk of direct or indirect virus introduction into poultry or captive bird holdings has led to the largest HPAI epidemic in the EU so far. This situation calls for a reflection and evaluation how preparedness, risk assessment, early detection and control measures could be improved.

The Commission and Member States are therefore in need of an epidemiological analysis based on the data collected from the disease affected Member States. The use of the EFSA Data Collection Framework is encouraged given it promotes the harmonisation of data collection. Any data that is available from neighbouring third countries should be used as well, if relevant.

Therefore, in the context of Article 31 of Regulation (EC) No. 178/2002⁹, EFSA should provide the technical and scientific assistance to the Commission based on the following Terms of Reference (TOR):

- 1) Analyse the epidemiological data on highly pathogenic avian influenza (HPAI) and low pathogenic avian influenza (LPAI), where co-circulating or linked within the same epidemic, from HPAI disease affected Member States.

⁹ Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31, 1.2.2002, p. 1–24.

- 2) Analyse the temporal and spatial pattern of HPAI and LPAI as appropriate in poultry, captive birds and wild birds, as well the risk factors involved in the occurrence, spread and persistence of the HPAI virus in and at the interface of these avian populations.
- 3) Based on the findings from the points above, describe the effect of prevention and control measures.
- 4) Provide for regular quarterly reports updating on the avian influenza situation within the Union and worldwide, in particular with a view to describe the evolution of virus spread from certain regions towards the EU. In case of significant changes in the epidemiology of avian influenza, these reports could be needed more frequently. These reports should in particular closely follow the developments of zoonotic avian influenza viruses (such as HPAI A(H5N6) and LPAI A(H7N9)) in collaboration with the European Centre for Disease Prevention and Control (ECDC).

A.2. Interpretation of the Terms of Reference

In reply to ToR 1 and ToR 2, this scientific report gives an overview of the HPAI and LPAI outbreaks in poultry, captive and wild birds detected in Europe between 16 September and 8 December 2021 and reported by Member States and neighbouring countries via ADNS or OIE. Member States where avian influenza outbreaks have occurred in poultry have submitted additional epidemiological data to EFSA, that have been used to analyse the characteristics of the affected poultry establishments.

It was not possible to collect data for a risk factor analysis on the occurrence and persistence of HPAI virus within the EU. Risk factor analysis requires not only case-related information, but also data on the susceptible population (e.g. location of establishments, population structure), that should be collected in a harmonised manner across the EU. Limitations in data collection, reporting and analysis were explained in the first avian influenza overview report (EFSA AHAW Panel, 2017).

If HPAI outbreaks in poultry are detected in the EU, a description of the applied prevention and control measures (ToR 3) is given in the case report provided by representatives from the affected Member States and attached as an annex. Information was collected for outbreaks that occurred from 16 September up to 8 December 2021. The main topics covered are increasing awareness, release and repeal of housing orders, strengthening biosecurity, preventive culling, implementation of a regional standstill, bans on hunting and derogations from restriction zone implementation after a risk assessment.

Monitoring of the avian influenza situation in other countries (ToR 4) is based on data reported to OIE WAHIS. The description focuses only on findings of avian influenza viruses occurring in countries that are considered to be of epidemiological interest for the EU/EEA and the UK or of public health relevance, specifically on HPAI A(H5N1), HPAI A(H5N2), HPAI A(H5N5), HPAI A(H5N6), HPAI A(H5N8), HPAI/LPAI A(H7N9) and LPAI A(H9N2). The background and epidemiology, detections, phenotypic and genetic characterisations are described based on information from confirmed human, poultry and wild bird cases that occurred between 16 September and 8 December 2021. Possible actions for preparedness in the EU are discussed.

This report mainly describes information that has become available since the publication of the EFSA report for the period May to September 2021 (EFSA et al., 2021b) and that might affect the interpretation of risks related to avian influenza introduction and/or spread in Europe.

Appendix B – Data and Methodologies

B.1. Data on animals

B.1.1. Overview of avian influenza outbreaks in Europe (ToR 1 and ToR 2)

Data on the avian influenza outbreaks that occurred in Europe from 16 September to 8 December 2021 submitted by Member States to the ADIS (European Commission, online) were taken into account for this report. Data extraction was carried on 8 December 2021. The OIE’s World Animal Health Information Database (OIE, online-a) was consulted to complement the information for European countries not reporting HPAI notifications to ADIS (United Kingdom and Serbia). In addition, HPAI-affected European countries were asked to provide more detailed epidemiological data directly to EFSA on the avian influenza outbreaks that occurred in poultry during the same period.

Wild bird species have been categorised according to Table B1.

The public GISAID’s EpiFlu Database was accessed to download newly released avian influenza sequences.

A descriptive analysis of the data collected is reported in Section 4.2.

Table B1. Categorisation of wild bird species for detection between 5 October 2020 and and 8 December 2021

Other wild bird species	Raptor	Waterfowl
Black-headed gull	Accipitridae	Anserinae
Common eider	Accipitriformes	Barnacle goose
Common gull	Common buzzard	Bean goose
Common pheasant	Common kestrel	Black swan
Common raven	Eurasian eagle-owl	Brant goose
Common starling	Eurasian sparrowhawk	Canada goose
Common wood pigeon	Falco sp.	Charadriidae
Cormorant	Golden eagle	Common eider
Corvidae	Marsh harrier	Common goldeneye
Curlew	Merlin	Common moorhen
Curlew sandpiper	Northern goshawk	Common guillemot
Dunlin	Peregrine falcon	Common merganser
Eurasian curlew	Short-eared owl	Common moorhen
Eurasian magpie	Strigiformes	Common shelduck
Eurasian oystercatcher	Tawny owl	Duck
Eurasian woodcock	White-tailed eagle	Egyptian goose
European herring gull		Eurasian coot
Fringillidae		Eurasian teal
Great black-backed gull		Eurasian wigeon
Great cormorant		Gadwall
Great skua		Garganey
Great white egret		Goose
Grey heron		Great crested grebe
Gruidae		Greater scaup
Gull		Greater white-fronted goose
Knot		Greylag goose
Lesser black-backed gull		Little grebe
Little egret		Mallard
Mediterranean gull		Muscovy duck
Northern gannet		Mute swan

Northern lapwing		Pied avocet
Pheasant		Pink-footed goose
Red knot		Swan
Ruddy turnstone		Tufted duck
Scolopacidae		Tundra bean goose
Sparrow		Whooper swan
Turdidae		Wigeon
Water rail		
Western jackdaw		
White stork		
Yellow-legged gull		

B.1.1.1. Literature review on phenotypic characterisation of HPAI viruses circulating in the EU

Information on the phenotypic characterisation of AI viruses circulating in the EU was extracted from the scientific literature by performing a literature review.

Review question Update on the phenotypic characterisation of HPAI viruses circulating in the EU in domestic and wild birds within the last 2 years.

Search The PubMed database was searched using subject index terms and free-text terms combined with the appropriate Boolean operators. Scientific articles added to the database from 15 August to 23 November 2021 were searched; the search was run on 23 November 2021.

Relevance criteria Scientific articles added to the database from 15 August to 23 November 2021 and reporting information on the presence or absence of clinical signs or pathological changes or mortality due to HPAI infection with viruses circulating within the last 2 years in the EU in domestic or wild birds.

Eligibility criteria Host species all domestic birds or wild birds present in the EU; the virus subtype should be reported; for experimental studies only, the age of the infected animals should be reported (at least as juvenile/adult).

Results The search retrieved 104 papers. The articles were subsequently screened against the relevance and eligibility criteria. Two of the screened papers was finally taken into consideration in the description of the phenotypic characterisation of HPAI viruses circulating in the EU in domestic and wild birds in the reporting period.

The search protocol and the results can be consulted at <https://doi.org/10.5281/zenodo.5795072>.

B.1.2. Overview of avian influenza outbreaks in other countries not reporting via ADNS (ToR 4)

Data from OIE WAHIS (OIE, online-a) on HPAI A(H5N1), HPAI A(H5N2), HPAI A(H5N5), A(H5N6), A(H5N8), HPAI and LPAI A(H7N9) in domestic, captive and wild birds, and environmental samples, were used to describe and to map the geographical distribution of avian influenza cases in domestic and wild birds in Africa, Asia and Europe based of the observation dates. Data were extracted on 24 September 2021. To avoid over-complication of the maps, captive birds and environmental samples have been mapped as domestic birds. Although some of these kept animals may be wild species, in most cases of captive birds, or, for environmental samples, the birds from which samples have been taken (mainly at live markets) will not move around and not spread the infection by migrating and, for this reason, have been considered as domestic birds in the maps provided in this report. Only when there was a strong discrepancy between the locality, the administrative regions and geocoordinates, the outbreaks were not taken into account in the analysis.

B.1.2.1. Literature review on phenotypic and genetic characterisation of HPAI viruses circulating on other continents

Information on phenotypic and genotypic characterisation of HPAI viruses circulating on other continents and in other regions (Africa, Asia, the Middle East) in domestic or wild birds or mammals (excluding humans) were extracted from the scientific literature by performing a literature review.

Review questions Update on the phenotypic and genetic characterisation of HPAI viruses circulating on other continents and in other regions (Africa, Asia, the Middle East) in domestic or wild birds or mammals (excluding humans) within the last 3 years.

Search The PubMed database was searched by using subject index terms and free-text terms combined with the appropriate Boolean operators. Scientific articles added to the database from 15 August to 23 November 2021 were searched; the search was run on 23 November 2021.

Relevance criteria Scientific articles added to the database from 15 August to 23 November 2021 that report information on the presence or absence of clinical signs, pathological changes or mortality or genotypic characterisation (only new information) due to HPAI infection with viruses circulating within the last 3 years in Asia, Africa or the Middle East in domestic or wild birds or mammals other than humans.

Eligibility criteria Host species all domestic birds or wild birds present in the EU or mammals other than humans; the virus subtype should be reported; for experimental studies only the age of the infected animals should be reported (at least as juvenile/adult).

Results The search retrieved 117 papers. The articles were subsequently screened against the relevance and eligibility criteria. Seven papers were in the end taken into consideration in the description of phenotypic and genotypic characterisation of HPAI viruses circulating on other continents and in other regions (Africa, Asia, the Middle East) in domestic or wild birds or mammals (excluding humans) in the reporting period.

The search protocol and the results can be consulted at <https://doi.org/10.5281/zenodo.5795072>.

B.2. Data on humans

The numbers of human cases caused by infection with avian influenza viruses were collected by ECDC. Multiple sources are scanned regularly as part of Epidemic Intelligence activities at ECDC to collect information on laboratory-confirmed human cases. Data were extracted and line lists developed to collect case-based information on virus type, date of disease onset, country of reporting, country of exposure, sex, age, exposure, clinical information (hospitalisation, severity) and outcome. All cases included in the line list and mentioned in the document have been laboratory-confirmed. Data are continuously checked for double entries and validity. The data on human cases cover the full period of time since the first human case was reported. Therefore, data on human cases refer to different time periods and are included irrespective of whether there have been any new human cases during the reporting period.

Annex A – Characteristics of the HPAI A(H5N8) and A(H5N1)-positive poultry establishments.

Table A.1: Characteristics of the HPAI A(H5N8) and A(H5N1)-positive poultry establishments by affected EU Member State from 16 September to 1 December 2021 (219). Unknown information is left as empty.

Country	Suspicion date	Holding production category	Poultry species	Production type	Number of susceptible poultry	Presence of mortality or clinical signs*	Number of exposed persons
Bulgaria	14/11/2021	Commercial	Chicken	Egg	33,120	Y	5
Croatia	18/11/2021	Non commercial	Other	Mixed	94	Y	
Czechia	27/09/2021	Non commercial	Other	Mixed	33	Y	3
Czechia	12/11/2021	Non commercial	Chicken	Mixed	39	Y	6
Czechia	18/11/2021	Commercial	Other	Mixed	1,225	Y	44
Czechia	20/11/2021	Commercial	Domestic goose	Breeding	1,665	N	67
Czechia	25/11/2021	Non commercial	Other	Mixed	132	Y	4
Czechia	29/11/2021	Non commercial	Other	Mixed	124	Y	3
Denmark	30/10/2021	Commercial	Turkey	Fattening	27,600	Y	
Estonia	21/10/2021	Non commercial	Chicken	Mixed	4	Y	5
France	21/11/2021	Commercial	Chicken	Egg	160,000	Y	
Germany	22/10/2021	Commercial	Domestic goose	Fattening	663	N	
Germany	30/10/2021	Commercial	Other	Mixed	224		
Germany	30/10/2021	Non commercial	Other	Mixed	16		
Germany	02/11/2021	Commercial	Other	Mixed	83	N	
Germany	05/11/2021	Commercial	Other	Mixed	3,275	N	
Germany	06/11/2021	Non commercial	Other	Mixed	48		
Germany	09/11/2021	Commercial	Domestic duck	Fattening	37,693	N	
Germany	09/11/2021	Non commercial	Other	Mixed	114		
Germany	10/11/2021	Commercial	Turkey	Fattening	9,345	N	
Germany	11/11/2021	Commercial	Turkey	Breeding	9,839	N	
Germany	12/11/2021	Commercial	Chicken	Egg	14,997	N	
Germany	12/11/2021	Commercial	Turkey	Fattening	10,100		
Germany	14/11/2021	Commercial	Turkey	Fattening	11,883		
Germany	15/11/2021	Commercial	Turkey	Fattening	7,480		
Germany	16/11/2021	Commercial	Other	Mixed	2,307		
Germany	17/11/2021	Commercial	Chicken	Egg	54,890		
Germany	17/11/2021	Commercial	Turkey	Mixed	7,858		
Germany	20/11/2021	Commercial	Turkey	Fattening	8,650		
Germany	23/11/2021	Commercial	Other	Mixed	13,125		
Germany	28/11/2021	Commercial	Domestic goose	Breeding	1278		
Hungary	15/11/2021	Commercial	Domestic duck	Breeding	38,373	Y	
Hungary	15/11/2021	Commercial	Domestic goose	Foie gras	620	Y	
Hungary	15/11/2021	Commercial	Domestic duck	Fattening	63,955	Y	
Hungary	16/11/2021	Commercial	Domestic duck	Fattening	29,452	Y	
Hungary	16/11/2021	Commercial	Domestic duck	Fattening	82,090	Y	
Hungary	16/11/2021	Commercial	Domestic duck	Fattening	16,855	Y	
Hungary	16/11/2021	Commercial	Domestic duck	Fattening	118,100	Y	
Hungary	17/11/2021	Commercial	Domestic goose	Breeding	4,595	Y	
Hungary	17/11/2021	Commercial	Domestic goose	Breeding	6,926	Y	
Hungary	17/11/2021	Commercial	Domestic duck	Fattening	16,550	Y	
Hungary	18/11/2021	Commercial	Domestic duck	Fattening	38,311	Y	
Hungary	18/11/2021	Commercial	Domestic duck	Fattening	42,721	Y	
Hungary	18/11/2021	Commercial	Domestic duck	Fattening	57,378	Y	
Hungary	19/11/2021	Non commercial	Other	Mixed	160	Y	
Hungary	19/11/2021	Commercial	Domestic duck	Fattening	71,885	Y	
Hungary	19/11/2021	Commercial	Turkey	Fattening	13,400	Y	
Hungary	19/11/2021	Commercial	Turkey	Fattening	15,331	Y	
Hungary	19/11/2021	Commercial	Domestic goose	Breeding	8,500	Y	
Hungary	20/11/2021	Commercial	Domestic duck	Fattening	17,500	N	
Hungary	21/11/2021	Commercial	Domestic goose	Breeding	1,419	N	
Hungary	21/11/2021	Commercial	Turkey	Fattening	29,880	N	
Hungary	21/11/2021	Commercial	Turkey	Fattening	19,978	N	
Hungary	22/11/2021	Commercial	Chicken	Breeding	19,448	Y	
Hungary	22/11/2021	Commercial	Domestic duck	Fattening	14,500	Y	
Hungary	23/11/2021	Commercial	Domestic duck	Fattening	11,450	Y	

Hungary	24/11/2021	Non commercial	Other	Mixed	49	Y	
Hungary	26/11/2021	Commercial	Domestic duck	Fattening	24,600	N	
Hungary	27/11/2021	Commercial	Domestic duck	Breeding	7,150	Y	
Hungary	27/11/2021	Commercial	Domestic duck	Breeding	7,275	Y	
Hungary	29/11/2021	Commercial	Turkey	Breeding	4,950	Y	
Ireland	19/11/2021	Commercial	Turkey	Fattening	36,500	Y	12
Ireland	22/11/2021	Commercial	Chicken	Breeding	14,800	Y	14
Italy	18/10/2021	Commercial	Turkey	Fattening	13,107	Y	
Italy	22/10/2021	Commercial	Turkey	Fattening	11,007	Y	
Italy	22/10/2021	Commercial	Turkey	Fattening	30,244	Y	
Italy	25/10/2021	Commercial	Turkey	Fattening	28,368	Y	
Italy	28/10/2021	Non commercial	Chicken	Egg	119	Y	
Italy	29/10/2021	Commercial	Turkey	Fattening	36,281	Y	
Italy	30/10/2021	Commercial	Turkey	Fattening	17,122	Y	
Italy	02/11/2021	Commercial	Chicken	Fattening	82,238	Y	
Italy	02/11/2021	Commercial	Turkey	Fattening	27,086	Y	
Italy	02/11/2021	Commercial	Turkey	Fattening	53,066	Y	
Italy	02/11/2021	Commercial	Turkey	Fattening	15,159	Y	
Italy	04/11/2021	Commercial	Chicken	Egg	194,847	Y	
Italy	06/11/2021	Commercial	Chicken	Fattening	54,023	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	41,548	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	43,890	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	19,360	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	14,003	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	17,472	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	10,150	Y	
Italy	07/11/2021	Commercial	Chicken	Fattening	75,548	Y	
Italy	08/11/2021	Commercial	Chicken	Fattening	99,783	Y	
Italy	08/11/2021		Other	Fattening	7,668	Y	
Italy	08/11/2021	Commercial	Turkey	Fattening	7,120	Y	
Italy	08/11/2021	Non commercial	Chicken	Other	21	Y	
Italy	09/11/2021	Commercial	Turkey	Fattening	14,694	Y	
Italy	09/11/2021		Other	Other	203,893	Y	
Italy	09/11/2021	Commercial	Turkey	Fattening	16,635	Y	
Italy	10/11/2021	Commercial	Turkey	Fattening	11,914	Y	
Italy	11/11/2021	Commercial	Chicken	Egg	47,300	Y	
Italy	11/11/2021	Commercial	Chicken	Fattening	125,909	Y	
Italy	18/10/2021	Commercial	Turkey	Fattening	13,107	Y	
Italy	22/10/2021	Commercial	Turkey	Fattening	11,007	Y	
Italy	22/10/2021	Commercial	Turkey	Fattening	30,244	Y	
Italy	25/10/2021	Commercial	Turkey	Fattening	28,368	Y	
Italy	28/10/2021	Non commercial	Chicken	Egg	119	Y	
Italy	29/10/2021	Commercial	Turkey	Fattening	36,281	Y	
Italy	30/10/2021	Commercial	Turkey	Fattening	17,122	Y	
Italy	02/11/2021	Commercial	Chicken	Fattening	82,238	Y	
Italy	02/11/2021	Commercial	Turkey	Fattening	27,086	Y	
Italy	02/11/2021	Commercial	Turkey	Fattening	53,066	Y	
Italy	02/11/2021	Commercial	Turkey	Fattening	15,159	Y	
Italy	04/11/2021	Commercial	Chicken	Egg	194,847	Y	
Italy	06/11/2021	Commercial	Chicken	Fattening	54,023	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	41,548	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	43,890	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	19,360	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	14,003	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	17,472	Y	
Italy	06/11/2021	Commercial	Turkey	Fattening	10,150	Y	
Italy	07/11/2021	Commercial	Chicken	Fattening	75,548	Y	
Italy	08/11/2021	Commercial	Chicken	Fattening	99,783	Y	
Italy	08/11/2021		Other	Fattening	7,668	Y	
Italy	08/11/2021	Commercial	Turkey	Fattening	7,120	Y	
Italy	08/11/2021	Non commercial	Chicken	Other	21	Y	
Italy	09/11/2021	Commercial	Turkey	Fattening	14,694	Y	
Italy	09/11/2021		Other	Other	203,893	Y	
Italy	09/11/2021	Commercial	Turkey	Fattening	16,635	Y	
Italy	10/11/2021	Commercial	Turkey	Fattening	11,914	Y	
Italy	11/11/2021	Commercial	Chicken	Egg	47,300	Y	
Italy	11/11/2021	Commercial	Chicken	Fattening	125,909	Y	
Italy	11/11/2021	Commercial	Chicken	Fattening	40,798	Y	

Italy	11/11/2021	Commercial	Turkey	Fattening	7,309	Y	
Italy	11/11/2021	Commercial	Turkey	Fattening	10,508	Y	
Italy	11/11/2021		Other	Other	490,678	Y	
Italy	12/11/2021		Turkey	Fattening	20,876		
Italy	12/11/2021		Turkey	Fattening	17,000		
Italy	12/11/2021	Commercial	Turkey	Fattening	13,525	Y	
Italy	12/11/2021	Commercial	Turkey	Fattening	19,889	Y	
Italy	12/11/2021	Commercial	Turkey	Fattening	11,923	Y	
Italy	13/11/2021	Commercial	Turkey	Fattening	23,478		
Italy	13/11/2021	Commercial	Turkey	Fattening	32,767	Y	
Italy	14/11/2021	Commercial	Turkey	Fattening	52,732	Y	
Italy	14/11/2021	Commercial	Turkey	Fattening	16,224	Y	
Italy	14/11/2021	Commercial	Turkey	Fattening	15,109	Y	
Italy	14/11/2021	Commercial	Turkey	Fattening	6,611	Y	
Italy	14/11/2021	Commercial	Turkey	Fattening	10,087	Y	
Italy	14/11/2021	Commercial	Turkey	Fattening	5,283	Y	
Italy	14/11/2021	Commercial	Turkey	Fattening	66,514	Y	
Italy	14/11/2021	Commercial	Turkey	Fattening	37,904	Y	
Italy	14/11/2021	Commercial	Turkey	Fattening	22,859	Y	
Italy	14/11/2021	Commercial	Turkey	Fattening	17,600	Y	
Italy	15/11/2021	Commercial	Chicken	Egg	575,630	Y	
Italy	15/11/2021	Commercial	Chicken	Fattening	107,575	Y	
Italy	15/11/2021	Commercial	Turkey	Fattening	20,307	Y	
Italy	15/11/2021	Commercial	Turkey	Fattening	13,947	Y	
Italy	15/11/2021	Commercial	Turkey	Fattening	9,083	Y	
Italy	15/11/2021	Commercial	Turkey	Fattening	6,700	Y	
Italy	15/11/2021	Commercial	Turkey	Fattening	21,659	Y	
Italy	15/11/2021	Commercial	Turkey	Fattening	14,125	Y	
Italy	16/11/2021	Commercial	Chicken	Fattening	34,172	Y	
Italy	16/11/2021	Commercial	Turkey	Fattening	7,342	Y	
Italy	16/11/2021	Commercial	Turkey	Fattening	22,827	Y	
Italy	16/11/2021	Commercial	Turkey	Fattening	20,274	Y	
Italy	16/11/2021	Commercial	Turkey	Fattening	17,062	Y	
Italy	17/11/2021	Commercial	Chicken	Egg	39,429	Y	
Italy	17/11/2021	Commercial	Turkey	Fattening	3,666	Y	
Italy	17/11/2021	Commercial	Turkey	Fattening	12,934	Y	
Italy	18/11/2021	Commercial	Chicken	Fattening	62,906	Y	
Italy	18/11/2021	Commercial	Turkey	Fattening	10,754	Y	
Italy	18/11/2021	Commercial	Turkey	Fattening	39,081	Y	
Italy	18/11/2021	Commercial	Turkey	Fattening	7,144	Y	
Italy	18/11/2021	Commercial	Turkey	Fattening	33,030	Y	
Italy	19/11/2021	Commercial	Chicken	Fattening	34,974		
Italy	19/11/2021	Commercial	Chicken	Fattening	79,320		
Italy	19/11/2021	Commercial	Domestic duck	Other	58,100	Y	
Italy	20/11/2021	Commercial	Chicken	Fattening	47,083	Y	
Italy	20/11/2021	Commercial	Turkey	Fattening	29,872	Y	
Italy	20/11/2021	Commercial	Turkey	Fattening	20,782	Y	
Italy	22/11/2021	Commercial	Chicken	Fattening	33,021		
Italy	22/11/2021	Commercial	Chicken	Egg	230,000		
Italy	22/11/2021	Commercial	Chicken	Egg	20,455	Y	
Italy	22/11/2021	Commercial	Chicken	Fattening	31,321	Y	
Italy	22/11/2021	Commercial	Turkey	Fattening	4,150	Y	
Italy	23/11/2021	Commercial	Chicken	Fattening	14,230	Y	
Italy	23/11/2021	Commercial	Chicken	Fattening	16,649	Y	
Italy	23/11/2021	Commercial	Other	Other	58,445	Y	
Italy	23/11/2021	Commercial	Turkey	Fattening	26,499	Y	
Italy	23/11/2021	Commercial	Chicken	Egg	148,861	Y	
Italy	23/11/2021	Commercial	Chicken	Fattening	7,992	Y	
Italy	23/11/2021	Commercial	Turkey	Fattening	19,356	Y	
Italy	23/11/2021	Commercial	Turkey	Fattening	18,629	Y	
Italy	23/11/2021	Commercial	Turkey	Fattening	12,884	Y	
Italy	23/11/2021	Commercial	Chicken	Fattening	24,255	Y	
Italy	23/11/2021	Commercial	Other	Other	17,464	Y	
Italy	23/11/2021	Commercial	Other	Other	18,320	Y	
Italy	23/11/2021	Commercial	Turkey	Fattening	9,354	Y	
Italy	24/11/2021	Commercial	Turkey	Fattening	26,972		
Italy	24/11/2021	Commercial	Turkey	Fattening	11,964	Y	
Italy	24/11/2021	Commercial	Other	Breeding	40,951	Y	

Italy	25/11/2021	Commercial	Chicken	Fattening	55,000	Y	
Italy	25/11/2021	Commercial	Chicken	Fattening	48,575	Y	
Italy	25/11/2021	Commercial	Other	Other	237,842	Y	
Italy	26/11/2021	Commercial	Chicken	Egg	106,365		
Italy	26/11/2021	Commercial	Chicken	Fattening	38,005	Y	
Italy	26/11/2021	Commercial	Chicken	Fattening	30,900	Y	
Italy	26/11/2021	Commercial	Chicken	Egg	168,750	Y	
Italy	27/11/2021	Commercial	Chicken	Fattening	40,500	Y	
Italy	27/11/2021	Commercial	Chicken	Fattening	28,800	Y	
Italy	28/11/2021	Commercial	Chicken	Fattening	32,631	Y	
Italy	28/11/2021	Commercial	Chicken	Fattening	72,206	Y	
Italy	28/11/2021	Commercial	Chicken	Fattening	25,136	Y	
Italy	29/11/2021	Commercial	Chicken	Fattening	35,640	Y	
Italy	29/11/2021	Commercial	Turkey	Fattening	7,483	Y	
Italy	29/11/2021	Commercial	Turkey	Fattening	4,533	Y	
Italy	29/11/2021	Commercial	Turkey	Fattening	10,480	Y	
Italy	29/11/2021	Commercial	Turkey	Fattening	18,480	Y	
Italy	29/11/2021	Commercial	Turkey	Fattening	16,703	Y	
Kosovo	29/09/2021	Commercial	Chicken	Egg	22,349	Y	
Netherlands	25/10/2021	Commercial	Chicken	Breeding	35,301	Y	
Netherlands	29/10/2021	Commercial	Chicken	Egg	105,059	Y	
Netherlands	31/10/2021	Non commercial	Chicken	Other	321	Y	
Netherlands	03/11/2021	Commercial	Domestic duck	Egg	10,455	Y	
Netherlands	05/11/2021	Commercial	Domestic duck	Egg	20,793	Y	
Netherlands	07/11/2021	Commercial	Chicken	Breeding	47,528	Y	
Netherlands	13/11/2021	Commercial	Chicken	Fattening	120,243	Y	
Netherlands	21/11/2021	Commercial	Chicken	Breeding	19,216	Y	
Norway	10/11/2021	Commercial	Chicken	Egg	7,500	Y	
Norway	16/11/2021	Commercial	Chicken	Egg	7,500	Y	
Poland	01/11/2021	Commercial	Turkey	Fattening	80,812	Y	19
Poland	02/11/2021	Commercial	Turkey	Fattening	61,469	N	18
Poland	03/11/2021	Commercial	Chicken	Fattening	287,045	N	7
Poland	03/11/2021	Commercial	Other	Fattening	7,000	Y	7
Poland	03/11/2021	Commercial	Turkey	Fattening	104,162	N	15
Poland	03/11/2021	Commercial	Turkey	Fattening	105,392	N	16
Poland	05/11/2021	Non commercial	Other	Mixed	192	Y	6
Poland	06/11/2021	Commercial	Turkey	Fattening	22,281	Y	3
Poland	07/11/2021	Commercial	Domestic duck	Fattening	31,234	Y	9
Poland	08/11/2021	Commercial	Turkey	Fattening	26,091	Y	4
Poland	11/11/2021	Commercial	Chicken	Fattening	25,061	Y	2
Poland	12/11/2021	Commercial	Domestic duck	Breeding	2,267	Y	10
Poland	12/11/2021	Commercial	Domestic duck	Breeding	5,051	Y	7
Poland	12/11/2021	Commercial	Domestic duck	Fattening	11,766	Y	15
Poland	12/11/2021	Commercial	Domestic duck	Fattening	9,858	Y	15
Poland	15/11/2021	Commercial	Chicken	Fattening	77,299	N	15
Poland	16/11/2021	Commercial	Domestic duck	Fattening	16,214	N	15
Poland	16/11/2021	Commercial	Domestic duck	Fattening	16,320	Y	13
Poland	16/11/2021	Commercial	Turkey	Fattening			5
Poland	16/11/2021	Commercial	Domestic duck	Fattening	8,288	Y	15
Poland	17/11/2021	Commercial	Domestic duck	Fattening	12,040	Y	9
Poland	17/11/2021	Commercial	Domestic duck	Fattening	4,203	Y	15
Poland	18/11/2021	Commercial	Domestic duck	Fattening	2,911	N	15
Poland	20/11/2021	Commercial	Domestic duck	Fattening	6,311	Y	9
Poland	23/11/2021	Commercial	Domestic duck	Fattening	5,535	Y	15
Poland	26/11/2021	Commercial	Domestic duck	Fattening	58,077	Y	20
Poland	27/11/2021	Commercial	Turkey	Fattening	24,108	Y	32
Slovakia	15/11/2021	Non commercial	Chicken	Mixed	14	Y	

Comm: commercial holding; Non comm: non-commercial establishment.

*If more than one species, field is completed with YES if at least one of the species presents clinical signs and/or increased mortality.

When information related to the presence of clinical signs and/or increased mortality is available only for one species and it is "NO", field is completed with NO.

Source: ADIS and Member States.

Annex B – Applied prevention and control measures on avian influenza

Scope

This document provides a brief overview of specific prevention and control measures applied in Albania, Bulgaria, Czechia, Denmark, France, Hungary, Kosovo², the Netherlands, Norway, Poland, and Slovakia from 16 September to 1 December 2021 in relation to avian influenza outbreaks in poultry and in wild birds. Information is only if it is relevant to the implementation of measures such as increasing awareness of stakeholders and the general public, housing orders, strengthening biosecurity measures (other than poultry confinement), preventive culling, regional stand-stills, derogations on restriction zone implementation after risk assessment, hunting or any other relevant measures that have been applied. This document is made to support the EFSA working group in generating an overview on the application of the selected measures at EU level.

Timing of the applied prevention and control measures

Tables B.1–B.13 of Annex B provide timelines for the prevention and control measures taken by the following countries: Albania, Bulgaria, Czechia, Denmark, France, Hungary, Kosovo², the Netherlands, Norway, Poland, and Slovakia. More information on the actions taken is provided in the sections below the tables.

B.1 Bulgaria

Aleksandra Miteva

Animal Health and Welfare Directorate – Bulgarian Food Safety Agency

Timing of the applied prevention and control measures

Table B.1 provides a timeline on the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.1: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience
15/11/2021	Confirmation of one primary outbreak of HPAI in poultry	Delegated Regulation (EU) 2020/687. Enhanced official inspections for biosecurity Enhanced passive surveillance in wild birds Ban for outdoor keeping poultry Ban for poultry market Ban for releasing game wild birds	Official vets, poultry farmers

Increasing awareness of the stakeholders and the general public

- Meetings with representatives of the poultry associations aimed at keeping them up to date with the epidemiological situation, present and further control measures to be enforced.

Housing order

- Precautionary measures such as keeping poultry indoors, trying to separate them from wild birds and ensuring feed and water is not accessible to wild birds were also required.

Strengthening biosecurity measures (other than housing orders)

Not applied.

Preventive culling

Not applied.

Regional standstill (beyond the restriction zones specified in the EU regulation)

Not applied.

Derogations on restriction zone implementation after risk assessment

Derogation in line with the Delegated Regulation (EU 2020/687).

Hunting

No restrictions have been implemented.

B.2 Croatia

Tihana Miškić and Gordana Nedeljković

Veterinary and Food Safety Directorate, Ministry of Agriculture, Zagreb, Croatia

Timing of the applied prevention and control measures

Table B.2 provides a timeline on the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.2: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience
18/11/2021	Suspicion on HPAI (increased mortality), owner delivered a carcass of one goose to authorised veterinary organisation (AVO)	AVO sent the carcass to the national reference laboratory (NRL) for testing	
24/11/2021	Confirmation of AI subtype H5N1	NRL confirmed AI subtype H5N1	
24/11/2021	Official veterinary visit and preventive culling of animals of listed species	Culling of all susceptible animals on the affected holding, cleaning and disinfection, and disposal of carcasses under supervision of veterinary inspection	
24/11/2021	Sampling and testing	Samples taken after culling (5 carcasses) and sent to NRL for testing	
26/11/2020	Confirmation of HPAI	NRL confirmed HPAI subtype H5N1	
26/11/2020	Restriction zone = protection and surveillance zone	Veterinary authority established restriction zone in radius of 10 km, including protection and surveillance zone	
29/11/2020	Confirmation of HPAI in samples originating from preventive culling	NRL confirmed HPAI subtype H5N1 in one of five carcasses from affected establishment	
30/11/2021	Instruction on inventory and official visits in restriction zone	Competent veterinary authority issued an Instruction to AVO in restriction zone	
Started 01/12/2021 Still ongoing	Epidemiological investigation in protection zone: 1) inventory, 2) official veterinary visit to representative holdings	Listing of all holdings keeping poultry and captive birds and official veterinary visit to holdings keeping over 50 birds in the protection zone, and over 250 birds, or commercial flocks for eggs, meat or breeding	
Ongoing	Epidemiological investigation in protection and surveillance zones:	Listing of all holdings keeping poultry and captive birds and official veterinary visit to holdings keeping over 50 birds in the	

	1) inventory, 2) official veterinary visit to representative holdings	protection zone, and over 250 birds, or commercial flocks for eggs, meat or breeding	
Ongoing	Measures in accordance with the order on measures for preventing occurrence and spread of avian influenza in the Republic of Croatia	Measures in place are in alignment with rules laid down in Regulation (EU) 2016/429, and Commission Delegated Regulation (EU) 2020/687	

Increasing awareness of the stakeholders and the general public

Brief description of the communication/activities during 2021:

- Continuously publishing summary of epidemiological situation related to AI in EU and surrounding countries to raise awareness regarding increased risk of avian influenza, recommendations to the poultry producers and bird keepers and other relevant information on official website of Ministry of Agriculture and Veterinary and Food Safety Directorate (<http://www.veterinarstvo.hr/>).
- Preparing information for general public via media (TV and newspapers, portals).
- Continuously informing of authorised veterinarians about signs of disease, reporting of suspicion and confirmation of the disease, epidemiological situation in neighbouring countries, transmission of knowledge about AI to the animal owners via e-mails.
- Written communication with Croatian hunting association to increase awareness among hunters.

Housing order

Order on measures for preventing occurrence and control of spread of avian influenza in the Republic of Croatia (Official Gazette, No 127/20) applied from 18 November 2020, prescribes obligatory confinement of poultry and game birds in fenced areas in such a way that any contact with wild birds is prevented.

Decision on establishment of restriction zones in Sisak-Moslavina County, issued by the Veterinary and Food Safety Directorate on 26 November 2021. It has set standstill and defined borders of restriction zones, including a protection zone and surveillance zone, in perimeters of 10 km around affected establishment.

Order was repealed with issuing of order on measures for preventing occurrence and spread of avian influenza in the Republic of Croatia (Official Gazette, No 132/21), which were applied from 5 December 2021 and prescribes the following:

- 1) Obligatory keeping of all the poultry and captive birds in closed confinements on whole territory of Croatia.
- 2) Preventive measures for early detection and control of spread in case of an outbreak of HPAI in Croatia, including confinement of poultry, captive birds, and game birds, and strengthening biosecurity measures (see below).
- 3) Measures in restricted zones, including ban of movement of live animals and products of animal origin of listed species, with derogations, and inventory and veterinary visits to establishments keeping poultry and captive birds.

Strengthening biosecurity measures (other than housing orders)

Annual order on measures to protect animal health from infectious and parasitic diseases and their financing (Official Gazette, Nos 2/21, 4/21, 7/21 and 19/21) prescribes obligatory biosecurity measures for poultry producers keeping 1,000 birds and more.

Order on measures for preventing the occurrence and spread of avian influenza in the Republic of Croatia (Official Gazette, No 132/21) applies from 5 December, prescribes the following biosecurity measures:

- Obligatory keeping of feeders and drinkers for poultry, game birds and birds in captivity in closed or covered areas, which prevents the landing and the contact of wild birds with feed and water.
- The water supply of poultry, game birds and captive birds with water from outdoor water tanks, or surface water tanks to which wild birds have access to is prohibited.
- Mandatory implementation and maintenance of sanitary conditions and biosecurity measures in all facilities for breeding and rearing poultry, game birds and captive birds:
 - use of personal protective equipment (PPE); disinfection of hands and footwear upon entering the facility; cleaning, washing and disinfection of footwear upon leaving the facility;
 - it is forbidden to leave the building in the same protective clothing and footwear;
 - ban of entry into the facility of unauthorised personnel;
 - disinfection of facilities and equipment in accordance with technological requirements, using approved disinfectant in the prescribed concentration;
 - storage of animal feed and litter in facilities protected from access of wild birds and rodents.
- Mandatory implementation of sanitary and biosecurity measures during movement of poultry, farmed and wild game, or captive birds, their hatching eggs, their products and by-products, including carcasses.
- Mandatory reporting of all the changes in the health status, drop of productivity and/or feed and water intake, or changes in behaviour of poultry, farmed and wild game or captive birds to the competent authorised veterinary organisation.
- Mandatory reporting of death or any contact of poultry, game birds and captive birds with potentially infected birds to authorised veterinary organisations.
- Hunting officers are responsible for implementation of biosecurity measures in the area under their jurisdiction.

Preventive culling

Preventive culling was applied only on affected holding with confirmed case of HPAI subtype H5N1. On other epidemiologically linked or contact holdings, only veterinary visit without preventive culling was applied.

Regional standstill (beyond the restriction zones specified in the EU regulation)

Establishment of restricted zones, including the protection zone (a bit more than a 3 km radius) and surveillance zone (up to a 10 km radius of the affected establishment) on 26 November 2021. Zoning details will be published in the Annex to Implementing Decision (EU) 2021/641 on emergency measures in relation to outbreaks of highly pathogenic avian influenza in certain Member States (EU). Zoning and restrictive measures will remain in place for the protection zone until 17 December 2021 and for the surveillance zone until 26 December 2021.

Regional stand still (beyond the restriction zones specified in the EU regulation) is not implemented.

Derogations on restriction zone implementation after risk assessment

Not applied.

Hunting

Hunting is allowed, only recommendations are given to improve biosecurity before, during and after the hunt involving game birds. Individuals engaged in hunting must avoid contact with domestic poultry

and must comply with all the prescribed biosecurity measures, as follows: cleaning and disinfecting shoes, clothes, surfaces, and equipment after the hunt on game birds, and personal protection measures applied during handling with hunted game birds (including evisceration). Hunters are obliged to report all changes in the health status and behaviour of poultry, game birds and captive birds, and recovery of a dead game **birds' carcasses**. It is forbidden to feed dogs, cats and poultry with remains of game birds.

B.3 Czechia

Lucie Kalášková

State Veterinary Administration

Timing of the applied prevention and control measures

Table B.3 provides a timeline on the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.3: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience (if applicable)
Still continuing	New occurrence of HPAI in other birds (non-poultry including wild birds) and in poultry in the EU	Regular updating of the State Veterinary Administration website on the HPAI situation in the EU: https://www.svscr.cz/zdravi-zvirat/ptaci-chripka-influenza-drubeze/vysocepatogenni-aviarni-influenza/	General public, all breeders
27/09/2021	Confirmation of HPAI outbreak of H5N1 in poultry in Czechia	Press releases related to the occurrence of HPAI in Czechia – a new subtype of H5N1 Regular updating of the State Veterinary Administration website on AI situation in Czechia: https://www.svscr.cz/zdravi-zvirat/ptaci-chripka-influenza-drubeze/ptaci-chripka-v-cr/	General public, all breeders
08/11/2021	High number of new outbreaks of HPAI in wild birds and in poultry in the EU	Official letter – increased risk for poultry farms, strengthening biosecurity	Poultry associations, breeders of captive birds, private veterinarians and Regional Veterinary Administrations
23/11/2021	High number of new outbreaks of HPAI in wild birds and in poultry in the EU	Veterinary measures for the whole territory of Czechia to control the spread of HPAI – for all poultry holdings (backyards, commercial holdings), all species of birds to be kept inside (with certain exemptions for animal welfare reasons)	General public, all breeders
29/11/2021	High number of new outbreaks of HPAI in wild birds and in poultry in the EU and high risk for Czechia	New informative leaflet to raise awareness of avian influenza and biosecurity, especially in the backyards: https://www.svscr.cz/wp-content/files/zvirata/Letak-AI-Pozor-na-ptaci-chripku.pdf	

Increasing awareness of the stakeholders and the general public

Information on the HPAI situation in Czechia and EU in 2021 is regularly updated on the website of the State Veterinary Administration (please see above).

Housing order

On 23 **November 2021** the **State Veterinary Administration of Czechia** issued a 'housing order' so that poultry in general has to be kept indoor (commercial holdings and also backyards) due to the increasing risk of HPAI.

The compulsory housing order requires all poultry to be housed indoors to protect the poultry from contact with wild birds. The housing order applies to the whole country and to all categories of poultry with certain exemptions for animal welfare reasons.

Current version: https://eagri.cz/public/web/file/690193/MZE_66362_2021_18140.pdf

Strengthening biosecurity measures (other than housing order)

On 8 November 2021 the State Veterinary Administration sent an official letter to poultry associations to strengthen biosecurity in their farms due to the HPAI occurrence in the neighbouring countries (please see above).

Preventive culling

Not applied.

Regional standstill (beyond the restriction zones specified in the EU regulation)

Not applied.

Derogations on restriction zone implementation after risk assessment

Not applied.

Hunting

The release of poultry (pheasant, mallard) for restocking and also other captive birds is forbidden in restricted zones (emergency veterinary measures) established around outbreaks.

B.4 Denmark

Lise Uldall Bak Simonsen, Francisco Fernando Calvo Artavia, Pernille Dahl Nielsen

Danish Veterinary and Food Administration

Timing of the applied prevention and control measures

Table B.4 provides a timeline on the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.4: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience (if applicable)
22/10/2021	HPAI H5N1 was detected in wild birds in Denmark. The detections were done in samples from Eurasian wigeons and from a common teal originating	The Danish Veterinary and Food Administration issued a press release urging the public to report findings of dead wild birds and poultry owners to increase their	Poultry holdings, backyard holdings, poultry associations and general public

	from the Wattenmeer in the southwestern part of Denmark. This was the first detection of highly pathogenic influenza A virus in wild birds in Denmark since May 2021	focus on biosecurity and protection against wild birds. 25/10/2021 First meeting in the national AI expert group (weekly meetings afterwards)	
28/10/2020	Rapid risk assessment performed. Risk level for introduction of HPAI by wild birds: High	01/11/2021 Requirements of compulsory housing of poultry in Denmark in the whole country. Fairs, markets, shows or other gatherings of poultry or other captive birds were prohibited in the whole country	Poultry holdings, backyard holdings, poultry associations and general public
01/11/2021	An outbreak of highly pathogenic avian influenza H5N1 was confirmed in a turkey holding with approximately 28,000 turkeys	The DVFA established zones of 3 and 10 km around the holding and was implementing the necessary measures to prevent spread of infection from the affected holding	Poultry holdings, backyard holdings, poultry associations and general public
03/11/2021	An outbreak of highly pathogenic avian influenza H5N1 was confirmed in a holding with captive birds: 50 hens, ducks and geese	The DVFA established zones of 3 and 10 km around the holding and implemented the necessary measures to prevent spread of infection from the affected holding	Poultry holdings, backyard holdings, poultry associations and general public
24/11/2021	An outbreak of highly pathogenic avian influenza H5N1 was confirmed in a holding with captive birds: 2 hens	The DVFA established zones of 3 and 10 km around the holding and implemented the necessary measures to prevent spread of infection from the affected holding	Poultry holdings, backyard holdings, poultry associations and general public

Increasing awareness of the stakeholders and the general public

The DVFA has continuously informed the stakeholders of the situation of HPAI. The stakeholders have been informed through several information platforms.

Information has been published on the website www.fvst.dk and www.ai.fvst.dk, where it is possible to get an overview of all findings in relation to HPAI.

Moreover, the stakeholders has been contacted with information of the outbreaks through mail.

The general public as well as the stakeholders has also been informed through press releases and social media. The staff of the DVFA call centre are prepared for answering questions from the public (via FAQs).

Representatives from the poultry industry participate in meetings in the AI expert group, giving the opportunity to exchange useful information and reach the stakeholders quickly.

DVFA uses the app for smartphones called 'FugleinfluenzaTip' ('Bird flu Tip') to make it easier for the public to notify the DVFA in case of findings of dead wild birds. This app allows the public to send exact data about findings of dead wild birds including the location and a photo. The submitted data are directly transferred to the DVFA wild bird database and allocated for collection by the Veterinary Inspection Units. The avian influenza situation in wild birds can be followed on the [Danish avian influenza database](#).

Housing order

The DVFA has followed a pre-determined strategy for implementation of measures in case of an HPAI epidemic. A rapid risk assessment performed after findings of HPAI in several wild birds near the Wattenmeer resulted in the risk level being raised from low to high. Consequently, a housing order was implemented on 1 November 2021 applicable for the whole country. The DVFA considers Denmark as a risk area due to its small size, the geographical position with many resting migratory birds, the long coast line and wide areas with wetlands and fjords.

The housing order is applicable for all production categories including zoos, professional and non-professional poultry holdings including other captive birds. The definition of housing: poultry/other captive birds have to be kept inside or fenced under roof, net or wire. Ducks, geese and ostriches are exempt from covering if wild birds effectively can be prevented from landing in the enclosure using **other methods**. Enclosures $\leq 40 \text{ m}^2$ are also exempted from covering. Furthermore, zoo birds vaccinated against avian influenza are exempt from the requirements.

The housing order is implemented based on a national legal act. Information to the public is given through the media (press release), the DVFA homepage and Facebook.

Housing order:

<https://www.retsinformation.dk/eli/Ita/2021/1996>

Press release:

<https://www.foedevarestyrelsen.dk/Nyheder/Aktuelt/Sider/Pressemeddelelser%202021/F%C3%B8devarestyrelsen-advarer-H%C3%B8j-risiko-for-fugleinfluenza.aspx>

Strengthening biosecurity measures (other than housing order)

On 1 November 2021, fairs, markets, shows or other gatherings of poultry or other captive birds were prohibited in the whole country.

Preventive culling

Not applied.

Regional standstill (beyond the restriction zones specified in the EU regulation)

Not applied.

Derogations on restriction zone implementation after risk assessment

Not applied.

Hunting

The DVFA is continuously evaluating the need to regulate hunting activities in the zones. During October–November 2021 it has not been prohibited to hunt in the zones, nor has there been any restrictions on hunting.

B.5 Estonia

Kärt Jaarma

Agriculture and Food Board

Timing of the applied prevention and control measures

Table B.5 provides a timeline on the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.5: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience
------	-----------------------------	----------------------	-----------------

30/09/2021	Dead wild bird findings	Internet application for notification of finding of dead wild bird. Accessible via mobile phone, pc or tablet	Hunters and general public to notify about finding of dead wild bird
22/10/2021	Third outbreak in poultry farm	Stamping out of all poultry on the infected holding and cleaning and disinfection of the infected holding. Establishment of a protection and surveillance zone of 3 and 10 km around the holding and implementation of measures in accordance with the Commission Delegated Regulation (EU) 2020/687	Poultry establishments in protection and surveillance zones, general public

Increasing awareness of the stakeholders and the general public

Press releases sent out on several occasions to raise awareness:

30 September 2021 – message about launching internet application for notification of finding of dead wild bird.

12 October 2021 – message about diagnosing HPAI in northern goshawk and Eurasian eagle-owl in Estonia.

22 October 2021 – Information about third outbreak of HPAI in poultry farm.

12 November 2021 – message about awareness and strengthened biosecurity due to HPAI findings in wild birds and outbreaks in poultry in Europe.

19 November 2021 – article to magazine for hunters about awareness and strengthened biosecurity due to HPAI findings in wild birds and outbreaks in poultry in Europe.

25 November 2021 – message about awareness and vigilance due to HPAI finding in red fox.

25 November 2021 – message about ending the restricted zones due to the third outbreak and pointing out awareness and strengthened biosecurity.

Housing order

Orders and prohibitions for poultry keepers in protection and surveillance zones designated around HPAI outbreaks are set out in the Commission Delegated Regulation (EU) 2020/687.

The ban for keeping domestic birds outside throughout the country was lifted on the 1 June 2021, but an amendment to the decree was made. Pursuant to the Decree of the Director General of Agriculture and Food Board, keeping of domestic birds outdoors is prohibited, unless the poultry are protected against contact with wild birds (e.g. with nets, roofs, horizontal fabrics or by other appropriate means) or the poultry are supplied with feed and water indoors or under a shelter that sufficiently discourages the access of wild birds. Information was sent out as a press release and directly to poultry keepers. The Agriculture and Food Board is responsible for official controls of the compliance of the housing order.

Strengthening biosecurity measures (other than housing order)

Further biosecurity advice is given and communicated on the website of the Agriculture and Food Board and directly to poultry keepers.

Preventive culling

Not applied.

Regional stand still (beyond the restriction zones specified in the EU regulation)

Not applied.

Derogations on restriction zone implementation after risk assessment

Not applied.

Hunting

Not applied.

B.6 France

Yves Lambert, Andrea Jimenez Pellicer

General Directorate for Food, Animal Health Office, Ministry of Agriculture and Food

Timing of the applied prevention and control measures

Table B.6 provides a timeline on the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.6: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience
09/09/2021	HPAI H5N8 outbreak confirmed in a farmyard with no epidemiological link with other poultry holdings	According to Regulation 2020/687: Culling, disposal of carcasses, cleaning and disinfection procedures. Establishment of restricted zone. Restrictions on movements of poultry and poultry products (with derogations). Epidemiological investigation. Clinical examinations and collection of samples in protection zone. Official notification to EU and OIE	Departmental decree Public
09/09/2021	HPAI infection dynamics in the main wild bird migratory corridors in Europe	Middle risk level of introduction of HPAI	National decree
14/09/2021	HPAI H5N8 outbreak confirmed in a farmyard with no epidemiological link with other poultry holdings. 200 m from 09/09/2021 outbreak	According to Regulation 2020/687: Culling, disposal of carcasses, cleaning and disinfection procedures. Establishment of restricted zone. Restrictions on movements of poultry and poultry products (with derogations). Epidemiological investigation. Clinical examinations and collection of samples in protection zone. Official notification to EU and OIE	Departmental decree Public
15/09/2021	HPAI H5N8 outbreak conformed in an individual holding various birds for private use. Mortality was observed after the purchase of birds on a market in Belgium from the trader, declared HPAI infected by the Belgian authorities (BE-HPAI (NON-P)-H5N8-2021-00004)	According to Regulation 2020/687: Culling, disposal of carcasses, cleaning and disinfection procedures. Derogation to the establishment of restricted zone according to Regulation 2020/687. Epidemiological investigation. Clinical examinations and collection of samples in protection zone. Official notification to EU and OIE	Departmental decree Public

27/09/2021	H7N7 wild bird case (swan)	Official notification to EU and OIE. The NRL concluded laboratory contamination	Departmental decree Public
04/11/2021	Strong HPAI infection dynamics in the main wild bird migratory corridors in Europe	High-risk level of introduction of HPAI	National decree
16/11/2021	HPAI H5N1 case confirmed in wild birds following significant mortality since 8 November on a lake in the Grand Est region in an area considered at risk of influenza epidemics for wild birds (special risk area)	Establishment of large restricted zone. Restrictions on movements of poultry and poultry products (with derogations). Restriction of hunting and other outdoor activities in the zone. Official notification to EU and OIE	Departmental decree Public
26/11/2021	HPAI H5N1 case in wild birds. Grouped mortality detected in a pond in the Grand Est region, located in a special risk area for the introduction of the avian influenza virus by wildlife	Establishment of large restricted zone. Restrictions on movements of poultry and poultry products (with derogations). Restriction of hunting and other outdoor activities in the zone	Departmental decree Public
26/11/2021	HPAI H5N1 case in wild birds. A sandhill crane found dead on a lake in the Grand Est region, located in an area at particular risk of introduction of the virus to wildlife	Establishment of large restricted zone. Restrictions on movements of poultry and poultry products (with derogations). Restriction of hunting and other outdoor activities in the zone. Official notification to EU and OIE	Departmental decree Public
26/11/2021	HPAI H5N1 outbreak conformed in a laying hen farm (15,000 out of 80,000)	According to Regulation 2020/687: Culling, disposal of carcasses, cleaning and disinfection procedures. Establishment of restricted zone. Restrictions on movements of poultry and poultry products (with derogations). Restriction of hunting in the zone. Epidemiological investigation. Clinical examinations and collection of samples in protection zone. Official notification to EU and OIE	Departmental decree Public
26/11/2021	HPAI H5N1 case confirmed on a lake in the Grand Est region located in a special risk area for the introduction of the avian influenza virus by wildlife	Establishment of large restricted zone. Restrictions on movements of poultry and poultry products (with derogations). Restriction of hunting and other outdoor activities in the zone. Official notification to EU and OIE	Departmental decree Public
01/12/2021	HPAI H5N1 case in wild birds. The municipality is in a wetland area considered to be at particular risk from avian influenza viruses	Establishment of large restricted zone. Restrictions on movements of poultry and poultry products (with derogations). Restriction of hunting and other outdoor activities in the zone. Official notification to EU and OIE	Departmental decree Public
01/12/2021	HPAI outbreak in a private individual holds two pairs of geese (white geese and Toulouse geese) on a pond	According to Regulation 2020/687: Culling, disposal of carcasses, cleaning and disinfection procedures. Establishment of restricted zone. Epidemiological investigation. Clinical examinations and collection of samples in protection zone. Official notification to EU and OIE	Departmental decree Public

Increasing awareness of the stakeholders and the general public

Frequent communication has been made with all stakeholders via periodic status updates, live exchanges and meetings during major changes in strategy. Press releases have been regularly written and a general presentation of the epizootic and its progress has been updated on the website of the Ministry of Agriculture: <https://agriculture.gouv.fr/influenza-aviaire-le-point-sur-la-situation-en-france>

Housing order

Three risk levels are defined according to the probability of introduction of HPAI from the wild compartment. **The 'moderate' level of risk impose reinforced measures of biosecurity in the wetlands and from a given category of palmipeds in the high density areas called 'areas at risk dissemination'***. The reinforced biosecurity measures are generalised **to the whole of the territory at the 'high' level of risk.**

Previous exemptions to confinement provided for by the previous national regulations have been repealed in favour of preventive sheltering measures based on an analysis of risks adapted to the species, types and methods of breeding and to the geographical area where the breeding is established.

***'Areas at risk of dissemination', in which the production methods are subject to an interprofessional agreement to reduce palmiped density have been defined.** In these areas at risk of dissemination, specific biosecurity measures and surveillance measures are applied depending on HPAI risk.

Strengthening biosecurity measures (other than housing order)

Measures other than the housing order applied will be **'moderate' (wetlands and areas at risk of dissemination) and 'high' risk level:**

- ban on the organisation of gatherings and the participation of poultry originating;
- enhanced conditions for the transport, introduction into the natural environment of game birds and the use of decoys;
- ban on racing pigeon competitions departing or arriving from France until 31 March;
- compulsory vaccination in zoos for birds that cannot be confined or protected under netting;
- daily clinical monitoring in all farms (commercial and non-commercial).

In areas with a high risk of distribution, samples are taken before movement and only people essential to the operation of the farms may enter them.

Regulated areas: According to European regulation, strengthening biosecurity measures have been established in the regulated area including disinfection of all animal likely transports, clinical inspection and analysis of poultry before movement and inspection of all holdings in the regulated zone (commercial and non-commercial holdings in the protective zone, commercial holdings in the surveillance zone).

Preventive culling

Not applied.

Regional stand still (beyond the restriction zones specified in the EU regulation)

Not applied.

Derogations on restriction zone implementation after risk assessment

In the regulated zones, derogations have been applied according to Regulation (EU) 2020/687 and to the national regulation.

Hunting

Restriction of hunting bird game and other outdoor activities have been implemented in restricted zones (cases and outbreaks) since the 16 November 2021 case: hunting activity is prohibited in the restricted zones (following the confirmation of an outbreak or a case). An exemption is possible for big and small mammal game hunting, subject to the following provisions: Every hunter has followed a biosecurity awareness programme, and is required to take measures to prevent any risk of the spread of the avian influenza virus, in particular precaution must be taken to avoid any direct or indirect contact with domestic poultry species. Hunters must strictly avoid entering a poultry farm (whether it is a professional farm or a private farm) and, particularly, within 2 days (2 nights) following their hunting activity. Dogs used for hunting activities must not enter into a poultry farm or any other place where birds are kept. Equipment or vehicles used for hunting activities must not enter a poultry farm or any other place where birds are kept.

B.7 Hungary

Georgina Helyes

National Food Chain Safety Office

Timing of the applied prevention and control measures

Table B.7 provides a timeline on the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.7: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience
12/11/2021	First wild bird finding	Increasing awareness, strengthening biosecurity	Farmers, local authorities, poultry association, ornithologists, general public
16/11/2021	First poultry outbreak	Increasing awareness, strengthening biosecurity, implement regional stand still, implement preventive culling, implement derogations on restriction zone implementation after risk assessment	Farmers, local authorities, poultry association, general public
21/11/2021	First poultry outbreak in Csongrád-Csanád county	Release housing order	Farmers, local authorities, poultry association

Increasing awareness of the stakeholders and the general public

All information about avian influenza is available on the website of the National Food Chain Safety Office. <https://portal.nebih.gov.hu/madarinfluenza>

The Chief Veterinary Officer (CVO) and head of the National Disease Control Centre has communicated the most important information about the epidemic to the national media.

Housing order

On 22 November 2021 the 4/2021 CVO Decision entered into force that ordered the closed keeping of poultry (including backyard) in the entire territory of the following counties identified as high risk: Bács-Kiskun, Békés, Csongrád-Csanád, Hajdú-Bihar, Szabolcs-Szatmár-Bereg, Győr-Moson-Sopron and Komárom-Esztergom.

Strengthening biosecurity measures (other than housing order)

The 3/2017 CVO Decision about strengthening biosecurity requirements has been in force since the 2016/2017 HPAI epidemic.

Enhanced checking of the poultry holdings was ordered on 28 October 2021.

Preventive culling

Preventive killing has been carried out in Bács-Kiskun, Békés and Csongrád-Csanád county. In these three counties depopulation of all protection zones has been performed.

Regional standstill (beyond the restriction zones specified in the EU regulation)

Since 17 November 2021 from the free area of Bács-Kiskun county and three districts in Csongrád-Csanád county (Csongrádi, Kisteleki and Mórahalmi district), the movement of poultry for slaughter and further keeping is only approved with preliminary laboratory examination. 20 cloaca and 20 trachea swabs (40 animals) have to be collected and sent to the NRL 72 hours before the movement. Transport is approved only following a favourable result. In this area from 19 to 26 November 2021 waterfowls could be transported only for immediate slaughter, other movements of waterfowls were forbidden.

Derogations on restriction zone implementation after risk assessment

Poultry movement from the restricted zones is approved only for immediate slaughter to designated slaughterhouses, other movement of the poultry is forbidden. From restricted zones 48 hours before movement, 60 swabs have to be sent to the NRL and transport is approved only with a favourable result.

Hunting

Not applied.

B.8 Ireland

Eithne White and Sunita Jeawon

National Disease Control Centre, Department of Agriculture, Food and the Marine

Timing of the applied prevention and control measures

Table B.8 provides a timeline on the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.8: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience (if applicable)
03/11/2021 (ongoing throughout reference period)	Confirmation of first wild bird case of H5N1 in Ireland. Pathogenicity testing confirmed HPAI H5N1 on 03/11/2021	Increase awareness of the presence of HPAI H5N1 in Ireland via social media awareness campaigns, release of 'Avian Influenza Updates' to interested parties (also published on DAFM website).	General public
04/11/2021 (ongoing throughout reference period)	Confirmation of first wild bird case of H5N1 in Ireland. Pathogenicity testing confirmed HPAI H5N1 on 03/11/2021	Meetings with industry stakeholders.	Poultry industry stakeholders
15/11/2021	Increased numbers of wild bird HPAI H5N1 cases	Introduction of national biosecurity legislation for poultry owners - Avian Influenza (Biosecurity Measures) Regulations 2021	All poultry/ captive bird owners and keepers
15/11/2021	Increased numbers of wild bird HPAI H5N1 cases	Introduction of national legislation to prohibit bird gatherings - Avian Influenza (Restriction on assembly of live birds) Regulations 2021	All poultry/captive bird owners and keepers
19/11/2021	Suspected avian influenza in a poultry (commercial turkey fattening) flock	Sampling and submission to Veterinary laboratory. Restriction of flock.	Suspected premises
20/11/2021 – 25/11/2021	Confirmation of first outbreak of HPAI H5N1 in a poultry flock in Ireland in 2021	Killing and destruction of all susceptible birds registered to the holding.	Infected Premises
20/11/2021	Confirmation of first outbreak of HPAI H5N1 in a poultry flock	Introduction of Restriction zones around infected premises to include a 3km Protection zone and 10km Surveillance zone.	All poultry/captive bird owners and keepers in the Protection and Surveillance Zones
20/11/2021	Confirmation of HPAI H5N1 in a poultry flock	Introduction of national legislation to confine all poultry and captive birds indoors or in a manner which prevents contact with wild birds - Avian Influenza (Precautionary Confinement of Birds) Regulations 2021 enforced	All poultry/ captive bird owners and keepers within ROI.
20/11/2021 – 07/12/2021	Confirmation of H5N1 in a poultry flock	Preliminary Cleaning and disinfection of Infected Premises	Infected Premises
22/11/2021	Suspected avian influenza in a poultry (Broiler breeder) flock - Secondary case	Sampling and submission to Veterinary laboratory. Restriction of flock.	Suspected premises
23/11/2021	Confirmation of H5N1 in the secondary case	Awaiting pathogenicity results	Suspected premises
24/11/2021	Confirmation of HPAI H5N1 in the secondary case	Killing and destruction of all susceptible birds registered to the holding.	Infected Premises
24/11/2021	Confirmation of HPAI H5N1 in the secondary case	Introduction of Restriction zones around infected premises to include a 3km Protection zone and 10km Surveillance zone.	All poultry/captive bird owners and keepers in the Protection and Surveillance Zones

24/11/2021 – 09/12/2021	Confirmation of H5N1 in the secondary case	Preliminary Cleaning and disinfection of Infected Premises	Infected Premises
29/11/2021	Suspected avian influenza in a poultry (laying hen) flock	Sampling and submission to Veterinary laboratory. Restriction of flock.	Suspected premises
30/11/2021	Confirmation of H5N1 in the poultry (laying hen) flock	Awaiting pathogenicity results	Suspected premises

Increasing awareness of the stakeholders and the general public

The National Disease Control Centre of the Department of Agriculture, Food and the Marine (DAFM) distributes regular Avian Influenza updates via email to a list of subscribers and publishes them on the **Department of Agriculture Food and the Marine’s website for the general public to have access to**. The first of these for the 2021/2022 Avian Influenza season was published on the 6th October 2021. A further 3 updates have been issued since.

<https://www.gov.ie/en/publication/50ce4-avian-influenza-bird-flu/#what-is-the-current-situation-with-avian-influenza>

Social media campaigns on the platforms of Facebook and Twitter have been ongoing on several dates through this relevant time period (from October – December 2021).

In addition, advertisement campaigns for increased biosecurity in poultry flocks are running on an online commercial trading website. A text alert was sent to all registered poultry owners who subscribed to the service operated by DAFM to remind them to implement the precautionary confinement of birds legislation.

Housing order

Avian Influenza (Precautionary Confinement of Birds) Regulations 2021 require all poultry and captive birds in the Republic of Ireland to be housed in a secure building or where this is not practical, steps to be taken to confine them so that they are kept separate from wild birds. This regulation came into force on the 20th November 2021. Details of this regulation which applies to the entire country can be found at the link below:

<https://www.irishstatutebook.ie/eli/2021/si/607/made/en/print?q=607+2021>

Strengthening biosecurity measures (other than housing order)

On November 15th, 2021 Avian Influenza (Biosecurity Measures) Regulations 2021 were brought into force.

<https://www.irishstatutebook.ie/eli/2021/si/593/made/en/print?q=avian>

A guidance document for poultry owners regarding the implementation of these measures was published **on the Department of Agriculture Food and the Marine’s website**.

<https://www.gov.ie/en/publication/50ce4-avian-influenza-bird-flu/#what-is-the-current-situation-with-avian-influenza>

Avian Influenza (Restriction on the assembly of live birds) Regulations 2021 were also introduced on 15th November 2021 to prevent avian influenza bans bird gatherings in the whole country until further notice. This includes fairs, shows, and sales of birds. It does not apply however to gathering of pigeons for example for racing purposes.

<https://www.irishstatutebook.ie/eli/2021/si/592/made/en/print?q=avian>

Preventive culling

Not applied.

Regional standstill (beyond the restriction zones specified in the EU regulation)

Not applied.

Derogations on restriction zone implementation after risk assessment

Not applied.

Hunting

Hunting continues to be allowed unless it contravenes the Avian Influenza (Restriction on the assembly of live birds) Regulations 2021. The release of captive birds is prohibited within restriction zones.

B.8 Italy

Scolamacchia Francesca, Dorotea Tiziano, Fornasiero Diletta, Mulatti Paolo
Istituto Zooprofilattico Sperimentale delle Venezie –IZSVe, Italy

Timing of the applied prevention and control measures

Table B.8 provides a timeline on the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.8: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience
15/10/2021	First detections of HPAI A(H5Nx) and HPAI A(H5N1) in domestic and wild birds in Russia, Kazakhstan and Mongolia at the end of the summer 2021 (July–September)	Increasing awareness, release housing order and strengthening biosecurity in high-risk areas for the introduction and spread of HPAI viruses	
18/10/2021	First poultry outbreak in a domestic poultry holding in a region not previously affected (Veneto region)	Control measures as provided by Commission Delegated Regulation (EU) 2020/687: culling, disposal of carcasses, cleaning and disinfection procedures. Establishment of protection and surveillance zones (3 and 10 km). Restrictions on movements of poultry and poultry products (with derogations). Epidemiological investigation. Clinical examinations and collection of samples in poultry holdings located in restricted zones. Preventive culling	
05/11/2021	Detection of outbreaks in domestic poultry in several municipalities within the same province (Verona Province, Veneto region)	Establishment of a further restricted zone	
22/11/2021	First poultry outbreak in a domestic poultry	Amendment of the further restricted zone	

	holding in a region not previously affected (Lombardy region)		
--	---	--	--

Increasing awareness of the stakeholders and the general public

Details on avian influenza outbreaks occurred in Italy and updates on the epidemiological situation at the European level are provided regularly through the website of Istituto Zooprofilattico Sperimentale delle Venezie, where the National and European Reference Laboratory for Avian Influenza and Newcastle Disease has dedicated sections: <https://www.izsvenezie.com/reference-laboratories/avian-influenza-newcastle-disease/italy-update/>; <https://www.izsvenezie.com/reference-laboratories/avian-influenza-newcastle-disease/europe-update/>.

Other websites at the local/national level from various stakeholder groups and associations (e.g. associations of poultry farmers, National and Regional veterinary associations, etc.) link directly to the IZSVE website for updates on AI epidemiological situation, making it possible to reach a broader audience.

Official communications by the competent authority (Ministry of Health) on a new positive event is forwarded for information to poultry farmer unions, poultry production companies, and veterinary associations. Updates on the epidemiological situation are also forwarded to the Directorate for Health and Food Safety of the European Commission, and the World Organisation for Animal Health (OIE).

Housing order

Following the alert raised by EFSA, ECDC and EURL for avian influenza and Newcastle Disease with the **publication of the monitoring report 'Avian influenza overview May–September 2021', published on the 29 September 2021**, the Ministerial Provision No 23818 was issued on 15 October 2021. This provision implemented, among other mitigating measures, a housing order in high-risk areas for the introduction and spread of HPAI viruses (as defined to follow up on the provisions of the Implementing Decision (EU) No 2018/1136). In the areas not at risk, the local competent authority may decide to implement biosecurity measures as strict as a housing order after a risk assessment.

Strengthening biosecurity measures (other than housing order)

In accordance with Ministerial Provision No 23818 of 15 October 2021, enhanced biosecurity measures should be applied in high-risk areas for the introduction and spread of H5/H7 HPAIV, in particular:

- implementation of proper cleaning and disinfection protocols, in particular for tools and equipment introduced in premises where poultry is kept;
- ban on access by unauthorised personnel to the poultry premises;
- record of movement of vehicles or people entering and leaving the poultry premises;
- correct storage and disposal of carcasses;
- correct storage and disposal of manure;
- correct storage of (clean) litter, which must be adequately covered and protected from any direct and indirect contact with wild birds;
- if the farm uses surface water for watering birds, this must be properly disinfected;
- appropriate disinfection methods should be arranged at the entrance and exit of buildings that house poultry or other captive birds, as well as at the entrance and exit of the poultry farm.

Additional control measures

In accordance with Ministerial provisions no. 24347 of 22 October 2021, additional control measures (with derogations) have been established:

- the release of birds intended for repopulating wild game in high-risk areas is suspended. However, the competent authority may grant derogations to this measure outside the densely

populated poultry areas (DPPAs) for welfare reasons and provided certain conditions (clinical examination and sampling for laboratory testing) are met for the release;

- enhanced surveillance during fairs, bird exhibitions and any other gatherings of poultry or other captive birds in areas different from high-risk areas;
- fairs, bird exhibitions and any other gatherings of poultry or other captive birds are banned in high-risk areas (with derogations). The Veneto region banned these type of gatherings in its high-risk provinces (without derogations);
- the use of live decoy birds belonging to the orders Anseriformes and Charadriiformes for hunting was suspended. Movement of live decoy birds from the holding where they are permanently kept to another location is not allowed. Derogations may be granted by the local veterinary authority provided certain conditions (clinical examination and sampling for laboratory testing) are met;
- transportation to slaughter of meat turkeys and of spent lay hens originating from the high-risk areas is allowed if a favourable clinical inspection and virological testing are carried out.

Preventive culling

Preventive culling, referred to as the killing and disposal of birds in farms considered at risk, and pre-emptive culling, referred to as the killing and disposal of birds also in the absence of evident contacts, were both applied to reduce the risk of uncontrolled spread of the disease.

Criteria used to decide which holdings should be depopulated were: (i) proximity to infected farms (within the 3-km radius); (ii) potential direct or indirect contacts (sharing of personnel, sharing of vehicles, farms belonging to the same owner, farms belonging to familiars of the owner). The precise details on the timeframe of culling and productive types are reported in the related ministerial provisions.

Regional standstill (beyond the restriction zones specified in the EU regulation)

Not applied.

Derogations on restriction zone implementation after risk assessment

Not applied.

Hunting

No restrictions on hunting activities has been implemented, but with Ministerial provisions n° 24347 of 22 October 2021:

- the use of live decoy birds belonging to the orders Anseriformes and Charadriiformes for hunting was suspended;
- the release of birds intended for repopulating wild game in high-risk areas was suspended. However, the competent authority may grant derogations to this measure outside the DPPAs for welfare reasons and provided certain conditions (clinical examination and sampling for laboratory testing) are met and the release.

Establishment of a further restricted zone

In view of the epidemiological situation and taking into consideration both the location of the HPAI A(H5N1) outbreaks (inside densely populated poultry areas) and the geographical distribution of poultry holdings, the Ministry of Health issued a provision to establish a further restricted zone (FRZ) to prevent the further spread of the infection (Ministerial Provision No 25660 of 5 November, as amended by Ministerial Provision No 27237 of 22 November 2021).

B.9 Kosovo²

Bahti Murati¹, Sadik Heta¹, Armend Cana², Kujtim Uka², Xhavit Merovci²

¹Department of Animal Health and Welfare, Kosovo Food and Veterinary Agency
²Food and Veterinary Laboratory, Kosovo Food and Veterinary Agency

Timing of the applied prevention and control measures

Table B.9 provides a timeline on the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.9: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience
21/05/2021–ongoing	Summer May–June 2021 outbreak First detected/confirmed outbreak in the village Kllo dernica, Skenderaj, Mitrovica region	All actions were taken based on Administrative Instruction No 2005/24 Against Zoonotic Disease Avian Influenza and National Contingency Plan for Avian Influenza. Increasing awareness, release housing order, repeal housing order (poultry confinement), strengthening biosecurity. Cooperation with hunting association and fishing association for the monitoring of wild birds and waterfowl. Information about avian influenza situation and instructions were published on the official website https://auvk.rks-gov.net Cooperation and sharing information with the National Institute of Public Health to screen for possible human cases. Passive surveillance ongoing	Private veterinarians, poultry associations, hunting association, fishing association general public, etc. Through media, meetings and brochures
29/09/2021	Re-occurrence of avian influenza A H5N8 in a poultry commercial farm on the village Sekiraqa, Podujevo Municipality, Prishtina region 29/09/2021	All actions were taken based on Administrative Instruction No 2005/24 Against Zoonotic Diseaseavian Influenza and National Contingency Plan for Avian Influenza Increasing awareness, release housing order, repeal housing order (poultry confinement), strengthening biosecurity. Cooperation with hunting association and fishing association for the monitoring of wild birds and waterfowl. Information about avian influenza situation and instructions were published on the official website https://auvk.rks-gov.net Cooperation and sharing information with the National Institute of Public Health to screen for possible human cases. Passive surveillance ongoing	Private veterinarians, poultry associations, hunting association, fishing association general public, etc. Through media, meetings and brochures

Increasing awareness of the stakeholders and the general public

Since 2020, there has been a continuous awareness campaign for the avian influenza threat, targeting private veterinarians, poultry farmers and association and hunter and fishing associations. During summer 2021, this campaign was intensified by involving the general public as well, to report every suspected death of wild bird, waterfowl and in poultry farms or backyard poultry across the country. This was done by regular meetings, media and brochures. Information about the avian influenza situation and instructions were published on a regular basis on the official website <https://auvk.rks-gov.net>. Moreover, information was shared with the National Institute of Public Health to screen for possible human cases in the infected farms. After the re-occurrence on 29 September 2021 these

measures were re-actualised.

Housing order

After the abolishment of the housing order on 13 July 2021, 25 days after the last case during the summer outbreak, the housing order was re-established again on 30 September 2021 after the re-occurrence of AIV H5N8 in a commercial poultry farm on 29 September 2021. Movement of poultry and all markets involving live poultry were prohibited again. All actions were based on Administrative Instruction No 2005/24 Against Zoonotic Disease Avian Influenza and National Contingency Plan for Avian Influenza. At the beginning, zoning (3 km protection and 10 km surveillance) was tentatively applied. However, shortly afterwards, the outbreak was detected in three regions and the whole country was considered as a high-risk area. During ongoing outbreaks, dissemination of infection by farm-to-farm spread in five out of 11 farms was identified. Preventive culling was not performed, except killing of poultry in the infected farms by gas. All measures were strictly monitored by official state veterinary inspectors.

Strengthening biosecurity measures (other than housing order)

The second outbreak during September–ongoing raised concern regarding the involvement of a high number of commercial farms. In five out of seven commercial farms the infection could be traced to movement (selling) of chicken broilers or hens from a single commercial farm.

Therefore, in the meetings with poultry association representatives and commercial poultry farmers, the importance of strict adherence of biosecurity measures was emphasised, such as: disinfection protocols (tools, equipment, vehicles etc.), restricted access of unauthorised persons to premises, taking record of human and vehicle entering and leaving the farm premises, storage of manure, carcasses and disposal, keeping food indoors, keeping poultry indoors and preventing contact with the wild birds.

Instructions were given also to small poultry backyard farmers to strictly keep poultry indoors and restrict human and poultry movements, and all measures to prevent contact with wild birds. Instructions for disinfection were given. All poultry live markets were closed.

Preventive culling

Not applied.

Regional standstill (beyond the restriction zones specified in the EU regulation)

The whole territory of Kosovo is considered a high-risk area due to the high density of backyard farms and the presence of migratory birds.

Derogations on restriction zone implementation after risk assessment

Not applied.

Hunting

Not applied.

B.10 The Netherlands

MAH Spierenburg DVM LLM

Netherlands Food and Consumer Product Authority (NVWA), Ministry of Agriculture, Nature and Food Quality (Min LNV)

Timing of the applied prevention and control measures

Table B.10 provides a timeline of the main events that triggered actions in relation to the selected

prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.10: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience (if applicable)
26/10/2021	First outbreak HPAI serotype H5N1-positive commercial poultry holding (organic laying hens)	Measurements for the protection and surveillance zone: As of 26 October 2021: Culling HPAI-positive commercial poultry holding, implement protection (3 km) zones and surveillance (10 km) zones around the HPAI-positive commercial poultry holding with transport restrictions for all birds, including commercial poultry and poultry products, sperm, manure and feed as well transport restrictions for domestic mammals, feed, sperm, milk and manure of these domestic mammals. Ban on hunting ducks or to hunting in general in wet areas with waterfowl Measurements for the whole country: As of 26 October 2021: 1: Housing order commercial poultry confinement and housing order hobby birds and other non-commercial captive birds confinement. 2: Measures regarding cover and application of litter on duck holdings. 3: Ban on visiting commercial poultry holdings and other holdings or locations where birds are held. 4: Mandatory visitors registration. 5: Ban on races and exhibitions with birds. 6: Ban on hunting ducks or to hunt in general in wet areas with waterfowl. 7: Mandatory clinical examination of birds for transport to or from commercial poultry holdings. 8: Mandatory intensive clinical examination ante mortem of ducks and turkeys at slaughterhouses. 9: Use of a hygiene protocol for visiting commercial poultry holdings. 10: Increasing awareness, repeal housing order (commercial poultry confinement), strengthening biosecurity, intensive wild bird monitoring	
29/10/2021	First HPAI-positive captive bird outbreak HPAI serotype H5N1 on a non-poultry hobby farm	Measurements for the whole country: same as above	
30/10/2021	Second outbreak HPAI serotype H5N1-positive commercial poultry holding (broiler)	Measurements for protection and surveillance zone: same as above. Measurements for the whole country: same as above	
01/11/2021	Third outbreak HPAI serotype H5N1-positive commercial poultry holding (laying hen)	Measurements for protection and surveillance zone: same as above. Measurements for the whole country: same as above	

03/11/2021	Second HPAI-positive captive bird outbreak HPAI serotype H5N1 on a non-poultry hobby farm	Measurements for protection and surveillance zone: same as above. Measurements for the whole country: same as above	
04/11/2021	Fourth outbreak HPAI serotype H5N1-positive on a commercial poultry holding (fattening ducks)	Measurements for protection and surveillance zone: same as above. Measurements for the whole country: same as above	
05/11/2021	First HPAI-positive wild bird finding on 22 October, 1 greylag goose (<i>Anser anser</i>) was found dead in a wetland area. On 5 November the national reference laboratory-confirmed HPAI virus H5N1 in the samples from the goose	Measurements for the whole country: same as above	
05/11/2021	Fifth outbreak HPAI serotype H5N1-positive commercial poultry holding (fattening ducks)	Measurements for protection and surveillance zone: same as above. Measurements for the whole country: same as above	
05/11/2021	Third HPAI-positive captive bird outbreak HPAI serotype H5N1 on a non-poultry hobby farm	Measurements for the whole country: same as above	
08/11/2021	Sixth outbreak HPAI serotype H5N1-positive on a commercial poultry holding (laying hen)	Measurements for protection and surveillance zone: same as above. Measurements for the whole country: same as above	
13/11/2021	Fourth HPAI-positive captive bird outbreak HPAI serotype H5N1 on a non-poultry hobby farm	Measurements for the whole country: same as above	
14/11/2021	Seventh outbreak HPAI serotype H5N1-positive on a commercial poultry holding (broiler)	Measurements for protection and surveillance zone: same as above. Measurements for the whole country: same as above	
21/11/2021	Eighth outbreak HPAI serotype H5N1-positive on a commercial poultry holding (laying hen)	Measurements for protection and surveillance zone: same as above. Measurements for the whole country: same as above	
01/12/2021	To date, in total there have been 49 HPAI H5N1-positive wild bird notifications to ADIS	Measurements for the whole country: same as above	

Increasing awareness of the stakeholders and the general public

Development of biosecurity measures during crisis in contact with poultry sector. Communication both by Ministry and poultry sector for example as follows: Directly published on government website (www.rijksoverheid.nl): Legal information/Information to Parliament/Information for press/Questions & Answers/Phone centre for questions from both poultry owners and general public, in direct contact with poultry advisers/Communication department in close contact with press/Meeting for all stakeholders and communication by media with the general public.

Housing order

The housing order was implemented in mandatory national legislation as 26 October 2021 after an executed risk assessment by the Commission of animal disease experts that consisted of this matter by avian influenza experts. This Commission advised the Chief Veterinary Officer and the Minister to apply measures against HPAI. The trigger for implementing the housing order was the HPAI H5N1-positive outbreak on a commercial poultry holding (organic laying hens) on 6 October 2021.

Strengthening biosecurity measures (other than housing order)

We have concluded multiple years service level agreements with suppliers who can deliver cleaning and disinfection equipment 24 hours/7 days within 4 hours after being called by the Dutch government for culling at every location in the whole country.

Preventive culling

This was applied in the first outbreak HPAI serotype H5N1-positive on a commercial poultry holding (laying hen holding) as 27 October 2021, there was a following tracing investigation for one other commercial poultry holding considered as a high-risk contact (poultry laying hen farm for disabled people) which was preventively culled. It was also applied in the second outbreak HPAI serotype H5N1-positive on a commercial poultry holding (Broiler) from 31 October 2021, there was also a following tracing investigation of one other commercial poultry holding considered as high-risk contact (broilers) in which birds were preventively culled. Both preventive culled poultry farms were sampled and tested PCR negative for HPAI. There have been no pre-emptive culling of other commercial poultry farms in the 1-km zones to date.

Regional standstill (beyond the restriction zones specified in the EU regulation)

No, only the 1 km/3 km and 10 km zones (protection and surveillance zones).

Derogations on restriction zone implementation after risk assessment

Not applied.

Hunting

There was a ban implemented on hunting ducks or on hunting in general in wet areas with waterfowl.

B.11 Norway

Siri Løtvedt¹, Grim Romo²

¹Norwegian Food Safety Authority, Head Office, Animal Health Section

²Norwegian Veterinary Institute

Timing of the applied prevention and control measures

Table B.11 provides a timeline of the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.11: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience
12/11/2021	First poultry outbreak	Stamping out, traceability, disease notification, disinfection, official disposal of carcasses, by-products, zoning, surveillance within containment zone terra, housing order	
18/11/2021	Second poultry outbreak	Stamping out, traceability, disease notification, disinfection, official disposal of carcasses, by-products, zoning, surveillance within containment zone terra	
17/11/2021	First wild bird finding in another region	Housing order	
16/11/2021	First wild bird finding in the outbreak region	Hunting ban implemented 26/11	

30/11/2021	Wild bird finding in the outbreak region		
------------	--	--	--

Increasing awareness of the stakeholders and the general public

Daily updates on the Norwegian Food Safety Authority (NFSA) webpages with information to the poultry industry, hobby farmers and the public.

https://www.mattilsynet.no/dyr_og_dyrehold/dyrehelse/dyresykdommer/fugleinfluensa/Utbrudd_av_fugleinfluensa_2020_2021/

In the beginning, daily video meetings with poultry industry organisations, poultry holders and hobby **holders' organisations centrally and locally. Lately when necessary, but at least twice a week.**

SMS notification and phone calls to all registered poultry holders and hobby holders in the zones affected by zones or housing orders, with the headlines and showing them to the webpages.

Digital letters to all registered poultry holders in the area of the Sør-Rogaland, Sirdal og Flekkefjord Department.

Separate telephone number to the NFSA for poultry holders in the zones.

Press releases and interviews were given.

Several posts have been published on social media, especially aimed at hobby farmers in the zone.

Housing order

On 12 November 2021 a housing order was applied in 15 municipalities around the two outbreaks in poultry holdings.

On 17 November 2021 a housing order was applied in seven municipalities around the wild bird finding.

The housing orders were based on risk evaluations performed by the Norwegian Veterinary Institute, taking into account the density and total activity of poultry production in the area and the presence of wetlands with gathering of wild birds.

The housing order applied to kept poultry and non-poultry birds. Birds shall be kept indoors or fenced and under roof, so that they cannot be in contact with wild birds.

The duration of the housing order will be evaluated after the zones have been lifted.

The regulation defining the high-risk area, amongst several other criteria, for kept birds is published here: <https://lovdata.no/forskrift/2005-12-05-1417>

Strengthening biosecurity measures (other than housing order)

Information on the webpages on biosecurity measures for commercial holdings, hobby holdings, hunters, animal transporters, the public etc., informing them on how to act. Meetings with local farmers and inspections of holdings in the zones.

There are also other criteria listed in the 'Housing order regulation' published here: <https://lovdata.no/forskrift/2005-12-05-1417>.

Preventive culling

One flock of ready-to-slaughter chickens from a holding close to the first outbreak holding was culled due to problems with finding a slaughterhouse that could receive them at short notice.

Regional standstill (beyond the restriction zones specified in the EU regulation)

Not applied.

Derogations on restriction zone implementation after risk assessment

Some specific derogation was given in the regulation: <https://lovdata.no/forskrift/2021-11-12-3193>

In addition, a guidance was produced for the use of derogations and that is published online: https://www.mattilsynet.no/dyr_og_dyrehold/dyrehelse/dyresykdommer/fugleinfluensa/Utbrudd_av_fugleinfluensa_2020_2021/veileder_krav_og_unntak_hpai_2021_utgave_11.pdf.45087/binary/Veileder%20krav%20og%20unntak%20HPAI%202021%20utgave%201.1.pdf

Hunting

On 25 November 2021 a hunting ban was implemented in the 15 municipalities with the housing order around the poultry outbreaks. The duration of the hunting ban will be evaluated after the zones have been lifted.

The regulation defining the hunting ban is published here: <https://lovdata.no/forskrift/2021-11-25-3282> with detailed information on the NFA website here:

https://www.mattilsynet.no/dyr_og_dyrehold/dyrehelse/dyresykdommer/fugleinfluensa/Utbrudd_av_fugleinfluensa_2020_2021/informasjon_til_jegere_om_fugleinfluensa_og_jaktforbud_i_rogaland.41433

B.12 Poland

Magdalena Gawędzka

General Veterinary Inspectorate

Timing of the applied prevention and control measures

Table B.12 provides a timeline of the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.12: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience
27/09/2021	HPAI outbreak in poultry in a neighbouring country	Meeting of CVO with Sanitary and Epizootic Council to analyse the situation and appropriate measures. After this meeting CVOs ordered to intensify monitoring in wild birds and information campaigns among poultry keepers	Sanitary and Epizootic Council
30/09/2021		CVO issued a National Strategy on Avian Influenza control	Veterinary inspection
02/11/2021	First HPAI outbreak in November (subtype H5N1)	Meeting with local veterinary officers – orders about measures in high-risk areas	Veterinary inspection, poultry keepers

Increasing awareness of the stakeholders and the general public

Information published on the website of the General Veterinary Inspectorate: <https://www.wetgiw.gov.pl/nadzor-weterynaryjny/grypa-ptakow>

The local veterinary authorities organised trainings for poultry farmers, disseminated leaflets and posters about the dangers related to HPAI.

Housing order

Orders and prohibitions for poultry breeders and keepers in protection and surveillance zones designated around HPAI outbreaks are set out in the Regulation of the Commission Delegated Regulation (EU)

2020/687 of 17 December 2019 supplementing Regulation (EU) 2016/429 of the European Parliament and of the Council, as regards rules for the prevention and control of certain listed diseases.

Requirements in the field of biosecurity applicable to poultry breeders throughout the country are set out in the Regulation of the Minister of Agriculture and Rural Development of 4 April 2017 on the ordinance of measures related to the occurrence of highly pathogenic avian influenza. This regulation imposes the following obligations on breeders:

- an order to keep poultry in a way that limits its contact with wild birds;
- reporting to the District Veterinary Officer places where poultry or other birds are kept, excluding birds kept permanently in living quarters;
- keeping the poultry in a way that excludes its access to water bodies to which wild birds have access;
- storing bird feed in a way that prevents contact with wild birds and their droppings;
- feeding and watering poultry and captive birds in a manner that protects feed and water from access by wild birds and their droppings;
- laying disinfection mats in front of the entrances and exits of livestock buildings in which poultry is kept, in a number ensuring the security of entrances and exits from these buildings – for farms where poultry is kept in a non-running system;
- use by persons entering livestock buildings in which poultry is kept of protective clothing and safety footwear, intended for use only in the given building – for farms where poultry is kept in a non-running system;
- personal hygiene rules applied by persons performing poultry-handling operations, including washing hands before entering livestock buildings;
- cleaning and disinfection of equipment and tools used for handling poultry before each use;
- abstentions by persons who have participated in hunting birds in the last 72 hours from carrying out poultry-handling activities;
- carrying out daily inspections of poultry flocks and keeping records containing, in particular, information on the number of dead birds, decrease in feed intake or lay;
- a ban on watering poultry and birds kept by humans with water from tanks to which wild birds have access;
- a ban on bringing (on foot or by vehicle) to the holding where poultry is kept, corpses of wild birds or carcasses of game birds.

Also CVO ordered local veterinary authorities to issue housing orders in high-risk areas. Those orders were issued in high-risk areas in: Kujawsko-Pomorskie, Lubelskie, Lubuskie, Mazowieckie, Podlaskie, **Pomorskie, Warmińsko-Mazurskie**, Wielkopolskie and Zachodniopomorskie voivodeships.

Strengthening biosecurity measures (other than housing order)

The Regulation of the Minister of Agriculture and Rural Development of 4 April 2017 regarding the ordinance of measures related to the occurrence of highly pathogenic avian influenza introductions into the territory of the Republic of Poland, among others an order to keep poultry in a way that limits its contact with wild birds or to store feed for birds in a way that prevents contact with wild birds and their droppings. The measures specified in the provisions of this Regulation are also applied during the outbreak of highly pathogenic avian influenza in the territory of the Republic of Poland.

In addition, information on avian influenza is available on the website of the Chief Veterinary Officer (link: <https://www.wetgiw.gov.pl/nadzor-weterynaryjny/grypa-ptakow>), including a description of biosecurity rules (<https://www.wetgiw.gov.pl/nadzor-weterynaryjny/zasady-ochrony-drobiu-przed-grypa-ptakow>)

Also CVO ordered local veterinary authorities to prohibit keeping of ducks and geese together with other poultry species in high-risk areas. Those prohibitions were issued in high-risk areas in: Lubelskie,

Lubuskie, Mazowieckie, Podlaskie, Warmińsko-Mazurskie, Wielkopolskie and Zachodniopomorskie voivodeships. Additionally in these areas and in high-risk areas in Pomorskie and Śląskie it is forbidden to organise fairs, exhibitions, shows or competitions where poultry or other birds are collected.

In high-risk areas in Lubuskie voivodeship it is forbidden to release poultry or other birds for restocking game birds.

Intensified controls on biosecurity measures in poultry farms are currently carried out, as of 15 to 28 November 2,556 controls were performed: 1,858 in commercial holdings and 698 in non-commercial holdings.

Preventive culling

Preventive culling was applied in the protection and surveillance zones established according to Regulation 2020/687 in Mazowieckie, Wielkopolskie and Lubuskie voivodeships, as follows:

- 3 holdings in Mazowieckie voivodeship;
- 7 holdings in Wielkopolskie voivodeship;
- 64 holdings in Lubuskie voivodeship.

In the holdings three outbreaks were confirmed in Wielkopolskie voivodeship.

Regional standstill (beyond the restriction zones specified in the EU regulation)

In the period covered by the report, a regional standstill was not applied.

In Wielkopolskie voivodeship in high-risk areas it is not allowed to restock poultry holdings without the permission of a powiat veterinary officer.

Derogations on restriction zone implementation after risk assessment

In the period covered by the report derogations on measures in further restricted zones in mazowieckie, wielkopolskie and lubuskie were granted.

Hunting

Local veterinary authorities established cooperation with hunting clubs to collect samples from shot wild birds, mainly in the surveillance and protection areas.

B.13 Slovakia

Martin Chudy, Vilem Kopriva

State veterinary and Food Administration of the Slovak Republic

Timing of the applied prevention and control measures

Table B.13 provides a timeline of the main events that triggered actions in relation to the selected prevention and control measures. More information on the actions taken is provided in the sections below.

Table B.13: Overview of main actions

Date	Event that triggered action	Type of action taken	Target audience
19.11.2021	Third poultry outbreak	All relevant measures ordered by DVFA in accordance with EU and Slovak national legislation for outbreak, protection zone and surveillance zone	Stakeholders, general public, private vets

Increasing awareness of the stakeholders and the general public

https://www.svps.sk/zvierata/choroby_chripka.asp

Other ways of providing information are through the media, municipalities, etc.

Housing order

Special emergency veterinary measures of the Chief Veterinary Officer of the Slovak Republic due to HPAI avian influenza are published on the website:

https://www.svps.sk/zvierata/mno_4373_05.asp

Strengthening biosecurity measures (other than housing order)

Checks on poultry health regarding avian influenza (including compliance with biosecurity measures) have been ordered by SVFA to DVFAs in relation to commercial poultry farms, not for backyard holdings. This commenced in December 2013.

Preventive culling

Not applied.

Regional standstill (beyond the restriction zones specified in the EU regulation)

Not applied.

Derogations on restriction zone implementation after risk assessment

Not applied.

Hunting

Not applied.

Annex C – Data on wild birds

Table C.1: Highly pathogenic avian influenza notifications in wild birds in Europe from 16 September to 8 December 2021. On one single reported detection of HPAI in wild birds, more than one bird might be involved. For 34 notifications the wild bird species was unknown or mixed, those notification are not included in the table.

Category of wild bird species	Wild bird species	Number of HPAI detections where the wild bird species was reported
Waterfowl	Greylag goose (<i>Anser anser</i>)	90
	Barnacle goose (<i>Branta leucopsis</i>)	59
	Mute swan (<i>Cygnus olor</i>)	58
	Eurasian wigeon (<i>Mareca penelope</i>)	37
	Swan (unidentified species)	37
	Mallard (<i>Anas platyrhynchos</i>)	31
	Canada goose (<i>Branta canadensis</i>)	20
	Anatidae (unidentified species)	9
	Eurasian teal (<i>Anas crecca</i>)	5
	Greater white-fronted goose (<i>Anser albifrons</i>)	5
	Bean goose (<i>Anser fabalis</i>)	2
	Charadriidae (Charadriidae)	2
	Common shelduck (<i>Tadorna tadorna</i>)	2
	Gadwall (<i>Anas strepera</i>)	2
	Whooper swan (<i>Cygnus cygnus</i>)	2
	Anserinae (unidentified species)	1
	Common eider (<i>Somateria mollissima</i>)	1
	Egyptian goose (<i>Alapochen aegyptiaca</i>)	1
	Ferruginous duck (<i>Aythya nyroca</i>)	1
	Goose (unidentified species)	1
Great crested grebe (<i>Podiceps cristatus</i>)	1	
Pied avocet (<i>Recurvirostra avosetta</i>)	1	
Pink footed goose (<i>Anser brachyrhynchus</i>)	1	
Raptor	Common buzzard (<i>Buteo buteo</i>)	11
	Accipitridae (unidentified species)	5
	Northern goshawk (<i>Accipiter gentilis</i>)	4
	Peregrine falcon (<i>Falco peregrinus</i>)	4
	White-tailed eagle (<i>Haliaeetus albicilla</i>)	4
	Common kestrel (<i>Falco tinnunculus</i>)	1
	Eurasian eagle-owl (<i>Bubo bubo</i>)	1
	Merlin (<i>Falco columbarius</i>)	1
Ural owl (<i>Strix uralensis</i>)	1	
Other	European herring gull (<i>Larus argentatus</i>)	21
	Laridae (unidentified species)	11
	Black-headed gull (<i>Larus ridibundus</i>)	8
	Ardeidae (Ardeidae)	7
	Common pheasant (<i>Phasianus colchicus</i>)	7
	Great black-backed gull (<i>Larus marinus</i>)	7
	Corvidae (unidentified species)	5
	Grey heron (<i>Ardea cinerea</i>)	5
	Common crane (<i>Grus grus</i>)	2
	Common redshank (<i>Tringa totanus</i>)	1

	Eurasian curlew (<i>Numenius arquata</i>)	1
	Eurasian magpie (<i>Pica pica</i>)	1
	Gull (unidentified species)	1
	Ruddy turnstone (<i>Arenaria interpres</i>)	1
	Western jackdaw (<i>Corvus monedula</i>)	1
	Yellow-legged gull (<i>Larus michahellis</i>)	1

Data source: ADIS and OIE WAHIS (data extraction carried out on 8 December 2021)